VOL. XIV No. 1

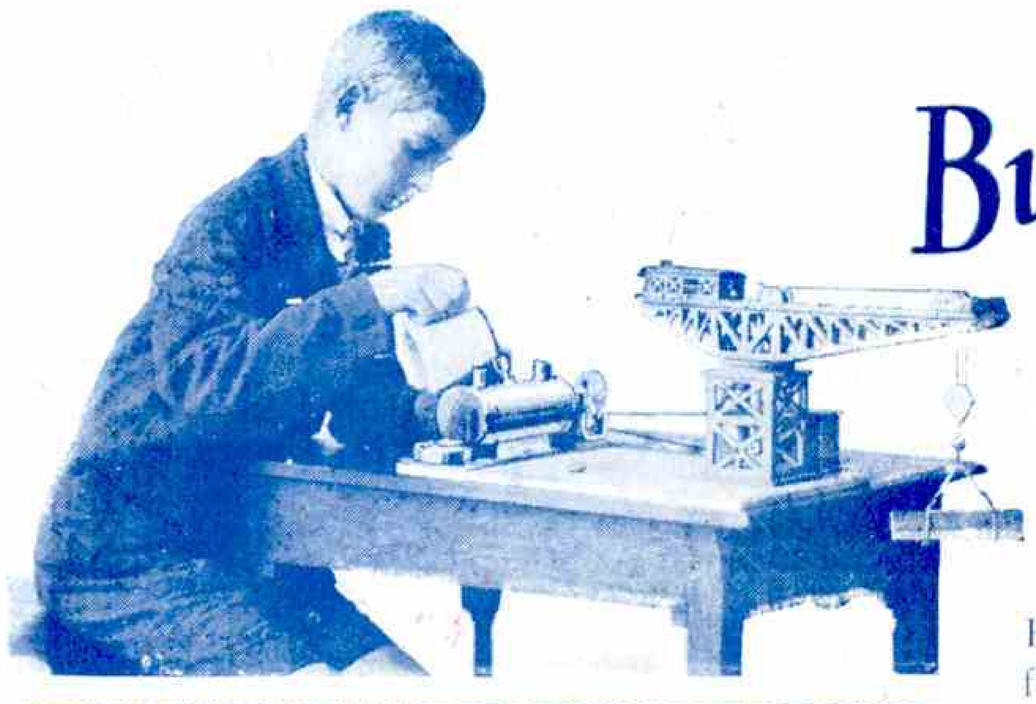
JANUARY 1929

MECCANO MAGAZINE

LANDING IN THE ATLANTIC

(see page 2)

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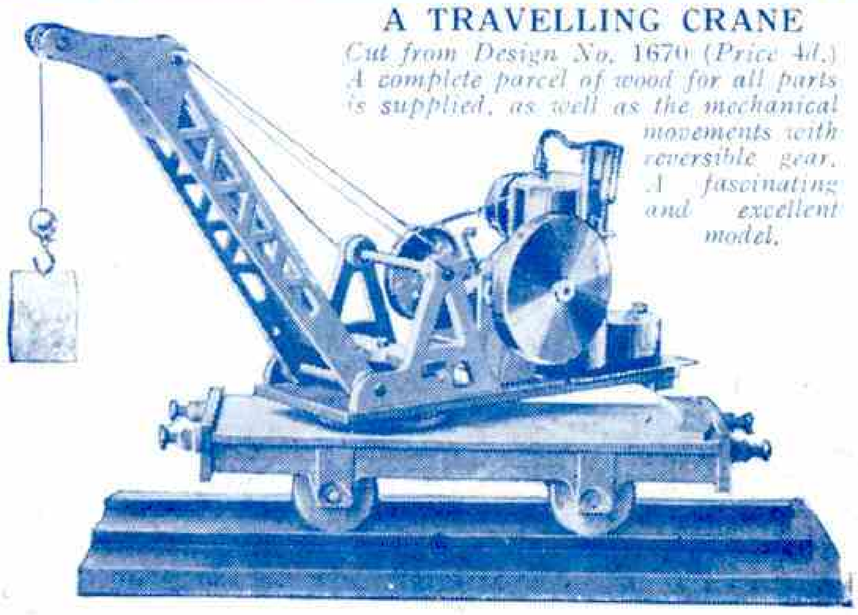


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Have you ever tried making working models with a fretsaw? It's so simple now that Hobbies publish specially planned designs. Look at the four illustrated here—any Meccano lad can cut out the parts in wood from the full size patterns provided; and build them into the complete article from the construction details supplied. Planed wood the correct thickness and ready to use is obtainable for each, whilst a special power unit is provided for each in the sturdy little Demon engine. The models are but one of the enormous variety of work which the owner of a Hobbies Fretwork Outfit can make. In addition he can make cabinets, clocks, toys, brackets, pipe racks, and heaps of other fascinating articles.

A TRAVELLING CRANE

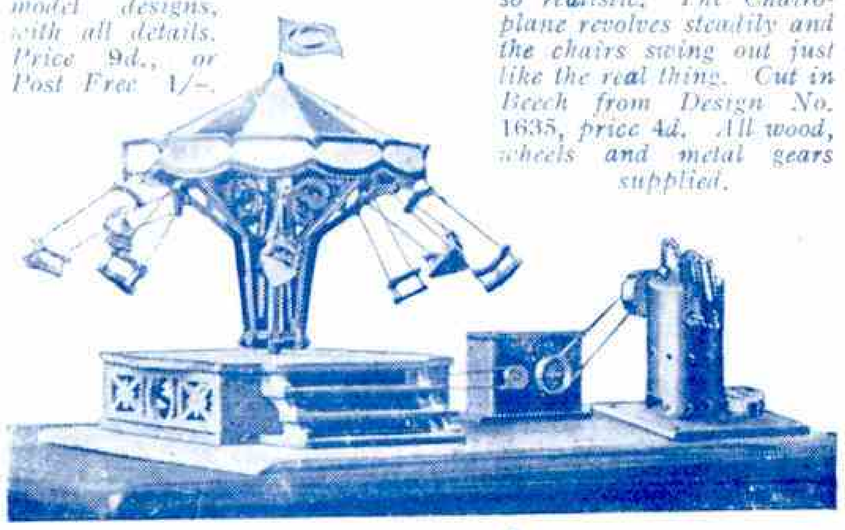
Cut from Design No. 1670 (Price 4d.) A complete parcel of wood for all parts is supplied, as well as the mechanical movements with reversible gear. A fascinating and excellent model.



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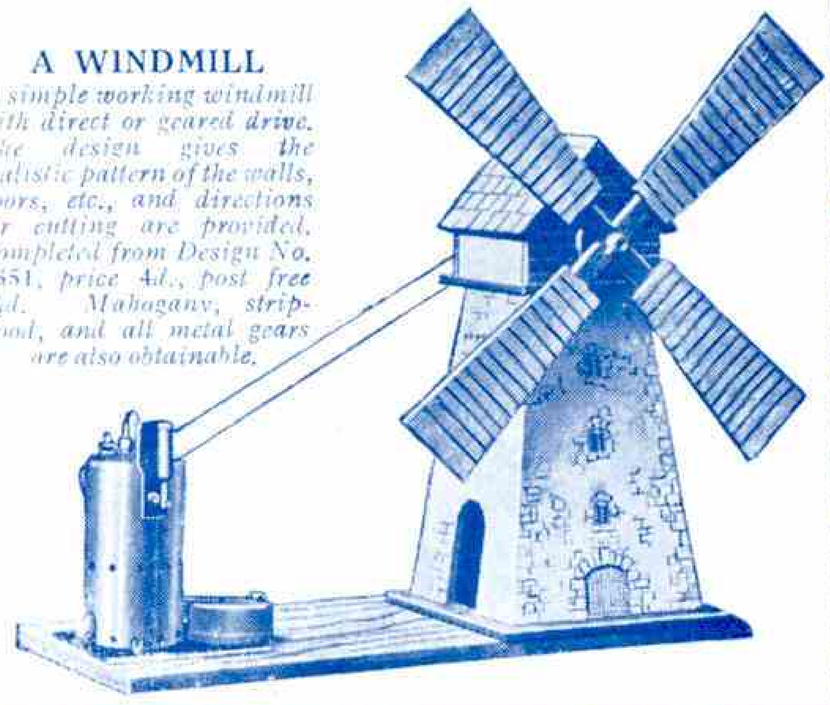
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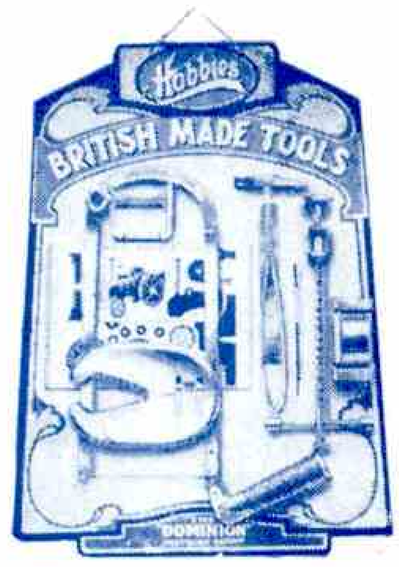
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January, 1929

With the Editor

Engineering Progress in 1928

At the end of each year it is always interesting to look back at the outstanding events of the previous twelve months. Many of the chief features of 1928, whilst definitely indicating progress, were not of a spectacular nature so that they probably passed almost unnoticed by the general public. Nevertheless, they foreshadow great changes and developments in Engineering. One interesting instance was the successful trial of a Diesel locomotive, the story of which is told on page 32 of this issue. The supremacy of coal has been undermined already by the growing tendency to use oil engines for the propulsion of ships, and it seems that the struggle between the two kinds of fuel may now be extended to the railways. It is too early to make any definite statements in regard to this, but many signs suggest that the triumph of the internal combustion engine will be completed eventually by its adoption on railroads.

Railway affairs in general were much quieter in 1928 than in the previous year. This is not surprising, for we could scarcely expect to see another succession of such wonderful engines as "*Lord Nelson*," "*King George V*" and the "*Royal Scot*." Nevertheless, the year did not pass without its sensation, for the L.M.S. and L.N.E.R. renewed the struggle commenced in the previous year for the honour of running the longest non-stop express. The east coast company won the fight by running the famous "*Flying Scotsman*" between London and Edinburgh without a stop. In order to enable this to be done they built tenders with corridors, thus making a change of crew possible during the run. Some ardent champions of the L.M.S. seem to regard the introduction of these tenders as a mild infringement of the rules of the game! They point with pride to the fact that on one occasion in April last "*The Royal Scot*" express ran from London to Glasgow without a halt. The distance covered is eight miles greater than the longest non-stop run on the rival company's route, and in this instance was made without change of crew. At the end of the summer the long non-stop runs on both railways came to an end. They were interesting experiments, but they showed quite clearly that such runs were not likely to prove economically sound.

The Greatest Air Speed—but not a Record!

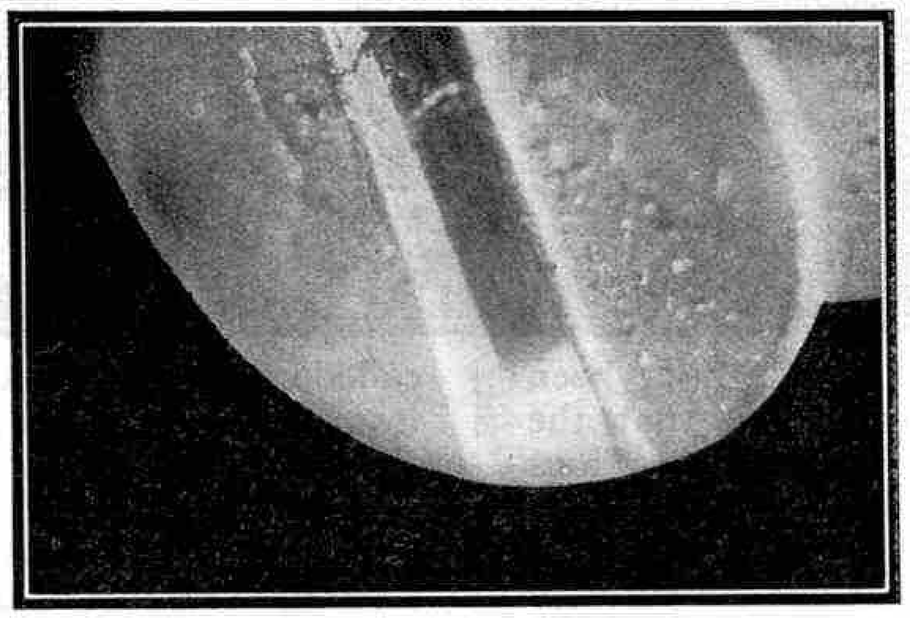
In the air the greatest interest was excited by the struggle between Great Britain and Italy for the world's speed record. Italy's defeat in the race for the Schneider Cup Trophy in 1927 was avenged by Major Bernardi, who deprived Lieut. Webster of this record by averaging 318 miles per hour over a measured course. It is by no means an easy task to add a few miles per hour to such a speed, but British designers set to work with great determination. After weeks of preparation and practice Lieut. D'Arcy Greig exceeded Bernardi's speed, but unfortunately, did not make a new record—the rules require a clear margin of five miles per hour, and the British airman's speed was only greater by one mile per hour!

During 1928 there were no flights quite so sensational as Lindbergh's famous dash across the Atlantic. It is true that this ocean was crossed from east to west for the first time, but the flight can scarcely be regarded as a great triumph, for the German airmen who made it, in company with the chief of the Irish Free State Air Force, were forced out of their path, and were thought to have been lost. A similar effort on the other side of the world went more smoothly. To fly west from California with the intention of making Australia in three "hops" required nerve at least equal to that of Lindbergh, and the whole world followed with breathless interest the fortunes of Kingsford Smith and his companions on their tremendous journey. This great exploit must not be allowed to overshadow Hinckler's wonderful flight in a light aeroplane from Britain to Australia, which showed that a regular air service on this route could be arranged with comparatively little difficulty.

Although less spectacular, the further progress of the slot principle invented by Mr. Handley-Page is of greater moment than any of the flights to which I have referred. It represents a very real advance in aero engineering, reducing very considerably the risk of stalling. If wisely used, it may do more towards making flying safe and universal than any other single invention since the Wrights showed us how to fly.

Airships figured more largely during the past year than in 1927. These modern cruisers of the air are veritable monsters. The "*Graf Zeppelin*," which flew across the Atlantic, is actually a little longer than the "*Mauretania*," while the British airships now under construction have a length of more than 700 ft. and tower 133 ft. above the ground. In spite of her size—or possibly because of it—the "*Graf Zeppelin*" proved to be a failure as a trans-Atlantic vessel. She was in serious trouble almost throughout her long voyage, and one of the great defects of giant airships was shown quite clearly when a head wind kept her in the neighbourhood of the Bermudas for many hours. It almost seems as if the builders of the "*Graf Zeppelin*" rushed her across the Atlantic in an effort to anticipate the British airships, and also to show the world that the German airship was still the best in the world. The results were disappointing. Possibly there would never have been any Atlantic flight by a German airship if R.100 and R.101 had not been approaching completion!

No. 2. WHAT EVER IS IT?

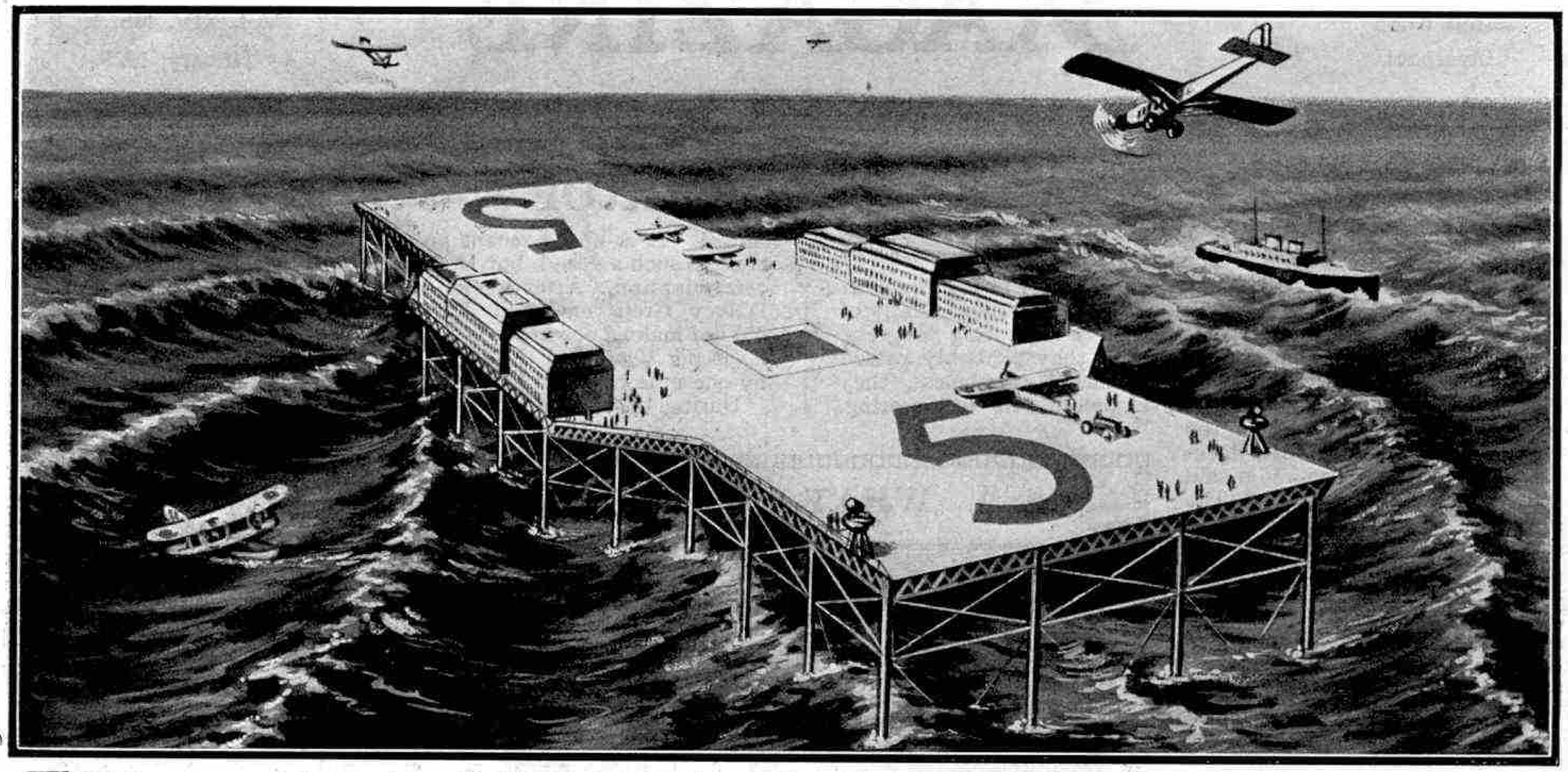


Last month's little puzzle (the result of which will be announced next month) created such extraordinary interest that I have decided to give you another this month. Can you solve the mystery of the photograph above? It is part of something—and not a very unfamiliar "something" either, so don't imagine that astronomers or entomologists have any advantage over mere engineers and railway enthusiasts!

To the first reader to send an exact answer—or to the reader who gets nearest—I will send an autographed copy of my recent book "Pioneers of Wireless." Solutions should be written on postcards only and addressed "Editor's Competition No. 2, Meccano Ltd., Old Swan, Liverpool." Closing date, 1st February next.

Wonderful Seadrome Scheme

Aeroplane Landing Grounds in the Atlantic



THE few successful aeroplane flights that have been made across the Atlantic have shown that the crossing is feasible under ideal weather conditions but extremely hazardous in bad weather. Even in the most favourable circumstances, however, the crossing is not an economic proposition on account of the relatively enormous weight of petrol that must be carried to accomplish the distance. There is no doubt that the range of aeroplanes will increase considerably during the next few years but nevertheless it appears probable that the solution of the Atlantic crossing problem will be found only in the provision of intermediate landing grounds.

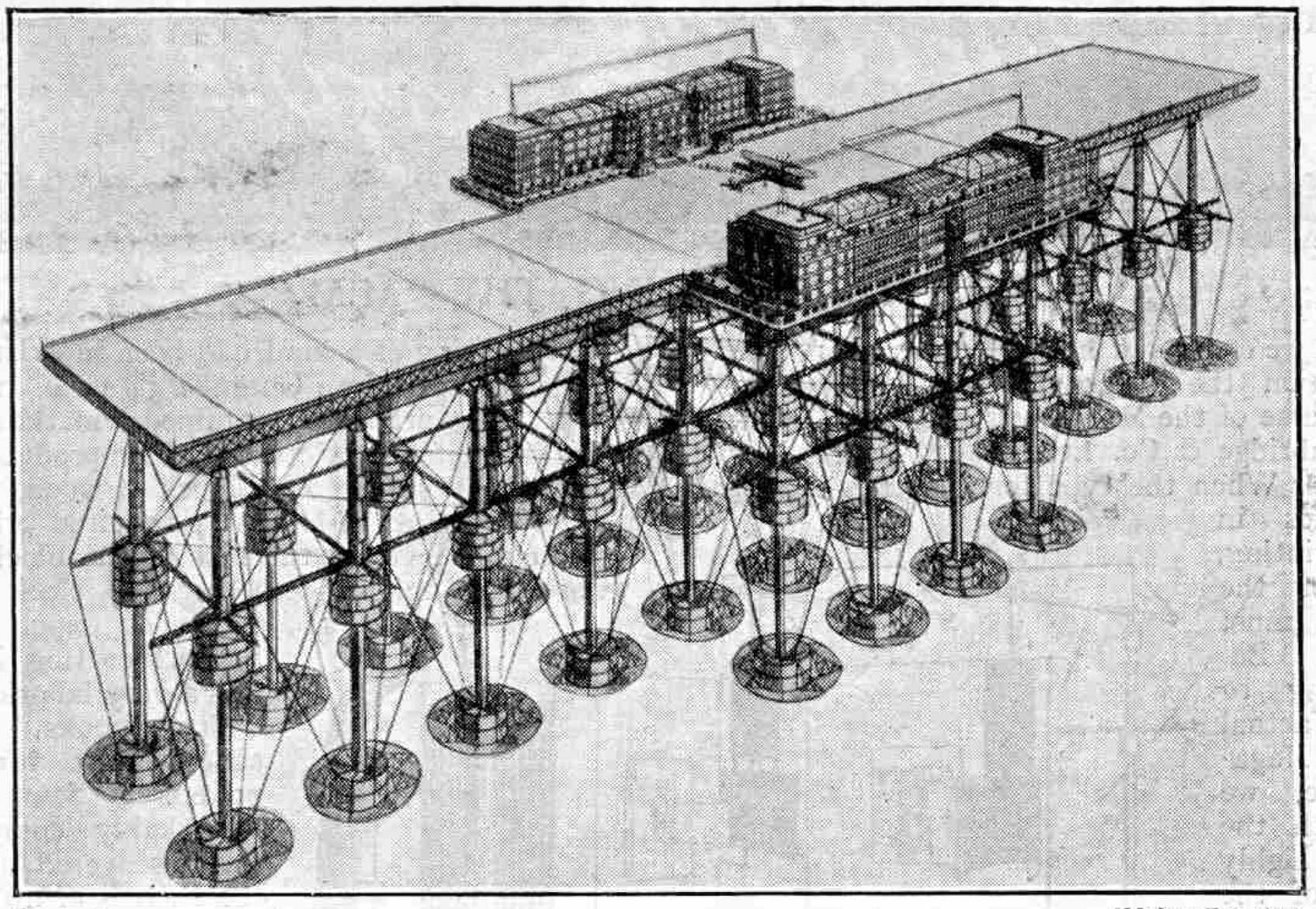
Until recently the idea of establishing a chain of floating aerodromes across the Atlantic appeared wildly fantastic, but a promising scheme has now been evolved by an American engineer, Mr. Edward R. Armstrong. This inventor has progressed so far as to have formed a company that intends to place a line of floating aerodromes across the Atlantic at intervals of 400 miles with smaller stations half way between them. If the scheme can be carried out successfully the year 1930 may see the establishment of a regular daily trans-Atlantic air service, maintained by amphibian aeroplanes of the Sikorski type. The operating range of these machines will be very greatly in excess of the distance between the seadromes, as the new structures may be called, and as a very detailed check upon weather conditions all along the route will then be possible, the Atlantic flight promises to become as safe as the journey by air from London to Paris.

For some years Mr. Armstrong was chief engineer of an American company and during this period he was called upon to design a floating factory to extract bromine from sea water for the purpose of manufacturing one of the constituents of ethyl petrol. One result of this work was to revive in his mind an idea that had occurred to him at least 20 years before—the possibility of placing a string of landing stages across the Atlantic to facilitate developments in aviation. Although he continued to turn over the idea in his mind he was too fully occupied with other work to make practical progress until 1926, when he reached the stage of constructing a model.

Subsequently the idea hung fire until the successful trans-Atlantic flights made by American pilots in 1927. A new model was then made and it was decided to proceed with the construction of a seadrome large enough to be placed at a point about 400 miles south-east of New York, in order to give the scheme a thorough test under service conditions. This particular position was chosen as the first stage of a route across the Atlantic that would be below the limit of drifting icebergs.

In planning his sea-raft Mr. Armstrong's chief aim has been to eliminate the effect of wave motion, and he claims to have accomplished this by taking advantage of the fact that oceanic disturbances are more limited in range than is generally supposed. The greatest waves seldom exceed 42 ft. in height, while the depth at which wave motion on the surface has any appreciable effect is considerably less than this. It seemed to the inventor, therefore, that a skeleton steel structure with its upper deck more than 45 ft. above water, and having its centre of gravity below the limit of under-water disturbance, would be practically free from the roll and pitch of surface vessels.

Experiments soon showed that this was the case. A structure was designed to have an upper deck 100 ft. above the water level, while its centre of equilibrium was to be lowered to the required depth by supporting the deck on telescopic steel tubes, the inner members of which could be extended to reach a depth of 185 ft. This method of construction was planned to make it possible to build the full scale seadrome in any shipyard, as it could be given a draft of less than 30 ft., which would be increased to the full amount after the giant raft had been towed to its anchorage. Discs of large area and weights were to be attached to the lower ends of the supports in order to keep the seadrome absolutely steady.



Courtesy [*Modern Transport*

Sketch of one of the projected Armstrong Seadromes for trans-Atlantic air services, showing the landing deck, the hotels and the supporting "legs"

Interesting information with regard to the probable behaviour of the proposed structure was obtained by experiments with a scale model in a pond. It was found that waves corresponding to a height of 120 ft. at sea had no noticeable effect on the level of the deck of the model, while waves only half the height completely swamped a model of the "*Majestic*" on the same scale that was used for comparison purposes. The first reason for this difference in behaviour between the seadrome and the liner is that the open method of construction adopted in the case of the former presents practically no obstacle to the passing waves, while the slight force that is exerted on the supporting columns is more than counterbalanced by the effect of the damping discs. The second reason is that the centre of gravity of the seadrome model was well below the area of disturbance, whereas in the case of the model of the "*Majestic*" it was practically at the place where the disturbance was greatest.

The landing-deck of the Armstrong seadrome will be 900 ft. in length and 240 ft. in width. Towards the middle the width will be increased to 400 ft. to accommodate hotel buildings, offices and a meteorological station. It is anticipated that soon after the inauguration of the service from 2,000 to 3,000 people will pass through each seadrome daily and that many will stay for longer periods than the 15 minutes allowed for refuelling the aeroplanes. The staff required to carry out the necessary work in the hotels, offices and workshops, will be at least 150 for each seadrome.

A special deck below the landing is to be used for work on the aeroplanes and on the seadrome itself. The petrol, oil and water required for replenishing the supplies of the aeroplanes prior to despatching them to the next station will be stored in watertight compartments in the hollow portions of the supporting columns.

The area of the landing deck, exclusive of the space covered by buildings, will be about six acres, and it is possible that the main seadromes eventually will be given a deck area of not less than 12 acres. The hotels will provide accommodation for 250 people so that, with the 150 required for the various services, there will be a total population of 400. Eight main seadromes, 400 miles apart, and nine subsidiary stations are planned, so that when the scheme is completed the Atlantic will probably possess a semi-permanent population of 4,000!

Approximately 10,000 tons of steel and iron will be used in the construction of the seadromes. Heavy ballast will be necessary to keep the raft trimmed, and this probably will be in the form of iron ore stored in the lower portions of the cylindrical legs, bringing the total weight to approximately 50,000 tons. It is anticipated that the cost of each station will be somewhere about £300,000.

The greatest difficulty of the whole scheme undoubtedly lies in the securing of efficient anchorage. The bottom of the Atlantic ocean is at an average depth of some two miles. The length of an anchor cable in practice is three times the depth of the anchorage, which means that in order to anchor a seadrome a chain six miles in length will be required. The trouble lies in the fact that a heavy chain of this enormous length would have quite sufficient to do in preventing itself from snapping under its own weight, without having to undergo any additional strain.

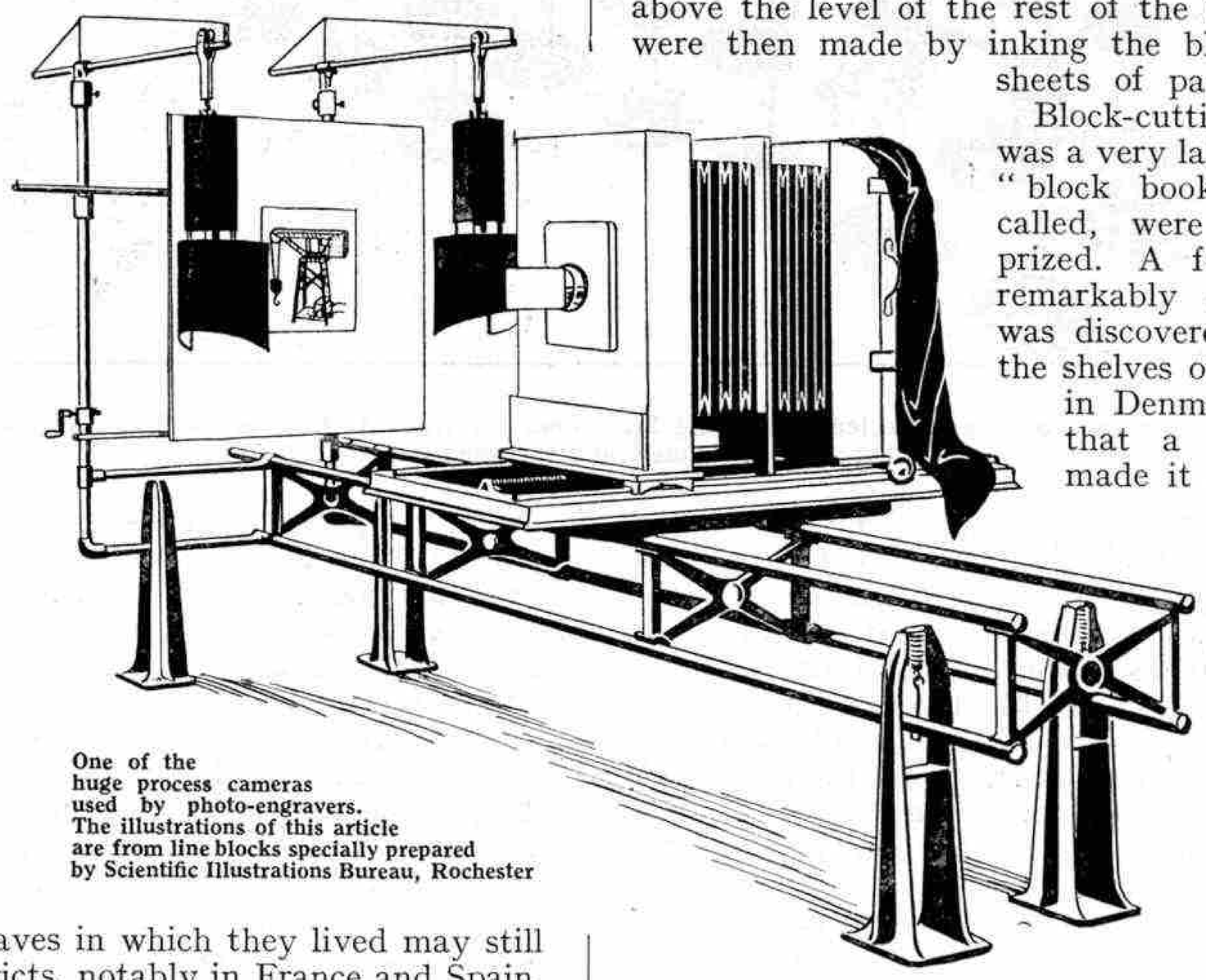
Mr. Armstrong proposes to solve this problem by not anchoring the seadrome directly to the cable, but to a huge spar buoy about 60 ft. in length and of small diameter, to which the upper end of the anchor cable will be secured This buoy, like the seadrome itself, will offer very little resistance to the waves. Thus the heaving stresses due to surface movement of the water will not be transmitted to the anchor cable, which will be called upon to do very little more than support its own weight.

The scheme appears feasible and details of the behaviour of the trial seadrome will be awaited with great interest.



VII.—ILLUSTRATING THE "M.M."

LAST month we explained how copy for the "*M.M.*" is set up on the Monotype, and followed the further course of the Magazine through the printing works of Stembridge & Co. Ltd., Leeds, as far as the proofing stage. When the type for its pages is placed in the formes in readiness for printing, the blocks of the illustrations must accompany it. Before proceeding to describe the actual printing of the Magazine, therefore, we shall deal with the fascinating and highly skilled work of the photo-engraver, as the craftsman who makes the blocks is called.



One of the huge process cameras used by photo-engravers. The illustrations of this article are from line blocks specially prepared by Scientific Illustrations Bureau, Rochester

Illustrations have always been an essential part of human life. Thousands of years ago our prehistoric ancestors carved pictures on the ivory tusks of the mammoth and the woolly rhinoceros, and their drawings on the walls of the caves in which they lived may still be seen in many districts, notably in France and Spain. Their pictures of animals and of hunting scenes were wonderfully life-like and full of energy. The same may be said of the productions of the savage Bushmen of South Africa, who also have developed artistic tastes and whose drawings are remarkably similar to those found in the long abandoned cave-dwellings.

Even to-day we use pictures to tell stories, as well as to illustrate them, and it is by no means surprising to learn that this was the case long before writing was invented. It is indeed almost certain that the hieroglyphics of the Egyptians, and even our own alphabet, were derived originally from simplified drawings of natural objects. The art of illustration is thus very ancient. The story of its development is quite continuous, however, and is full of interest.

The beginnings of modern book illustration may be traced back to the days before movable types were invented. Readers of these articles will remember that printing of a kind had been in existence in Europe for centuries before Gutenberg's time, and many of the books then produced contained remarkable illustrations. The characters or pictures to be reproduced were marked out on the surface of a block of wood, which was then cut away so as to leave the required print standing up above the level of the rest of the block. Impressions were then made by inking the blocks, and pressing sheets of paper on them.

Block-cutting in this manner was a very laborious process, and "block books," as they were called, were rare and highly prized. A few months ago a remarkably complete specimen was discovered unexpectedly on the shelves of an ancient library in Denmark. It is believed that a Flemish craftsman made it about 1460, and it is one of the finest of the 34 block books known to be still in existence. The seven illustrations it contains are far more important than the text. They are vividly coloured woodcuts, and their excellence shows that the engravers at that time had attained a remarkable degree of skill.

The production of block books interests us chiefly because wood engravings were still in use until about 50 years ago. The illustrations in early numbers of such publications as the "*Graphic*" and the "*Illustrated London News*" were thus reproduced by the same method as that used long before printing was invented! Naturally many improvements had been made in the interval. These included the use of better ink and of a more suitable wood. The engravers of last century worked on boxwood, which is not only very hard, but is of extremely fine grain and can thus be cut cleanly and sharply in any direction. A small illustration was produced by engraving the picture on the flat surface of a single block of wood. When a larger picture was required, several engravers were set to work on separate portions, and the complete block was made by joining them together. Any reader who has an opportunity

of examining early copies of the "*Graphic*," or similar journals, will notice white lines or cracks running across the pictures. These show where the separate blocks have been joined together.

Another reason for producing large blocks in sections was that production was speeded up. Time was of little importance to the engravers of block books, and they were able to work slowly with the single aim of producing a perfect engraving. Illustrations intended for a weekly journal have to be completed in a very short time, however, and by dividing the task in this manner large blocks were made within a few days that otherwise would have taken several weeks to engrave.



Printing on zinc plates in a giant frame. The negatives are kept in close contact with the plates by air pressure

This method continued to be employed until about 1870, by which time photography had been introduced. Artists then made drawings on paper and these were photographed on the wood. This was a great improvement, for pictures could be drawn of any size, and reduced as required when they were being photographed.

Not long afterwards the use of wood engraving was abandoned. Metals such as copper and zinc were used instead of boxwood, and the laborious carving process was replaced by etching with acids. The splendid illustrations that appear on the pages of the "*M.M.*" are printed from blocks of these metals, upon which the pictures have first been photographed and then engraved by chemical methods.

Two forms of illustration are used—line and half-tone engravings. Diagrams and line drawings of all kinds are reproduced by the first of these, while the illustrations that have the appearance of photographic prints are reproduced from half-tone blocks, which are also used for colour work. The excellence of the illustrations in the "*M.M.*" and particularly of the remarkable coloured covers for which it is famous, show the astonishing skill of present-day photo-engravers.

In this article we shall follow the various steps in the making of line blocks. These are made of zinc, and are usually referred to as "zincos." The name is used to describe a block that prints an illustration composed of lines only. In order to make this quite clear, special line blocks to illustrate this article have been prepared by Scientific Illustrations Bureau, of Rochester, the photo-engravers who make practically all the blocks used in illustrating the "*M.M.*" Readers will be interested to note that they show various stages in the making of a line block to illustrate the well-known model of a Girder Crane.

Whatever subject is to be illustrated, whether it is a portrait, a machine or a Meccano model, it is necessary to make a first-class black and white drawing in line. Good Indian ink only is used in preparing the drawings, which are then photographed. The photographic studio is usually a large, well-lighted room on the top floor. In it there is a line of seven or eight huge cameras. They are expensive pieces of apparatus, and some of them are capable of taking negatives up to 30 in. square. Occasionally larger blocks than this are required, and special photographic arrangements must then be made. The largest block ever made by Scientific Illustrations Bureau measured six feet in length, and the successful production of such an immense block naturally called for an extraordinary amount of care and skill.

Examining the negative of a model of a Girder Crane. The black lines of the original photograph are white on the negative

Each camera is fixed on a travelling bed that slides along iron rails, which also support the board on which is pinned the drawing to be reproduced. The illustration on page 4 makes this clear, and shows also that the "copy," as photo-engravers call it, is not directly in front of the camera, as one would expect, but is at the side. A mirror is placed in front of the lens and the camera actually photographs a reflection of the original drawing instead of the copy itself!

It is not difficult to see why the mirror is introduced. Readers who are amateur photographers will know that on their negatives scenes are reversed from left to right. A second reversal takes place in making contact prints and thus the finished pictures are quite correct. A block is a positive print on a metal plate, and the impression it makes on paper would therefore be the wrong way round unless corrected in some manner. It is for this purpose that the mirror is introduced. This is not of the ordinary kind, but takes the form of a glass prism that fits close to the lens of the camera. The rays of light enter by one of

the short sides and are reflected from its base into the camera. A prism is used because a smaller proportion of the light is lost in reflection than is the case with a plain mirror.

Most photo-engravers use collodion wet plates in preparing their negatives. They are made as required by coating clean sheets of plate glass with a film of collodion, and immersing them in a solution of silver nitrate, the operation being carried on in a dark room. As soon as the plate has received the required deposit of silver nitrate it is drained and placed in a dark slide. It is then ready for exposure in the camera.

When all is ready the copy is pinned to the board and illuminated by means of two powerful arc lamps, one being fixed on each side in order to give even lighting. The operator focusses the image on the ground glass screen, taking care to make it of the required size. He then inserts the dark slide and makes the exposure. The plate is developed, fixed and dried in the customary manner.

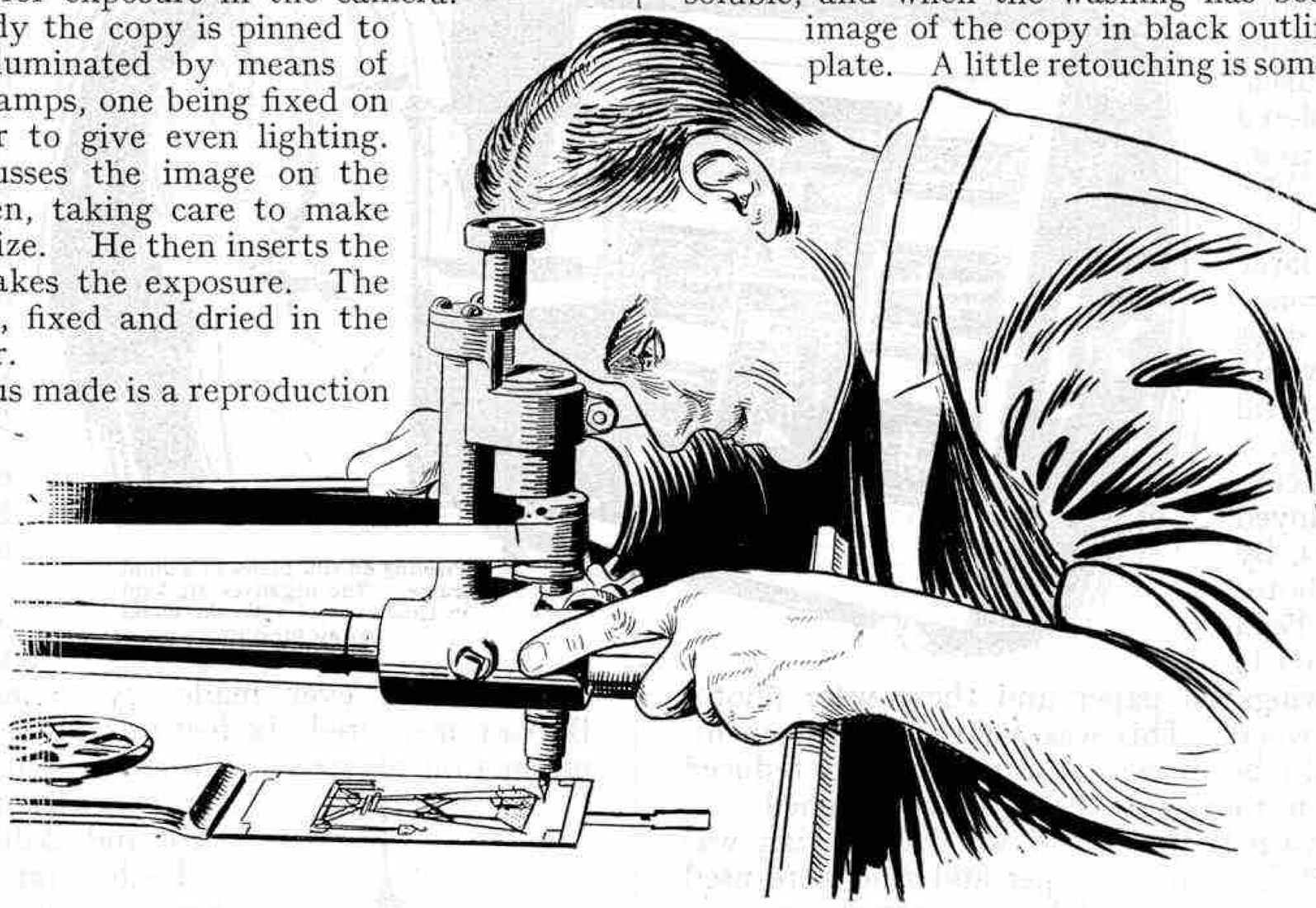
The negative thus made is a reproduction in reverse of the original drawing. On it the black lines of the copy appear as clear glass, and spaces that in the finished illustration will be white are now covered with an opaque film.

The negative is now taken to the printing room in order to make the positive print that is later transformed into a block. The sheets of zinc used are specially polished to give a perfectly flat surface, and are prepared for use in a dark room partitioned off from the printing room. One surface of the metal is coated with a film of albumen containing bichromate of potash, a mixture that is sensitive to light. As large a portion as necessary is then cut off, placed in contact with the negative and inserted in the printing frame in which the positive is made.

The printing frames used by photo-engravers are quite different from those used in ordinary photography. The aim is to obtain perfect contact over the whole surface of the negative, and the necessary even pressure used to be obtained by the use of screws or clamps. Air pressure is now used instead. The wooden frames are very large and heavily made. Their backs are closed by strong rubber covers, the edges of which may be clamped down firmly to make the interior of the frame air-tight. When the negative and the sensitized zinc plates have been placed in position on the thick plate-glass of the frame, the rubber sheet is fastened down and air is pumped out until inside there is an almost perfect vacuum. The outside air presses with great force on front and back of the frame, and thus makes perfect contact between the sensitized zinc plate and negative. The pressure is so great that the shape of the zinc and negative stands out in bold relief on the rubber cover.

The exposure may now be made, powerful arc lamps being used as a source of light. These are hung from the ceiling, and the giant printing frames are stood on edge around them. After exposure for the necessary length of time the clamps are released and the air rushes in as the rubber cover is raised.

The plate is taken out of the frame and rolled with a special black ink that resists attack by acids. It is placed in water. Those portions of the bichromated albumen film that have not been acted on by light are washed away, leaving a clean zinc surface. The rest of the film has undergone a change that makes it insoluble, and when the washing has been completed an image of the copy in black outline is seen on the plate. A little retouching is sometimes necessary, and for this purpose the plate is passed on to artists who perfect any weak or broken lines.



Operating the routing machine, which cuts unwanted metal from the finished plate

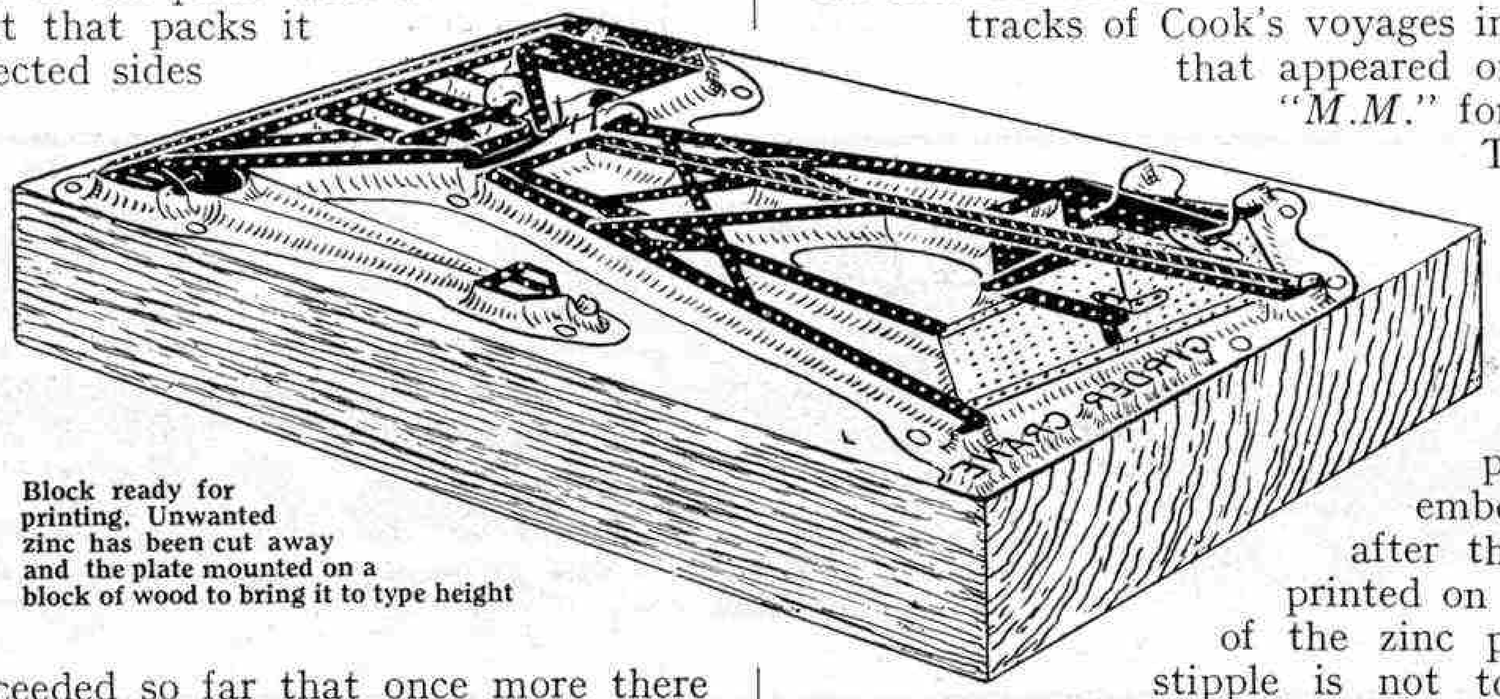
When the plate is quite ready it is taken to the etching department, where it undergoes the most interesting of the many processes through which it must pass before it becomes a finished block. The etching is carried out with the aid of dilute nitric acid, which slowly dissolves zinc. The metal beneath the black lines on the plate is protected by the ink, and when etching has been completed the drawing stands out in relief from the general surface of the zinc plate.

On entering the department a line of large earthenware troughs is seen. These are etching machines, and their purpose is to speed up the action of the acid by throwing it forcibly at the plates. Inside each trough is a small shelf on which the plates to be etched are reared, and also grooved paddles that are rotated by means of electric motors. As the paddles revolve, the tips of their blades dip into the acid contained in the bottom of the machine, and throw a spray of the liquid against the plates. Naturally the machine is covered in, for nitric acid is a dangerous corrosive, and in addition ventilating shafts are fitted to carry away the unpleasant fumes.

The etching of a line block is not as simple a proce as may be imagined, for it must be carried out in stages. The illustration on page 7 will make this clear, and also will help to explain why a single prolonged etching is not satisfactory. It shows cross sections of a plate before etching begins, and at various stages in the progress of the work. The action of the acid on the unprotected portions of the surface soon causes the lines of the drawing to show in relief, but the sides of the ridges thus formed also become exposed to its attack. If this were allowed to continue, the lines that have been carefully protected from the direct attack of the

acid would soon be eaten away from below!

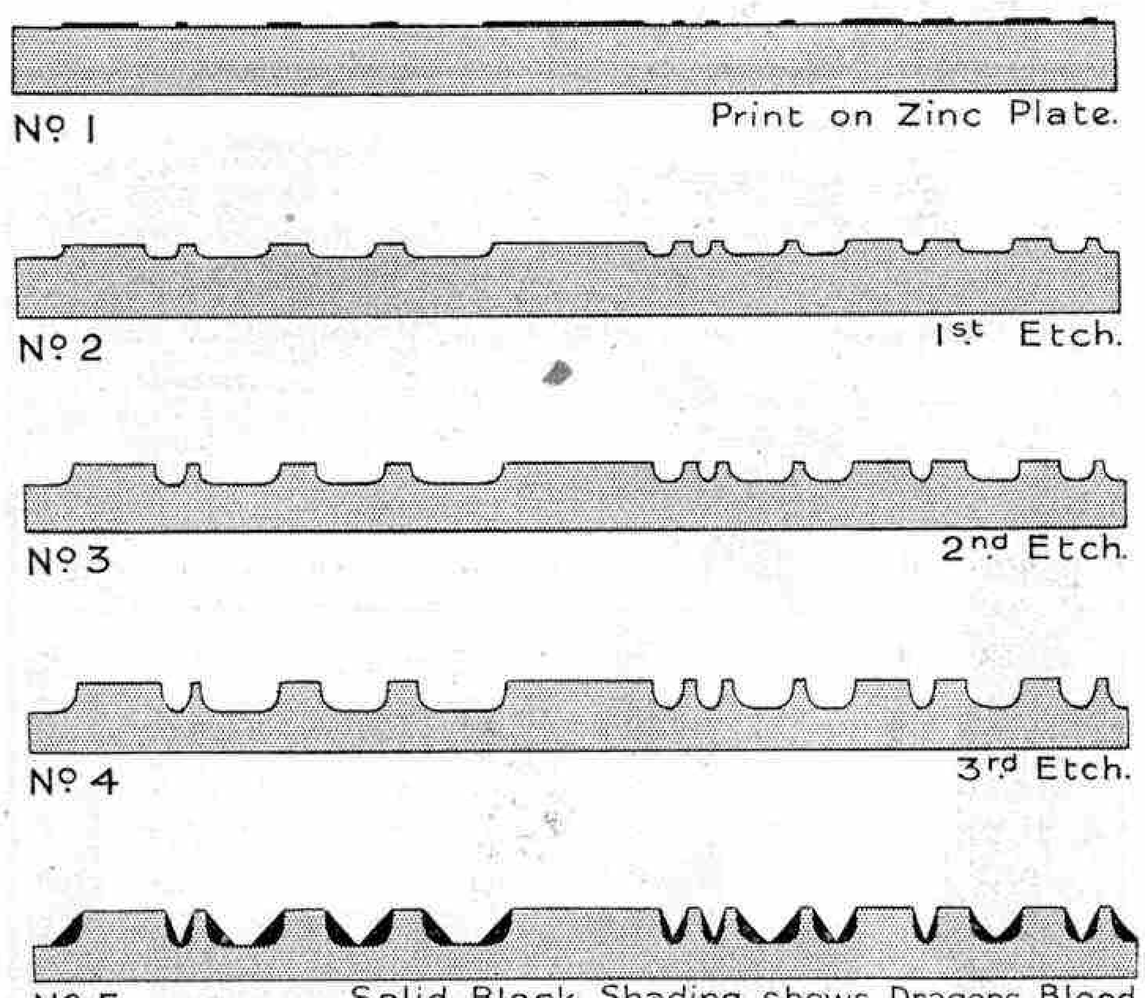
In order to prevent damage to the lines of the drawing by action of this kind, photo-engravers use a resinous powder which has the somewhat surprising name of "Dragons' Blood." It probably owes its name to its bright red colour, for it certainly has nothing whatever to do with dragons! Workmen clad in overalls brush it over the surface of the plate with a sweeping movement that packs it against the unprotected sides of the lines of the drawing. The plate is then heated over a gas stove, when the powder changes into a black pigment that is acid-resisting. The etching may now be continued, and "Dragons' Blood" is again applied when this has proceeded so far that once more there is danger of the acid eating under the lines.



Block ready for printing. Unwanted zinc has been cut away and the plate mounted on a block of wood to bring it to type height

Etching and powdering continue alternately until a sufficient depth of metal has been etched away, and the lines stand out in bold relief. The resisting material is then cleaned off, revealing the face of the plate in the condition in which it is used for printing. A proof is immediately taken, and this is "pulled" in a manner similar to that used by printers. The block is inked by means of rollers, and an impression taken on a sheet of smooth-surfaced paper. The pull is carefully compared with the original drawing in order to make sure that it is an exact reproduction.

The next step is to remove unwanted metal. High-speed cutting machines called "routers" are used for this purpose. The actual cutting tool makes 20,000 revolutions per minute, and with it the operator "routs" away the zinc until the lines of the design are surrounded only by a narrow rebate, or edging of metal.



Drawings of sections across a zinc plate, showing successive stages of the etching process. The lowest drawing shows how Dragons' Blood is applied between the etches

The plate is now ready for the final operation, the object of which is to bring it up to the height of the types with which it is to be printed. This is done by mounting it on blocks of hard wood. Nails are driven through holes drilled in the rebate in order to hold the plate firmly on its mount. A final proof is then taken on art paper, which has a superfine surface that is likely to show up any defects in the block; and when these have been approved the block is ready for despatch to the printers.

Although it is possible to obtain very artistic effects by the careful use of thin lines for shading, zincos suffer from the drawback that they reproduce one tone only. In order to make them more attractive, blockmakers often introduce what are known as mechanical stipples. These are patterns of dots or dashes that may be laid on certain parts of a drawing in order to give a suggestion of a tone intermediate between black and white. They are often used on maps to distinguish land from sea. An excellent instance of this is the map showing the tracks of Cook's voyages in the Pacific Ocean, that appeared on page 1010 of the "*M.M.*" for December last.

The manner in which stipples are applied to blocks is very interesting. They are printed from thin sheets of celluloid, on which the pattern to be used is embossed, and are applied after the picture has been printed on metal. Those parts of the zinc plate on which the stipple is not to be engraved are painted over with a substance that is easily dissolved by water. The embossed film is then carefully inked and pressed gently into contact with the plate, in order to transfer the dots. The soluble substance is removed by washing the plate, and carries away with it the portion of the stipple that it received, leaving the pattern on the unprotected parts of the plate only.

The ink with which the stipple is printed is not acid-resisting and the plate is therefore dusted over with a light resin, that adheres to the dots while they are in a tacky condition. The resin is then melted by heating, when it forms a "resist," as photo-engravers term it. When etching takes place it protects the dots, which stand out on the surface of the finished plate, and thus impress the pattern on paper during printing.

Even with the aid of stipples the range of a line block is very limited, however. A comparison of a pen and ink drawing with a good photographic print shows that the former completely misses many intermediate tones and shades. Fortunately a process has been discovered that gives very artistic and satisfactory results. It is called the "half-tone" process, and to-day is almost universally used, especially for high-grade work on smooth-surfaced paper.

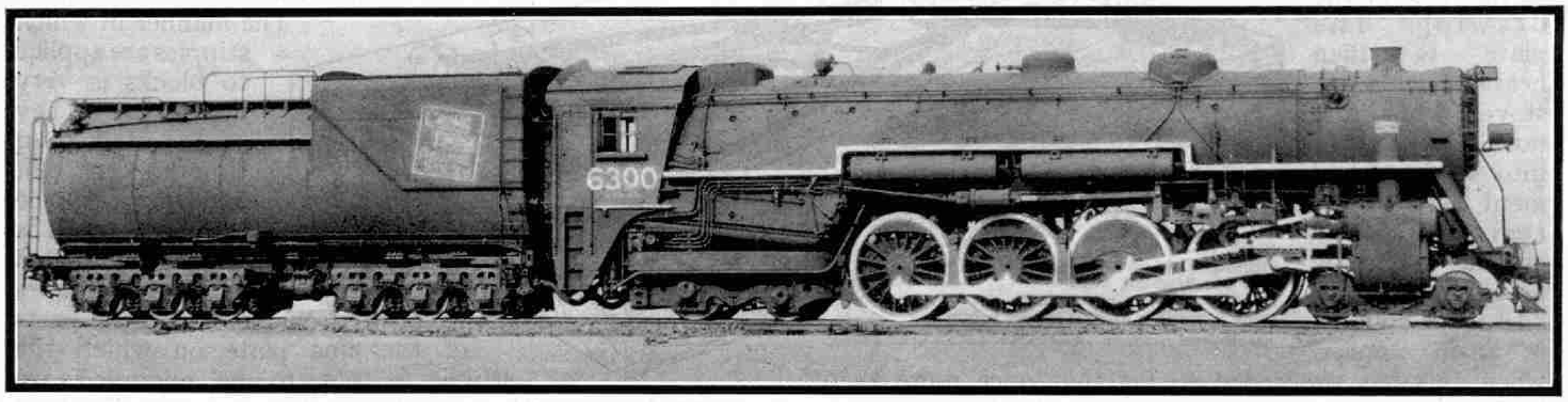
Half-tone blocks give impressions that resemble photographic prints in the faithfulness with which they reproduce the tones of original pictures. They are used for the majority of the illustrations in the "*M.M.*," and next month we shall explain the ingenious process by which they are made.

FAMOUS TRAINS: XXIV.

The "*International Limited*"

Canadian National Railways

By Cecil J. Allen, M.Inst.T., etc.



4–8–4 Express Locomotive, Canadian National Railways, "6300" class. This type is used for working the "International Limited" over United States territory between Port Huron and Chicago. For these and the other photographs illustrated in this article we are indebted to the Canadian National Railways

ONCE again those travelling bags of yours are to be requisitioned this month. We are about to make a trip over the largest railway in the whole world, and this makes it necessary for us to cross the Atlantic and set foot on the Continent that lays claim to one-half of the three-quarters-of-a-million miles of railway that have been laid, up to the present date, over the world's surface. The railway in question is the immense system in Canada known as the Canadian National Railways, incorporating the old Grand Trunk, the Canadian Northern, and various other lines.

Controlling as they do no less than 22,675 route miles of line, the Canadian National management are responsible for an aggregate mileage only less by a mere one thousand miles than the total length of all the railways in Great Britain. A very large proportion of the territory served by the Canadian National Railways is thinly populated, however, so that most of the Canadian National mileage is only single-tracked, and in the case of a large number of branches one passenger train each way per day—and sometimes one only on every alternate or every third day—suffices to meet the needs of the traffic. In fact, only 1,200 miles of the Canadian National lines are double-tracked.

Starting from Sydney, on the Atlantic coast in the extreme east of Cape Breton Island, from which the passage across to the mainland of Nova Scotia is made by train-ferry from Port Tupper to Mulgrave, the Canadian National can take you for the world's longest continuous railway journey over one railway system—4,127 miles—in its own trains throughout, to Prince Rupert, on the Pacific coast of British Columbia. The journey of 3,941 miles from Sydney to the better-known Pacific seaport of Vancouver can, indeed, be accomplished with but one change of trains intermediately, at Montreal. What is more, this is an "all-red" route, as throughout its traverse of the North American Continent the Canadian National main line concerned never once leaves Canadian territory.

At the same time the Canadian National authorities have vital interests in the United States. Most important, probably, and busiest of their main lines, is the one travelling south-westward from Quebec and Montreal up the River St. Lawrence and then along the north shore of Lake Ontario to Toronto, whence it continues through London—with a branch to Windsor, and Detroit, famous as the home of the Ford car—to Sarnia. Here the line burrows under the St. Clair River, connecting the lakes of Erie and Huron, by means of the St. Clair Tunnel, whence it passes into the United States and continues for 334 miles in U.S.A. territory to the great Middle West city of Chicago. From Montreal the whole of the 848 miles to Chicago are double-tracked throughout. Within United States territory the old name of "Grand Trunk" is retained, though the control is completely in the hands of the Canadian National Railways. It is over this route that we shall presently travel.

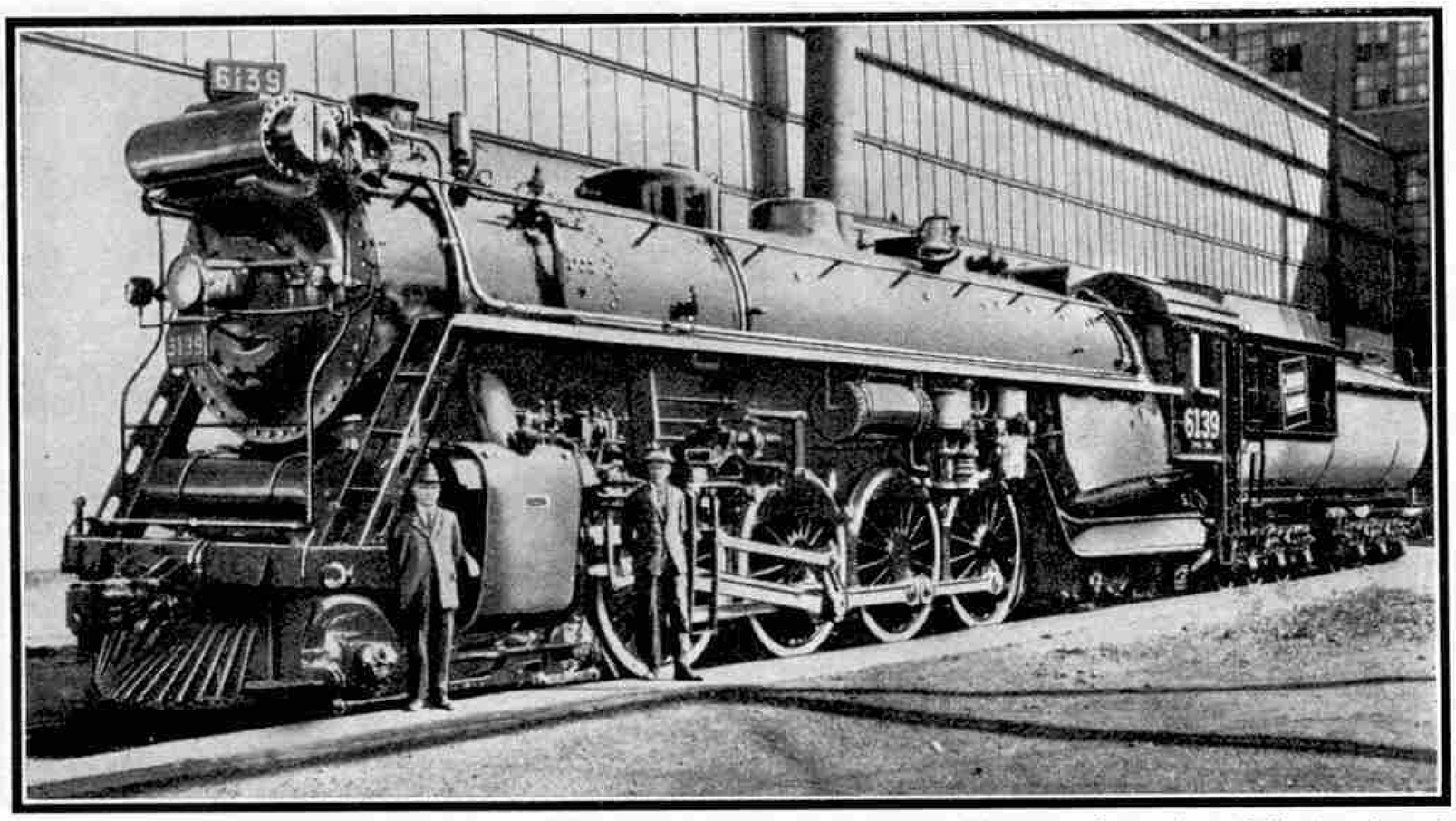


The latest type of C.N.R. Compartment Sleeping Car. The size and luxurious fittings of these cars may be judged by comparing this compartment with the best available on English trains

Dividing the bulk of the Canadian National system from the lines in New Brunswick and Nova Scotia and a part of Quebec, is the wide waterway of the River St. Lawrence. Below Montreal this is bridged at one point only. For many years there was no railway communication across the river east of the great Victoria Bridge at Montreal, over which passes the main flow of the traffic between the Maritime Provinces and the mainland of Canada. But of later years, in order to give direct access from Quebec to New Brunswick and the Atlantic seaboard, the more remarkable Quebec Bridge has come into being. The history of this structure is one of the great romances of modern engineering. We have

no space to deal with it here but the whole story is told and fully illustrated in the *"Meccano Book of Engineering."*

Meanwhile it is high time that we began to think about the train by which we are to travel. As we have already crossed the Continent by means of the *"Trans-Canada Limited"* of the Canadian Pacific, we will try a change of direction this time, and make use of the *"International Limited"* of the Canadian National Railways. The title is derived from the fact that the train directly connects two countries — Canada and the United States — running through between the Canadian cities of Montreal and Toronto and the American city of Chicago. We must be at Bonaventure Station at Montreal some time well before ten o'clock in the morning, when we are due to leave. Connecting trains, such as the famous *"Acadian"* and the *"Ocean Limited,"* have brought their through passengers from the Maritime Provinces; at Montreal they must change into the *"International Limited"* for the continuation of the journey.



4–8–4 Express Locomotive "Confederation" (6100) Class, Canadian National Railways. An engine of this type is used to work the "International Limited" throughout the 511 miles from Montreal to Sarnia without change

We are struck, first of all, by the difference between the station and the type of station to which we are accustomed in Great Britain. With the temperature well below freezing point, as it certainly is at this present moment, and possibly even below zero, no Canadian passengers want to wait for their trains on exposed platforms. The platforms themselves, therefore, are little more than pathways to the trains, raised very slightly above the tracks; but the interior of the station, designed on very palatial lines, would, we shall agree, put not a few of our British terminals in the shade.

The first effect of the low platform is to emphasise the size of the rolling stock used in America. Certain of the coaches in our train are of all-steel construction, up to 80 or 82 ft. in length and no less than 75 to 78 tons in weight, as against the maximum of 70 ft. and 45 tons—in the case of the heaviest dining and sleeping cars—in Great Britain. Every one of these coaches, we notice, is carried on 12 wheels. Although we can see that the gauge between the rails is equal to the British 4 ft. 8½ in., yet the height available, beneath bridges and tunnels, in which to build the rolling stock, is 15 ft. 3 in., as compared with a maximum of 13 ft. to 13 ft. 6 in. in the Home Country. In America, too, there is width available on each side of the track more than in proportion to the increased height. The absence of platforms, which in England cut off 3 ft. 6 in. of the height of the vehicles standing at them, adds yet further, as just mentioned, to the apparent height; so that in mounting the Canadian cars by the flight of steps provided at each end we feel pygmies indeed in contrast to such enormous coaches.

In America, by the way, the term "coach" has a definite significance. It indicates the lowest grade of passenger travel, such as the British third class. But the best trains are composed almost exclusively of Pullman cars of various types, and against some of them we read in the timetables the singular note "no coaches." This does not indicate a kind of "Ghost Train," but merely that on this particular service no carriages of the ordinary type are run, and that extra fare must be paid by every passenger for the use of Pullman accommodation.

Our *"International Limited"* is composed entirely of Pullman and first-class accommodation. Its formation will vary according to the season and the number of expected travellers, but may be taken as an average of 12 vehicles, two of them being baggage cars, two first-class passenger cars, a dining car, two "parlor" or drawing-room cars, four sleeping cars, and on the rear a compartment car (all the others are open cars) with a library and an observation platform at the back end. The tare or empty weight of this train of 12 vehicles is 850 tons, or 350 tons heavier than the very biggest expresses worked in normal service in Great Britain.

But it is the engine that is by far the most impressive feature of the turn-out. Easily the biggest and most powerful locomotive that we have yet seen on one of our *"Meccano Magazine"* journeys—and the biggest passenger locomotive in the British Empire until displaced quite recently by another Canadian type that is very slightly larger—the Canadian National "Confederation" class weigh, with their tenders, 289 tons each in full working order. Eight coupled driving wheels are provided, in order that there may be sufficient adhesion weight to transmit to the rail the power developed in two 25½ in. by 30 in. cylinders; and not only is the engine provided with a leading bogie, but a bogie is also necessary at the rear end to carry the enormous firebox. The wheel arrangement is therefore 4–8–4, as compared with the 4–6–2 type that represents the biggest development of passenger power in Great Britain to present date.

Leading Dimensions of 4-8-4 Express Locomotives Canadian National Railways

	"6100" type Canadian Section	"6300" type Western (U.S.A) Sec.
Cylinders, dia.	25½ in.	26½ in.
„ stroke	30 in.	30 in.
Driving Wheels, dia.	6 ft. 1 in.	6 ft. 1 in.
Heating Surface, tubes	3,814 sq. ft.	4,171 sq. ft.
„ „ firebox	315 „	314 „
„ „ superheater	1,117 „	1,388 „
„ „ total	5,246 „	5,873 „
Firegrate Area	84.4 „	84.3 „
Working Pressure, per sq. in.	250 lb.	250 lb.
Tractive Effort, at 85% Wkg. Press.	56,785 lb.	60,190 lb.
„ „ (with booster)	67,700 lb.	
Adhesion Weight	103¾ tons	104¾ tons
Tender, Water Capacity	11,300 gals.	13,500 gals.
„ Coal „	20 tons	20 tons
Weight of Engine in working order	173¼ „	178 „
„ Tender „ „	116 „	119½ „
„ Engine and Tender	289¼ „	297½ „
Length „ „ over all	94 ft. 1½ in.	94 ft. 1½ in.

There are differences innumerable to be noticed between American and British locomotive practice. Starting at the front end, there is the feed-water heater, carried across the front of the smokebox in the only position available for its accommodation. Below we see the powerful electric headlight and the "cowcatcher," which together are a reminder that railways in the American Continent are not fenced as they are in this country, so that it is necessary to provide against the presence on the track of the "trespasser," and for seeing possible obstructions ahead. Mounted on the top of the boiler is a large bell, which clangs dismally as we approach the many "grade" or level crossings on the route, and as, in certain places, we actually proceed at a snail's pace along the streets of the towns.

Looking behind the wheels, we notice that the main frames of the engine are formed by an assemblage of steel bars, now usually composed of various sections of steel castings firmly bolted together. The "bar" frame is the American alternative to the British plate frame. All the wheels are exposed to view by the high level of the "running-plate," on to which the driver can step by a door in the front of the cab; and the engine appears to carry a large proportion of its parts distributed in somewhat unsightly fashion over its exterior. But there is reason for this, as the parts thus disposed externally are much more easily got at for repairs and attention than in their concealed positions on many British designs.

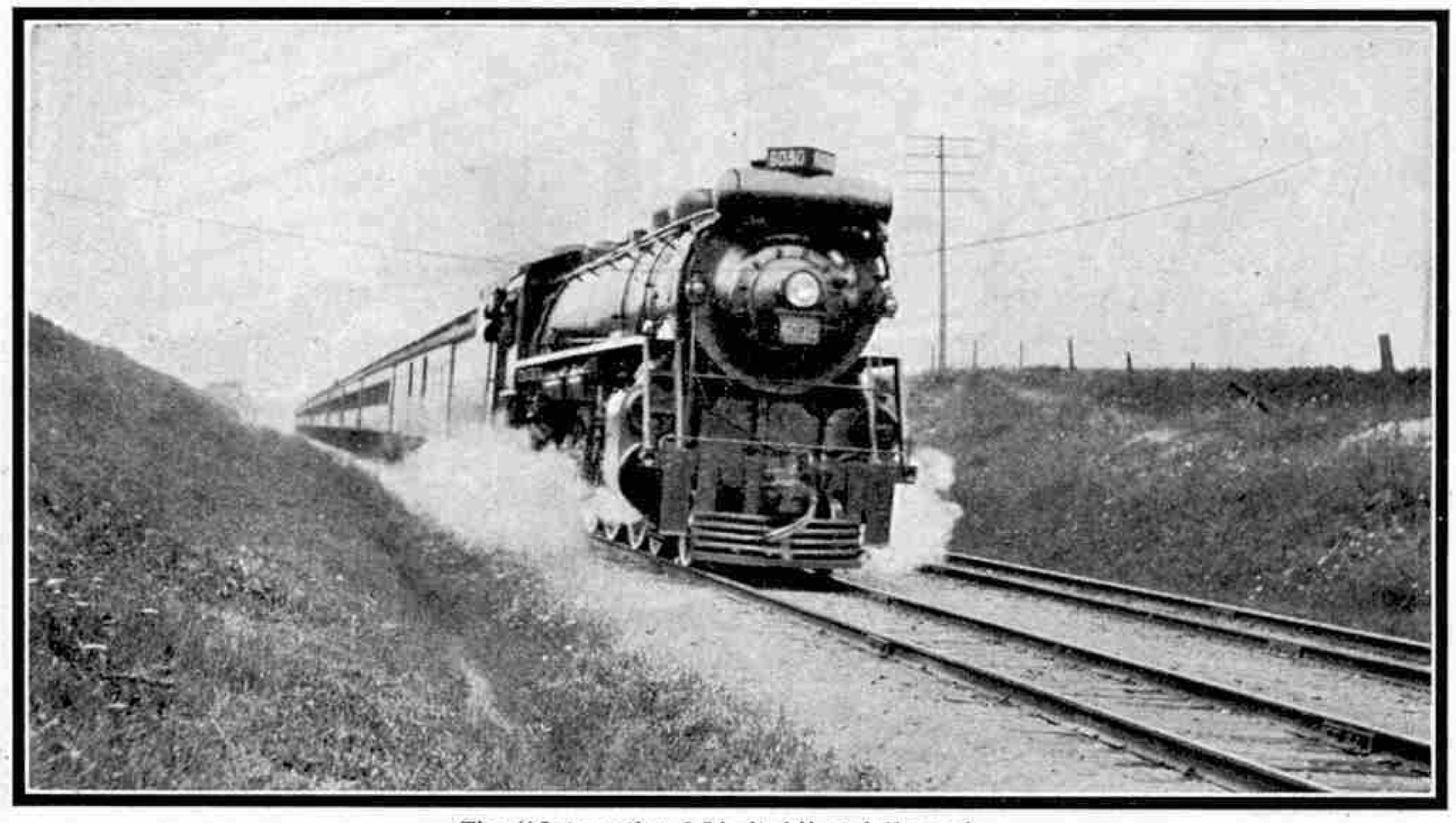
The rear pair of bogie wheels under the firebox of the engine

are provided with driving power of their own. A small two-cylinder engine is attached to the rear bogie truck, and provides valuable assistance to the main cylinders of the engine when the latter is starting or tackling heavy grades with our enormously heavy train. As soon as the train gets into speed, the driver—or, as he is called over here, the "engineer"—can, by means of suitable gearing, cut the auxiliary engine out of mesh altogether, just as you might bring your free-wheel into operation on your bicycle; so that it does not oppose any frictional resistance to high speeds nor does it constitute a perpetual drain on the steam supply of the boiler. In expressive American language, the small two-cylinder engine is called a "booster," because it helps to "boost" things up at the start. It has been tried in Great Britain, and is fitted to "Atlantic" No. 4419 and the two large "Mikado" (2–8–2) freight engines of the L.N.E.R.; in all three cases driving the rear pair of wheels. The "Confederation" class engines are rated as capable of hauling sixteen 12-wheeled cars on these trains, with a total weight behind the tender of at least 1,150 tons.

The tender of the "Confederation" is in itself a study. It is carried on 12 wheels, and we see that for the most part it resembles a vast steel barrel. This is the water-tank, capable of accommodating 11,300 gallons of water at one time. On the top of the tank, at the forward end, is arranged the coal space, where 20 tons of coal is the maximum provided for. It need hardly be said that no fireman is capable of handling manually the amount of fuel consumed by a locomotive of proportions such as these. Automatic stoking is, therefore, provided, a conveyor passing the coal from the tender direct into the firebox. The rate of feed is under exact control by the crew, and can be varied according to the relative severity of the work to be performed by the locomotive over each section of the journey. There is also equipment for shaking up the fire-grate, to prevent the formation of clinker.

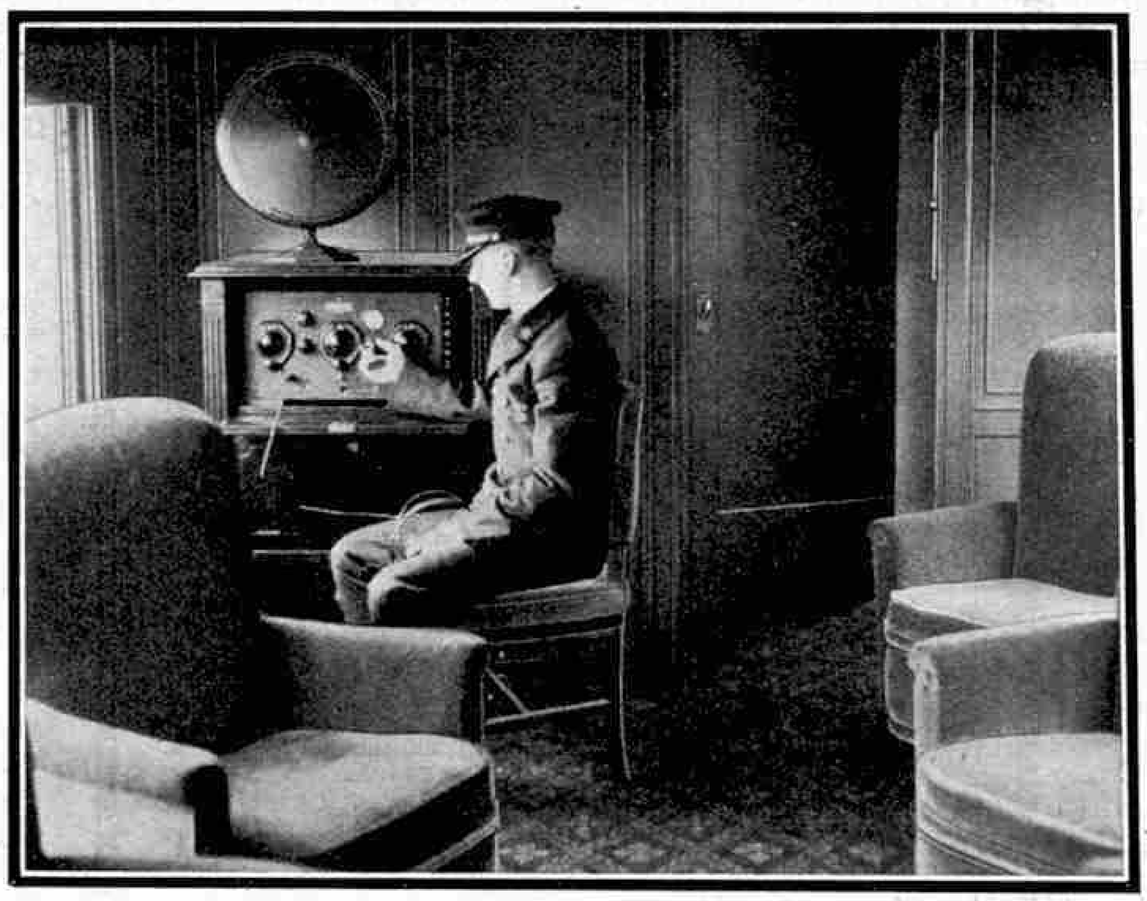
As we board our car, we are welcomed pleasantly by a black-skinned conductor; most of the jobs of this kind in America are carried out by negroes, and efficiently and well, too. We may have reserved a sleeping car berth, of which as yet we can see no signs; or a "drawing room," which is a separate compartment at the end of the car, with four berths; or, yet again, a single-berth sleeping compartment, of the type to which we are accustomed in Great Britain, and which is just now coming into use in Canada. The supplementary price for the three grades of travel rises in proportion to the privacy afforded. So, at ten o'clock in the morning, we get away from Montreal. To our ideas, the start may be somewhat jerky, but getting on the move these heavy all-steel American trains, with their rigidly-coupled cars, is not an easy business even for so gigantic a locomotive as one of the "Confederations."

The fastest running of the "*International Limited*" is made over the 334 miles between Montreal and Toronto. Here the country is level, and the Canadian Pacific also run a service between the two cities, the trains by the competing routes being actually within sight of each other over certain sections of their journeys, with results that can be imagined! We need not expect any non-stop runs of great length, as facilities must be given to many important towns intermediately. Actually we make 14 stops in the 334 miles, the longest run without a break being the 46¼ miles from Cornwall to Prescott, covered in 51 minutes, at an average start-to-stop speed of 54.4 m.p.h. This is also the fastest point-to-point booking of the whole trip. It is 5.40 in the evening when we run into Toronto, our average speed to this point, inclusive of all stops, being 43.6 m.p.h.



The "International Limited" at full speed

We may be surprised, on going to look at the engine in the 20 minutes' wait allowed at Toronto, to find at the head of the train the same engine that pulled us out of Montreal. And not only so, but to our astonishment it is not being detached even yet. One engine of the "Confederation" type works the "*International Limited*" right through without change over the 511 miles from Montreal to Sarnia, at the Canadian frontier, the complete trip taking 10 minutes under 13 hours. The return journey is made on the following day. Needless to say, the same engine-crew do not work through; enginemen are changed three times, at Brockville, Belleville and Toronto. The last stage, from 6.0 to 10.50 p.m., is the longest continuous spell.



The radio operator at work on the "International Limited" Express. As explained in the article, the C.N.R. are the only system in the world to control their own extensive radio service

After leaving Toronto, before or after dinner, we very likely gravitate to the observation car, where we find an attendant manipulating a fine radio set up in one corner, and each arm-chair equipped with head-phones. The Canadian National Railways are the only system in the world to control their own extensive radio service. Eleven broadcasting stations send out their programmes, from Moncton in the east to Vancouver in the west, and these programmes are picked up in the chief express trains for the amusement of passengers. The radio has another use, too, in that it enables the management of the railway to keep in touch with their employees all over this huge system, many of them located in very isolated and in some cases almost inaccessible places.

Of the eight stops between Toronto and Sarnia, the most important is at London, where through day coaches and parlor cars are detached for Detroit, and are replaced by sleeping cars from Detroit for Chicago, 20 minutes being allowed for the marshalling. Sarnia is reached at 10.50 p.m., and here at last our hard-worked steed is detached from the train and replaced by an electric locomotive for the three-mile journey through the St. Clair Tunnel to Port Huron. Another 4–8–4 locomotive, of a slightly different type, is awaiting us on the other side of the river, and will haul us over the final 334 miles from Port Huron to Chicago. On crossing the United States frontier we put our watches back an hour in order to agree with the time observed in (*Continued on page* 34)

A Wild Night Ride with "Cyclone" Harmon

And The Good Resolution It Led To

By H. W. Pontin

BUSINESS on the R.S. and V.R.R. was booming. More and more specials, heavy laden with fruit, were speeding eastward, and the increasing traffic called incessantly for more drivers, who were recruited from the ranks of the most experienced firemen. Fortunately there was an adequate supply of locomotives in good condition and new ones were already arriving from the builders.

One day Billy Weedon floated into Corson City just in time to have his name put down on the "extra" list as fireman. Billy had fired before, but he was what is known as a "boomer." He simply loved to wander, and he never remained in any one place long enough to call it home.

It was not long before Billy was informed by Tom Kirby, engine despatcher, that he must be ready for a call at any time, and while giving this information Kirby expressed the hope that Billy, for his own good, would never fire for "Hank" Harmon, known as the "Cyclone" of the mountain division.

"Why not?" demanded Billy.

"Well," said Tom, "the 'Cyclone' has the reputation of being a speed merchant; in other words, whatever else you do, bring your life insurance policy with you!"

"Well," replied Billy, "I guess I can ride just as fast as he can."

But in spite of his apparent unconcern, Billy was just a little worried as he walked towards his room. Shortly afterward he went to his bed so as to be prepared for the call for duty whenever it came.

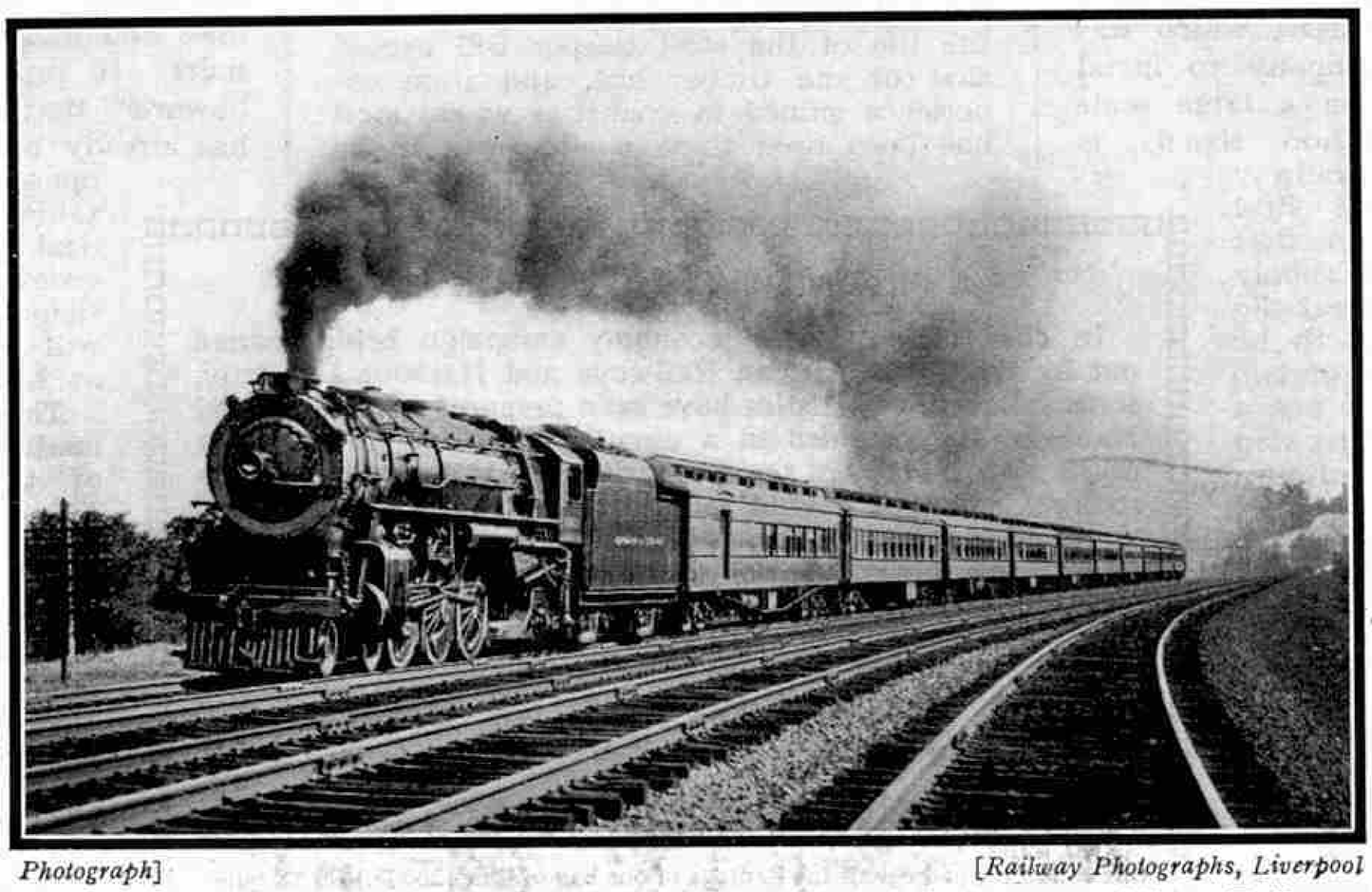
The next thing Billy remembered was a violent shaking and a rough voice in his ear: "Wake up, you. You're called for a fruit special east, engine 1672, with 'Cyclone' Harmon. If ever you rode in your life you'll ride to-night, my lad!"

Billy jumped out of bed quickly and made his way to the station restaurant, but he did not live up to his usual custom of eating a hearty meal. The fact was that he did not feel altogether easy in his mind. Arriving at the engine house he soon discovered "1672," one of the R.S. and V.'s new "Pacifics," and climbing aboard he met the "Cyclone" face to face. "Cyclone," a tall red-headed individual, was in the act of filling his oil can in preparation for the run. "Well Bo, where are you going?" he demanded.

"With you," said Billy, trying to feel unconcerned.

"Well son, I hope you come back with me," was the ominous reply from the "Cyclone" as he climbed down to oil around.

By this time Billy was feeling thoroughly unhappy. He had ridden fast before, but somehow this was different—a strange road, a strange engine, and this wild-looking driver! His thoughts were soon interrupted, however, by the return of the "Cyclone." Leaving the yard, "1672" nosed her way through the gathering dusk, and on reaching the terminal backed on to 19 refrigerator cars all marked New York. The conductor announced that all was in readiness, and getting under way "1672" soon made the mile posts fly. Billy was kept busy trying to keep pace with the "Cyclone's" heavy "batting," and soon they were hitting the 70 mark.



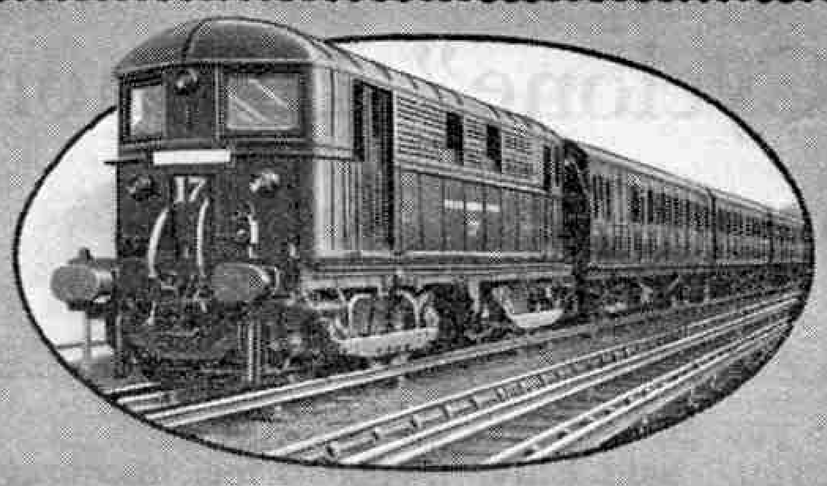
Photograph] [*Railway Photographs, Liverpool*

The "*North Shore Limited*," a famous American Train, of the Boston & Albany Railway. New Pacific type engine (No. 595) passing Western Park, Mass., U.S.A.

Billy leaned from the side of the cab for a much-needed breath of fresh air, and to his astonishment he noticed the next signal at "caution." He quickly told Harmon, but the latter simply ignored the warning. Another glance showed Billy that the next signal was dead against them, and the blood surged to his temples as, without the least slackening of speed, they thundered on. Then, in the distance, he saw what unmistakably were the tail lights of a freight train! Just then Harmon opened the whistle wide and, as the last car of the freight train crawled into a siding, it seemed that the flagman had barely time to throw over the switch for the onrushing "1672." Grinning widely, "Cyclone" gave his engine a little more steam.

On and on they flew, mile after mile. They were now approaching Saybrook River drawbridge and Billy saw with horror that the bridge was against them, with a tug just passing through the draw. "Cyclone" blew the whistle again and again, and slowly the great drawbridge swung towards them. Would it line up in time? Just as it seemed that all was over "1672" flashed on to the bridge and a second later was speeding beyond! Billy's heart was now throbbing painfully and he found it difficult to breathe; but still Harmon's face wore the same grin.

On and on they went, tearing (*Continued on page* 37)



A METROPOLITAN TRAIN

RAILWAY NEWS

Steel Sleepers for the Southern Railway

An initial order for 70,000 steel sleepers, equal to 5,000 tons of steel, has been placed by the Southern Railway with a British firm. The Southern, which was the first main line company to instal colour-light signalling on a large scale in place of the semaphore signals, is thus the first British railway company to adopt the steel sleeper in preference to that made of timber. The supply ordered will enable about 35 miles of selected track to be equipped over a period of two years. Although this is not a great amount, it is the first step towards a new avenue of production for the British steel industry.

A ton of steel equals about 14 sleepers, and costs about £11, the sleeper complete costing about 15/6. The "chair" is integral—unlike the wooden sleeper, to which it must be separately fixed—and only the "key" and two small plates remain to be provided.

The price of timber sleepers has been increasing, on account of shortage, and a further point in the present innovation is that all the most suitable timber is foreign. With the double view of avoiding the higher costs in future, and helping, if possible, a British industry that is far from flourishing, the Southern Railway have for some years been making experiments with steel sleepers on the London-Portsmouth line, over which pass the heavy "King Arthur" type locomotives, and the most modern rolling stock. The results having satisfied their technical experts, the directors have approved the first substantial order for steel sleepers, and money that hitherto has gone abroad will now stay in Britain.

When it is remembered that the annual consumption of sleepers on railways in Great Britain is in the neighbourhood of 4,000,000, it will be seen that, if only 10 per cent. of this total were steel sleepers, it would mean an order to the British steel industry of about 30,000 tons of steel every year.

At the present issue price of timber sleepers, with the necessary chairs and fastenings, and assuming an equal life of 20 years for the steel and timber article, the cost of installation and maintenance, including renewal, is about the same. If the price of timber sleepers increased by only 6d. however, there would be a considerable saving in favour of the steel sleepers, not only in the initial outlay but also in maintenance and renewal. It is anticipated, however, that the life of the steel sleeper will exceed that of the timber one, and from experience gained in countries where steel has been used there would seem to be every likelihood of this. In Germany it is estimated at 30 years. On the other hand, if steel sleepers become general in Britain, it is reasonable to assume that the price will go down, which will enable still further economies to be effected.

Metal sleepers have been employed for many years on main lines in various tropical countries where timber sleepers are liable to the disastrous attacks of the white ant. The appetite of this insect is truly remarkable, and the most elaborate preserving processes for the timber do not stop but only slow down its activities. In such parts of the world sleepers of iron or steel are very necessary, because even the white ant has to admit defeat when faced with metal.

A PRACTICAL ECONOMY CAMPAIGN

In connection with an economy campaign being carried out by the South African Railways and Harbour Company, some interesting statistics have been prepared by the General Manager and included in a circular issued to all members of the staff. Many of the comparisons instituted are certainly striking and they cannot fail to impress upon all who read the circular that economy is worth while even in the smallest and cheapest articles. We have only space to quote a few representative items from the list.

In revenue, the cost of :—

One lead pencil equals the haulage of one bag of maize for ten miles.
One penholder equals the haulage of one bag of fertilizer (200 lb.) for five miles.
One packet of mixed pins equals the haulage of one bag of fertilizer (100 lb.) for 10 miles.
One large blotting pad equals the haulage of one ton of sand for 100 miles.
One small blotting pad equals the haulage of one ton of crushed stone for 27 miles.
One scribbling pad equals the haulage of one bag of lime (200 lb.) for 18 miles.
One shorthand notebook equals the haulage of one bag of cement (187 lb.) for 13 miles.
One truck buffer equals the haulage of ten tons of coal for 89 miles.
One coupling link equals the haulage of one ton of fertilizer for 65 miles.
One coupling pin equals the haulage of one ton of bones for 87 miles.
One coachscrew equals the haulage of one bag of coal (200 lb.) for 13 miles.
One fishplate equals the haulage of one ton of salt for 16 miles.

THIS MONTH'S RAILWAY STORY

Breathless Passenger : "Think I can catch the 10.20, porter ?"

Porter : "You might, sir, it's only had ten minutes' start !"

Japan's First Underground Railway

The first underground railway in Japan has been opened in Tokyo. Originally the system was built on experimental lines and had a total length of only 1½ miles. It proved to be so successful, however, that an extension of 1½ miles has already been completed and will be opened shortly. The undertaking has aroused a great deal of interest in the large cities of Japan and it is anticipated that smaller railways will be constructed before long at Kobi, and Yokohama.

The Tokyo railway has been modelled largely on the lines of the New York subways. The cars, of which there are at present only ten, in operation have seating accommodation for 60 passengers but during the rush periods are capable of carrying twice this number. The stations at present in use are fairly roomy and the platforms have been built to take six cars at a time. They are only temporary structures, however, and will be replaced by permanent stations as soon as the new extension is in working order.

* * * *

Pennsylvania Railroad Electrification Scheme

The Pennsylvania Railroad Company have announced their decision to electrify all their track between New York and Wilmington, Delaware, at a cost of approximately £20,000,000. The distance between these two places is 325 miles, and the scheme equals the electrification of about 1,300 miles of single track. The work will take at least six years to complete and will be carried out in sections, the busiest areas being dealt with first. This will be the biggest scheme of electrification ever undertaken by any railway company in the world and it is stated that probably the whole of the Pennsylvania Company's track, totalling some 21,000 miles, will ultimately be operated by electric trains.

In order to operate the route, 365 new electric locomotives will be required, of which 165 will be used for passenger services and the remainder for freight trains. The freight locomotives will be capable of hauling trains consisting of as many as 125 cars at a speed of 25 miles an hour.

First-Class and Third-Class Fare Averages

According to the recently published Railway Returns for 1927, the average first-class fare received on British railways was 5s. 5.56d., while the average third-class fare was 1s. 2.42d. The average yearly sum paid by a first-class season ticket-holder is estimated to be £28 7s. 7d., the corresponding figure for a third-class holder being £11 5s. 4d. By way of amplification of these figures "*The Engineer*" has calculated that £32.18 is earned in a year by every third-class seat but only £24.58 by each first-class seat.

* * *

Relative Costs of Travel in Europe

The German Travel Bureau have put forward the claim that third-class travel on German trains is cheaper than third-class travel on any other European system. In Germany the approximate cost of a third-class journey of about 185 miles is stated to be approximately 11/–. A journey of the same distance would cost 19/– in Norway, 14/3 in Switzerland, 12/3 in Holland, 12/– in Italy, and £1/3/6 in England! Although the cost is so much higher than in Germany it must be borne in mind that English third-class carriages are a great deal more comfortable than the corresponding German carriages, the latter being fitted only with non-upholstered wooden seats.

* * * *

Southern Railway Insulated Containers

The Southern Railway have put into service 100 new insulated containers for perishable traffic. The containers are mainly to operate between Southampton and London, and they will save a great deal of handling of produce. They are lowered into the hold of a docked ship and filled with frozen meat, and are then transferred to the train and carried to London, where they are placed on lorries and transported to Smithfield Market.

The containers are capable of carrying a load of approximately 3½ tons, and are about 21 cwt. in weight. They are 11 ft. 8¾ in. in length, 5 ft. 7⅝ in. in width, and 6 ft. 6 in. in height, and are fitted with a pair of air-tight double doors on each of their four sides. Insulation of the sides, roofs and doors of the containers is effected by a lining of cork, while the floors are insulated by sheets of asbestos.

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Short Station Names

In addition to the second list of short station names published in last month's "*M.M.*," there are, according to the "*Railway Age*," a number of two letter station names to be found in Denmark. They are "He" and "Ry" on the Varde Grinsted Railway, "No" on the Ringkobing Ornhoj Railway, Jutland, and "Ro" on the Ronne Allinge Railway, Island of Bornholm.

Fool-proof Signalling for Railways

An invention that possibly may have an important bearing upon railway engineering by preventing a train from passing a "danger" signal, even if the driver be insensible or even dead, is attracting considerable attention in railway circles.

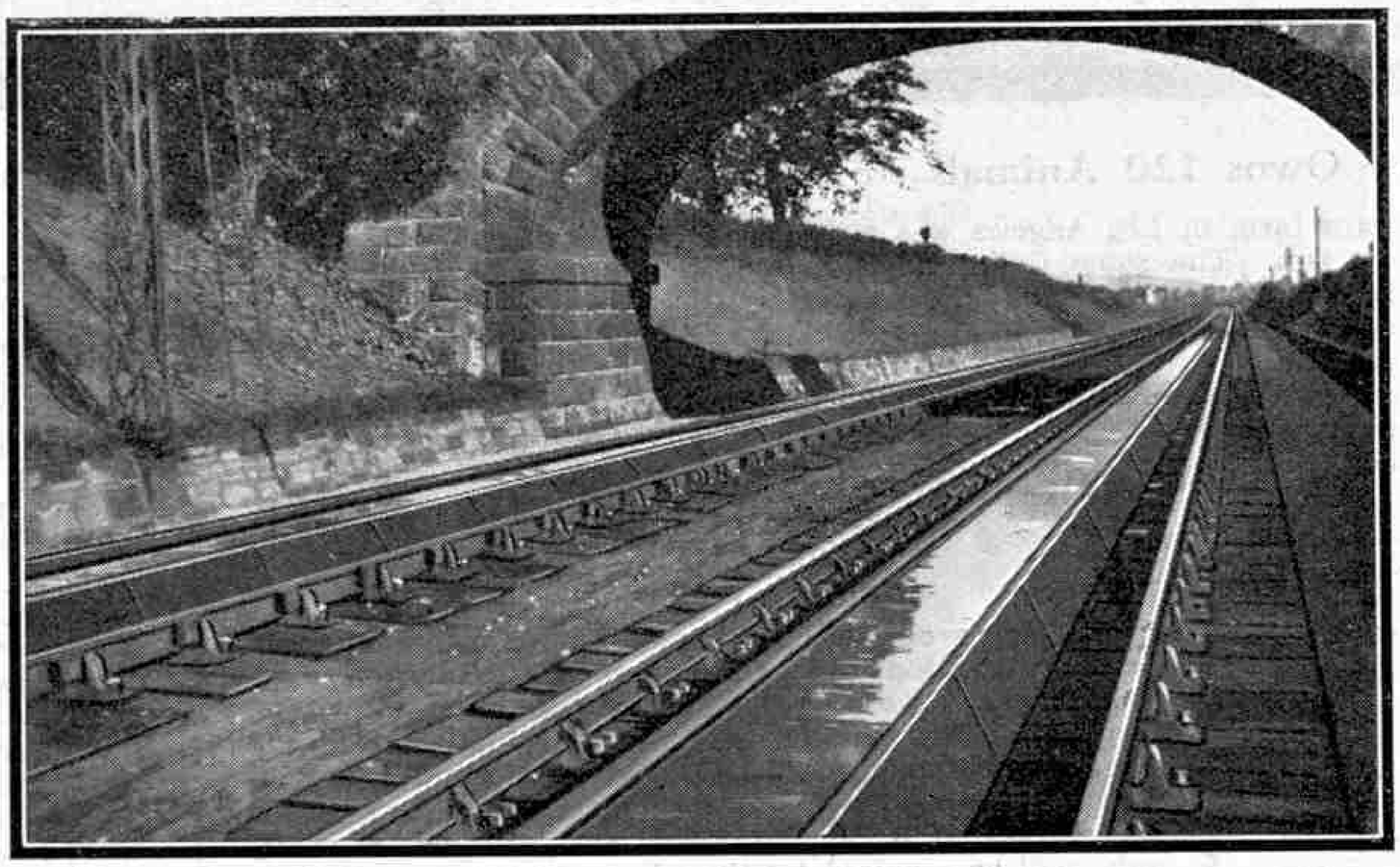
The system is worked by a selenium bridge which is placed by the side of the track at the base of the signal. A ray of light is played on the bridge in such a way that when the train passes the light is momentarily cut off, thereby altering the resistance in the bridge. This sets a relay in operation, the signal arm is raised and a light in the centre of the track is illuminated. This plays upon a second selenium bridge, and when another train enters the section and interrupts the ray of light a similar action takes place. This time it brings into play a mechanical relay, that automatically applies the brakes if the preceding train is still in the section. When the way is clear the signal is then automatically lowered and the light in the track is extinguished so that the brakes are released and the train proceeds on its way. This system works efficiently regardless of weather conditions, as the infra-red rays present in the beam of light are able to penetrate fog and so act upon the bridge to bring the train to a halt.

Another operation to which this system has been applied is that of switching on and off the lights of a train when entering or leaving a tunnel. In this case an artificial beam of light is not shone upon the bridge as the darkness of the tunnel causes the relay to function and the light to be switched on on entry, and the daylight causes the lights to be extinguished on emerging.

* * * *

Periscopes for Guard's Vans

The Southern Railway are equipping 50 guard's vans with periscopes to replace the old-style sighting glasses formerly fixed on the side of the van, and which frequently come dangerously close to tunnel walls.



A striking photograph of the London Midland and Scottish Railway water troughs at Carstairs, taken by an old reader, J. J. Cunningham. The great length of the troughs and the dead level nature of the ground are clearly indicated

New Type of Wagon for Heavy Loads of Small Bulk

A new type of well trolley wagon is being constructed at the Darlington works of the L.N.E.R. This wagon has been designed specially to carry heavy loads that are comparatively small in bulk and its capacity will be 150 tons. In order to prevent damage to the track, cantilever girders provided with balance weights are to be fitted so as to divide the total weight between four wagons. Each of these girders will be 76 ft. in length and will be fitted with a 25-ton weight so that 50 tons will be taken off the wagon-carrying load. The total length of the complete vehicle will be 225 ft. and it will be carried on 56 wheels.

* * *

All-Metal Grain Vans

There are now in use on the L.M.S. two grain vans of a new type constructed entirely of metal. They are filled with grain through sliding doors at the top and in order to ascertain to what extent they have been filled small windows are fitted on the sides. The obvious advantage of transporting grain in such a wagon as this instead of in the older type covered with a tarpaulin is that during the journey the wagon is impervious to any kind of weather. In addition the new wagons can accommodate twice as much grain, being able to contain 20 tons at a time.

* * * *

New Piccadilly Circus Tube Station

The new tube station at Piccadilly Circus, which is the largest underground junction in the world was formally opened a short time ago. The station is now capable of dealing with a daily traffic of 150,000 passengers and 1,600 trains, while twenty-four automatic ticket machines are provided. Six subways lead from the Circus to the station and five escalators are provided to carry passengers to a landing from where another six escalators carry passengers either to the Bakerloo or Piccadilly lines. Bakerloo is situated 80 ft., and Piccadilly 120 ft. below ground level. We hope shortly to publish an interesting article on the construction and equipment of this station.

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New Sidings for L.M.S.R.

The L.M.S. Railway Company have now brought into operation their new marshalling sidings at Gresty Lane, between Crewe and Nantwich. The marshalling yard already in existence at Crewe has also been enlarged, and the total cost of the scheme is approximately £60,000. Every wagon passing through the Shrewsbury and South Wales area will be sorted at Gresty Lane and considerable speeding-up of traffic is expected to result from the improvements.



Of General Interest

Lion Farmer Owns 120 Animals

An account of an alligator farm in Los Angeles was given in the "*M.M.*" for February last. The same Californian city is also the home of a lion farmer, but whereas the alligators bring profit through their hides when killed, the lions are only of value when alive, as the majority of them are trained actors and earn large sums in the film studios of Hollywood. One of them, in fact, has brought in £10,000 during the last five years!

The farm was started eight years ago by Mr. C. Gay, who for many years was associated with Frank Bostock, the famous English animal trainer. There are now 120 lions on the farm and the care of this large number is not an easy matter. Lions have highly nervous dispositions that vary considerably. Some are docile and affectionate, others merely tolerate human beings, while a few are definitely hostile and impossible to handle. Their principle food is fresh meat, and two horses are slaughtered daily to provide it.

In addition to the lions and the horses kept for their food, chickens and goats are reared on this strange farm. The chickens serve as occasional dainties for sick lions, while the goats are kept for the sake of their milk. Baby lions are bottle-fed and it has been found that goat milk is the most suitable food that can be given them.

Farms on which strange animals are kept are fairly numerous. On some of them such animals as the silver fox and the muskrat are kept for the sake of their fur, or angora rabbits for their wool. Perhaps the strangest of all farms are those devoted to poisonous snakes. The best known of these are in South Africa, Brazil and the United States, and their purpose is to enable anti-toxins to be prepared from the poison periodically squeezed out of the deadly fangs of the reptiles.

Over a Hundred Years Ago!

Buses a Century Ago!

"A steam carriage is shortly to commence running between London and this town. The machinery is contained in a very small compass, and is to propel the carriage at the rate of ten miles per hour. At every stage, instead of the old-fashioned way of travelling by changing horses, they will stop for the supply of coals and water. It is calculated that seven bushels of coals, only, will be required for the whole journey."—"HANTS. ADVERTISER," 27th Oct., 1827.

A New Invention

"A patent has been granted to a person in Somers Town, for a machine for making shoes, gloves, caps, and various other articles of leather, from one piece, without seam."—"HANTS. ADVERTISER," 27th Oct., 1827.

Before the Propeller

"A patent has been obtained by Mr. Roentgeres, a ship-builder, at Rotterdam, for an improvement in the construction of steam-boats; which consists in placing the wheels behind."—"HANTS. ADVERTISER," 6th Oct., 1827.

After the Disaster

"Operations have recommenced at the Thames Tunnel. The whole of the boxes have been satisfactorily replaced, and the miners are enabled to resume their situations without much apprehension of danger."—"THE TIMES," 6th Oct., 1827.

Over the Falls

"A letter from Montreal, received on Thursday, announces the grand spectacle of the sloop descending through the Falls of Niagara to have taken place, in the presence of 50,000 people. She struck at the entrance of the two rapids, and was ultimately dashed to pieces in descending the great pile. There were a few cattle, bears, and dogs on board."—"HANTS. ADVERTISER," 13th Oct., 1827.

Insects that Bury Themselves for 17 Years

In the eastern portion of the United States a visitation of a swarm of so-called 17-year locusts occurred during the summer of last year. The remarkable insect known by this name lays its eggs in rows in the twigs of trees and then dies. As the pupæ hatch they drop from the trees and commence to burrow in the ground. They stay there, shedding their coats every two or three years to give themselves room to grow, until 17 years have elapsed. Then they feel a strong desire to visit the daylight world from which they came, and they force their way out of the soil, finally growing wings and forming a swarm of destructive insects exactly as their parents did 17 years previously. After a few months of gay life they lay their eggs and then die and so the whole process is repeated.

Some 30 broods of this kind are known, each covering a more or less definite area and distinguished by a number. The brood that is expected to appear next year is known to biologists as Brood III, and centres chiefly around the State of Ohio; while Brood X, last seen in 1919 and due again in 1936, extends over the eastern states and as far south as Alabama and Georgia. The swarm that emerged from the ground last year was the one that is known officially as Brood II, and its previous visitation in 1911 is well remembered.

Myriads of the 17-year locusts constitute each brood, and so numerous are the swarms that when one settles on a road this becomes dangerous to motorists, who are liable to disastrous skids. The insects make their presence known by a burring rattle that is almost deafening at close quarters. Curiously enough, this sound is produced by the male insects only, the female being silent. A popular superstition regards the appearance of the locusts as a prophecy of war, for a dark brown marking on each fore-wing resembles the letter "W."

The insect is really a cicada, and not a true locust, which belongs to the grasshopper tribe. It is not believed to do much harm during its lifetime, although it sucks out the juices from the tissues of plants. The egg-laying process is very destructive, however, and many twigs are often broken, causing the loss of newly set fruit in orchards.

Explosive Cures Sea-Sickness

A Russian doctor has discovered that nitro-glycerine, the well-known explosive that enters into the composition of dynamite, is a very effective cure for sea-sickness. He gives sufferers a single drop of a one per cent. solution, and its effect is so remarkable that patients have been known to eat a good dinner within 20 minutes of swallowing the dose! Many other people have been protected from ill effects during stormy voyages by placing a drop of the solution on their tongues.

A drug that has a similar physiological effect is sodium nitrite. This is now being tried out on a large scale, and it is hoped that it will prove more successful in curing sea-sickness than the mixtures now sold for the purpose. Many of these are merely sedatives, and they are not always effective!

Atlantic Fish Invade the North Sea

A remarkable feature of the North Sea during the past few years has been the number of fishy strangers that have been caught in its waters. Many fishes, including hake and halibut, enter the North Sea for limited periods, either in search of spawning grounds or of food, while other fishes now seem gradually to be finding their way into it either singly or in small shoals.

Several kinds of shark are numbered among these fishes, including the basking shark, sometimes mistakenly called a sunfish. This is the largest fish found in the North Atlantic Ocean and it often attains a length of more than 30 ft. It does not possess the formidable teeth of its fierce man-eating relative and is quite harmless unless attacked, in which case a blow from its tail is liable to prove disastrous to the timbers of a small boat. Its name is derived from its habit of lying on the surface of the water with the arch of its back exposed.

Another shark comes from the Mediterranean Sea and is known as the six-gilled shark. It is now appearing in the North Sea in such numbers that it has found its way into the German fish-markets, for it is quite good to eat. A rarer visitor is the devil-fish of St. Helena and the waters of the South Atlantic Ocean.

These visitors are usually trawled from the deeper portions of the North Sea, particularly the Norwegian Channel, a strait more than 100 fathoms in depth that runs parallel with the Norwegian Coast. It is supposed that they have been carried into it by a strong deep-water current that flows from the Atlantic Ocean round the north of Scotland before turning south along the Norwegian Channel towards the mouth of the Baltic Sea. That this is the door by which they enter is made probable by the fact that some of the visitors are found actually within the Baltic Sea itself.

ANGEL FISH AT THE ZOO

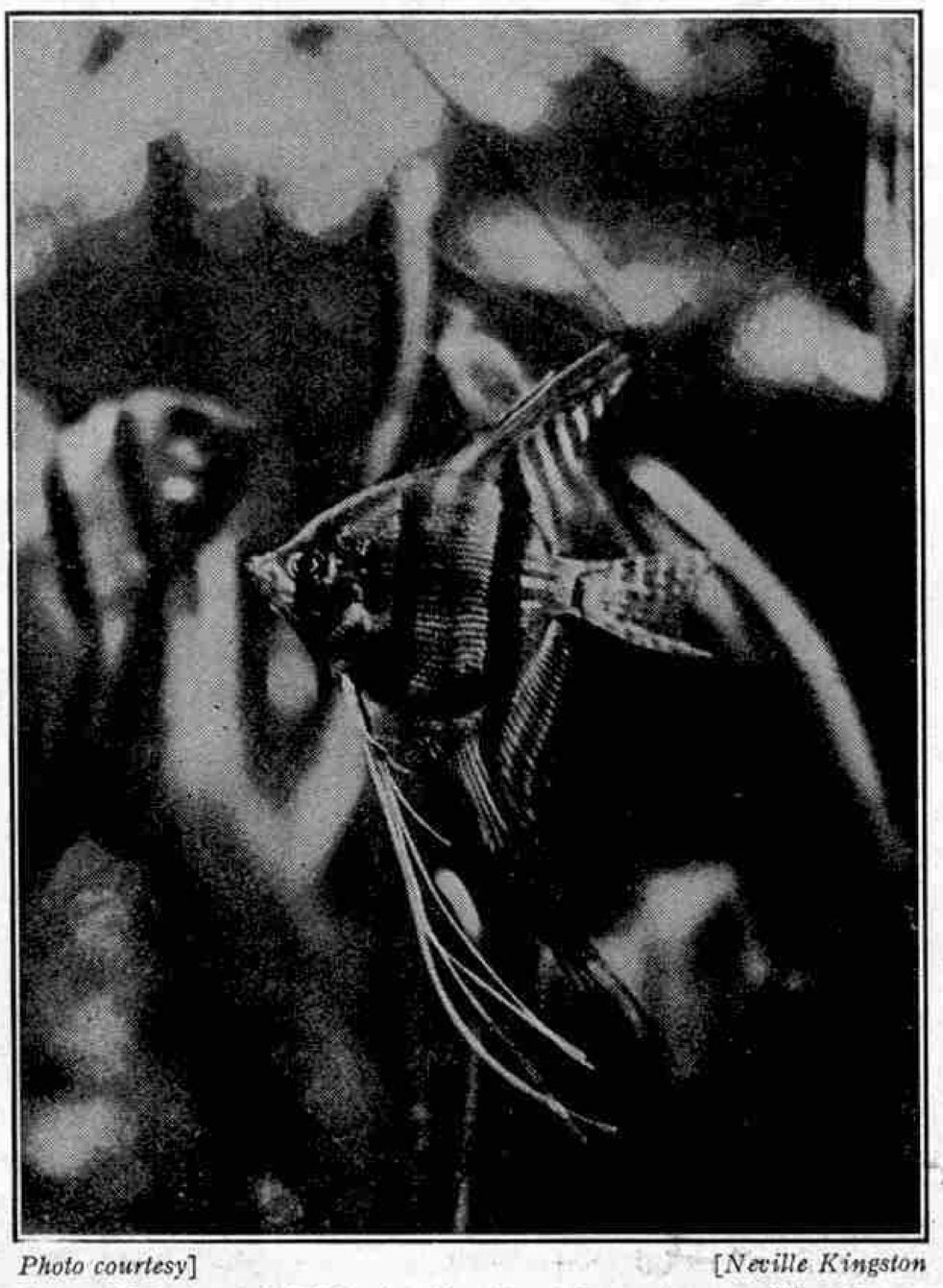


Photo courtesy [*Neville Kingston*

Beautiful Angel Fish in the Zoo Aquarium. The long, bony spines in front prevent the delicate lower fin from being damaged by the stones at the bottom of the water

A Whirling Dome of Rubber Flakes

Until a few years ago rubber was produced on the plantations by coagulating the milky latex collected from the trees by the addition of a preparation of acetic acid or by the action of smoke, and it was then shipped to industrial centres to be refined and used in various manufactures. Subsequently there was discovered a remarkably simple and rapid method of transforming the liquid by spraying it, and it is probable that increasingly large quantities of rubber will be manufactured by the new process on the plantations and in the countries to which the rubber is exported.

The method was first tried in New York on a single pint of latex from Sumatra, which had been prevented from coagulation during its long journey by adding to it a little ammonia. The experiment proved successful and eventually a plant was erected for carrying out the process on a large scale.

From the tanks of the ship in which it reaches New York from South America or the East Indies, the liquid is pumped into tank cars that carry it direct to the factory, which is in New Jersey. There it is stored in large reservoirs, from which it is pumped as required into a small tank situated on the top floor of the building. From this tank it flows through tubes on to the centre of a large aluminium disc that is placed in the spraying room below.

The disc is the central feature of the spraying plant. It is from 18 in. to 20 in. in diameter and is driven at 4,000 revolutions per minute. As the latex falls on the disc it is whirled off in minute drops by centrifugal action. The process is continuous, so that the drops form an umbrella-shaped dome stretching to the ground from just below the ceiling, where the disc is situated. Dry air heated to about 265°C. is pumped into the room and its action on the latex blizzard is to drive off the protecting ammonia in gaseous form, thus allowing coagulation to take place.

The floor of the room is covered with platforms 2 ft. in width, which are mounted on castors in order that they may be withdrawn from time to time and the layers of rubber formed on them stripped off. As these layers are formed by the accumulation of tiny flakes of warm and sticky rubber, air is retained in the mass, giving it the texture of a very fine sponge. This air is squeezed out in an hydraulic press and the rubber is then ready for vulcanisation.

An example of the advantages that follow from the importance of latex instead of crude rubber is supplied by the improvements effected in the manufacture of cord tyres. Formerly the cords forming the basis of these tyres were simply held together by a loose weft and buttered over with soft rubber; now they are fed continuously into the latex before this is coagulated. The liquid saturates them completely, and when coagulation has been effected the cord and the rubber have become integral parts of the tyre and it is practically impossible to separate them, even under the high stresses to which the tyres are usually subjected.

A London Landmark

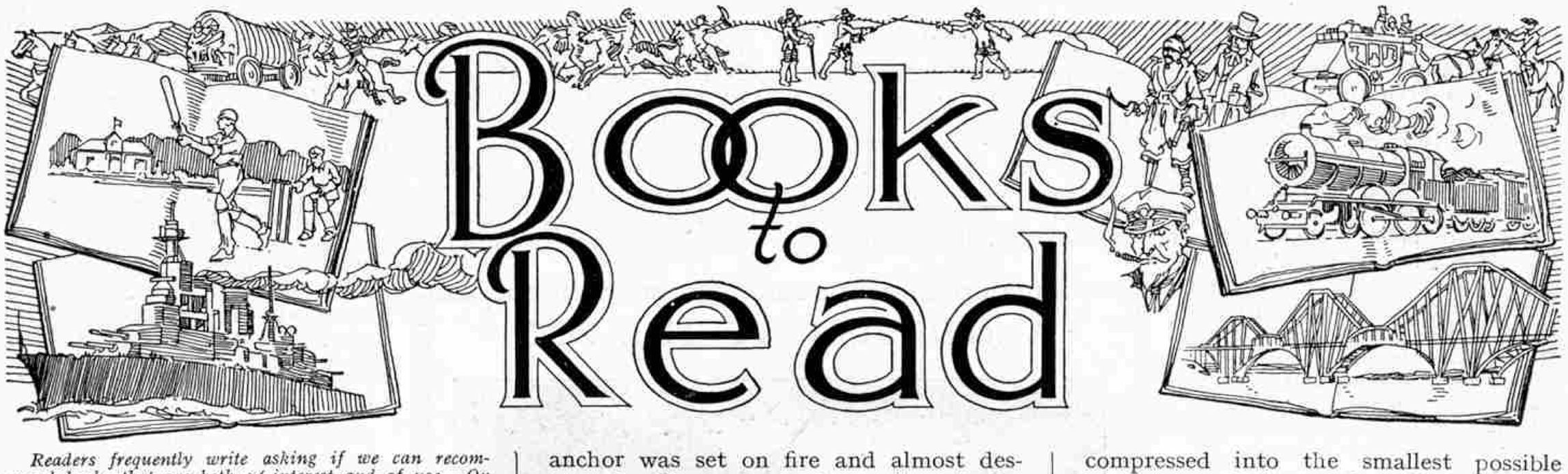
If Charing Cross Railway station is removed from the north to the south bank of the Thames, the famous Shot Tower, a well-known London landmark, may have to be pulled down to make room for it. The Tower is situated on the premises of a firm of lead and shot makers that was established in the year 1778. It is thus more than 100 years old, and it is satisfactory to know that it will be rebuilt on another site if the works of which it forms a part are disturbed.

The Tower is more than an ancient landmark, for lead shot are as necessary to-day as they were when the Tower was built. In making them pig-lead is melted in a room at the top of the Tower and poured through a colander, from which it falls in a silvery rain into a tub of water at the base. The drops of molten lead become more or less globular during their descent, and they retain this shape on solidifying. Afterwards the pellets are graded and polished by machinery.

Fly-Wings

It takes six million fly-wings to weigh a pound. This was discovered by Dr. Abbot, an American astronomer who used them in some experiments on the force of impact of light. Strange as it may seem, anyone who turns on the electric light in a dark room receives a distinct blow! Nobody has ever complained about it, for the simple reason that the light from an ordinary bulb is not strong enough to move a fly out of its course. The blow is real, however, and its energy may be measured if a material that is sufficiently light to be moved by it is used. Dr. Abbot found that fly-wings answered this need admirably, and actually succeeded in measuring the energy radiated by many different sources of light.

The pressure exerted by ordinary electric lamps and other earthly sources of light is of no importance, but the case of a glowing mass such as the Sun is quite different. He actually radiates 120 billion tons of himself away every year, and has been doing so for millions of years! Fortunately he is so large that even this huge loss is scarcely noticeable.



Readers frequently write asking if we can recommend books that are both of interest and of use. On these pages we review books that will specially appeal to readers of the "M.M." We do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

"The Wonder Book of the Navy"

(Published by Ward Lock & Co. 6/-)

This is a new edition of a book that has proved to be a very popular member of "The Wonder Book" family, and the subject justifies the prediction that the new edition will repeat the success of its predecessor.

Ever since the Great War, which taught us how much we owe to the Navy, many changes have taken place. The great ships that fought at Jutland have now been outclassed by new battleships, such as the "*Nelson*" and the "*Rodney*" and the mighty cruiser "*Hood*." Aircraft and submarines have developed, too, and in many other ways the Navy of to-day is very different from the Navy of even a few years ago. Only the spirit of the Navy remains, however, and our sailors are still as ready as ever to go anywhere and do anything. As Earl Jellicoe says in his interesting foreword: "This book is intended for boys and girls, but it will, one hopes, make the same appeal to children of larger growth for it deals with the subject about which nobody can be too well informed or understand too thoroughly."

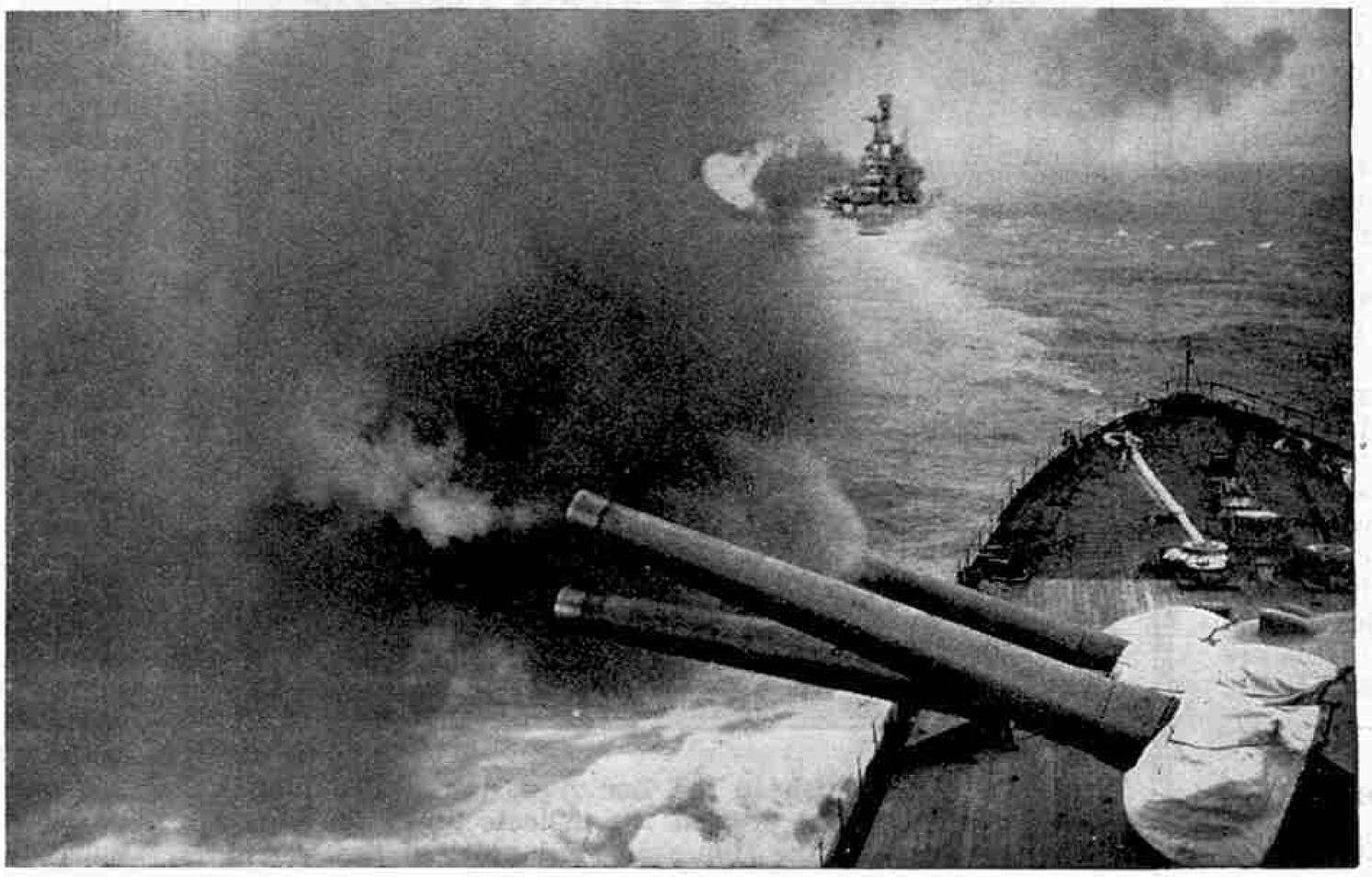
The book contains 12 pages in colour and there are some 300 illustrations. The articles are simply written by naval officers and experts, and cover such subjects as the Day's Round Aboard Ship; What a Naval Battle is Like; The Navy's Guns; The Navy as a Career; Life and Work in a Destroyer; How a Warship is Navigated; A Day in the Life of a Midshipman; Wireless in the Navy, etc.

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"Rival Schools at Schooner Bay"

By R. A. H. Goodyear (3/6 net)
(Ward Lock & Co. Ltd.)

"*Rival Schools at Schooner Bay*" centres around a ship's anchor and a silver casket that were kept as treasured relics at Scudfleet School. One Guy Fawkes night the casket disappeared and the anchor was set on fire and almost destroyed. There was no clue to the culprits, but suspicion fastened upon certain members of a rival school. Naturally enough, strong ill-feeling sprang up between the schools, resulting in some very exciting episodes and strenuous times for the people chiefly concerned. The solving of the mystery and the ultimate destination of the casket form the material for a rattling good yarn in which the interest is maintained to the last line.



H.M.S. "*Renown*" firing her 13 in. guns. From "The Wonder Book of the Navy" (reviewed on this page)

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"Slogger and Co."

By St. John Pearce (5/- net)

"*Slogger and Co.*" is a tale that should be read by all boys who love cricket. The real cricket atmosphere is well maintained throughout and the necessary thrill is provided by an exciting and at times breathless hunt for a lost stamp collection of great value. The excellent illustrations add considerably to the interest.

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"The Holiday Book for Boys"

Edited by Druce Raven
(Nelson & Sons Ltd. 2/6)

This is really a very remarkable book, and for its size it is probably unique in the amount of ground it covers. Starting with outdoor hobbies, it deals with camping, cycling, sketching, photography, fishing, swimming, and boat sailing. The chapters devoted to each subject contain an immense amount of useful information compressed into the smallest possible compass, and the various hints are obviously the result of practical experience. The remainder of the outdoor section deals with birds and their eggs, the collecting of butterflies and moths, and the rules of rugby, soccer, cricket, golf and lawn tennis, with interesting hints on the playing of each game.

The indoor section contains far more items than we have space to enumerate. Commencing with a survey of a great variety of games, interesting suggestions are given for the organising of concerts, plays, and miscellaneous entertainments. We then pass on to a very interesting list of books worth reading and a curious section dealing with the old-fashioned games over which our grandfathers used to get so excited. An "Odds and Ends" section is packed with hints on all kinds of topics, and the final chapter gives some thoroughly sound and sensible advice on how to keep fit. The book contains four coloured plates and a large number of diagrams.

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"Marvels of Modern Mechanics"

By H. T. Wilkins
(Published by Fisher Unwin. 10/6)

We live in an age of inventions and mechanical marvels that a short time ago seemed to be impossible or existed only as the fantastic dreams of some romantic novelist. It is not so very long ago, for instance, that Jules Verne wrote "A Voyage to the Moon." In those days such a trip was beyond the wildest dreams of even the most imaginative person, but to-day we find scientists discussing the possibility of sending a huge rocket to the Moon.

This book is an attempt to set out in an interesting manner the romance of some of the wonderful inventions of our time. Among the subjects dealt with are the Wonders of Radio; the Romance of Excavation; Surveying Unknown Seas; Wonders of Marine Salvage; the Sun's Secrets, including some account of ultra-violet rays and photo-therapy; the Strange Powers of the Gyroscope; and much else of absorbing interest.

"The Railwayman"

By S. T. James (Nelson & Sons Ltd. 6/- net)

This addition to railway books is a welcome change to the usual type, for it tells us of many railway matters in a new style and describes in a most interesting manner the work of the railwayman by night and day on the iron-way. There are chapters dealing with life in the locomotive sheds; the fireman's job; the art of the driver; thrills of the iron-way; surveying and building; railway detectives and their work; time-table errors; a peep behind the scenes, and many similar subjects.

There is plenty of humour, too, as for example, in the story of a station-master who was aroused one dark winter night with the alarm that a train was on fire near his station. The blazing train was shunted into a siding and here the station staff grimly fought the flames. They found in the course of their operations that there were swords, rifles and other military equipment in some of the vans. Breaking into another van they saw, to their horror, a mass of figures in scarlet uniforms in a corner—obviously soldiers overcome by the smoke. After desperate efforts the first of the soldiers was rescued and was found to be a dummy! So were the others—the whole contents of the train was the stock-in-trade of a travelling circus!

In the chapter on railway detectives and their work we learn that there are over 3,000 men employed on our railways as policemen and detectives, quite a good number being drawn from Scotland Yard and other special training grounds. These men are stationed at important railway centres and their lives are exposed to all kinds of discomfort and at times to no little bodily danger. Most of the time is spent in enquiring about merchandise that has been lost in transit. Railway crime was never more frequent than it is to-day and there are many clever thieves to be dealt with. In 1927, £10,000 in the form of bank notes was stolen from a Great Western Mail Train between Cardiff and Paddington. Then again £10,000 worth of valuables was stolen by a skilful gang of Continental thieves, the actual theft being carried out by two guards who confessed to many previous robberies, so skilfully executed that suspicion would have been hard to justify.

The book is one of the most interesting of its kind that we have read for many a day and it manages to impart a great deal of information in a most interesting manner. It is illustrated by a number of excellent full-page plates that add greatly to its attractiveness.

"The Schoolboy's Pocket Diary"

(Charles Letts & Co. 1/6)

The Schoolboy's Pocket Diary for 1929 fully maintains the high reputation of the well-known firm of Letts. As in previous years, its pages are packed with an astonishing variety of information, ranging from Latin, Greek and French verbs to a very complete list of sporting and athletic records. Included in this section is an alphabetical list of record athletic performances at the principal British public schools. This will be of great value to enthusiasts, and will enable them to make interesting comparisons between the performances of athletes of their own and other schools. Another notable section deals with careers for boys. The steps that must be taken to enter them are explained, and valuable information is given in regard to the prospects in various professions.

The diary pages themselves are made attractive by short illustrated paragraphs on a great variety of subjects. Among other things, these explain many puzzling facts of natural history, and give instructions for making a boomerang, a sunshine recorder, and a simple weather glass. In addition, a number of amusing and easily-performed electrical tricks are described.

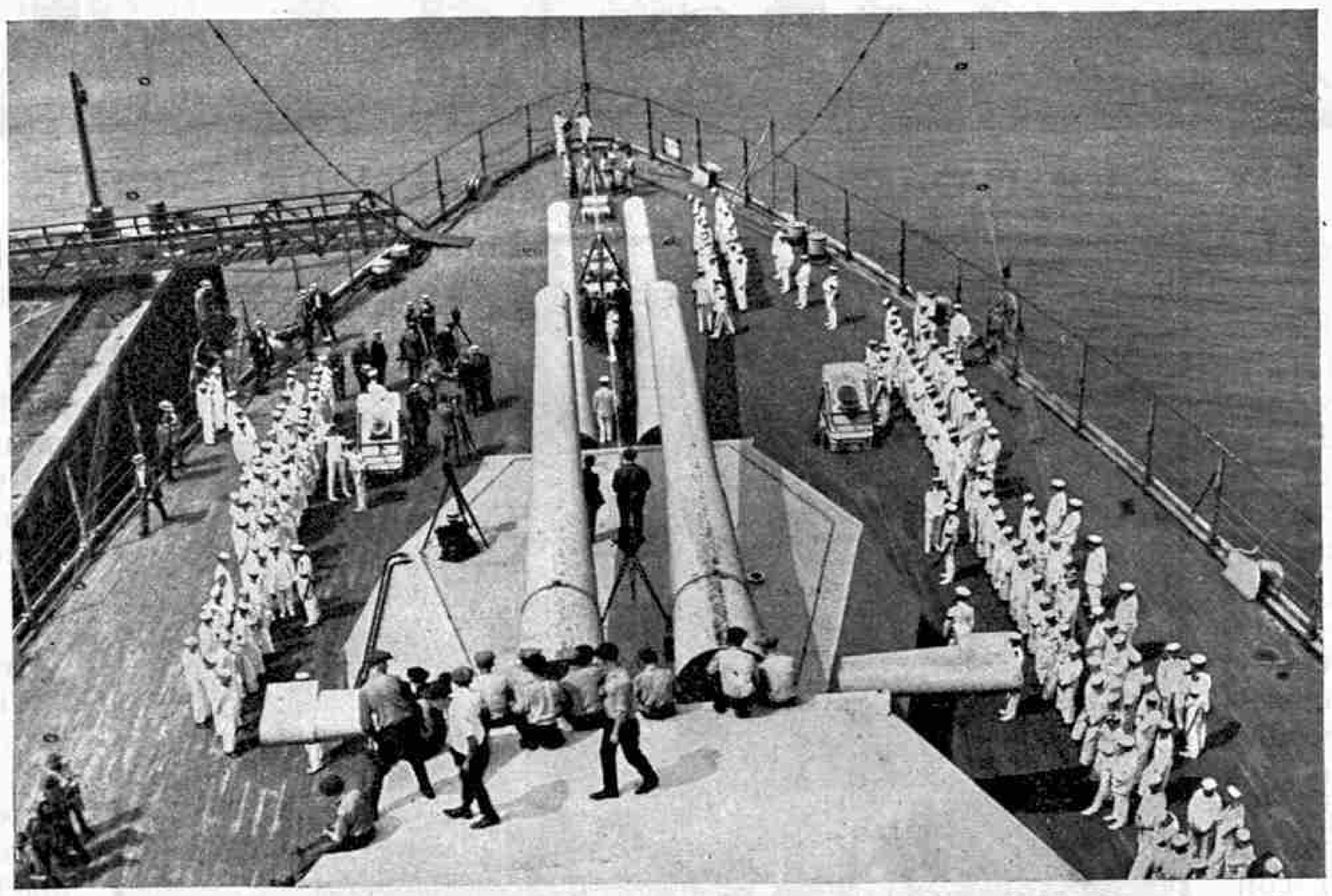
* * * *

"Gulliver's Travels"

By Dean Swift. (Ward Lock & Co. Ltd. 6/- net)

We were pleased to see a new edition of this splendid book which, although written many years ago is still full of interest. Everyone is interested in big people and even in our nursery days we liked best those stories that had to do with wonderful giants. All the big people are interested in little people and even the biggest men (big either in body or in mind) are nearly always really little people at heart. Dean Swift found out all this many years ago and we all love his wonderful stories of Lilliput, the land of the little people and of Brobdingnag, the land of the giants. Gulliver's adventures are so real, and the whimsical people are so life-like, that we almost forget as we read that both these countries are in the land of make-believe. Perhaps this is because—as the ancient philosophers tell us—fancy is sometimes nearer to truth than fact! In any case, "Gulliver's Travels" makes splendid reading, and to those who think as well as read the story conveys some useful lessons.

This edition is beautifully illustrated with 48 coloured plates that will appeal at once to young and old. There are 344 pages of delightful entertainment and the book is a welcome addition to the famous "Prince Charming" series of coloured books.



Two pairs of 16 in. guns on the U.S.A. battleship "*Colorado*." From "The Wonder Book of the Navy" (see previous page)

* * *

"Heroes of Modern Adventure"

By H. Tiltman and T. C. Bridges (Harraps. 7/6)

In this book are related the narratives of some great adventures by sea and land during recent years. The stories are told of Sir Alan Cobham's flights to the Cape and Australia; Lindbergh's flight across the Atlantic; Lawrence adventuring in Arabia and Mitchell Hedges battling with giant deep-sea fish. In it we may also read of Cherry Kearton photographing wild life in the heart of Africa and the Court Treatt's Expedition by motor car from the Cape to Cairo. The Arctic and Antarctic explorers dealt with include Amundsen and Stefansson, also Captain Evans, who was a member of Scott's last expedition. The thrilling feats of these and other explorers in unknown lands are recounted and fascinate us.

"Every boy is an adventurer at heart," says the Authors' foreword, "and it is not surprising therefore that the present generation of explorers and travellers have performed feats of courage and endurance at the ends of the earth, as fine as any in the records of the hardy pioneers of former generations. These living explorers of our own and other lands have, indeed, accomplished journeys which will go down in history among the great stories of exploration."

The book is well illustrated and will thrill any boy interested in the exploration of unknown lands and seas.

Interesting New Books

We hope to deal with the undermentioned books in an early issue.

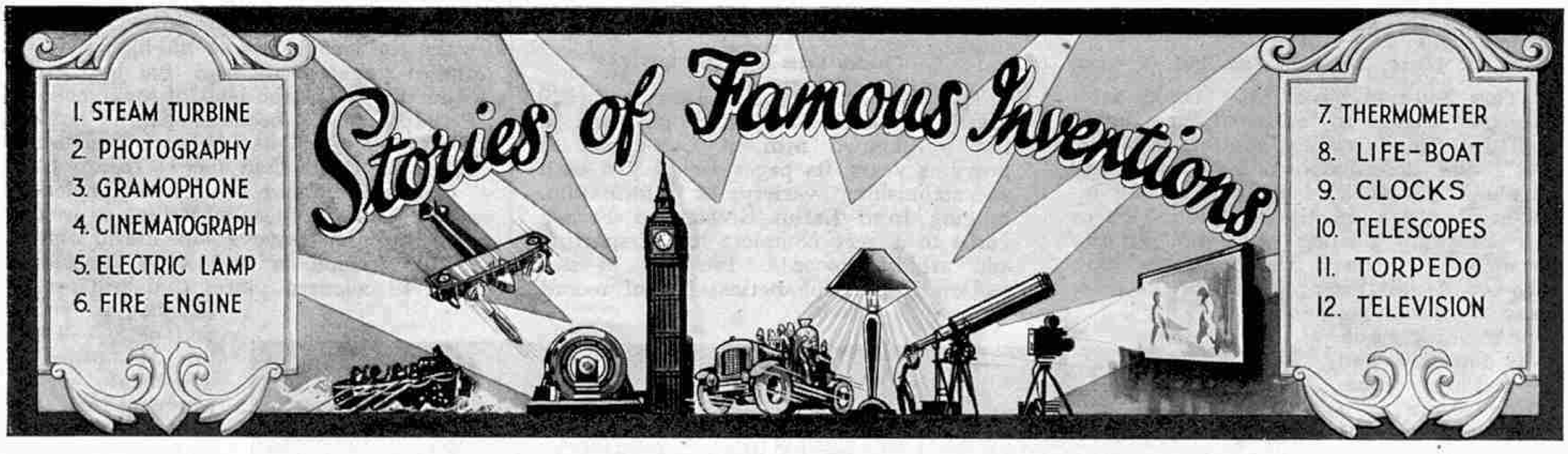
"Patty Who Believed in Fairies" D. MacCormac (Dent), 5/6

"Gay Neck, The Story of a Pigeon" *by* Mukerji (Dent), 6/-

"The Story of the Hive" *by* Canning Williams (Black), 6/-

"White's Selborne for Boys and Girls" *by* Marcus Woodward (Blackwell), 7/6

"Two Essays in Early Locomotive History" *by* C. F. Dendy Marshall (Locomotive Publishing), 12/6



IX.—FIRE FLOATS AND CHEMICAL FIRE ENGINES

THE modern fire engine is a remarkably efficient machine, but in spite of the great power of its pumps and the extensive range of its turntable ladder it is at a serious disadvantage in dealing with buildings that stand flush with a waterway. A great many immense warehouses and similar buildings stand in such situations along the banks of rivers or canals, and their contents are not only extremely valuable but in many cases of an inflammable nature. The necessity of being able to attack a fire in such a building from the water side was realised when organised fire-fighting became established in this country during the 18th century.



Illustrations courtesy [*Merryweather & Sons Ltd.*

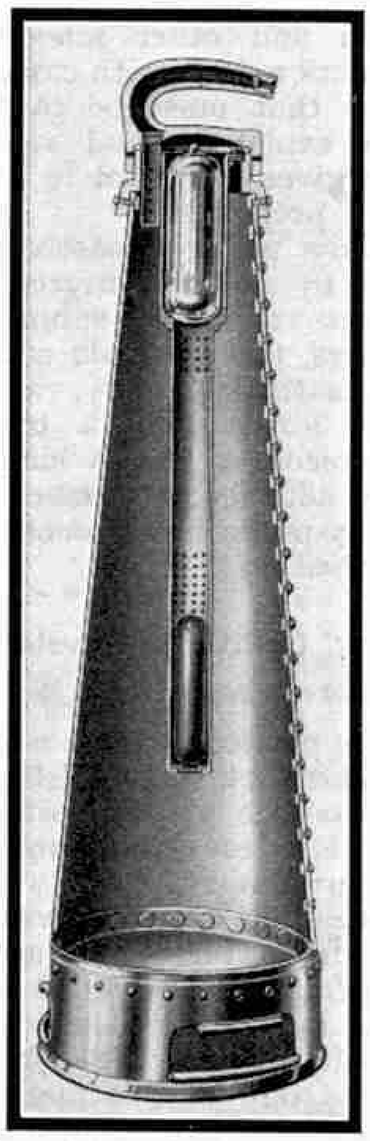
The destruction by fire of Boulton and Watt's Mill, London, in 1791. The illustration shows a hand-operated fire float in action

The earliest fire floats were merely large rowing boats in which a hand-operated pump was installed. The vessel was rowed as near to the burning building as possible, the hose was then connected to the pump, and the free end of the suction hose was immersed in the river. While one or two men worked frantically at the pump, others held the delivery hose and directed the feeble jet of water on to the burning property.

A hand-operated fire float of this type was used in conjunction with land fire engines to combat the disastrous fire at the historic Albion Mill, London, on 2nd March, 1791. This mill was situated on the bank of the Thames near the south-east end of Blackfriars Bridge and was owned by Boulton and Watt, the Birmingham firm who were pioneers of steam engine construction.

It was equipped throughout with steam-driven corn milling machinery and it was intended to demonstrate to corn millers the great superiority of steam power over water power. When the two steam engines installed were working together, the mill could deal with 150 bushels per hour, an output that was far in excess of that of any other mill at that time. The mill commenced operations early in 1786 and seemed assured of a profitable future, but its career was abruptly cut short by fire five years later.

There appears to be little doubt that the mill was fired deliberately by people who feared that the new machinery would deprive them of employment. The outbreak occurred in several parts of the structure simultaneously, and at the time of low tide in the Thames when the drawing up of water was most difficult. Further than this, it was discovered subsequently that the main cock of the water system of the mill had been securely tied up.



Sectional view of a modern portable chemical fire extinguisher

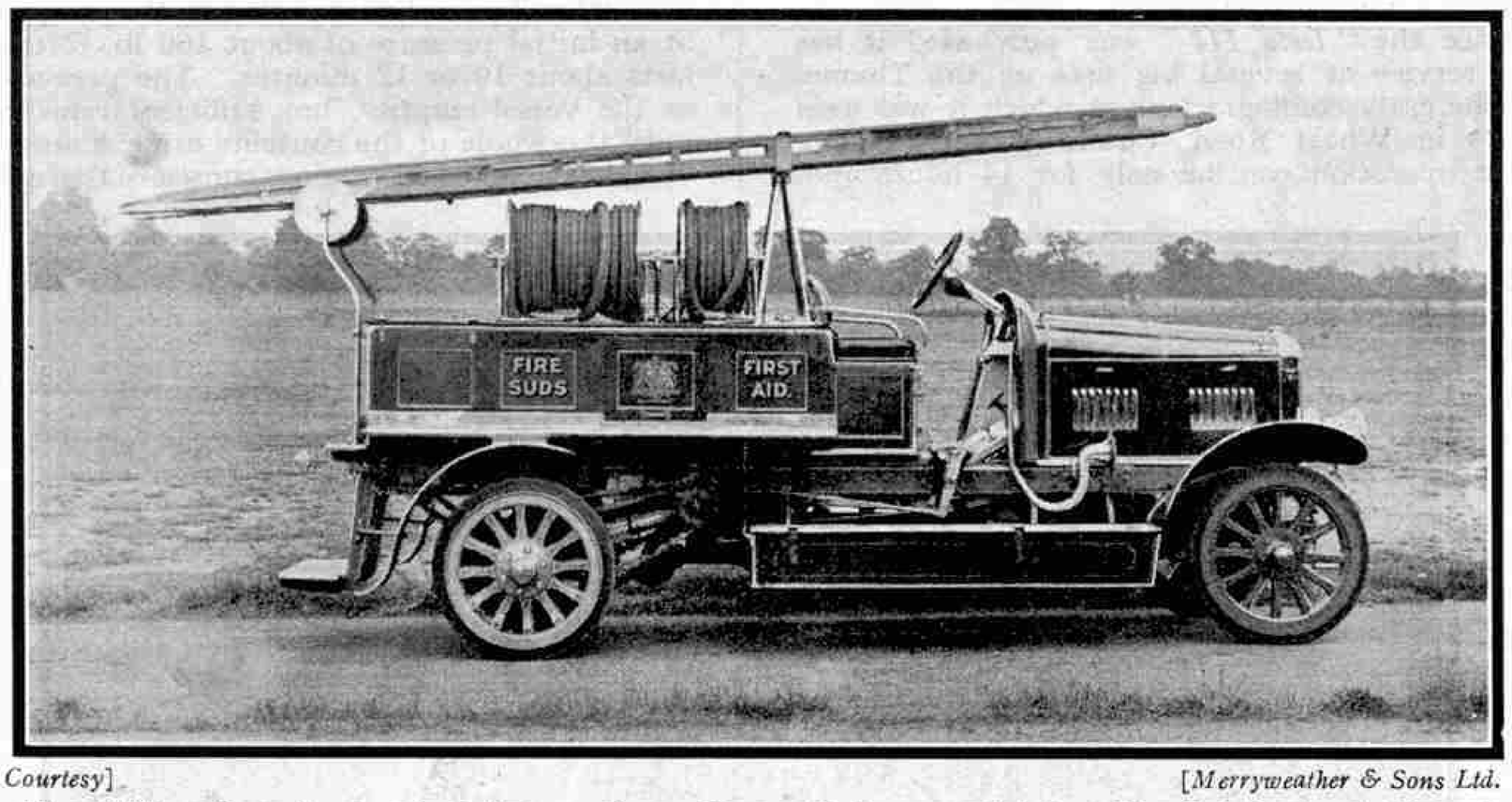
The destruction of the Albion Mill meant a loss of £6,000 to Boulton and £3,000 to Watt, in addition to smaller misfortunes to minor shareholders. A substantial reward was offered for information regarding the culprits but it was never claimed.

One of the first steam floating fire engines built in this country was made by Merryweather and Sons Ltd., in 1841, and was supplied to Cronstadt. C.F.T. Young, in his book *"Fires, Fire Engines and Fire Brigades,"* says of this interesting craft:—

"It consisted of an iron hull 60 ft. long by 16 ft. beam, in which the engine, fitted with three working barrels 7½ in. diameter × 14½ in. stroke, was placed. These pumps were worked by means of four cranked handles 12 ft. long with 18 in. radius, connected to three 6 in. cranks by means of toothed gearing. Each pair of cranked handles was provided with a fly wheel 6 ft. in diameter to equalise the motion, and the handles were fixed at 90 degrees relatively to each other. The engine was placed in the middle of the hull,

which had both ends alike to avoid the necessity of turning, and two paddle wheels were placed nearly amidships, on the shaft of which bevelled wheels were fitted, capable of being put in gear with the crank handles when the pumps were disconnected. On the upper end of the air vessel was a revolving T piece carrying two nozzles, on which two lines of hose could be attached if needed. When used with a $1\frac{1}{8}$ in. jet a vertical height of 120 ft. was reached, and a horizontal distance of 136 ft."

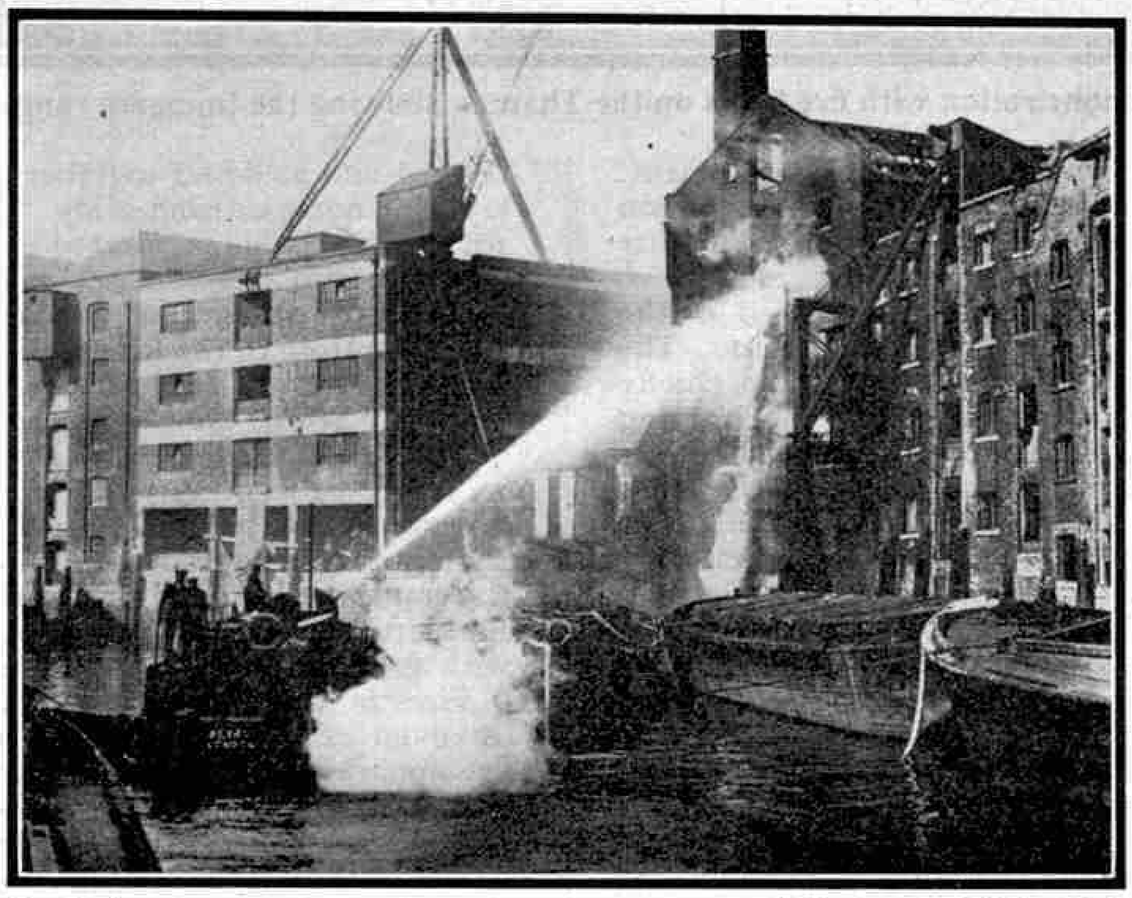
In time the use of steam fire floats became more general. Vessels carrying pumps of greater power and provided with better hose were produced, and they were used not only to combat fire in riverside buildings but also to battle with outbreaks of fire that occured in vessels in harbour and dock.



Courtesy] [*Merryweather & Sons Ltd.*

The "Fire Suds" chemical fire engine. The cylinders containing the Sulphuric Acid and Bicarbonate of Soda are enclosed in the box-like body of the machine

As described in the "*M.M.*" of November last, the motor-driven fire engine is now gradually superseding the steam machine, and a similar change is taking place in respect to fire floats. The latest fire float to be added to the London Fire Brigade's fleet is a motor-driven vessel. The "*Beta III*," as it is named, is a twin screw vessel 70 ft. in length, 13 ft. 6 in. in breadth and 3 ft. 9 in. in extreme draft. It was built throughout under Lloyd's special survey, Class 100 A.1. for fire-floats, and also to Board of Trade requirements. The hull is of steel. The whole of the amidships portion of the vessel is devoted to the machinery space and is covered by a raised teak deck.



Courtesy] [*Merryweather & Sons Ltd.*

The powerful fire float "*Beta III*," owned by the London Fire Brigade, at work

The main equipment consists of two separate petrol-paraffin six-cylinder engines, each capable of developing 110 B.H.P. at 500 revs. per minute. They are arranged so that, by means of special clutches, their power may be used either for propelling the vessel or for driving the turbine pumps. The engines are coupled to reverse gears and when used for propulsion are capable of driving the boat at a speed of over 10 knots.

At the forward end of each of the engines, and operated by the clutches just mentioned, are two three-stage turbine pumps made entirely of gunmetal. These operate at a considerably higher speed than the main engines, and the increase in revolutions is provided for by the interposition of an enclosed chain drive. Each pump is nominally rated to deliver 1,000 gallons per minute, at a pressure of 90 lb. per sq. in., but under test has proved capable of discharging as much as 1,350 gallons per minute at this pressure. When operating at a pressure of 50 lb. per sq. in. each pump delivers 2,400 gallons per minute.

A special arrangement of valves and piping permits the pumps to be driven either in parallel, for large quantities of water at ordinary pressure, or in series, for very high pressures up to 170 lb. per sq. in., as required. The contract figures have been considerably exceeded throughout, a result that is principally attributable to the very high efficiency of the pumps.

The auxiliary machinery includes two combined dynamo and air pressure sets driven by two 3-cylinder 14 h.p. engines. These compressors are employed for charging cylinders containing the compressed air used for effecting an instantaneous start with the main engines. The dynamos furnish the current for lighting the vessel, and also for operating a 20-in. Admiralty type searchlight fixed on deck.

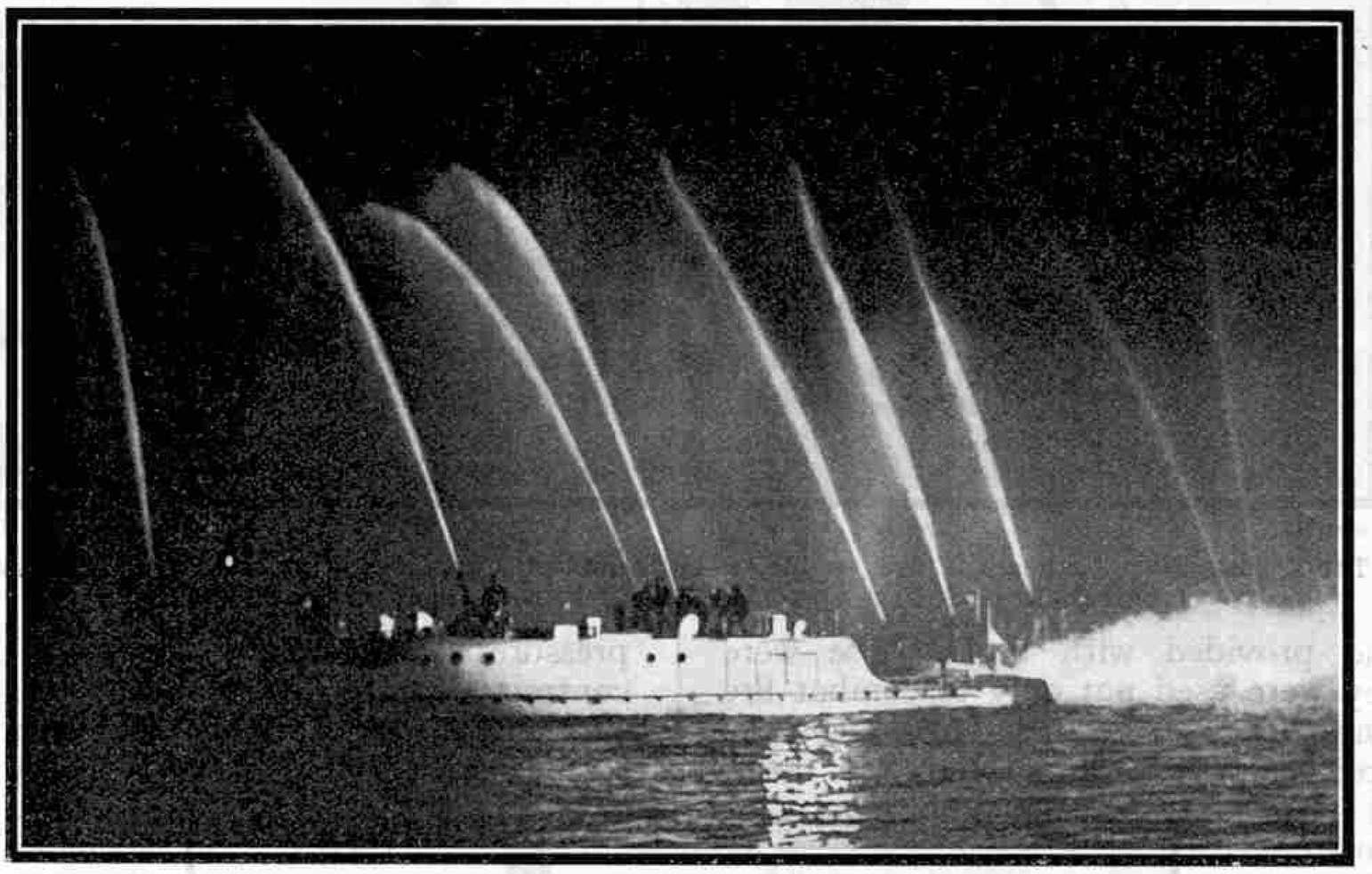
The suction arrangements include the ordinary suction feed to the pumps through strainer boxes fitted on each side of the vessel. There are also four special salvage suction inlets on deck, two port and two starboard, arranged to take standard London Fire Brigade 4 in. suction hoses. The delivery arrangements comprise a special delivery monitor arranged to take nozzles from $1\frac{1}{2}$ to $3\frac{1}{2}$ in. diameter, and two deck discharge boxes each fitted with four valves and connections for delivery hose. The discharge pipes from the pumps are so arranged that either or both pumps may serve either the monitor and the deck boxes simultaneously, or the monitor alone, or either of the deck boxes separately, or both together.

The vessel has been specially designed for easy manipulation in a restricted space, and is capable of turning

in twice its own length under normal conditions.

The official trial of "*Beta III*" was carried out at Charing Cross floating fire station and provided a remarkable display of pumping that was witnessed by a large crowd assembled on the Embankment. At one time eight powerful jets were in the air together, but perhaps an even more impressive sight was the single 3½ in. jet that rose to an enormous height and appeared to reach half-way across the river! The pumping tests continued for four hours without a hitch of any kind.

In the period since the "*Beta III*" was purchased it has performed excellent service at several big fires on the Thames waterway. One of the early conflagrations at which it was used occurred in premises in Wharf Road, Cubitt Town, London. The fire float was in operation continuously for 14 hours and, with one monitor and four delivery hose in action, she threw 1,710,000 gall. (7,500 tons) of Thames water into the burning building. This was a record delivery for any river float in the London Fire Brigade.



A night demonstration with fire floats on the Thames, showing the immense range of the jets

Another type of fire extinguishing apparatus now in common use is the chemical fire engine. This is not a rival to the ordinary fire pump, but it provides an effective and economical means of dealing with minor conflagrations or with the first phase of a big fire. For this reason some modern fire engines are provided with chemical fire extinguishing apparatus in addition to the ordinary fire pump equipment. The chemical appliance can be brought into immediate action and, in the case of a big fire, is operated while the ordinary fire pumps are being connected up and the hose laid out.

Two distinct principles of fire extinction are embodied in the use of ordinary fire pumps and of chemical fire apparatus. The efficiency of the jet discharged by an ordinary fire pump chiefly lies in the *cooling* effect that the water has upon the burning material, but the jet from a chemical fire engine achieves its object by smothering, or "blanketing," the flames with a gas that is heavier than air and does not support combustion. The most suitable is carbonic acid gas which may be easily and cheaply prepared. Two types of chemical extinguishing machines are in use, in one of which the fire is blanketed by the gas itself and in the other by a specially prepared foam.

Chemical fire apparatus of the gas-blanketing type depends for its efficient action on the property of carbonic acid gas to dissolve in water. When this gas is produced in a closed vessel full of water, sufficient pressure is set up to enable the gas-charged water to be forced through a hose pipe and nozzle, and thrown to a considerable distance with great impact force. As the water is projected on to a fire it releases the gas which, being much heavier than air, lies like a blanket over the burning material, prevents the access of oxygen from the surrounding atmosphere, and thus quickly and effectually subdues the flames. In addition sufficient cooling action takes place to lower the temperature of the smouldering material to a degree that renders a revival of the fire extremely improbable.

A chemical fire engine constructed by Merryweather & Sons Ltd., consists of a cylindrical vessel of from 35 to 500 gall. capacity, built of hammered copper and internally coated with an incorrodible alloy. It is tested to double its maximum working pressure and is fitted with a locked safety valve by which such pressure cannot be exceeded. The cylinder is kept about three-quarters filled with water in which a charge of bicarbonate of soda has been dissolved, and in this condition it is ready for use.

A gunmetal dome that is closed by a screwed cap is mounted on the upper part of the cylinder, and contains an inverted lead bottle containing sulphuric acid. A shaft, also made of gunmetal, runs through the centre of the cylinder, and upon this shaft are arranged fans, or agitators, for facilitating the rapid mixture of the acid with the solution in the cylinder. When the apparatus is required for use the shaft is rotated by means of an external handle. A small cam that is mounted on the shaft then imparts a reciprocating motion to a toothed pricker that punctures the metal seal of the acid bottle. The freed acid immediately passes into the cylinder where its chemical action on the soda solution causes the formation of carbonic acid gas.

A 60-gallon cylinder delivers the mixture through a nozzle at an initial pressure of about 160 lb. to the sq. in. The charge lasts about 10 or 12 minutes. The pressure gradually decreases as the vessel empties, but sufficient remains to give a good jet until the whole of the contents are exhausted.

Some chemical fire engines consist of two cylinders, each operated independently, and by this arrangement one cylinder is in operation while the other is being recharged. In this manner a continuous jet is obtained.

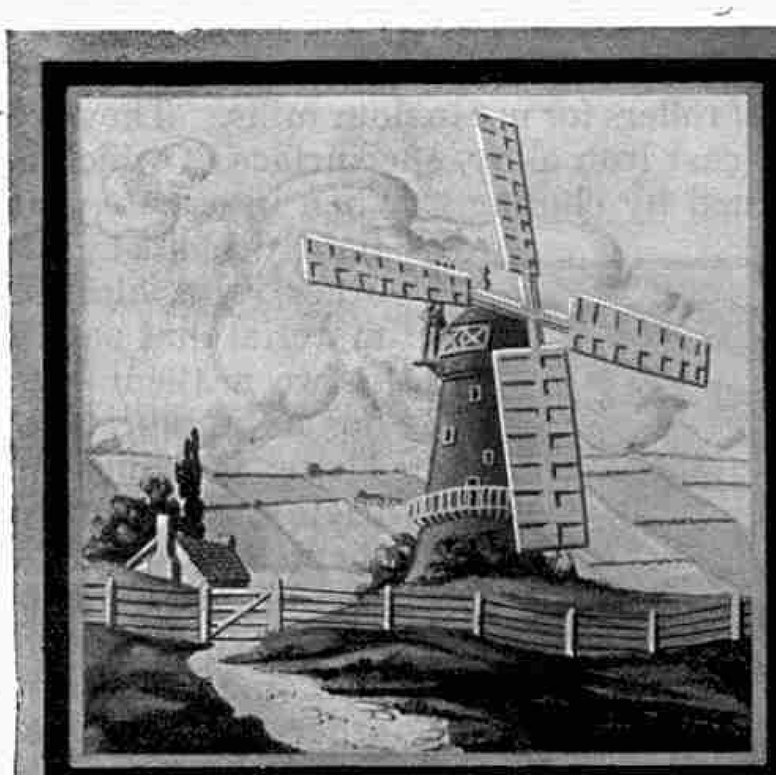
An interesting development of the chemical fire engine is the small hand extinguisher so familiar to-day in large buildings. From the sectional drawing we give of an extinguisher of this type it will be seen that the principle of operation is the same as that of the parent chemical fire engine already described. The "Konus Kemik," as this particular extinguisher is called, is constructed of steel plates strongly riveted and soldered together, and coated internally with a thick layer of non-oxidising alloy. The interior of the vessel is fitted with a detachable perforated cylinder kept in position by a screwed cap that also closes it. This cap forms a convenient handle for carrying the apparatus and is combined with a distributing nozzle. At the bottom of the interior cylinder is a loose-fitting lead weight, while at the top of the cylinder, close up to the cap, lies a hermetically sealed glass receptacle filled with strong sulphuric acid.

The vessel is filled with a solution of bicarbonate of soda and in this condition is ready for immediate use. When required for action it is quickly turned over, upon which the lead weight, sliding down the cylinder, pulverises the glass receptacle against the cap and allows the acid to mix instantly with the soda solution. Pressure is immediately generated, and the mixture is projected with great force on to the flames.

Fires in which petrol, oil, tar or other inflammable liquids are involved cannot be quenched by water, and tests with chemical fire apparatus have proved that foam blanketing agents are more effective than those of the gas-blanketing type in extinguishing such fires. The method generally employed is to smother the flames with a layer of froth compound that excludes air, so that they die out from lack of oxygen. This principle is embodied in the chemical fire engines known as "Fire-Suds" machines, one of which we illustrate.

As will be seen from the photograph, the body of the "Fire-Suds" machine does not differ greatly from that of the ordinary fire engine. The chemical apparatus from which the machine takes its name is enclosed in the box-like body of the machine. The body is divided up into several separate compartments, the first of which is arranged as a tool box under the driver's seat, while the second holds a galvanized welded steel water tank for "first-aid" purposes. In the centre of the body is a compartment for hose, with hinged doors opening upward on each side, and in the rear of these are two galvanized steel tanks each containing 20-25 gall. of an alkaline solution. The tanks are filled through the large circular covers on top. Behind them are six lead-lined compartments each containing an acid solution and closed by a lead-lined rubber-jointed mahogany cover. A further compartment in the rear carries a supply of "Fire-Suds" charges in metal cylinders.

Continued on page 81



THE STORY OF OUR DAILY BREAD

BY
W. COLES FINCH

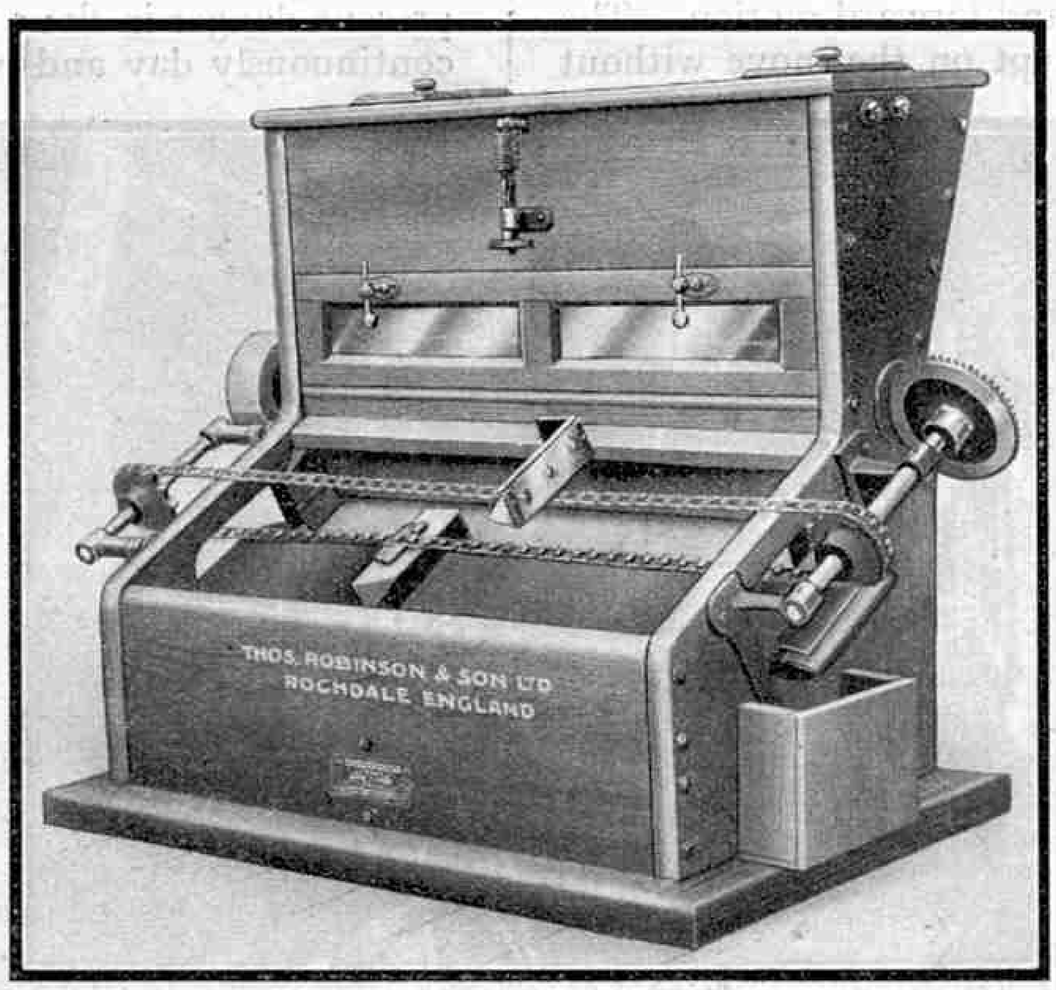
VII.—FROM WASHED GRAIN TO BAKER'S FLOUR

LAST month we saw how wheat intended for making flour was cleaned in preparation for the actual grinding. The grinding operations to-day are very different from those of last century, for the heavy grindstones used in the old wind and water mills have now been replaced by rollers of chilled iron. These rollers are superior to the old grindstones in many respects, notably in that their working can be controlled much more delicately, with the result that a whiter and more evenly ground flour is produced.

In order to see the rollers at work we must follow the clean wheat as it is carried by a conveyor to the roller floor on the milling side. Visitors who remember the clanking and rumbling heard in an old water mill will find this strangely quiet, although it is full of machines through which constant streams of wheat or partly ground flour are passing. The reason is that the roller mills now used are almost completely enclosed, the only portions visible being the pulleys on the ends of the driving shafts and the control wheels. They are double machines, and are roughly of the same shape as two pianos placed back to back. The resemblance extends to the inspection cover, which is of the same shape as the keyboard lid of a piano and occupies a similar position. Its removal discloses the rollers that grind the wheat, and also the smaller ones above them that regulate the flow of the grain and spread it over the whole length of the machine.

As we move about examining the various mills we notice that the rollers differ considerably. Many are quite smooth, but some are corrugated. The latter are called "break rollers," and it is through a series of mills in which they are fitted that the whole wheat is first passed. The flutings run diagonally and are smaller in successive machines. The rollers turn at different speeds, and tear open the wheat berries as they are caught between the ridges. The skin, or bran, is peeled off in large flakes, leaving the starchy interior practically unbroken.

It is the centre of the wheat berry that is eventually made into flour. The miller calls it "semolina," and his purpose in passing the grain through the series of break roller mills is to separate it as completely as possible from the bran. This is very delicate work, for the skin of the wheat berry is only one four-hundredth of an inch in thickness, and accurately ground rollers must be used to scrape the thin and fragile skin clean without breaking it. It must not even be pressed heavily; if it were, a liquid that is really a dye would be squeezed out and the colour of the flour would be ruined. Every machine is fitted with micrometer adjustments, by means of which the attendants set the rollers with absolute accuracy.



Courtesy [*Thomas Robinson & Son Ltd.*

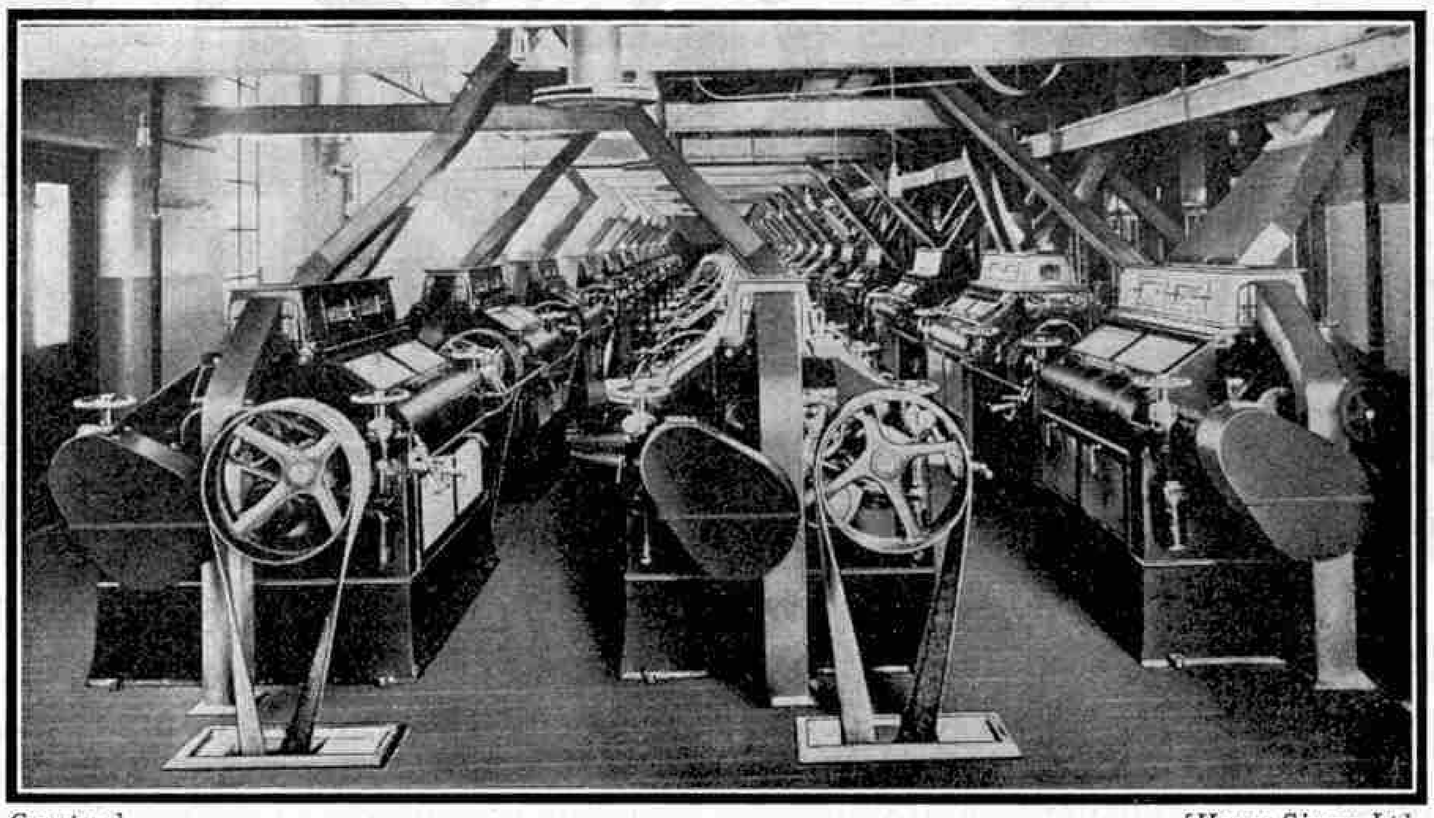
The magnetic separator used in cleaning wheat. Electro-magnets retain nails and other iron and steel scrap on the inclined plate from which the scraper removes them

The semolina and bran in the mixture that comes from the break rollers must be separated before the former is ground into flour. This is done by exposing them to a powerful blast of air in a machine called a cyclo-pneumatic separator. At the centre of this machine is a revolving disc on which the mixture is allowed to fall. The speed at which the disc rotates is so great that the partly ground wheat is immediately flung off the edge to fall in a circular spray, and it is here that the wind meets it. A stream of air from a large fan blows right across the spray and carries the bran and other light particles with it into an expansion chamber, where it deposits them as its speed is decreased. The semolina and partly broken wheat grains are undisturbed by the blast and fall into chutes that carry them forward to the next machine.

The separation is completed in mechanical sieves. Several kinds of machines have been invented for this purpose, and of these the most popular is the "plansifter." It contains several sieves, the uppermost being made of steel, while the lower ones are of fabric and have a

very fine mesh. They are built into two large wooden boxes, which are connected together by a smaller section containing a mechanism that gives the machines a circular motion. In order to allow for the movement of the machines, one section of each of the necessary chutes is made of canvas.

The plansifters are usually grouped together on one floor, and the effect of standing between two rows of the machines at work is very weird. Each of them swings out toward the visitor in a threatening manner and then seems to draw back for another spring! The circular movement is necessary in order to distribute the material over the sieves. It resembles that of a hand sieve and is more gentle than a mere backward and forward motion. The bran and semolina are thus kept on the move without being broken up.

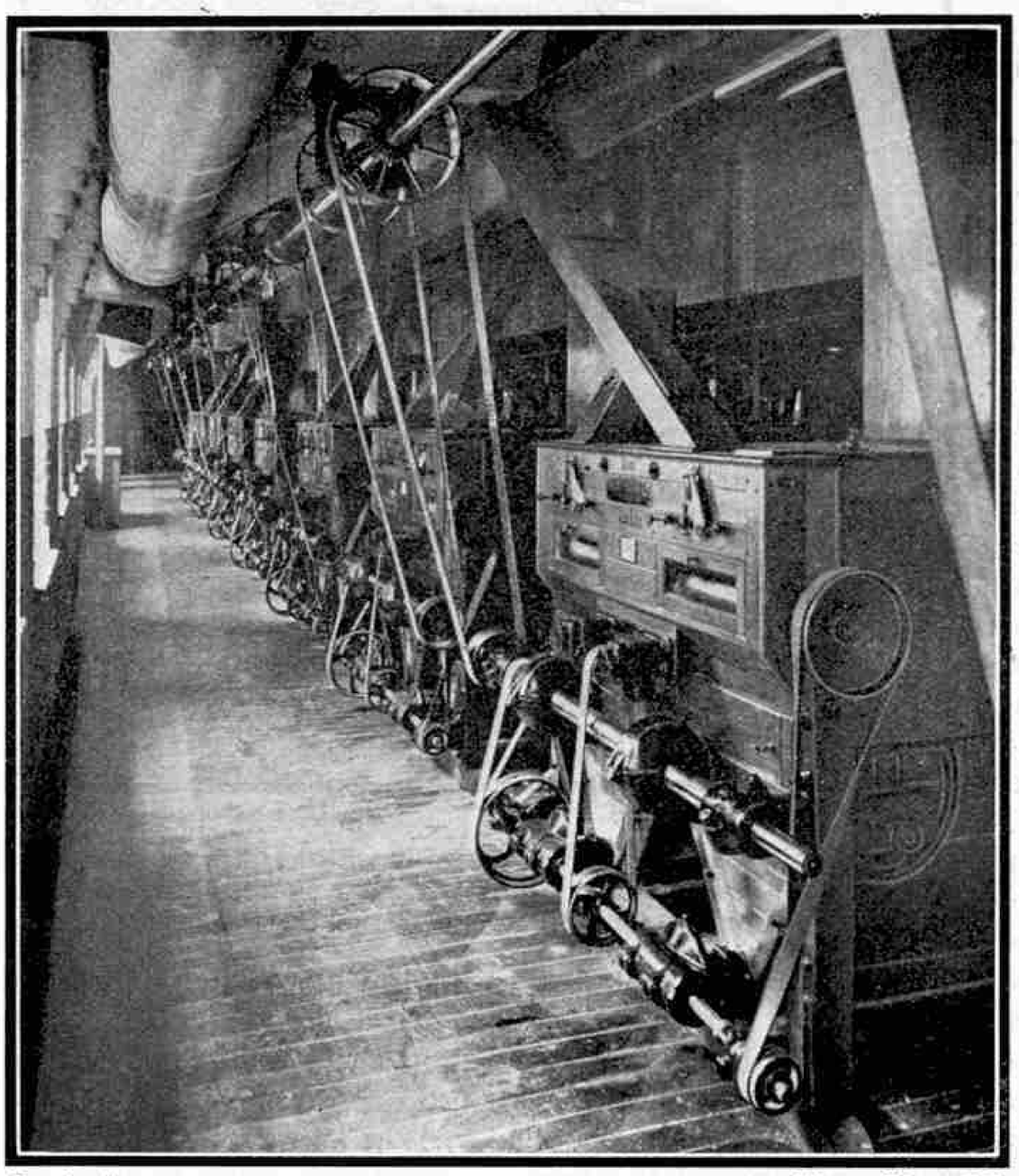


Courtesy] [*Henry Simon Ltd.*

On the roller floor of a flour mill. Each mill contains two pairs of rollers that grind wheat continuously day and night

When the bran and other offals have been removed by means of the machines we have described, there remains the semolina, or the starchy centre of the grain, in a coarse state. The next step is to reduce this to flour. There is very little difference in external appearance between the mills in which this is done and those used in breaking up the berry. The real difference is in the rollers, which are not fluted, since it is only necessary to crush the semolina to as fine a powder as possible. The rollers also are shorter, being only 40 in. in length instead of 60 in.

One reason for using shorter rollers in reduction mills is the extraordinary degree of accuracy necessary in making them. If any part of a roller is only one three-thousandth of an inch too large or too small it is impossible to obtain the best results from its use, and it is not easy to grind a 60 in. roller to this limit of accuracy. Trouble also would be experienced with the feed. Unless the semolina to be ground is spread out over the whole length of the rollers, the latter are worn unevenly, and it has been found that efficient feeding is most easily obtained when rollers not more than 40 in. in length are used.



Courtesy] [*Henry Simon Ltd.*

A line of purifiers, the machines in which the flour is finally sifted after milling

It is easy to see that great engineering skill is needed in the manufacture of rollers for use in flour mills. They are made of a special cast iron alloy, the surface of which is thoroughly hardened by chilling. When in use they fit tightly against each other, the film of material that passes between them acting as a lubricant. There is sufficient friction to make them hot, and a steady current of air is drawn through the machines in order to keep the temperature low.

If the pressure at one end is greater than that at the other, over-heating is bound to occur, which would not only spoil the quality of the flour, but if not remedied in time might even start a disastrous fire. This is an ever-present danger in flour mills, where the machinery runs continuously day and night, and the machines must be inspected regularly in order to see that the rollers remain parallel to each other. In a large mill this task may occupy the whole time of several men, who continually adjust the rollers by means of micrometer screws.

Between grindings the material is sifted, or "dressed," in order to separate the flour from unreduced semolina. The purifiers in which this is done contain very fine sieves, that slope slightly downward and are shaken backward and forward. They are made of silk and four different grades of mesh are always used. The mixture from the roller mills passes over each portion of the sieves in turn, and the finely ground flour is thus separated completely from the larger particles.

Light bran and pieces of fine offal may still be present, and the purifying stage is the last opportunity for removing them. The usual air blast is brought into action for this purpose. It blows upward through the flour, and is directed sideways by cowls placed above the sieves, with the result that the remaining impurities are lifted out on to platforms at the sides of the machine. Rolling and purifying continues until the whole of the centre of the grain has been ground.

The flour from the final dressing is passed into conveyors

that carry it to the warehouse. It does not flow so easily as the wheat grains from which it was made, and worm gear is fitted into the troughs of the conveyors in order to push it along.

On arrival at the warehouse the flour is given a final sifting, to make sure that no pieces of paper or string have found their way into it, and is then packed into bags. This is done in machines that are capable of filling a sack in less than a minute. The flour from one floor falls into a cylinder that is fixed to the ceiling of the room below. A bag is attached to the lower end of the cylinder by means of a strap and buckle, and a lever is then pulled to release the flour. While the bag is being filled, mechanism moves it rapidly up and down over the cylinder in order to pack the flour tightly.

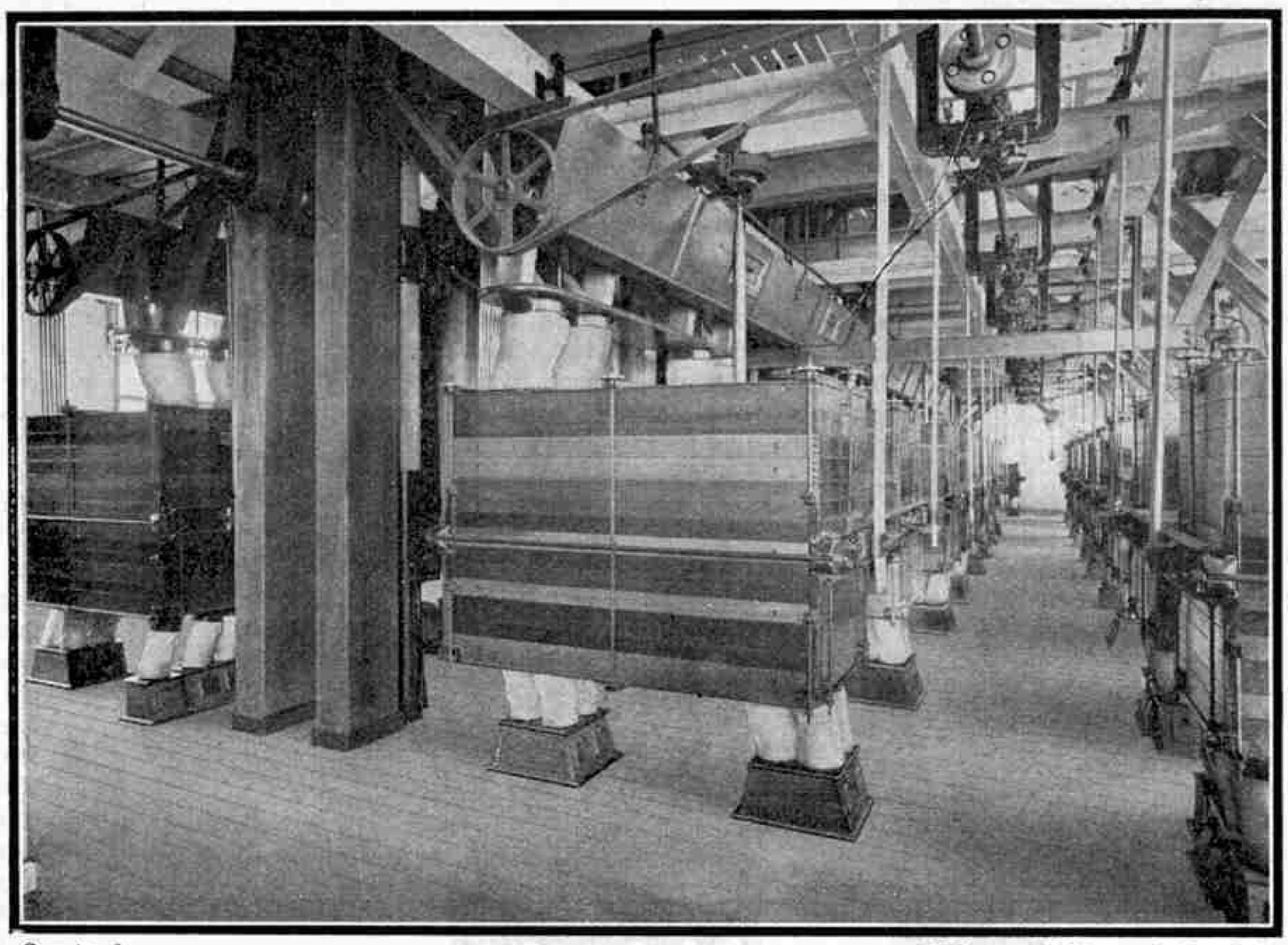
The sacks are then carried on hoists, or slid down spiral chutes of small gradient to the despatching platforms. There they are loaded into railway wagons, or in some cases into canal barges, for distribution to bakers.

It will be quite clear from this short account of work in a modern flour mill that the grinding of corn for our daily bread has grown to be a very complicated business. Primitive races who pounded corn in mortars, or crushed it in a saddle-stone, made practically no effort to separate the various parts of the berry, and their meal was naturally coarse and dark in colour. The carefully cut grindstones used by the Romans, and by our own millers for hundreds of years, were a great improvement. By varying the distance between the upper and nether millstones the grain was torn open in such a manner that the offals were excluded from the flour, which was still a little dark but much more digestible.

Since the decay of mills driven by natural power the appearance of flour has become more important, and the present demand is for one that is perfectly white. The invention of the roller mill has made this possible. It breaks up and grinds the wheat in several stages, and thus enables millers to separate thoroughly the different parts of the berry. As we have seen, the skin is carefully removed and sold as bran, while the outermost layers of the starchy matter it encloses find their way into flour of low grade only.

The best white flour sold to-day is made from the inner portion of the wheat. It is much more digestible than the wholemeal bread that was eaten by our forefathers, but unfortunately the all-important vitamins have been removed with the offals. This applies particularly to Vitamin D, which has been described as concentrated sunshine. The lower food value of modern white bread was known even before we learned of the existence and importance of vitamins, and brown bread has long been recognised as superior in this respect. The flour from which it is made contains more of the outer layers of the wheat grain, and in some cases also contains the germ, or the tiny embryo that grows into a wheat plant when the seed is sown. It is in these parts that the vitamins are found, and their presence gives brown bread a greater food value, but at the same time makes it more difficult to digest than white bread.

The principal foodstuff in ordinary white bread is starch, which comes from the inner portion of the wheat grain. It resembles the sugars in being a heating and fat-forming food. There is no difficulty in showing its presence in flour. Place a table-spoonful in a muslin bag, and knead it gently while holding it in a stream of water. The liquid running away at first will have a milky appearance. It should be collected and allowed to stand for some time, when a sediment will be formed. This is starch, as the following simple test will show. Mix a little of the sediment with water and boil the liquid. It will then become clear, because the starch granules burst and allow their contents to dissolve. Allow it to cool and add a drop of iodine solution. The liquid will turn a deep blue colour, which can be produced only when starch is present. The blue liquid becomes colourless on warming, but the colour returns when it is cooled.



Courtesy] [*Thomas Robinson & Son Ltd.*

Plansifters at work. The flexible sleeves in the feed and discharge chutes are clearly seen

The bag containing the flour should be washed and kneaded for some time after the liquid running from it has become clear, in order to make sure that all the starch has been removed. A sticky mass will still remain in the bag. This is gluten, a foodstuff that builds up muscle. This little experiment thus helps us to see why wheat has become the chief food of such a large proportion of the world's population. It is a well-balanced foodstuff, containing materials that form fat and build up muscle, together with health-giving vitamins.

So greatly superior is wheat to all other cereals that it is rapidly displacing them, even in countries where it has to be imported. One instance is China, where rice has been the staple food for centuries. Wheat is now being taken to that country in increasingly large quantities, a large proportion of it coming from the Canadian prairie provinces, more than 6,000 miles away.

In Europe rye has been the chief rival to wheat. It is cheap and hardy, and until recently was the principal crop in Scandinavia, Russia and many parts of Germany. Bread made from it is so dark in colour that it is usually described as "black" bread. It very quickly becomes sour, but a greater danger to those who live on it is a fatal disease that may attack them. This is due to a fungus that grows on the ears of the plant,

(*Continued on page* 81)



Engineering News

Huge New Searchlight

A huge searchlight with a mirror 200 cm. in diameter has recently been constructed at the works of the London Electric Firm, Croydon. This searchlight, which is probably the largest in the world, is constructed on a truck to enable it to be run along rails, and is so adapted that it may be controlled either by the operation of handles on the machine itself, or from a distance by means of a remote control apparatus.

* * * *

Extensive Hydro-Electric Power Scheme for Rome

For the past three years work has been proceeding on an extensive scheme for supplying hydro-electric power to Rome, and power works have been constructed at the Marmore Falls, which are situated on the River Velino a short distance to the north-east of the capital city. A movable breakwater has been constructed across the River Velino to regulate the amount of water contained in the Lake of Piediluco, which forms a reservoir capable of containing 2,000,000 cubic metres of water. The scheme also provides for the construction of three reservoirs to be fed by the Rivers Salto and Turano and equipped with hydro-electric generating machinery operated by these rivers.

In addition to these projects a canal is to be constructed along which water will flow from River Velino, Lake Piediluco, and the River Nera, another river that is to be harnessed. Water in the canal will operate two generating stations, one at Galleto, and the other at Narni, while a third station is to be constructed in the Valley Visso.

The canal carrying the water of the River Nera through the Visso Valley is approximately 2,800 ft. in length and for nearly 2,200 ft. of its total length travels underground. The waters utilized for the Galleto power station are fed through two pipes each over 580 ft. in length and possessing a cross sectional area of 200 sq. ft., into a canal 2,200 ft. in length, from where they pass into a reservoir and eventually return to their natural course.

* * * *

Work has commenced on the 5,360 ft. tunnel under the Detroit River, joining Detroit, Michigan and Windsor, Ontario.

Another Huge Water Storage Reservoir in Quebec

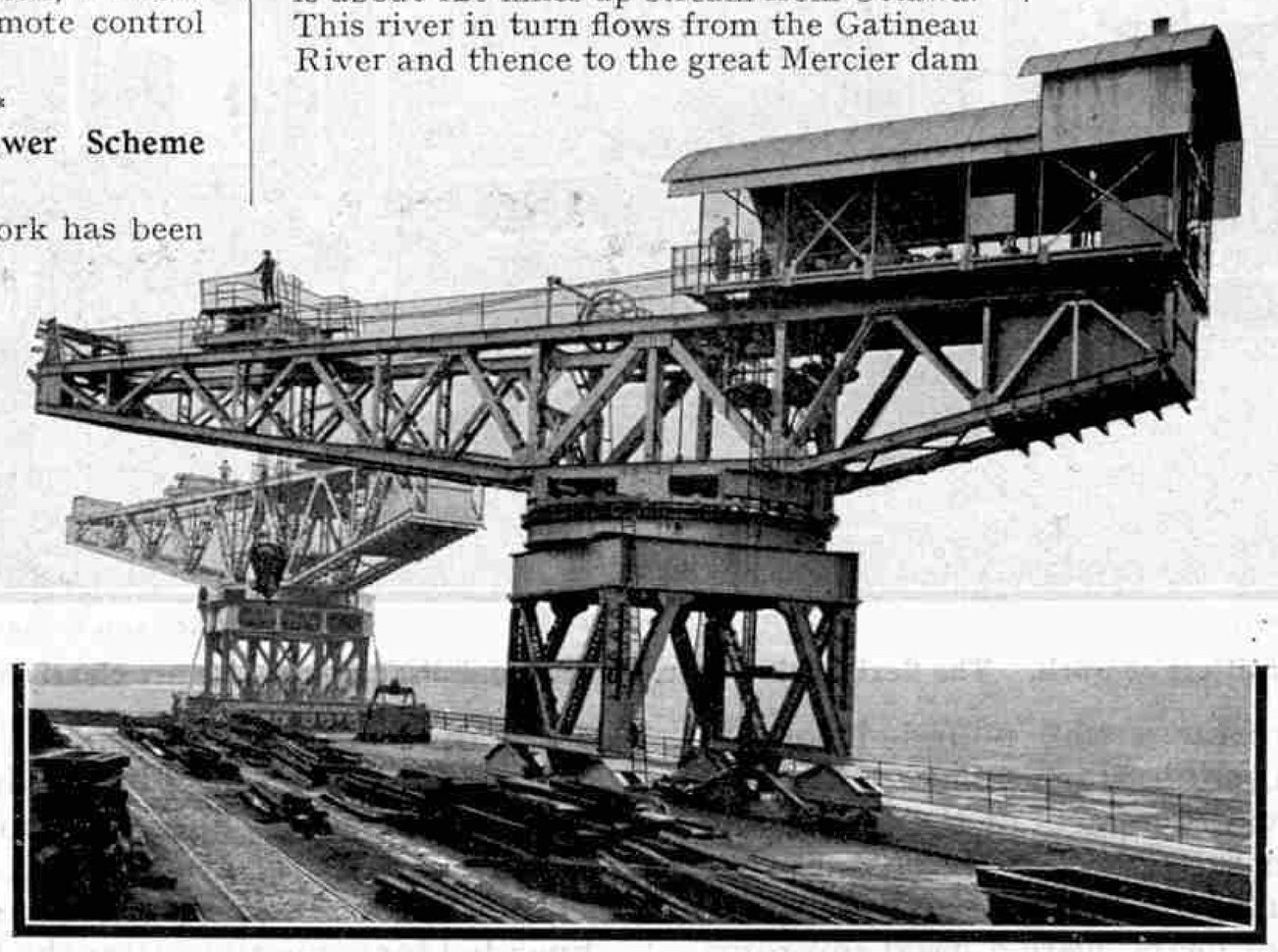
In order to secure the further regulation of the flow of the Gatineau River, a tributary of the Ottawa River, Canada, the Gatineau Power Company are constructing a dam at the outlet of Cabonga Lake where it empties into the Gens de Terre River, 50 miles north of Baskatong Lake, which is about 120 miles up stream from Ottawa. This river in turn flows from the Gatineau River and thence to the great Mercier dam at Bitobee which, when closed, creates a lake with an area of more than 100 square miles and capable of impounding 95,000,000,000 cu. ft. of water for use during the low flow season.

The construction of the new dam is planned in order to create another great storage reservoir that will contain some 45,000,000,000 cu. ft., making in all nearly 150,000,000,000 cu. ft. of water that the company will have in storage for the use of its Gatineau River power plants.

* * * *

Conversation at Five Pounds a Minute !

A conversation was carried on a short time ago between a business man in Guiseley, near Leeds, and another man in Vancouver. The conversation lasted for about five minutes and the cost of the call was £25. Before this call was made the record was claimed for one between London and Los Angeles, California.



Two giant block-setting cranes at work on a South African Harbour. The part that these cranes play in the construction of harbours and breakwaters is fully described in the "Meccano Book of Engineering," which may be obtained from any Meccano dealer or direct from the Editor (price 3d. post free)

The Singapore Naval Base

Work is soon to be commenced on the construction of the Naval Base at Singapore, which, according to the contract terms, must be completed within seven years. The site of the base is at the north of the island and about twelve miles from the civil harbour and docks. A frontage of about six miles will be provided and the work involves the construction of a graving dock capable of holding the largest warship afloat.

The harbour will consist of the eastern half of the Strait that separates the island from the mainland, and which has been cut up by the building of a causeway to carry a railway across. The 50,000 ton floating dock that has made a successful and comparatively uneventful journey from England will be anchored in this artificial harbour.

The total cost of the scheme is estimated at approximately £7,750,000. Of this sum £6,917,000 will be spent on the construction of the base itself, while the machinery and furniture fitted are to cost £810,000 and £23,000 respectively.

* * *

Africa's Longest Bridge

Work is now proceeding on a bridge spanning the River Benue, at Makurdi, Nigeria. This will be the largest bridge in Africa, its length being 2,584 ft. between abutments. The bridge will have 13 spans and some 8,000 tons of steelwork will be used in its construction, the estimated cost being approximately £960,600. The structure will take more than four years to complete and it is intended to carry a railway track to replace a train ferry that has been operated at this point by the Nigerian Eastern Railway Company.

* * * *

A large turbo-generator for the East River station of the New York Edison Company is being constructed by the General Electric Company. The completed machine will develop 215,000 h.p. and is undoubtedly the largest single-shaft, single-unit turbo-generator at present in existence. Steam will be obtained from four boilers each capable of supplying 550,000 lb. of steam per hour.

New Motor Boat Engine

A new type of high-power petrol engine, intended for naval motor boat service, has been subjected to a number of tests at Turin by representatives of the Royal Italian Navy. The engine is designed to develop 750 b.h.p. at 1,940 r.p.m., with a propeller speed of 1,700 r.p.m. The maximum horse-power it is capable of developing is 790 at 2,050 r.p.m., with a propeller speed of 1,800 r.p.m. The unit weighs 3,950 lb. and consumes only 0.55 lb. of petrol per horse-power-hour, and 0.02 lb. of lubricating oil per horse-power-hour. The engine is arranged for starting by compressed air.

* * *

A Giant Elevator

The world's largest single unit grain elevator has been officially opened at Port Arthur, Ontario. It has a capacity of over 7,000,000 bushels of grain, and some idea of the dimensions of the building it serves may be gathered from the fact that it is 1,100 ft. in length, has 235 storage tanks each 125 ft. in height, and 558 interspace and outerspace bins. The elevator was constructed in the record time of 149 days.

* * *

An interesting engineering feat has been brought to conclusion with the completion of the new Canadian Pacific Railway bridge over the Don Valley, near Toronto. The bridge, which is 1,150 ft. in length, has 13 spans supported on concrete piers.

* * * *

Wireless for Fire Engines

It is frequently of great importance for fire engines when out on duty to keep in touch with headquarters. In thickly populated districts it is usually fairly easy to do this by telephone, but in outlying districts this is often impossible. The Rochdale, Lancashire, Fire Brigade have solved this problem by installing wireless sets on their fire engines so that constant communication can be maintained with headquarters no matter where the engine may be.

* * * *

Escalator 500 ft. in Length

A public escalator has been constructed at Havre in France, which, with its length of 500 ft., easily ranks as the world's largest escalator. It is provided with a concrete roof and has been constructed to carry pedestrians, baby carriages, bicycles, dogs, etc., up a steep hill where new houses have been constructed. The steps of the escalator are approximately four feet square, and move at about 80 ft. a minute, but during rush periods they are speeded up to 120 ft. a minute.



Photo courtesy] [The Aircraft Operating Co. Ltd.

This wonderful air view shows the bridge over the Zambesi Gorge—one of the most striking illustrations of the triumph of the engineer over natural difficulties. The bridge carries the Cape to Cairo Railway over 400 ft. above the roaring torrent beneath. The Victoria Falls are seen in the background, with the River Zambesi plunging over a wall of rock a mile in length

New Motor Ship for Nelson Line

The "*Highland Monarch*," an important new motorship in the service of the H. & W. Nelson Line, has now completed her maiden voyage. The ship is the first of five, the remaining four of which are under construction at the Belfast works of Harland & Wolf Ltd. Three of the four are named "*Highland Chieftain*," "*Highland Brigade*" and "*Highland Hope*," respectively, while the fourth is as yet unnamed. They are intended to operate a regular fortnightly service between England and Brazil and Argentina, via Spain and Portugal, and they will carry both passengers and frozen cargo.

The "*Highland Monarch*" has a gross tonnage of 14,137 and is 520 ft. in length and 69 ft. in breadth, while her cruising speed is 15 knots. There is room on board for 135 first-class and 66 second-class passengers. The ship is equipped with two sets of eight cylinder double-acting Diesel engines each developing 4,000 s.h.p. at 100 r.p.m.

* * * *

New Bridge for Old in Twenty-four Hours

An interesting engineering achievement has been carried out at East Linton, Haddingtonshire, where a bridge was demolished and replaced by a new one within 24 hours. The work was commenced in the early hours of the morning by the blowing up of the old bridge, over which runs the main London and North Eastern Railway line from London to Edinburgh and Aberdeen. The new bridge, constructed of iron and weighing 160 tons, was carried into position on a special trolley and before midnight the work was completed and rails were laid over the bridge. The notable feature of this replacement was that it was carried out without first erecting a temporary bridge.

The New White Star Liner

A definite decision has not yet been arrived at with regard to the type of engines to be fitted in the new White Star liner to which reference was made in the "*M.M.*" for July and August of last year. It has been stated by the Chairman of the company that the transmission will be electric, but the current may be generated either by steam turbines or internal combustion engines. Whatever machinery is eventually fitted, it will most certainly be the largest of its kind in use on ships throughout the world, as it is practically certain that a shaft horse power of 100,000 will have to be developed. The greatest shaft horse power at present developed by a turbo-electric engine is 17,000.

* * *

Record Steel Casting

A steel casting to be used as the anvil block for a 5-ton friction drop stamp has been made by Cammell Laird & Co. Limited. The completed casting is 95 tons in weight and is claimed by the makers to be the heaviest casting at present in existence. It is 6 ft. 1 in. in height and the base measures 9 ft. 2 in. by 10 ft. 2 in. This is probably the first casting of this kind to be made of steel, as it is the usual engineering practice for them to be of iron.

* * * *

The Ascot-Pullin Motor Cycle

During recent years there have been very few alterations in the outward appearance of motor cycles, and we have become so accustomed to their general design that any departure from standard practice gives us a slight shock. The new "Ascot-Pullin" motor cycle is an excellent example of this. In many respects it shows very little resemblance to the ordinary type of machine, but on closer examination we realise that the purpose of the changes is to make motor cycling more comfortable.

The most important of the many innovations in the model is the frame, which is made of pressed steel and completely encloses all the working parts. A windscreen is fitted in front of the handle bars, where it protects a miniature instrument board on which a lamp, clock, ammeter, speedometer and an oil gauge are mounted.

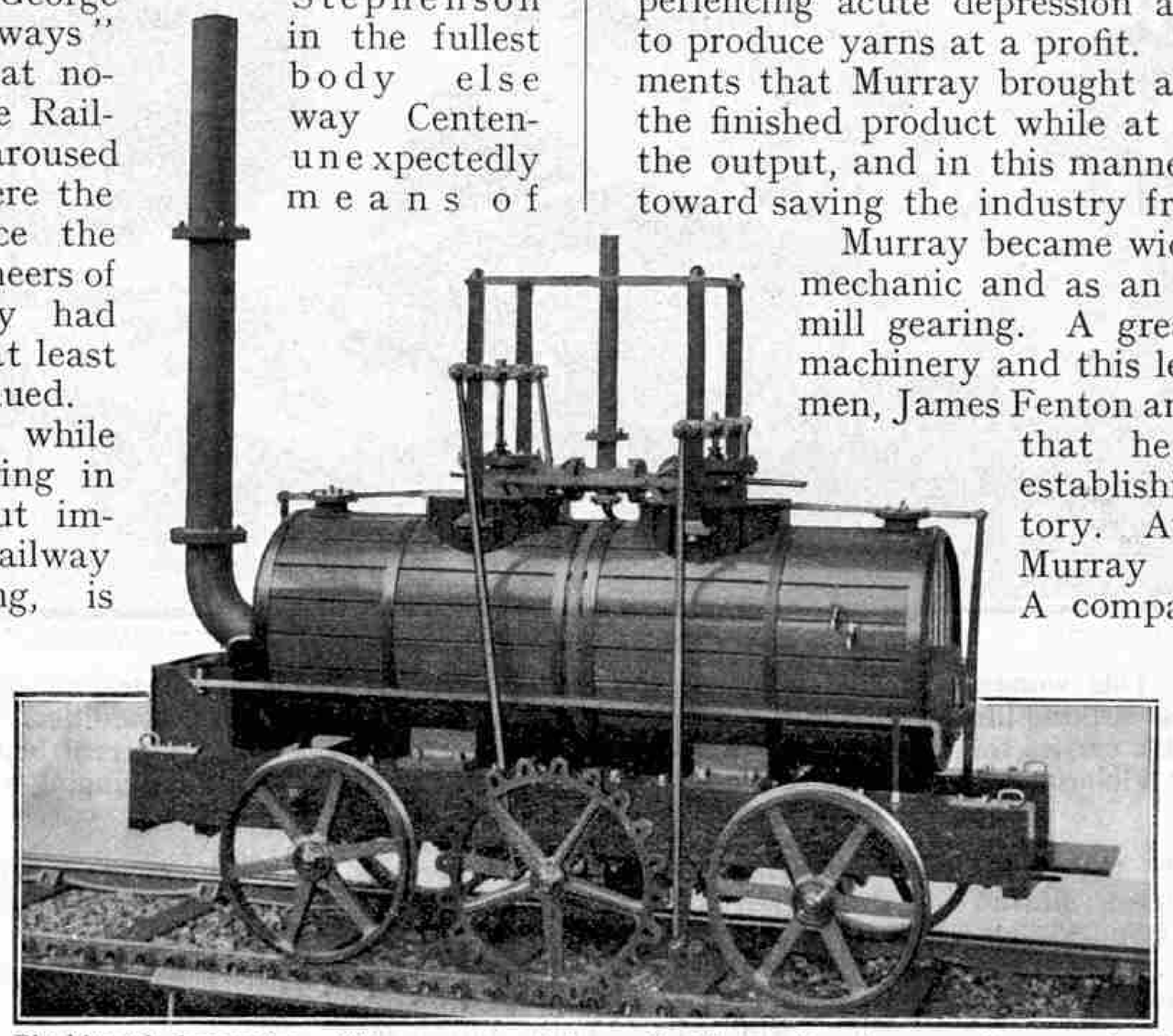
The engine is of the single cylinder, overhead valve gear type, with a capacity of 496 c.c., and forms a single unit with the gearbox. Driving the machine is made easier by the provision of hydraulic brakes and automatic lubrication of many moving parts. Its weight is approximately 330 lb. and the petrol consumption is stated to be over 100 miles a gallon.

Matthew Murray—Pioneer Engineer

Builds Locomotives for First Successful Steam Railway

IT is characteristic of all great engineering developments that the work of one or two men should stand out so prominently as to completely overshadow the contributions of others. This is particularly the case in regard to railways. It is only during the past few years that the general public have realised that we owe our present magnificent railway system not to one man but to many. For years it was assumed without any particular inquiry that George Stephenson was the "Father of Railways" in the fullest sense of the term, and that nobody else mattered very much. The Railway Centenary Celebrations in 1925 aroused unexpectedly keen interest and they were the means of bringing into prominence the work of several of the pioneers of railways who previously had been either unknown or at least very seriously undervalued.

Among the men who, while seldom or never appearing in the limelight, carried out important pioneer work in railway and general engineering, is Matthew Murray, born at Stockton-on-Tees in 1765. When he became old enough he was apprenticed to a local blacksmith and his mechanical aptitude soon made itself noticed. The completion of his apprenticeship happened to occur at a time when trade at Stockton was at a very low ebb and Murray resolved to seek work in the busier city of Leeds. Gathering together his essential belongings he made them into a bundle, swung this over his shoulder, and set out to walk to Leeds. He reached his destination without difficulty but then found that he had not sufficient money to pay for a bed. This was rather a serious predicament but he was fortunate enough in finding an inn where the landlord agreed to trust him on being assured that he confidently expected to get work at Marshall's mill on the following morning.



Blenkinsop's locomotive. This was one of the earliest locomotives in use and was employed at Leeds. Note the spur gearing used unnecessarily to prevent wheel slip. (From the Editor's book "Engineering for Boys" by permission of the publishers, T. C. & E. C. Jack Ltd.)

Murray obtained the work he sought at the mill which was then beginning the manufacture of flax. The machinery of the mill was naturally a great source of interest to him and very shortly he began to suggest ingenious ways in which its efficiency could be increased. These hints were very greatly appreciated by his employer who acknowledged the value of the suggestions in a practical manner by the gift of £20. Shortly afterward Murray was appointed chief mechanic in the factory workshop.

During the 12 years that Murray was associated with the Marshall concern he devised many important improvements in the machinery for combing out and separating the fibres of flax and the Society of Arts awarded him a gold medal in respect of his "heckling" machine. He also produced a machine which by means of an arrangement of sponge weights performed what is known as "wet" flax spinning, a process embodied in the preparation of very fine yarns.

At this period the flax spinning industry was experiencing acute depression and spinners were unable to produce yarns at a profit. The mechanical improvements that Murray brought about lessened the cost of the finished product while at the same time increasing the output, and in this manner undoubtedly did much toward saving the industry from ruin.

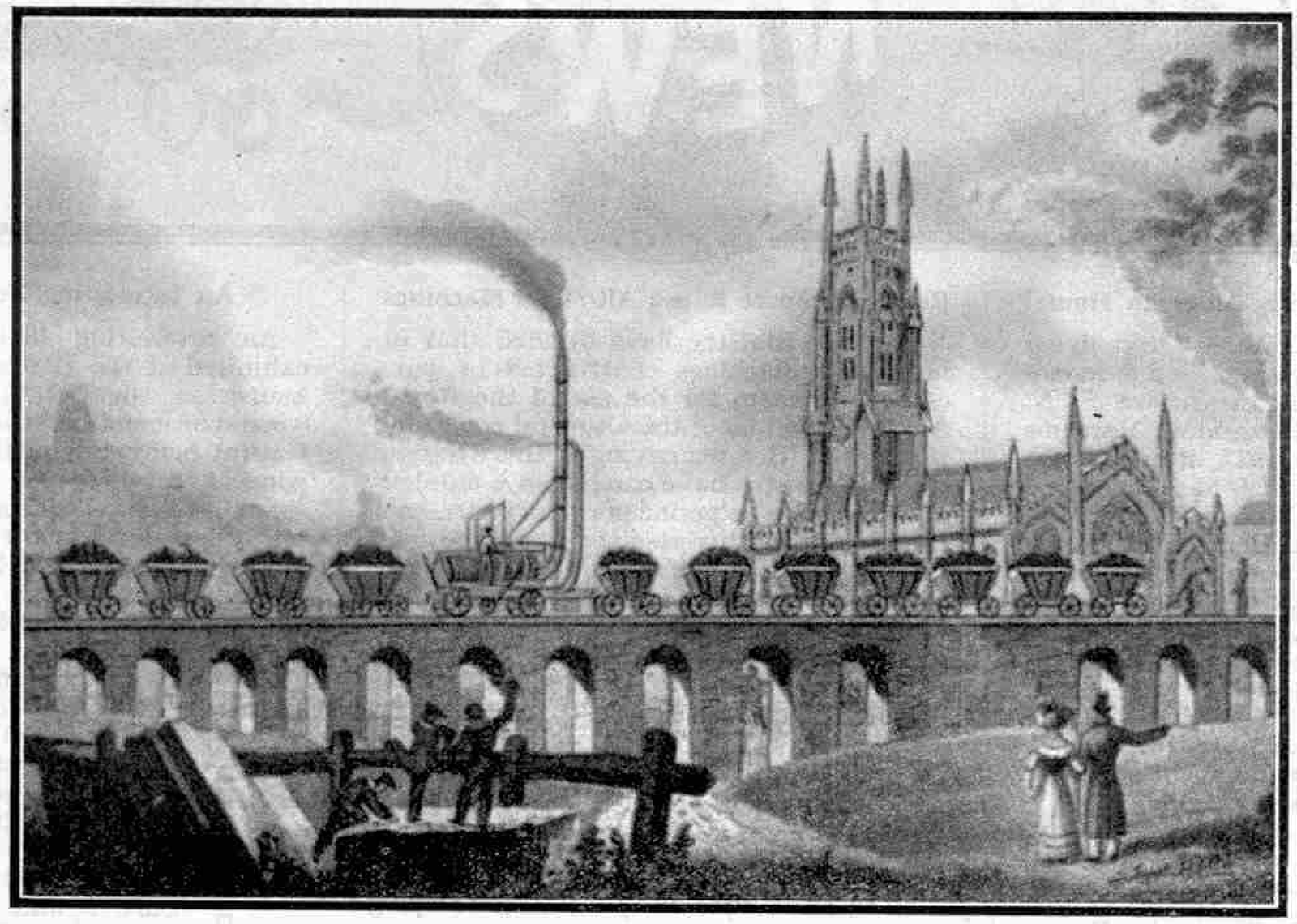
Murray became widely known as a first-rate mechanic and as an expert on the subject of mill gearing. A great demand arose for his machinery and this led to two Leeds businessmen, James Fenton and David Wood, to suggest that he should join them in establishing an engineering factory. After careful consideration Murray agreed to the project. A company was formed in 1795 under the title of Fenton, Murray and Wood, and a factory was established at Holbeck. This factory became known as the "Round Foundry."

While at Marshall's mill, Murray had gained considerable practical knowledge of steam engines and had commenced experiments in this direction as early as 1786. The partners in the Holbeck enterprise therefore decided to include a steam engine building department at their factory, and Murray was given chief control over this section. This branch of the factory quickly proved very successful. As time went on Murray introduced one improvement after another, many of these being of great practical value. In 1799, for instance, he invented a self-acting apparatus that could be attached to a boiler for the purpose of regulating the intensity of the fire beneath it, and in consequence controlling the production of steam. Murray also brought all the valve openings in his steam engines into one valve box. This principle became known as the short "D" slide valve and has since been universally adopted. It is interesting to note that in order to make the surfaces of the valves perfectly accurate and steam tight he designed and built a planing machine. This machine appears to have been produced at an earlier date than the planer invented by Fox of Derby, who is sometimes credited with having been the first to introduce this type of machine.

It was not long before Murray extended his engineering

operations to include the building of steam locomotives and one of his most important achievements was the improvement of the locomotive as built by Trevithick. In 1812 he built four steam locomotives for a colliery railway laid down by John Blenkinsop between Leeds and Middleton.

When Blenkinsop drew up the design for the first of these engines Murray suggested that two cylinders should be fitted as an improvement upon the single cylinder of the Trevithick engine and this idea was adopted. In order to overcome the difficulty of the "dead points" that resulted from the provision of only one cylinder, Trevithick had employed a fly wheel, but Murray built his locomotive with two cylinders driving two cranks set at right angles. This locomotive thus could start hauling from any position. A toothed driving wheel was fitted to the engine to engage in projecting lugs fixed at the side of the rail with the object of eliminating any possible wheel slip.



The Colliery Railway from Middleton to Leeds, in 1812, showing one of the four "Blenkinsop" locomotives built by Matthew Murray

The first of the four engines to be completed was named "*Prince Regent.*" It was tried out on the Middleton wagonway on 24th June, 1812, and proved capable of exerting a power five times as great as that of Trevithick's engine, although it was itself no heavier. The locomotive cost £380 to build, but this sum included a premium of £30 paid to Trevithick in respect of his patent right.

"*Prince Regent*" was put into service shortly after the trial and was in regular use for many years. It had the distinction of being the first engine to regularly work upon a railway and, together with its three associates, was for long an object of great curiosity to the many strangers who came to view the railway and its equipment. This was the first railway in this country to be worked by aid of a rack rail and among the notable people who inspected it were Stephenson in 1812 and the Grand Duke Nicholas (afterwards Emperor) of Russia, in 1816.

Murray was probably the first to centrally heat a house by means of steam pipes, and his house at Holbeck, heated on this plan, was nicknamed by local residents the "Steam Hall." Another direction in which he displayed initiative was in respect to the then new illuminant, coal gas. He was the first to manufacture this for lighting a factory and was instrumental in inducing the Leeds City Council to consent to have a public supply of gas.

One of the outstanding features of Murray's character was entire absence of jealousy for his competitors. His frank, open disposition made him dislike any kind of secrecy and he was always ready to give information where he knew it would be genuinely appreciated. Even in the case of such a formidable rival firm as that of Boulton & Watt, Murray does not appear to have with-held anything for we are told that on the occasion of a visit in 1799, of this firm's representatives, Murdoch and a man named Abraham, he admitted them into every part of his factory. Boulton Junior in a letter regarding this visit says:—"Murdoch and Abraham are now returning from their excursion highly delighted and full of panegyricks upon Murray's excellent work. Abraham is now entirely convinced of his inferiority, and what is more of the possibility of amendment in the boring. . . Murray presented Murdoch with a specimen of his forge work no doubt with a view to exciting his astonishment. I must candidly acknowledge that it was the most beautiful and perfect piece of work I ever beheld. . . ."



Matthew Murray

This friendly treatment appears to have been wasted on Boulton and Watt however. They became so jealous of the success of Fenton, Murray and Wood that they purchased a large plot of land adjoining the Holbeck Works, in order to prevent the firm from extending their premises. There appears to be no doubt that Boulton and Watt bought the land entirely for this purpose for they made no use of any part of it and according to Samuel Smiles:—"It remained disused, except for the deposit of dead dogs and other rubbish, for over half a century."

Murray subsequently became interested in the possibilities of internal combustion engines, and in a letter written in 1824 he makes an interesting reference to experiments with an explosive gas engine. "The principle," he wrote, "was to drop by drops bituminous or inflammable substance on a red hot plate at the bottom of the cylinder. At the same instant an (*Continued on page 37*)



Three Hundred and Fifty Miles an Hour !

Flight Lieutenant D'Arcy Greig, flying the Supermarine "Napier" S.5 monoplane on which Flight Lieutenant S. N. Webster won the Schneider Maritime Trophy for England in 1927, at an average speed of 281.54 m.p.h., has succeeded in exceeding the speed set up as a world's record by Major De Bernardi. Major De Bernardi flew a Macchi seaplane with a Fiat A.S.-3 engine at the Lido, Venice, on 30th March, 1928, over a three kilometre course at an average speed of 318.464 m.p.h., but owing to the fact that Flt. Lieut. D'Arcy Greig only set up an average speed of 319.57 m.p.h. his flight cannot be claimed as a record, as an increase of at least 5 m.p.h. is necessary. It is estimated that at times this daring pilot attained the amazing speed of 350 miles an hour, and it is to be hoped that Great Britain will wrest the world's speed record from Italy early next summer.

* * * *

Aeroplane to Aid Big Game Hunting

Lieut.-Commander Glen Kidston and a number of friends recently commissioned and reconditioned a Fokker Armstrong-Siddeley air liner to take them to Nairobi, Kenya Colony, where they intend to spend some time in big game hunting. Contrary to reports that have appeared in certain papers, the party do not intend to do any shooting from the air. Their headquarters will be situated at Nairobi, where reports will be sent by advance bodies of scouts who will be scouring the jungle for traces of big game. After sending their reports the scouts will make clearings in the forest in order to enable the aeroplane to descend and the game will then be followed up on foot.

* * * *

British Machine for Endurance Record

The Fairey Aviation Company have been at work for some time on a new monoplane that has been designed to make an attempt on the world's endurance record, which is held at present by Germany with a flight of 65½ hours. Although the description and capabilities of the machine are being kept secret, it is reported that the preliminary test flights were quite satisfactory. A Napier engine has been fitted to the machine and approximately 1,500 gallons of petrol will be carried.

* * * *

All Midshipmen in the Royal Navy now undergo a fortnight's intensive aviation study in an aircraft carrier in order to obtain a certain amount of knowledge of the work done by aircraft at the present time.

Royal Air Force to use All-Metal Machines

The Air Ministry have decided that in future all machines constructed or purchased by them for the use of the Royal Air Force will be of the all-metal construction type. Before arriving at this decision the Air Ministry have conducted a number of exhaustive experiments and tests, and the results of this resolution will be far-reaching in the British aircraft industry, as up till now our aircraft construction firms have tended to specialise more in wood construction.

THIS MONTH'S AIR STORY

"And does that small propeller really make this huge aeroplane fly along?" asked the inquisitive old lady.

"Oh, no, madam!" replied the Service pilot. "It's merely put on to scare birds away while we're flying!"

Proposed Light Aeroplane Club for Belfast

Efforts are being made to establish a light aeroplane club in Belfast and with that object a meeting has been held at which Brigadier General Groves, Secretary-General of the Air League of the British Empire, was present. The Commander of the Ulster Bombing Squadron stated that there was a growing demand amongst Belfast business-men for aeroplanes in which they could travel when on urgent business.

* * * *

Automatic Anti-Aircraft Gun

Some interesting experiments with an automatic anti-aircraft gun have been carried out at war demonstrations arranged by the Army Ordnance Association in Maryland, U.S.A. The gun, which is mounted on a moving truck, fires 3-inch shells and calculates and maintains its own range from the sound waves set up by the enemy aeroplane. During the trials a sleeve target was towed in the usual manner by an aeroplane flying at such a great altitude as to be invisible to the naked eye. When the direction-finding apparatus of the gun was switched on, the shells fired recorded theoretical hits. There are obviously great possibilities in weapons of this nature for protection against air attack.

* * * *

Civil Aviation in Germany

According to the German Official Register recently issued, there are now 686 aircraft in Germany. Of these, Deutsche Luft-Hansa, who are the German counterpart of Imperial Airways Ltd., own 186; the Verkehrsfliegerschule (training school) 117; private owners 85; industrial firms 77; and flying clubs 33.

An Interesting New Monoplane

An interesting little monoplane was exhibited at the Berlin Aero Show. It is known as the G.M.G.11 and is of all-wood construction, the most noteworthy feature being the method by which the wing is attached to a sort of bridge that spans the two cockpits, which are set rather low down in the fuselage.

The machine is 20.2 ft. in length and possesses a wing span of 36.1 ft. It has a tare weight of 605 lb. and a loaded weight of 1,100 lbs., and it is capable of a maximum speed of 84 m.p.h. with full load. The cruising speed is 81 m.p.h., but the landing speed is only 37 m.p.h., and the cruising range at full throttle is 420 miles. Its climbing powers are indicated by the fact that with a full load only 7 min. 36 sec. are taken in reaching 3,280 ft., while with pilot only, that altitude can be attained in 4 min. 30 sec.

* * * *

Light Aeroplane Altitude Record

A new altitude record for light aeroplanes has been set up by Lady Heath in her "Cirrus-Moth." The flight was made from Croydon Aerodrome and 70 minutes were taken in attaining a height of 23,000 ft. Lady Heath was not compelled to resort to oxygen breathing apparatus but towards the end of the ascent the cold was so intense that frost formed on her goggles. Visibility was so good that the coast of France was seen quite clearly.

This record exceeds by approximately 2,000 ft. the one set up by Capt. G. de Havilland and his wife, and noted in the October, 1928 *"M.M."* It also exceeds the height reached in September by Herr Schinzinger on a Junkers W.34 machine. This machine was fitted with a Bristol "Jupiter" engine, carried a load of 1,000 kilos. and attained a height of 22,320 ft.

* * * *

Air Mail for Yukon Territory

It has been decided by the holders of the mail-carrying contract between Whitehorse and Dawson, Yukon Territory, to employ two aeroplanes during the winter. The machines, a Fairchild monoplane and a de Havilland "Moth," are fitted with skis and also pontoon and wheel landing gear. It is intended to use the Fairchild aeroplane for express mail freight and occasional passenger traffic for the Treadwell Yukon Mines Company, near Keno City. The distance from Whitehorse to Dawson is over 360 miles and from Dawson to Keno City 72 miles, so that a great saving of time will be effected by the employment of these machines.

Lisbon-Mozambique Flight

Four Portuguese airmen have flown from Lisbon to Mozambique in two Vickers "Valparaiso" aeroplanes, fitted with Napier "Lion" engines. Throughout the whole of the journey—a great deal of which was flown over country affording no safe landing places and populated by hostile tribes—both the machines and their engines functioned perfectly and, apart from minor repairs that were carried out on the spot by the airmen themselves, the journey was completed without a hitch.

On the first day of the flight, in spite of adverse weather conditions, the airmen flew from Lisbon to Agadir, via Casablanca, a distance of 826.5 miles, in 5 hrs. 20 mins. From Agadir the journey was continued along the coast by way of Port Etienne as far as Bulama, where the total flying time was 22 hrs. 50 mins. From Bulama the airmen flew through the interior to Accra on the Gold Coast, via Kayes, Sikasso, and Bingerville. From Accra they proceeded down the coast to Benguela, stopping at Lagos, Duala, Port Noir and Loanda on the way.

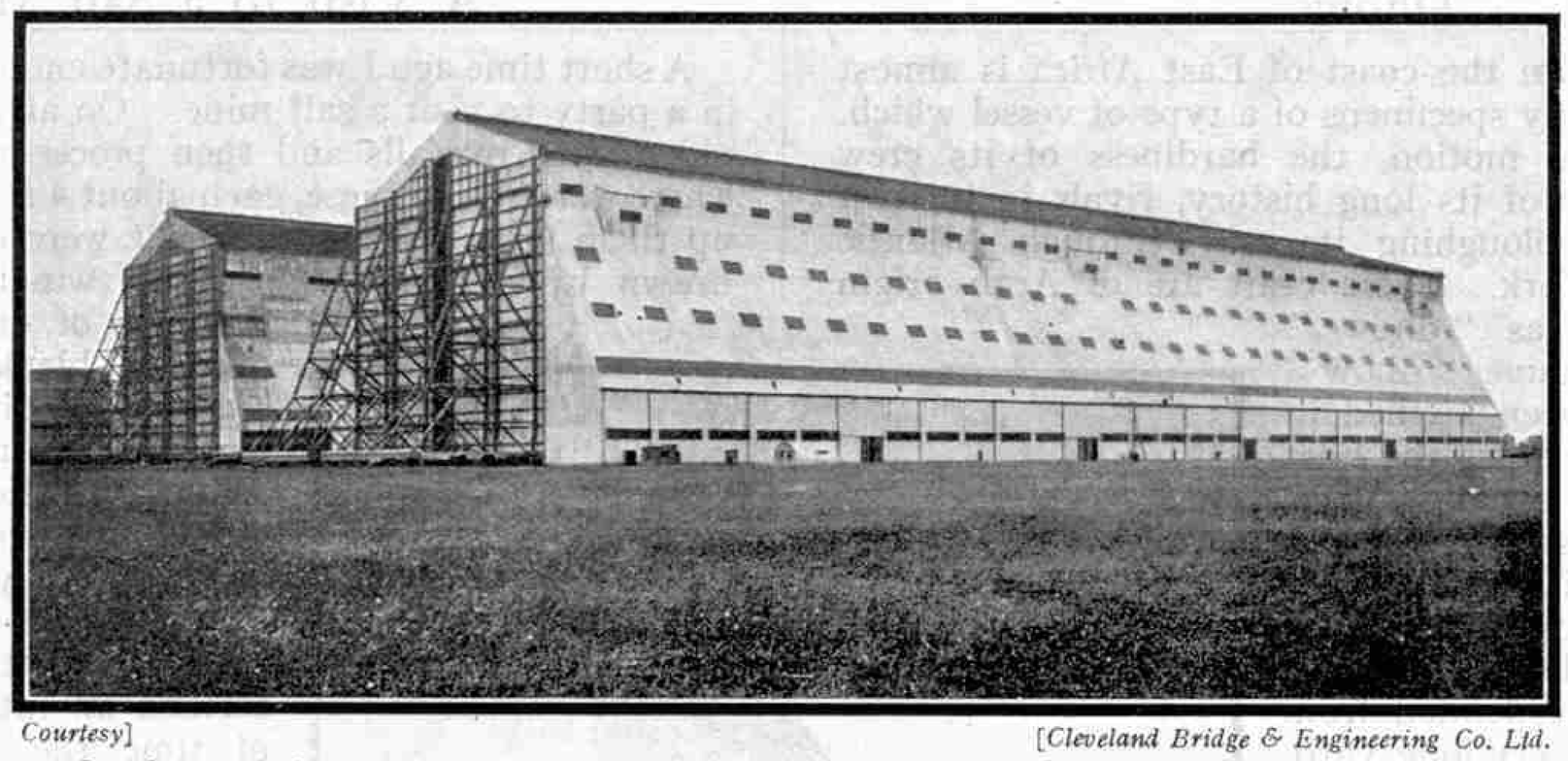
The last section of the journey was across Central Africa, by way of Silva Porto, Kozombo, Elizabethville, Tete, and Beira, to Mozambique, and on this portion of the flight, the airmen were flying over land never previously crossed by aircraft. The total distance covered by the machines was 9,950 miles, and the actual flying time occupied from start to finish, was 100 hrs. 34 mins.

* * * *

The Cross-Channel Air Services

It is interesting to note the increase of the growth of traffic on the cross-Channel Air Services as shown by the statistics now available for the years 1921, 1924 and 1927. In 1921 British aircraft carried 5,256 passengers to and from Croydon, and in 1924 this number had risen to 10,456 passengers, while during 1927, a total of 16,533 passengers were carried. French aircraft carried 4,352 people in 1921, while in 1924 and 1927 their figures were 5,619 and 5,199 respectively. In 1921 Dutch aircraft carried 480 passengers, 1,559 in 1924, and 3,586 in 1927. Belgian machines were responsible for the transport of 630 people in 1921, and although they did not run a service in 1924 their figures had risen to 1,466 in 1927. German 'planes carried 216 passengers in 1924 and 1,972 in 1927. Besides these numbers a few people were carried by 'planes belonging to other countries and the total number of passengers who passed through Croydon in 1921 was 10,731, 17,858 in 1924, and 28,764 in 1927. The total value of the merchandise imported and exported by air, (exclusive of bullion) for these years was £571,191, £1,350,960 and £2,691,267 respectively. The fact that during 1927 imports and exports of bullion, gold and silver to the value of £7,740,962 were carried by air affords striking proof of the safety and regularity of services across the Channel, and it will be seen from the figures given that Imperial Airways still carry the largest number of passengers.

The New Airship Shed at Cardington



Courtesy] [*Cleveland Bridge & Engineering Co. Ltd.*

Our photograph shows the new airship shed at Cardington, which has been transferred from Pulham by the Cleveland Bridge and Engineering Company Limited. The shed consists of some 4,350 tons of steelwork, is 812 ft. in length, 180 ft. in width and 159 ft. in internal height. It covers an area of six acres.

The airship R.101 is rapidly approaching completion in Shed No. 1, the end of which may be seen on the left of the new shed.

A Handley Page Napier air liner owned by Imperial Airways Ltd., recently made the journey between Cologne and London in exactly three hours. This is 45 minutes less than the scheduled time and the journey by boat and train would have occupied at least 15 hours.

* * * *

Pretoria-Capetown Non-Stop Record

A notable record-breaking flight between Pretoria and Capetown has been carried out by Sir Pierre Van Ryneveld, the Director of the South African Air Force, in a D.H.9 machine fitted with a 450 h.p. Jupiter radial engine. Carrying General Brink, Chief of the General Staff, as passenger, he flew non-stop from Pretoria to Capetown in the record time of 7 hours 25 minutes, taking breakfast and lunch at centres one thousand miles apart. This record was again broken by him on the return flight which was made in 7 hours 20 minutes.

* * * *

New Light Aeroplane Engine

Amongst other new aeroplane engines produced during the past few months, one intended for service in light aeroplanes has attracted considerable attention. The engine, known as the Pobjoy "P" type after its designer Mr. D. R. Pobjoy of Kent, has undergone a 50 hour endurance test, and according to reports issued has also successfully completed other trials.

The engine is of the seven cylinder type possessing a total capacity of 2,479 c.c., and the drive to the air-screw shaft is transmitted through a simple gear train. The machine developes a maximum of 67.5 b.h.p. at 3,300 r.p.m. and uses fuel at the rate of .57 lb. per horse power hour.

Air Port of Manchester

The Air Ministry recently sent a circular letter on the subject of establishing municipal aerodromes to the town clerks of the chief provincial cities and towns, and also to a number of the more important Urban and Rural Councils. In this letter it was stated that, in the opinion of the Air Council, every town of any importance will sooner or later find it very essential to possess well situated aerodromes, and as delay may result either in land suitable for aerodromes being built upon, or its price becoming prohibitive, the Council suggest that Corporations should consider the advisability of establishing municipal aerodromes with as little delay as possible.

The first city to act in this matter was Manchester, which is now the first official air port in Great Britain. The site chosen for the site of the aerodrome is the historic Chat Moss—the bog across which George Stephenson and the engineers of the Liverpool and Manchester Railway almost despaired of laying a railway. The Moss is on the main Liverpool road, is six miles from Manchester itself and, as it is already the property of the Corporation, it will not cost a great deal more than £100 to make it into a perfect landing ground. It is expected that the aerodrome will be in full use in a few months' time, and that before long regular services between Manchester and air ports on the Continent will be in operation.

* * * *

The Westland "Wizard"

The Westland "Wizard" type of single seater fighting monoplane was added to the list of machines in the service of the Royal Air Force during the latter part of 1928, and it is the first single seater monoplane to be used by the R.A.F. since the war. The machine is constructed entirely of metal except in the case of the first one made, in which the wing was made of wood.

A Rolls-Royce F.XI engine is fitted to the 'plane, and this can easily be removed for repairs as soon as the cowling has been taken off. The petrol tanks, of which there are two, are arranged in the wing and are capable of holding a total amount of 68 gallons of petrol. Two machine guns and a wireless receiving and transmitting outfit are also standard fittings.

The total length of the monoplane is 26 ft. 10 in., and the wing span is 39 ft. 6 in., while the tare and gross weights are 2,467 lb. and 3,326 lb. respectively. When fitted with a supercharged engine the machine possesses a cruising range of approximately 570 miles, while at 10,000 ft. the maximum speed attainable is 188 miles an hour.



FROM OUR READERS

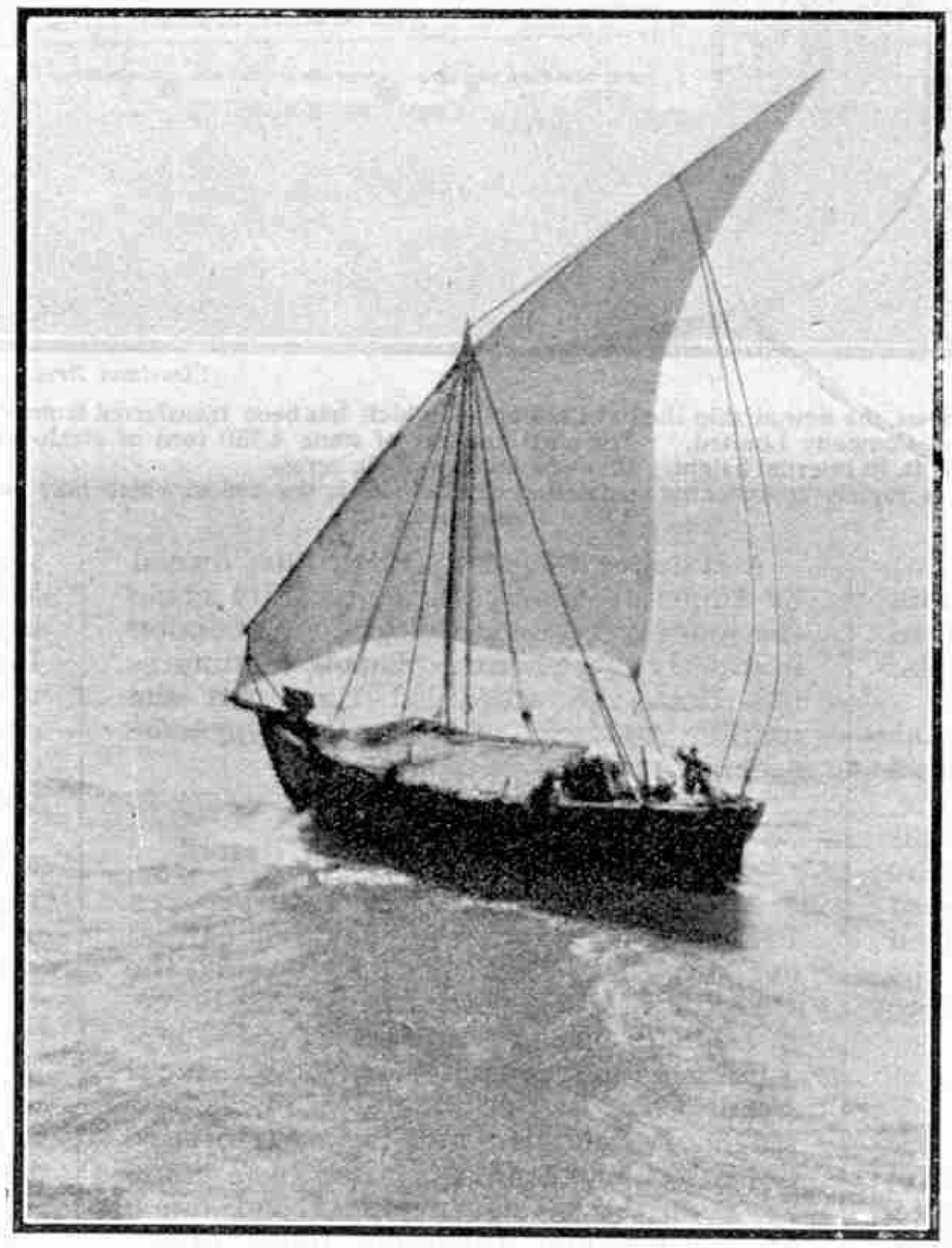
These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Dhows

A traveller down the coast of East Africa is almost certain to see many specimens of a type of vessel which, from its graceful motion, the hardiness of its crew and the romance of its long history, rivals in interest the great liner ploughing its way through Atlantic mists to New York. These craft are of Arab origin and are known as "dhows."

Though the name "dhow" has sometimes been applied to any craft in use along the East African coast, it usually means an undecked vessel of 150-200 tons, its prow rising above the water in a long slope. The single sail is of the "lateen" type—triangular and suspended from the mast by a very long yard. When at rest the dhow appears heavy and cumbrous, but once the cargo is covered and the sail set, the boat skims away across the sunlit Indian Ocean as gracefully as a bird on wing.

Between Mozambique and Zanzibar is the centre of the old slave-trading area in which "Black Ivory" was merchandised for centuries, the traffic dating back to the time of King Solomon. Higher up the East African Coast also it assumed the proportions of a great trade. Ibo, a tiny island belonging to Portuguese East Africa, and Lindi, on the coast of Tanganyika Province, were the chief centres of the traffic. This trade persisted until suppressed by Sir Harry Johnston who, after many hard fights, succeeded in driving the slave traders from their favourite hunting ground round Lake Nyassa. Before that event thousands of Africans had been marched to the coast to be sold as slaves.



A dhow under sail off Portuguese East Africa. The lateen sails of this type of vessel have been a familiar sight in the Indian Ocean for many centuries

The lateen rig enables a boat to sail closer to the wind than a similar vessel with square sails. This fact was known in Egypt more than 2,000 years ago and sailors visiting the country at that time saw that the new rig was better than their own and began to adopt it. In this manner the triangular sail gradually spread over a very wide area. Several types of lateen-rigged boats were subsequently developed, the most interesting of these being the dhow and the felucca. The latter is the fastest sailing craft in the Mediterranean Sea.

W. G. ADDISON (Trowbridge).

A Visit to a Salt Mine

A short time ago I was fortunate enough to be included in a party to visit a salt mine. On arrival we were provided with overalls and then proceeded to the shafts. There were two of these, each about 4 ft. in diameter, and up them large tubs of rock salt were continually being drawn by a noisy little steam winding engine. The prospect of droping down one of those black holes in a tub seemed startling, but the experience was really interesting. An aristocratic tub, lined with red flannel, was produced, and standing stiffly upright in it we were lowered three at a time into the depths. After what seemed an interminable length of time the tub reached the bottom with a slight bump.

All round us were twinkling tallow candles, and on the opposite wall of the mine was a huge "WELCOME" spelled out in lighted candles stuck on the rock face. The air was surprisingly clear and we were informed that mechanical ventilation was unnecessary and that the mine was so dry that no pumping engine was needed.

We were each given a candle and then we proceeded to the stables. All the animals seemed quite happy as they stood in their whitewashed boxes, and even one that had not seen daylight for 20 years did not seem any the worse.

We were next taken round the intricate workings, and on being told that it was quite possible for even a miner to lose his way in the mine, we naturally kept very close to our guide! Very soon we came across some miners breaking up the rock with picks and others drilling holes for blasting. We were fortunate enough to see—and hear—blasting in progress, and the manner in which the charge is placed was shown to us. The method of working is known as "benching." This consists of drilling and blasting the rock away from a ledge or "bench" near the roof of the mine. On the "bench" is a machine known as the cutter, which is really a heavy circular saw placed on its side and driven by compressed air. It cuts into the rock face for about 20 inches, level with the floor of the "bench," and the rock so undermined is removed by blasting. Thus the "bench" is

gradually extended farther back, while its outer edge is removed by picks and more blasting.

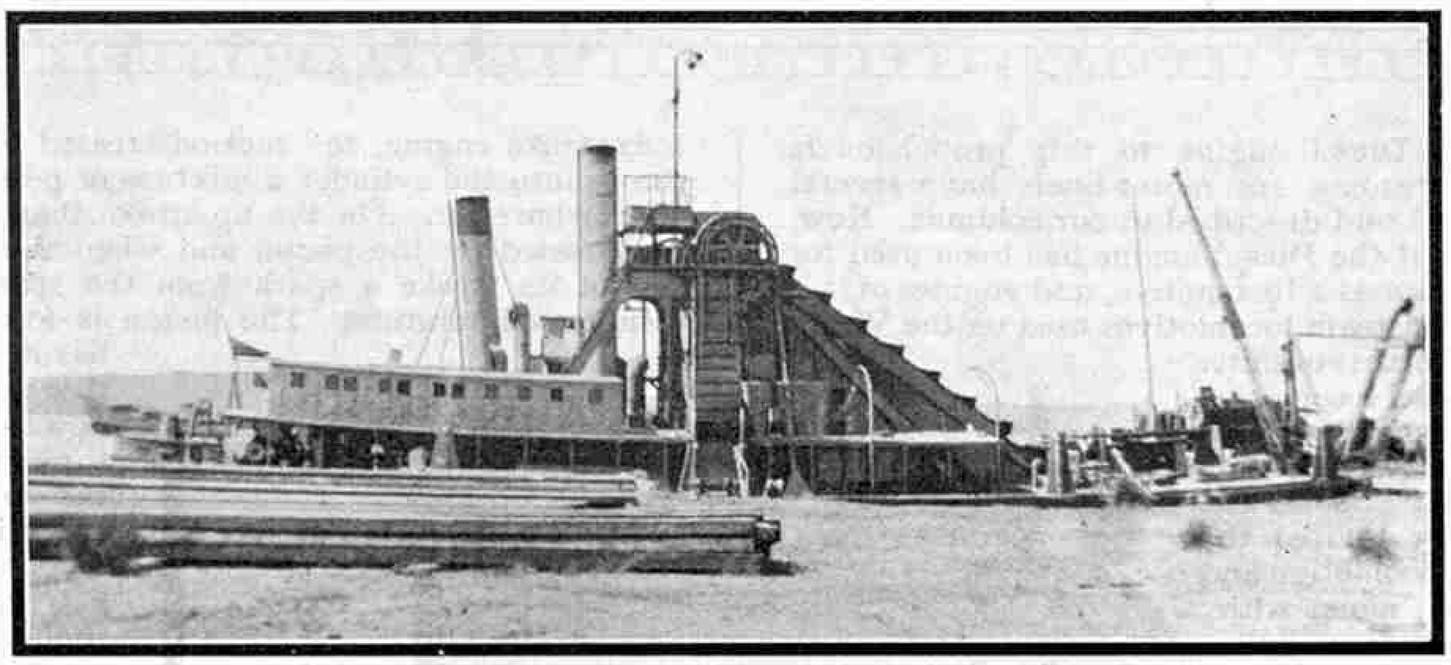
As we passed through the galleries we noticed that the roof was supported by massive pillars of rock 12 yards square. The law requires that one of these pillars be left every 25 yards, a rule that has greatly diminished the number of land subsidences for which the Cheshire salt districts have become notorious.

At last we came back to the shaft bottom, and while we were being hoisted up we began to wonder how the horses were got up and down the narrow shafts. It seems that the animals are placed in a wooden frame, while an arrangement of ropes draws their legs together beneath them. Trussed up in this manner they are hauled up nose first —a procedure to which they naturally object!

After the rock is broken up it is sorted. Different sized lumps are used for different purposes, and the value of the rock varies according to the percentage of clay or marl that it contains. Rock salt is used in the refining of copper, and in alkali and other chemical works, besides being shipped abroad in large quantities for the use of cattle.

In comparison with coal mining, salt mining is said to be a singularly safe and healthy occupation, for there is little dust in the atmosphere and no danger from gas, while falls of rock are extremely rare. Nevertheless I much prefer to remain on the surface!

L. Gordon Wilkins (Liverpool).



Dredger at work deepening the channel leading to the graving dock in Durban Harbour

Dredging in Durban Harbour

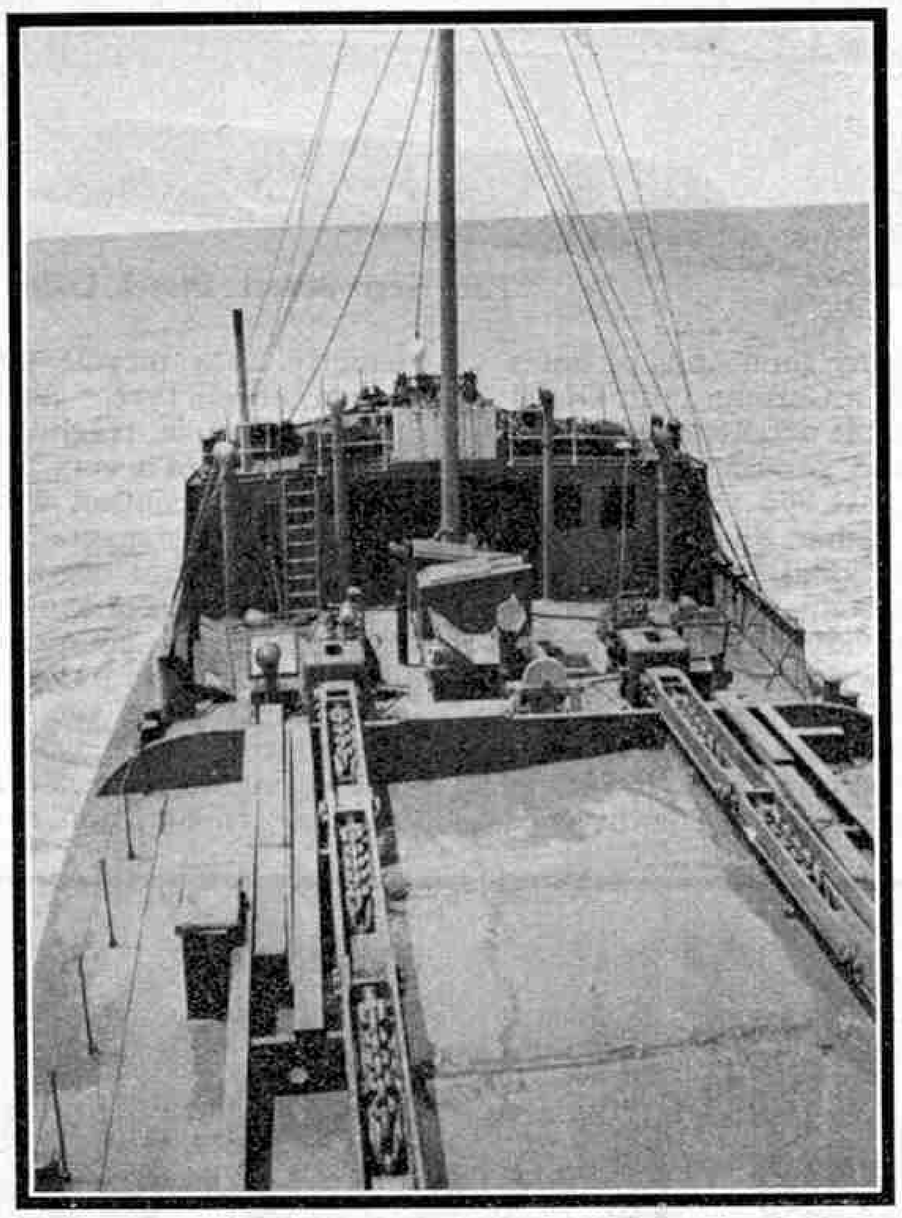
During our holidays two chums and myself visited a bucket dredger that was deepening the channel that leads to the graving dock in Durban Harbour. She was lying close in-shore and we were quickly ferried out to her in a small boat. We had tea with the mate in his cabin, where we noticed a collection of clay blocks, and were greatly interested to learn that these were samples of the different materials through which the dredger had cut a passage.

The mate then took us to the navigating bridge, from which the vessel is steered when she is moved about. Next we went forward to see the tower from which the bucket arm is suspended. This goes through a channel in the middle of the boat, and when the dredger is at work an endless chain of buckets passes up and down continuously. On the port side of the vessel is a small crane to lift heavy objects on board.

The mud brought up by the buckets is discharged into a hopper moored alongside. When our inspection of the tower was finished the sound of a whistle told us that the hopper was full and about to cast off, and hurriedly we stepped aboard in order to make the trip to the dumping ground seven miles away. Three miles brought us to the entrance to the harbour and we had to go at least four miles out to sea before dumping the mud and clay that had been brought up from the bottom of the harbour.

The strange vessel on which we made the short voyage was really an old suction dredger with the pipes taken out. In addition, the bottom of the vessel had been cut into two sections that opened downward like doors. On arrival at the dumping ground the plugs holding the chains were released. The bottom of the hopper then appeared to fall out, carrying with it the mud that we had brought from the harbour. When the last remnant of this had been cleaned out the engines hauled in the chains in order to close the doors. The vessel then turned round and we made our way back to the dredger once more. A small boat was waiting to take us to land and our delightful day was at an end.

G. Cartledge (Durban).



Cargo of mud and clay on its way to the dumping ground

How Felt Hats are Made

The fur from which felt hats are made is first torn into a soft fluff. The exact amount needed to make one hat is then fastened to a machine in which there is a rotating copper cone about three feet in height. This is perforated and air drawn through its tiny holes carries particles of fur on to its damp outer side, forming a thin covering of felt. A wet cloth is thrown over the matted fur and pressure applied to complete the felting. The cone of felted cloth is then dyed and given a bath of shellac to stiffen it. It is plunged into boiling water and moulded into shape while hot by ingenious machinery. The brim is curled by the pressure of small bags of hot sand.

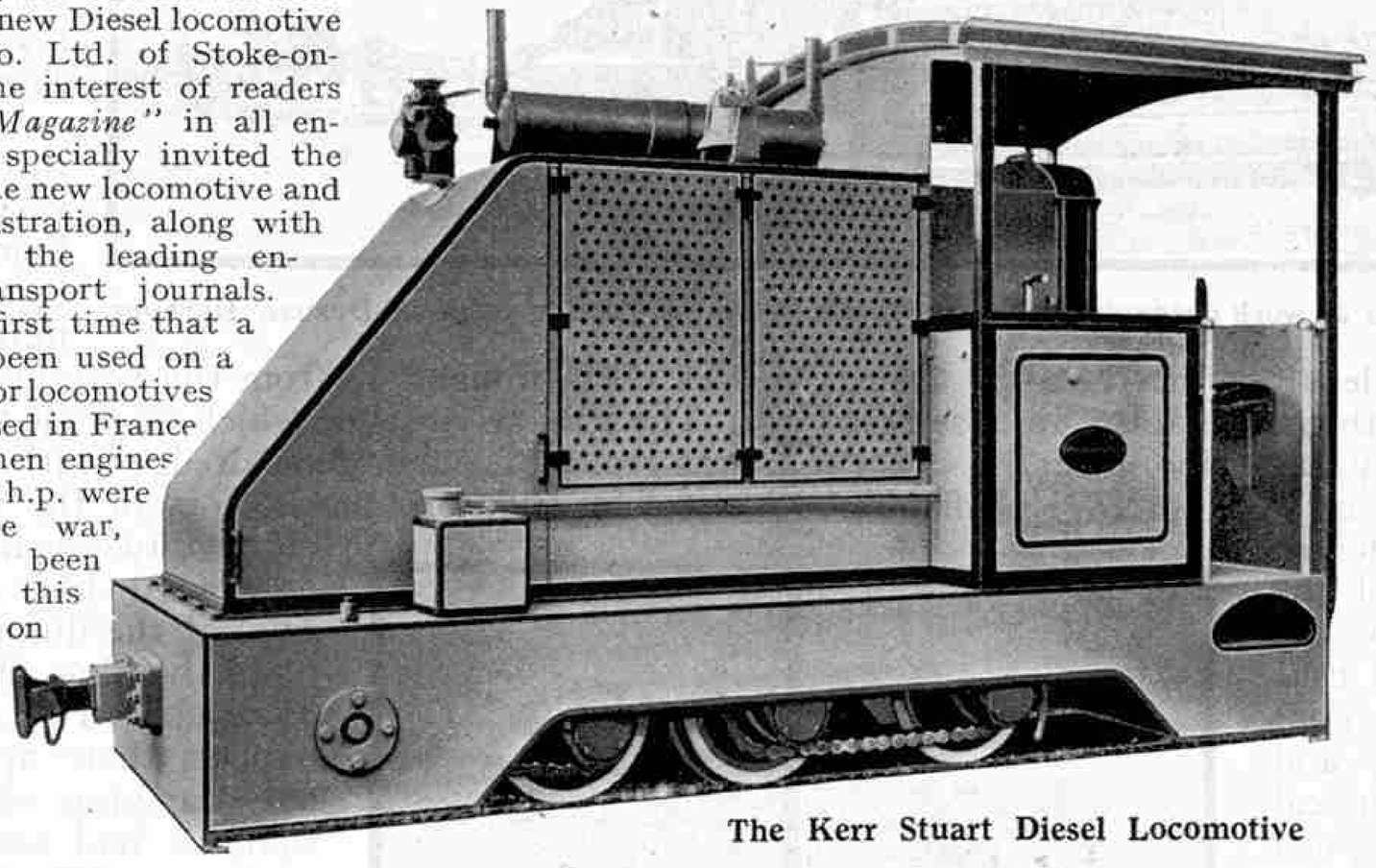
Neville H. Field (Holywell).

Locomotives of the Future:

Trial Trip of New Diesel Railway Engine

THE application of the Diesel engine to ship propulsion is well known to our readers, for motor-liners have several times been mentioned and described in our columns. Now, we are able to announce that the Diesel engine has been used for the first time in Great Britain as a locomotive, and engines of this type will shortly replace the steam locomotives used on the Welsh Highland Railway, in Caernarvonshire. The makers of this new Diesel locomotive (Kerr Stuart & Co. Ltd. of Stoke-on-Trent), knowing the interest of readers of the "*Meccano Magazine*" in all engineering matters, specially invited the Editor to inspect the new locomotive and to attend a demonstration, along with representatives of the leading engineering and transport journals.

This is not the first time that a Diesel engine has been used on a railway, of course, for locomotives of this type were used in France during the war, when engines of from 100 to 200 h.p. were built. Since the war, too, there have been developments in this direction, notably on the Continent. A Diesel locomotive, built in Germany for use in Russia, was delivered at Moscow early in 1925, and has proved very successful, having travelled many thousands of miles over severe gradients. Then again, in 1926, a German-built Diesel locomotive of 1,200 h.p. attracted considerable attention, carrying sufficient fuel for a run of 1,000 miles and proving capable of hauling such huge loads as of from 800 to 1,350 tons over any average gradient. An experiment of a rather different nature was made in 1925, when the Canadian National Railways introduced the first Diesel-electric cars into Canada. These cars are self-propelled railway coaches, each embodying a combination of Diesel engine and electric generator. The first nine cars proved so successful that several others have since been placed in service by the company. The latest example of this type of rail coach has undergone successfully a number of very severe tests, including a run across Canada, from Montreal to Vancouver. The distance of 2,937 miles was covered in 67 hours, giving an average speed of 43½ m.p.h., and throughout the journey the engine was never stopped.



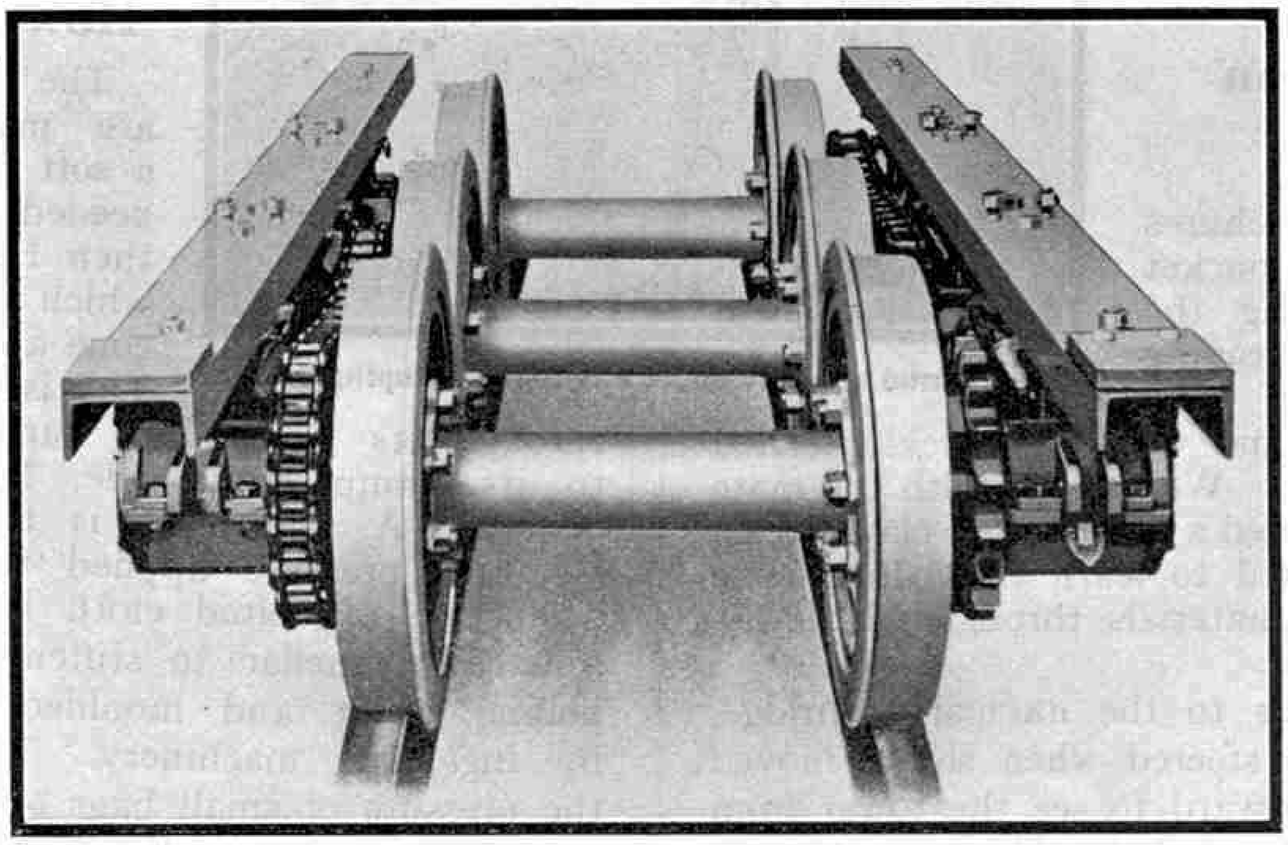
The Kerr Stuart Diesel Locomotive

Let us, for a moment, digress to learn something about the principle of the Diesel engine, which our readers will remember was invented by Dr. Rudolf Diesel about the year 1895. To understand the difference between the Diesel engine and the ordinary petrol engine will present no difficulty to those readers who have followed our recent series of articles dealing with "*The Story of the Motor Car.*" It will be remembered that in the earlier articles explaining the working of the petrol engine, we described how during the first stroke in a four-stroke engine, the suction created by the descending piston draws into the cylinder a mixture of petrol, vapour and air from the carburetter. On the up-stroke that follows, this mixture is compressed by the piston and when the piston is nearly at the top of its stroke a spark from the sparking plug explodes the compressed mixture. The piston is forced downwards and the burnt gases are ejected from the cylinder on the next upward stroke of the piston through the exhaust valve, the opening of which is timed accordingly.

A four-cycle Diesel engine has four strokes that are similar to those of the petrol engine. There is a difference, however, in that on the induction stroke only, air is drawn into the cylinder. On the second stroke this air is compressed, but to a much higher ratio than in the case of the petrol engine. On the latter, the compression ratio generally employed is somewhere between 4 : 1 and 6 : 1, but in the Diesel engine the compression ratio may be in the nature of 25 : 1. This causes the air to be compressed to as high as 450 lb. to the square inch, it becoming very hot in the process, exactly as a bicycle pump becomes hot when compressing air into a bicycle tyre. At a fraction of a second before the maximum compression is reached, a pump injects a small charge of oil (in the form of a very finely-divided spray) into the cylinder. On coming into contact with the air, this oil is ignited by the heat and thus the magneto—(or coil-and-battery)—required in the case of a petrol engine, is eliminated.

The injection of the oil is so timed that as it burns it maintains the maximum compression pressure while the piston travels downwards. Its burning results in a steady push on the piston, as distinct from the sudden explosion-like rise of pressure in the petrol engine. This evenness of burning effort gives the Diesel engine, to a certain extent, the characteristics of a steam engine. In addition to this valuable feature, the Diesel engine has the high thermal efficiency of all internal combustion engines, because the fuel is burnt inside the cylinder in the exact place where the work is being performed.

The Diesel has a distinct advantage over the petrol engine, however, in that whereas a large amount of the energy contained in the fuel of a petrol engine is lost in the form of heat, this waste is not nearly so marked in the Diesel, which is much cooler in working. For instance, even after hours of heavy pulling, the cooling water of the Kerr Stuart Diesel locomotive, with which we are concerned in this article, is never more than about 200°F. No matter how hard the engine is worked, the

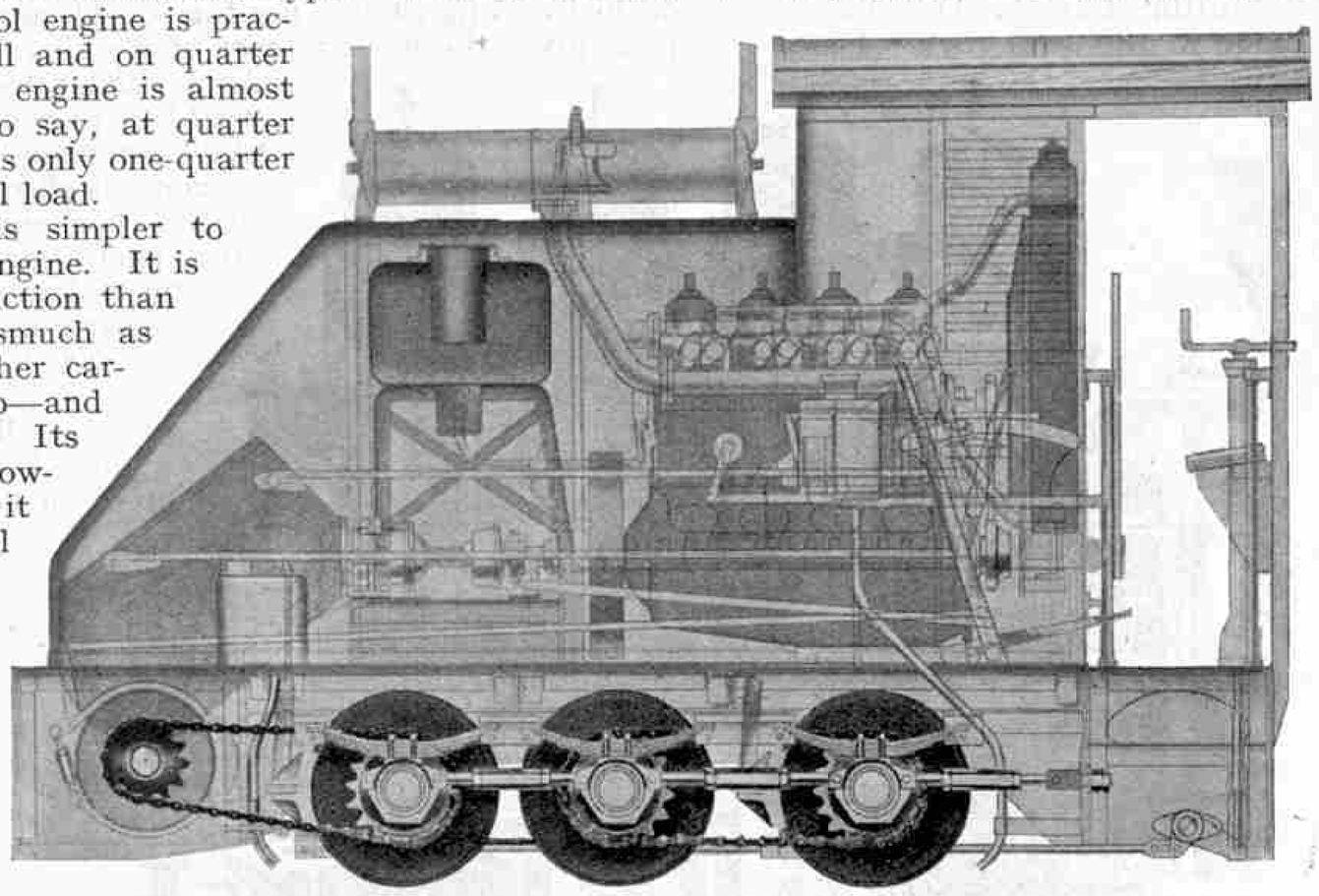


Our illustration shows the method of suspension and the chain drive

water in the radiator will never boil.

A Diesel engine is controlled by altering the amount of fuel injected into the cylinder, the compression pressure remaining constant, irrespective of load or speed. Similarly the efficiency of the engine remains constant at all loads and speeds, thus eliminating one of the greatest sources of loss present in internal combustion engines of the carburetter type. Whereas the fuel consumption of a petrol engine is practically the same on full and on quarter load, that of a Diesel engine is almost proportional—that is to say, at quarter load the fuel consumed is only one-quarter of that consumed at full load.

The Diesel engine is simpler to operate than a steam engine. It is more simple in construction than the petrol engine—inasmuch as it does not require either carburetter or magneto—and is far more reliable. Its greatest advantage, however, is the fact that it saves 75 per cent. in fuel and running costs, as compared with a steam locomotive of corresponding power and size. Kerr Stuart & Co. Ltd. claim that the use of this type of engine will give 15/- change out of every £1 previously spent in fuel. These and certain other good qualities, lead some engineers to think that the Diesel engine will somedav supersede every other type of engine as a prime mover.



An interesting view showing a section through the Kerr Stuart Diesel Locomotive. The forward movement is, of course, from left to right

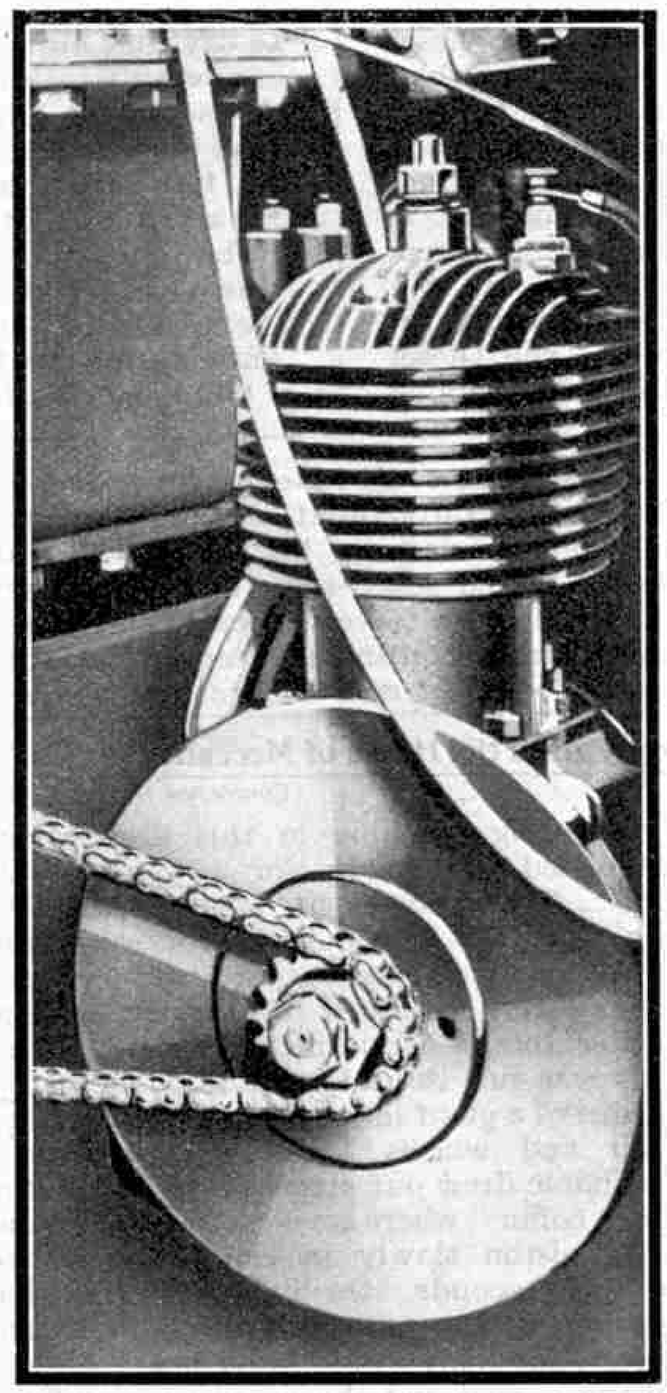
The engine that we are describing has four cylinders and develops 60 h.p. The cylinders are 200 m.m. stroke by 135 m.m. bore, the cylinder heads being detachable. The inlet and exhaust valves are carried in the cylinder heads, and here, too, is a special chamber into which the fuel is injected by the fuel pump. The purpose of this chamber is to give a more regular fuel ignition and easier starting. The four-throw crankshaft—supported by five large bearings, lined with white metal—is a drop forging, and is drilled throughout for forced lubrication to all big ends. The pistons are fitted with five rings, the bottom ring in each case being a scraper ring, its purpose being to return the surplus lubricating oil to the sump. The valves are of the overhead type and all valve bearings are fully enclosed by dustproof covers, a necessary feature in those countries that abound in sandy soil and where high winds are prevalent.

Perhaps the most interesting and certainly the most important, part of the engine, is the fuel pump, which takes the place of both carburetter and magneto on a petrol engine. Actually, there are four fuel pumps—one for each cylinder—and they are worked by means of a rocking lever from a camshaft contained within the assembly. The pumps inject into each cylinder a carefully-determined amount of fuel at the correct instant in the stroke and are capable of exerting a tremendous force. This is necessary, for not only have the pumps to work against the full compression in the engine cylinder but they also have to inject the fuel with such force that the latter is broken up into spray—or " atomised," as it is called—so that combustion shall be rapid and complete.

The pumps are controlled by a centrifugal governor that automatically adjusts their stroke according to the speed at which the engine is running. If the governor is left to itself it will maintain the speed of the engine at about 800 r.p.m., which is its maximum running speed. To enable the engine to be run more slowly—as when the locomotive is standing with the engine running idle—a hand accelerator is provided. This controls the tension of the governor spring, which may be adjusted so as to reduce the speed of the engine to any degree desired.

The transmission is of massive construction, and designed to withstand much hard wear and rough handling. A cone clutch is used, the two outstanding good points of this type being its complete freedom when withdrawn and its absence of slip when in position—the two features on which, after all, a good clutch depends. A strongly-constructed gear box is fitted, the drive being taken from the propeller shaft direct to a bevel pinion meshing with two bevel wheels on the first cross-shaft. These bevels are loose, but the shaft can be connected to either of them by means of a sliding dog-clutch placed between them, thus giving reverse gear. The cross-shaft drives a second lay-shaft by means of heavy duplex chains, which dip into an oil sump, carrying oil over the top of the bevels, whence it is splashed to every moving part of the gear box.

The wheels of the locomotive are chain-driven and although at the first glance this principle looks simple, actually it is a feature that calls for considerable skill in design. In earlier makes of geared locomotives, the principle adopted has been to drive each pair of wheels by means of a chain from either end of the engine crankshaft. It is obvious that this principle is quite wrong, for should there be any variation in the sizes of the wheels, one chain will gradually wind up tight until the difference is forced out by wheel-slip. In the Kerr Stuart locomotive the difficulty is overcome by driving from the source of power to the leading pair of wheels, and then progressively to the remaining wheels of the locomotive by heavy roller chains of 2½ in. pitch. The leading pair of wheels are driven from the gear box and have the middle and trailing wheels coupled to them by chains, thus ensuring a positive drive to each pair of wheels.



The starting engine—a petrol engine of the motorcycle type

One of the greatest drawbacks of large petrol engines, especially those of sufficient size to drive a locomotive, is the difficulty of starting-up in cold weather. A large engine may require as much as an hour of strenuous effort on the part of those responsible, and even then it may be necessary to tow it with another locomotive before it will start up. Electric starters have been tried, but naturally they have not been found successful for such heavy work. The Kerr Stuart Diesel engine is started by a 4 h.p. petrol engine of the type usually fitted to motorcycles. This small engine, which is tucked away out of sight at the front of the locomotive, can be started without the slightest difficulty in any weather. Once it is running it has sufficient power to turn over the main engine at full pressure for as long a period as may be necessary until the compressed air reaches its correct working temperature. Even on the coldest morning the Diesel engine can be under way in less than three minutes.

To refer, now, more particularly to the interesting demonstration at which the writer was present. This took place on the Welsh Highland Railway, a narrow-gauge railway originally opened from Dinas Junction to the west end of Quellyn Lake in 1877, but extended to Rhyddu (now known as South Snowden) in 1885. At first this line, which was then known as the " North Wales Narrow Gauge Railway," carried considerable traffic during the tourist season, and also conveyed large quantities of slates all the year round from the quarries at Bryngwyn. Although passenger traffic was discontinued during the

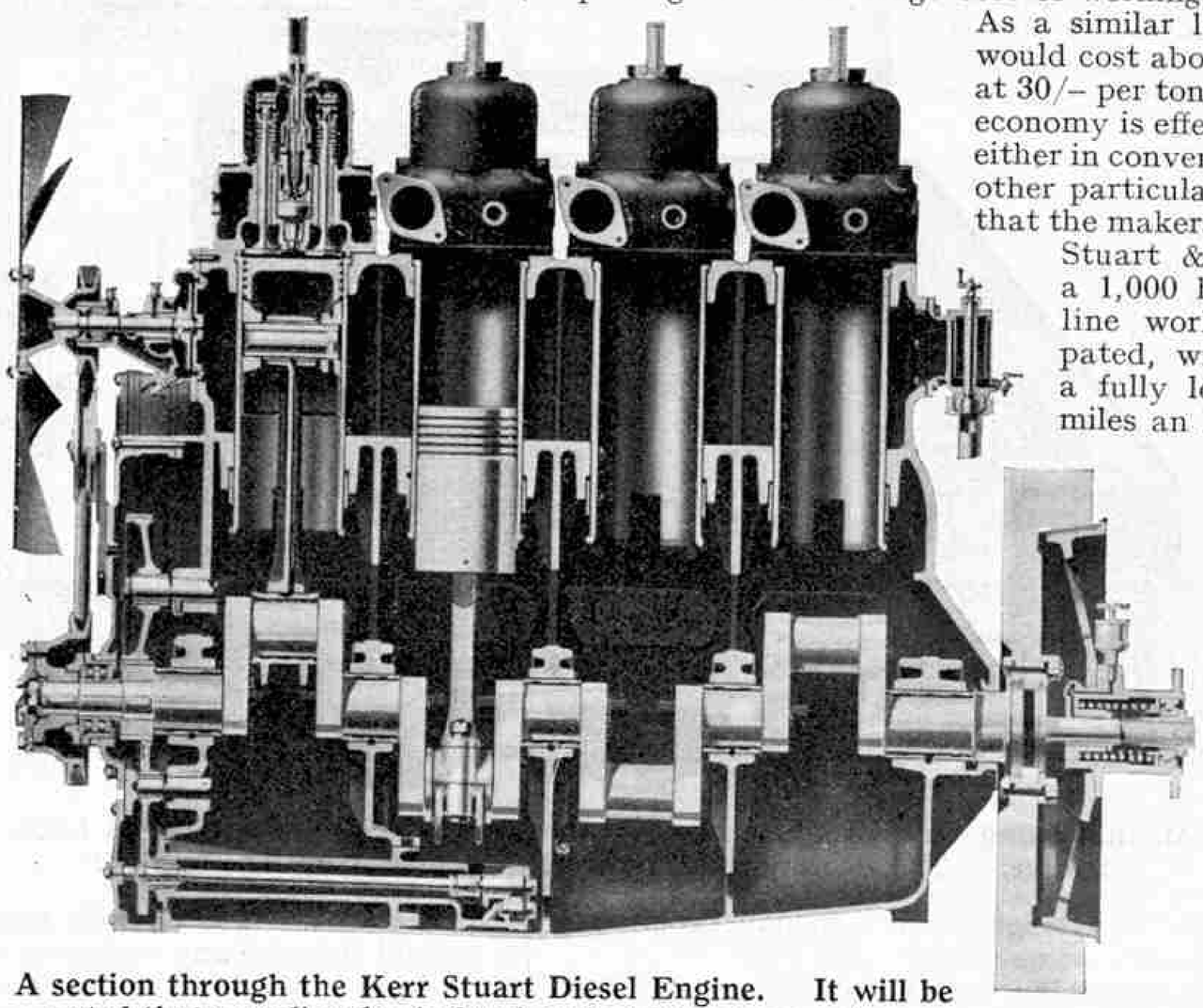
war, a fair amount of goods traffic was carried, especially timber from areas in which the Forestry Corps were working.

In 1922, the Welsh Highland Railway was constituted, the new company taking over the partly completed works of several other railways and tramways that connected Portmadoc with Beddgelert, South Snowden, etc. The railway now runs from Portmadoc, and after crossing the Great Western Railway by means of a level crossing, goes through the beautiful Pass of Aberglaslyn passing through several tunnels made in the solid rock. From Beddgelert the line descends almost with a continuous gradient of 1 in 30 to Pitts Head, and although the gradient eases to South Snowden and Dinas, curves are numerous all the way. The rails throughout are British Standard Section, flat bottomed and average 40 lb. per yard. The trains are worked by staff and ticket. The beauty of the scenery alongside the track is such that if the railway were constituted in Switzerland, France, or anywhere other than in Great Britain, it would be thronged throughout the tourist season by passengers who love beautiful scenery. It was in such picturesque surroundings as these that the new industrial locomotive was demonstrated.

The party assembled at Chester one evening and next morning were conveyed to Caernarvon by special saloon, and then by motorbus from Caernarvon Station to Dinas. Here the engine was found standing in the sidings attached to the miniature coaches used on this railway, consisting of a buffet and saloon coach and a brake van. After a preliminary inspection of the locomotive, the small auxiliary engine was started up and when it had been running for a few seconds the clutch was let in and the big engine commenced to turn over. In about a couple of minutes the Diesel engine was running by itself, as steadily and with as little trouble, as if it had been going for hours. Incidentally, it may be mentioned that when the big engine takes up the running, an ingenious arrangement automatically throws out of gear the starting engine, so that no further attention is required from the engineer.

The visitors now boarded the train and she pulled out of Dinas with ease, although immediately after leaving the Station the line rises sharply. This rise continues for several miles with gradients as steep as 1 in 35, but this did not trouble the Diesel locomotive, which negotiated them on top gear, and even stopped and re-started in top gear, without the slightest difficulty. Arrived at Tryfan Junction the train was stopped and a smart piece of shunting work was carried out, the engine being detached and run up the line to be attached at the other end of the train for the return journey.

The engine is capable of hauling 300 tons in bottom gear at four miles an hour, or 133 tons at twelve miles an hour. She runs on fuel costing £4/3/– per ton, or 4d. per gallon, and fuel at this price gives the average cost of working at exactly 7d. per hour. As a similar locomotive run by steam would cost about 2/– per hour with coal at 30/– per ton, it is obvious that a great economy is effected without any sacrifice either in convenience, reliability or in any other particular. It is interesting to find that the makers of this locomotive (Kerr Stuart & Co. Ltd.), are building a 1,000 h.p. locomotive for main line working, which, it is anticipated, will be capable of hauling a fully loaded train at 60 or 70 miles an hour.



A section through the Kerr Stuart Diesel Engine. It will be noted that a cooling fan is fitted, as in motor car practice

The result of the demonstration was to create the impression that here was something revolutionary and of far-reaching importance to the industrial world and Kerr Stuart & Co. Ltd., as the pioneers of this type of railway engine, are to be congratulated on their enterprise. It is probably something more than an idle dream to imagine that in five or ten years' time the steam locomotive, as used in this country for industrial purposes, will be completely superseded by the Diesel engine locomotive. Whether or not this prophecy can be extended to apply to main line working would be difficult to say, but almost any development seems possible in view of the ease with which the trial locomotive negotiated the steep inclines of the Welsh Highland Railway. At any rate it is safe to say that there is a great future before this type of locomotive, and we feel sure that all our readers will join us in wishing Kerr Stuart & Co. Ltd. "good hunting" in their efforts. They are to be congratulated on the foresight they have shown in planning this novel locomotive, and also on their courage in putting their ideas into practice. We all look forward with very keen anticipation to further news of the type generally but of the 1,000 h.p. "big fellow" in particular!

Famous Trains—(*continued from page 10*)

the Middle West of the U.S.A. So at 10.30 p.m. we make our start in United States territory, through which we are to travel for just short of nine hours.

By now all the sleeping berths will have been made up by our negro friend. In the ordinary sleeping cars they are all longitudinal, the seats being pulled out to meet and form the lower berths, while the upper are let down from the roof of the car. Curtains are then drawn down both sides of the central gangway, and with this somewhat scanty privacy we have to undress in our berths and get to sleep. Through the night our 4–8–4 giant is forging on, and experiences but one change of crew, at Battle Creek. The longest run on this section of the journey is over the 63¾ miles from Port Huron to Flint, allowed 84 minutes. In all, 10 stops are made between Port Huron and Chicago. At Valparaiso a fresh dining car is attached in place of the one that we lost at London, in order to provide for our breakfast; and at 7.25 a.m., 22½ hours after leaving Montreal, we pull into Chicago. Our 848-mile trip is at an end, and although the average speed of 38 miles an hour that we have made throughout the journey may not seem to us very high, yet, when all the stops and speed reductions have been allowed for, we have witnessed, probably, some harder continuous locomotive work performed than ever before in our lives.

My Visit to the Home of Meccano—

(*Continued from page 43*)

A baling machine in this department interested our party for a considerable time. Truck loads of waste material—the skeletons of the strips of steel and brass that had been used to make various parts—were dumped into what looked rather like a large metal coffin. When this was full the lid was closed down by means of a giant lever, a clutch was thrown over and wheels began to revolve. A mechanic drew our attention to one end of the "coffin" where we noticed a ponderous steel piston slowly moving. We waited a few seconds, thrillingly aware that gigantic forces were at work right at our feet. Suddenly the movement of the piston ceased and the lid of the "coffin" flew open. The tangled mass of steel and brass that had been placed inside had vanished; all that could be seen was a cube of metal, a little larger than a biscuit tin, which was promptly seized and sent along to the Waste Department.

Incidentally, I would recommend this baling machine as an excellent subject for a Meccano model. The piston, or ram, is forced against the metal by means of a steel hawser passing round two sets of pulleys and winding slowly on to a revolving drum. In the Meccano model this mechanism would resemble that employed in the Hydraulic Crane (Model No. 724 in the 4-7 Manual), but of course, instead of the ram transmitting power to the cord that passes round the Pulleys, the cord would be arranged so as to transmit power to the ram.

There were many other fascinating machines in this department, some turning out Flanged Plates, Pulley Wheels, Girders, and other Meccano parts, while the remainder were making Hornby Train Boilers, Wagon Frames, Coach Sides, and dozens of minute parts which, try as I would, I failed to recognise, but which Mr. Hornby informed me would all be included in some well-known Hornby Railway accessory.

(*To be continued*)

Famous Aero Engines

VI.—The "Bristol" Jupiter

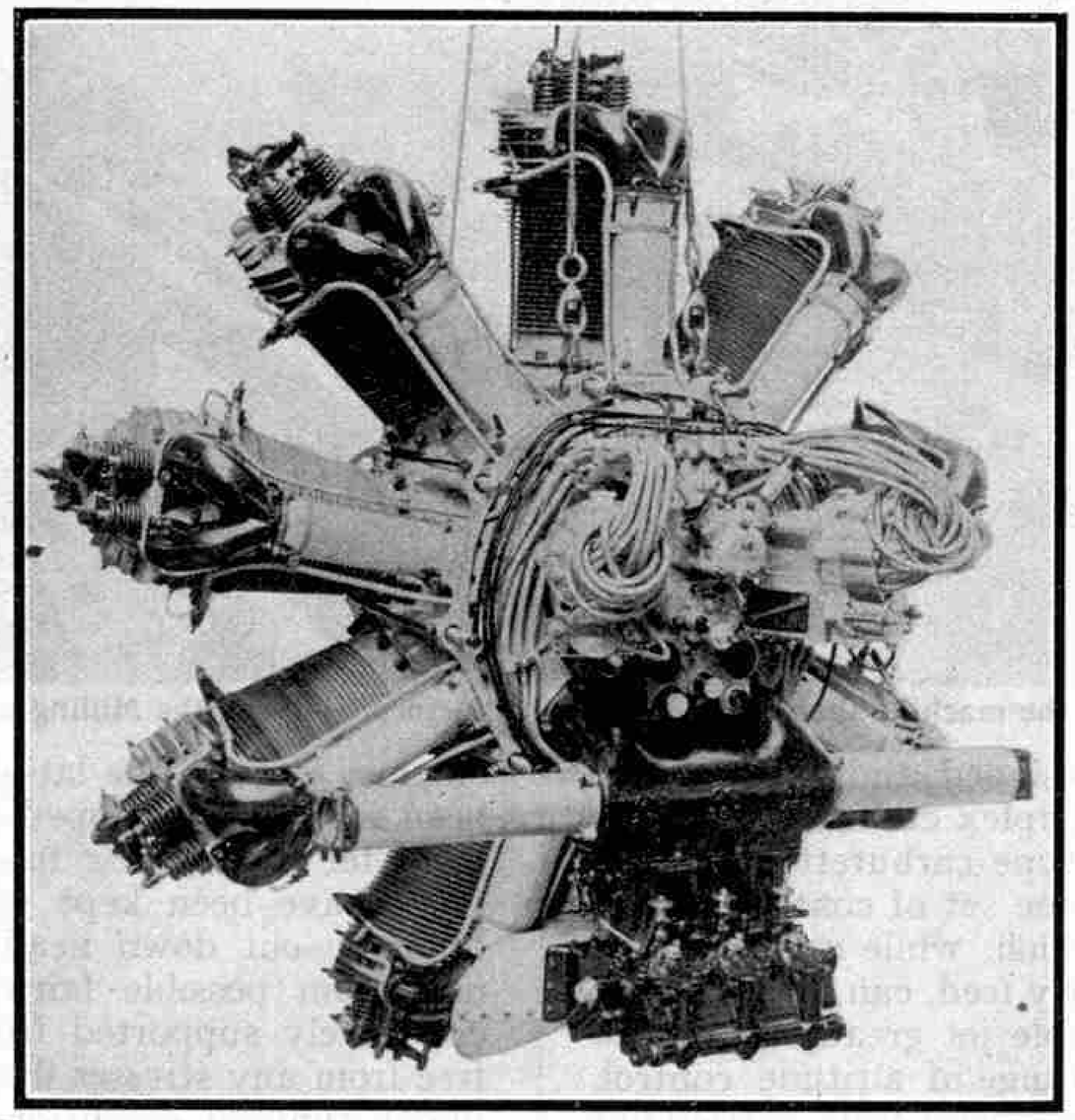
ONE of the most popular aero engines of to-day is the "Bristol" Jupiter, produced by the Bristol Aeroplane Company Limited. It is of the air-cooled type, and with its nine radially disposed cylinders it has been designed for application to machines varying from the fast high altitude scout to the heaviest commercial or military machines.

It was the first engine embodying air-cooling principles to pass the official tests of the Air Ministry. This success was achieved in September 1921, and for some time afterwards no other air-cooled engine obtained similar results.

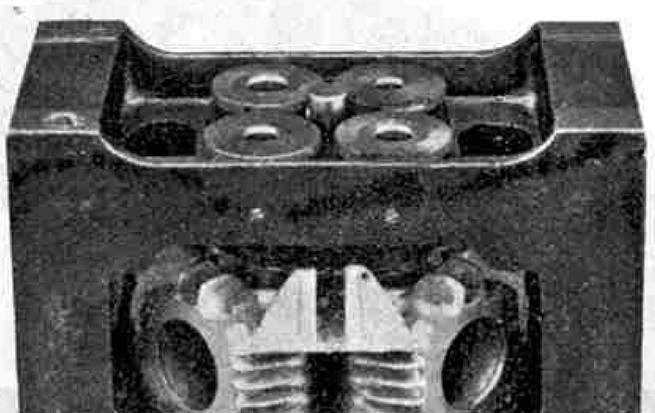
The standard direct drive Jupiter, known as the Series VI, is of extremely robust construction, but in spite of this it is very compact and convenient for installation. The grouping on the rear cover of the auxiliary drives and accessories, such as magnetos, carburetter, controls, oil pump, oil filters, etc., insures the necessary protection for these components and allows of the use of a simple form of cowling with a detachable rear panel that gives ready access to all components likely to require routine attention on service. Three types of the engine are produced —a high compression service engine specially suitable for machines normally operating at altitudes of 15,000 ft. upwards; a standard service engine for machines normally operating at medium altitudes and requiring the maximum power available at ground level when using standard fuel; and a standard commercial engine specially designed for commercial machines.

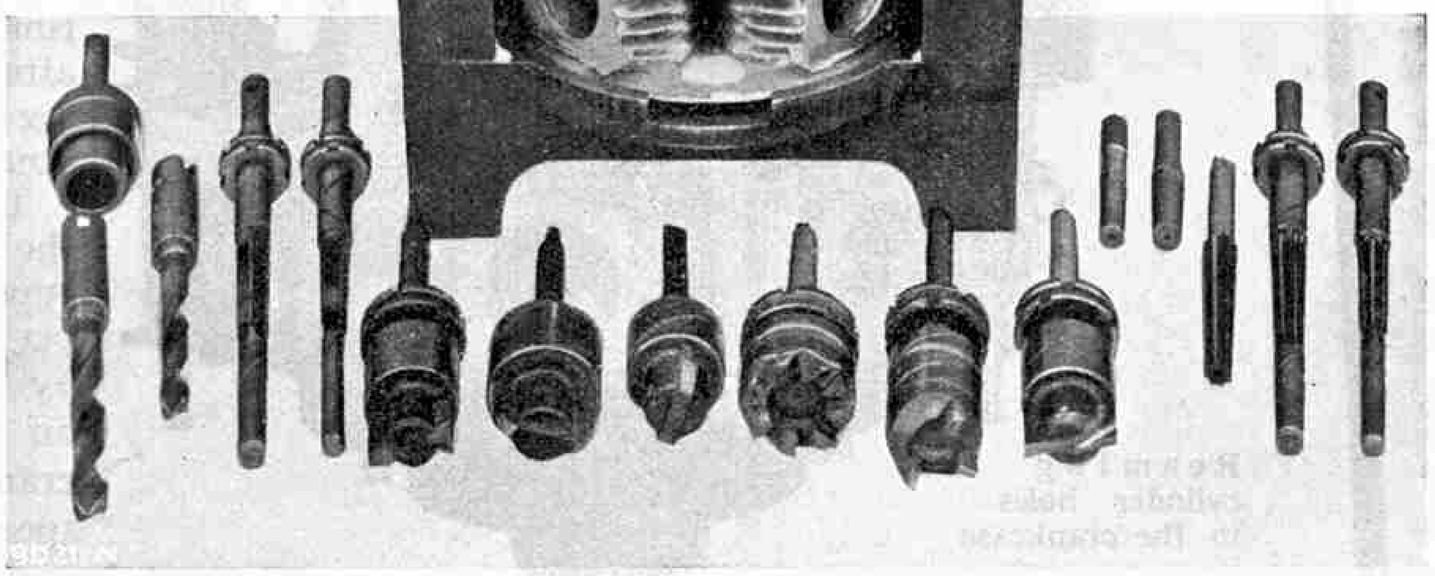
The front and rear half crankcase are machined from duralumin stampings, a face joint being made on the centre line of cylinders by nine collar bolts, the rearward projections of which are used for attaching the engine to the aeroplane mounting. The crankshaft is of the built-up type manufactured from specially hardened and tempered nickel chrome steel stampings. The shaft is drilled throughout for lightness, communicating holes and blanking plugs allowing of the resulting chambers being utilised for oil circulation and distribution. The master connecting rod and the eight articulated rods are also of nickel chrome steel stampings. The built-up crankshaft allows the use of a solid big end for the master rod which is lined with a hardened steel sleeve, bearing directly upon the bronze backed white metal lined bush floating on the crankpin. The pistons are of cast aluminium alloy and are of the slipper type, carrying two gas rings and, in addition, one oil scraper ring of special design.

The cylinders are of composite construction. The barrels, machined from alloy steel forgings, have an integral combustion head upon which the overhead valves, two inlet and two exhaust, seat direct. The head, which embodies the valve ports and carries the valves, valve guides and rocker mechanism, is of cast aluminium alloy of high heat conductivity, and is secured to the steel barrel by studs and set screws, a faced joint being made with the cylinder barrel to insure the maximum heat conductivity. To compensate for the difference in expansion between the aluminium head and the steel securing studs, Invar packing sleeves are fitted under the nuts, ensuring good contact between the head and the barrel throughout the range of working temperatures. Double concentric valve springs are fitted, and the valves are of cobalt chrome steel with special hardened steel caps to take the thrust of the rocker screws.



Three-quarter rear view of the "Bristol" Jupiter engine Series VI. For this and the other photographs illustrating this article we are indebted to the Bristol Aeroplane Company Limited





Jig, drills and taps used for drilling valve guide holes in the cylinder head

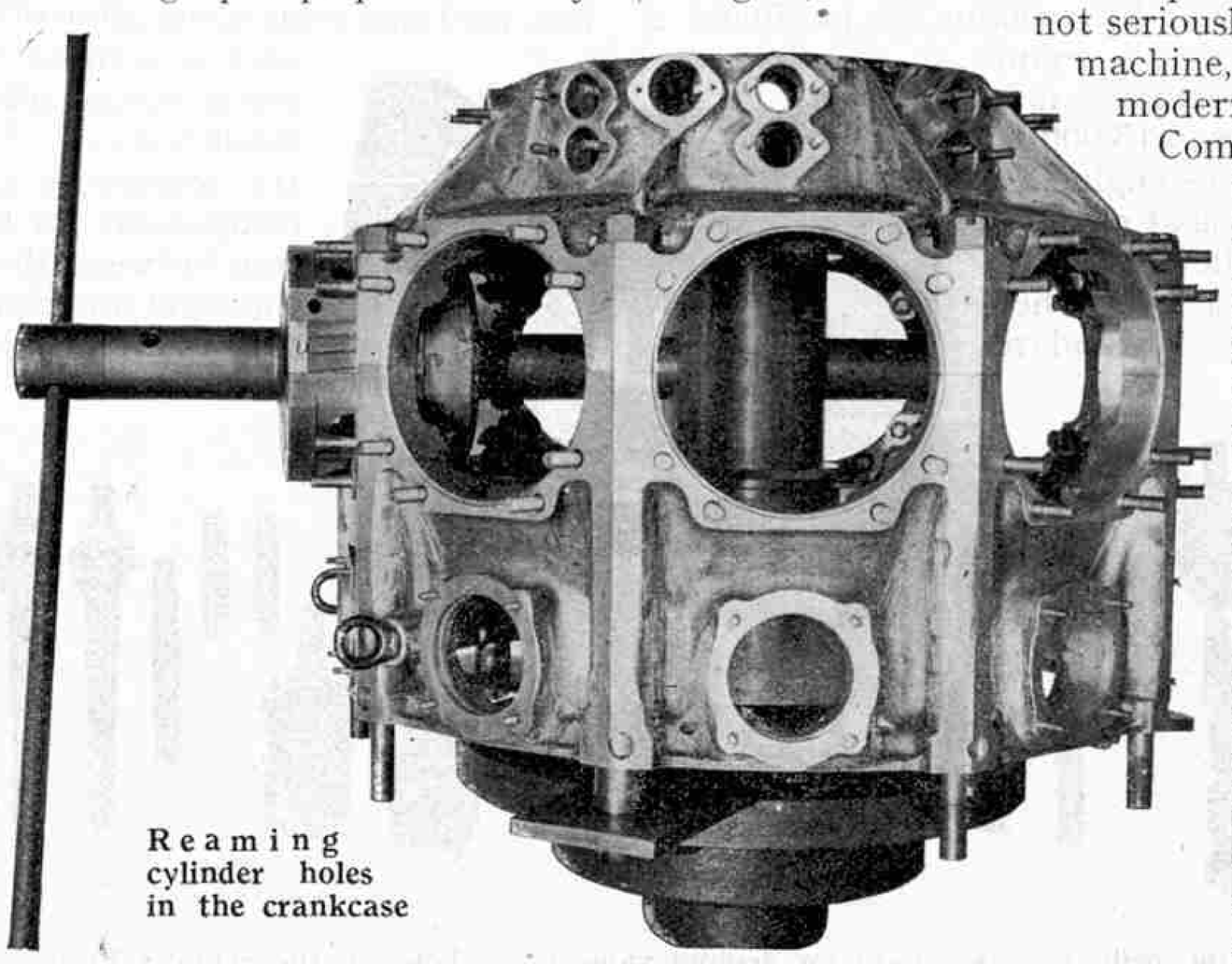
One of the huge bays in the machine shop of the "Bristol" factory, showing the Milling and Broaching machines

The carburetter specially designed and supplied for this engine is the "Bristol" Triplex carburetter. This consists of three variable jet type carburetters formed in one body and operated by one set of controls giving a very compact instrument which, while mounted low enough to allow of a good gravity feed, can be tucked up inside the cowling. The variable jet greatly facilitates tuning and gives exceptional range of altitude control, as borne out by the results of official tests carried out in high altitude scouts.

A special air intake elbow heated by the hot oil drawn from the engine by the scavenge pump, prevents any possibility of the freezing up of the carburetter; while in order to insure thorough atomisation of the mixture the induction elbow is exhaust heated.

An additional good feature is the fuel economy obtained under throttle or cruising conditions. It may be added that this carburetter was fitted to the Jupiter-engined Farman machine that won the French Coupe Zenith in 1926, which is essentially a flight fuel economy test.

Coming now to the exhaust system, the latest "Jupiter" exhaust ring has been specially developed for the Series VI engine. The diameter of the ring has been reduced and the down pipes have been kept within the cylinder outlines in order to cut down head resistance and to afford the maximum possible fairway for gunfire. The ring is completely supported from the engine and is entirely free from any stresses due to expansion and contraction under running conditions. Owing to the methods of manufacture adopted the rings are interchangeable. A satisfactory exhaust system that will not damage the engine, will not corrode, is practical and robust, and does not seriously increase the drag of the machine, is an essential feature in modern aircraft. The Bristol Company were among the first to develop and standardise a practical exhaust system for a radial air-cooled engine and it is interesting to note that many Bristol exhaust rings are still in service after some $2\frac{1}{2}$ years, having exceeded a thousand hours' running.



Reaming cylinder holes in the crankcase

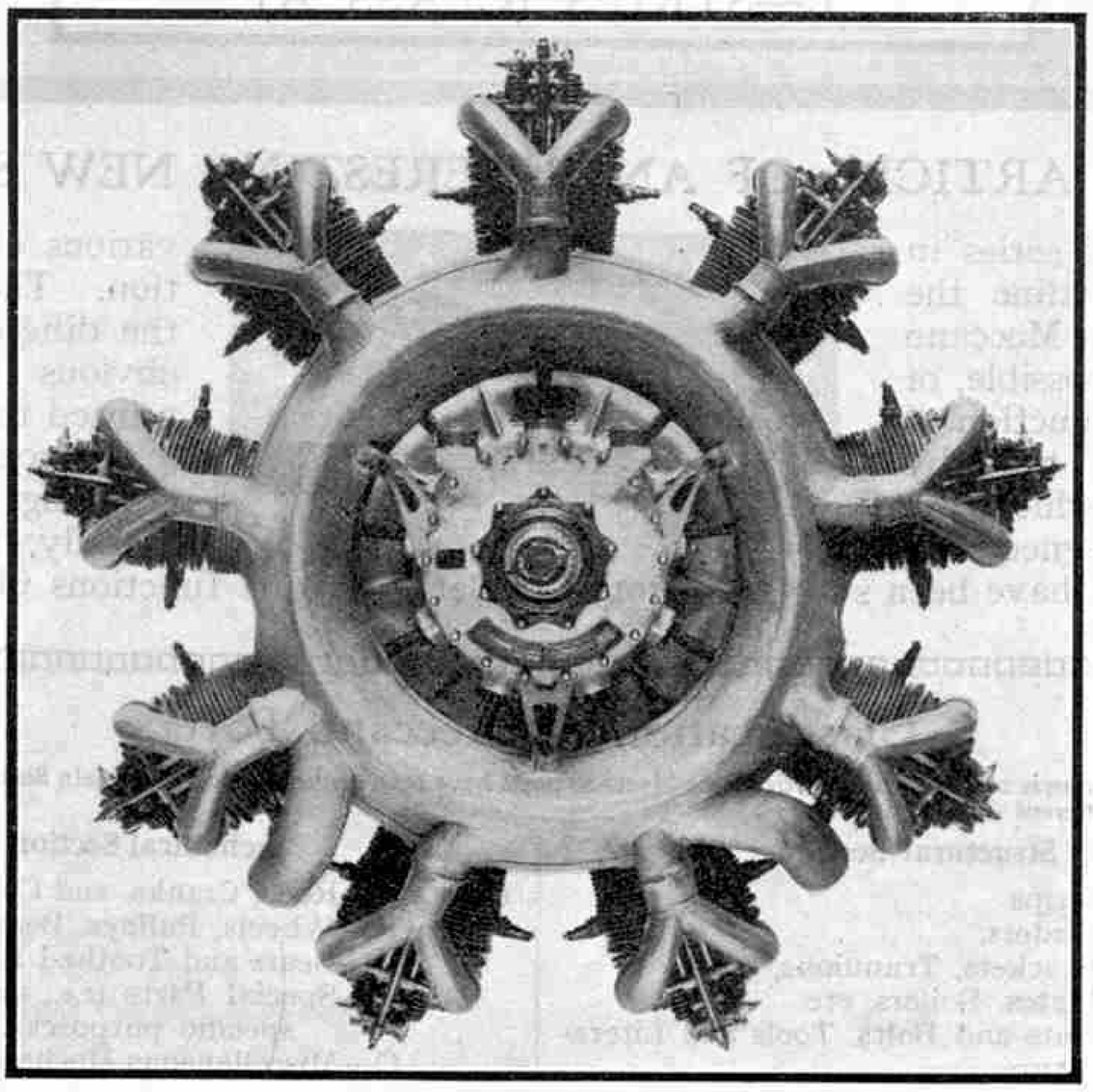
The magnetos used are the B.T.H. Polar Inductor type giving four sparks per revolution and driven by bevel gearing directly off the tail end of the crankshaft at $1\frac{1}{8}$ engine speed. As the most simple and reliable means of

starting a high powered aero engine is the gas starter system, the standard "Bristol" Jupiter is equipped with a gas distributor located on the rear cover between and immediately above the magnetos.

The Series VI direct drive "Bristol" Jupiter is now available either as a supercharged or reduction gear type. The former, known as the Series VII, retains the reliability, robustness, and simplicity of design of the Series VI, but it incorporates an integral gear-driven supercharger in place of the spiral induction system of the latter. The blower is of the high-speed centrifugal type embodying certain patented features to eliminate the inertia problems inherent in this type of mechanism. Excellent results over a prolonged series of official flight tests have been obtained with the Series VII. The engine develops its full normal power at 12,000 ft., at which height the increase in power compared with the Series VI engine is over 30 per cent., while the increase in weight is approximately only 5 per cent.

The reduction gear type, known as Series VIII, IX, or XI, according to the compression ratio, incorporates the well-known Farman patent bevel epicyclic reduction gear, for which the Bristol Company hold sole rights in this country. This gear is of extremely high efficiency and during the past 18 months or so has been well tried out in half-a-dozen different types of aircraft, covering hundreds of hours' running with complete reliability.

The "Bristol" Jupiter engine has attained its present-day popularity as the result of several outstanding features among which first place must be given to its extremely high standard of reliability. In this connection must be mentioned the 25,000-mile officially controlled endurance flight carried out with a Series VI engine in the early days of 1926. The engine was installed in a "Bristol" Bloodhound Biplane and was then taken over by officials of the British Air Ministry, and a series of flights were carried out by pilots of Imperial Airways Ltd. At each descent the machine immediately passed into the charge of the Air Ministry representatives so that no engine adjustment or replacement was possible. At the conclusion of the 25,000-mile flight, completed in 225 hours, not a single seal had been broken nor a single adjustment or replacement made, and the engine was running just as smoothly and satisfactorily as when the trial commenced. Immediately after the conclusion of the flights the engine was stripped for inspection and officially certified to be in excellent condition and ready for further service after replacing one valve and spring.



Exhaust System of the Jupiter VI

When it was decided by Imperial Airways Ltd., to open up an aerial route from Cairo to India they decided to employ Jupiter engines and this choice has been well justified by the splendid results obtained during the initial flights.

The opening of the air route was signalised by a flight from London to Delhi during which distinguished passengers were carried including the British Secretary of State for Air (Sir Samuel Hoare), with Lady Maud Hoare and Air Marshal Sir Geoffrey Salmond. The flight along the 6,300 mile route was carried out absolutely to schedule, as was also the return flight from Delhi to Cairo, making 10,000 miles in all. Throughout the whole course of this trip not a single engine spare part was used, certainly a remarkable feat when it is borne in mind that altogether 30,000 engine miles were covered and that this represents probably nearly fifty million engine revolutions.

Matthew Murray—*(continued from page 27)*

admission of air caused it to explode and force up the piston."

Murray died on 20th February, 1828, at the age of 61.

It is interesting to know that a scheme has been launched to erect a worthy memorial to Matthew Murray and his pioneer work in engineering. The project takes the form of a "Matthew Murray Memorial Fund," the receipts of which will be expended on the erection of three bronze memorial tablets. One tablet is to be erected at the entrance of the old Round Foundry, in David Street, Holbeck, Leeds; the second in City Square or the Town Hall, Leeds, and the third in the Institution of Mechanical Engineers, London, where it will be placed near to the bronze tablet to George Stephenson erected by railwaymen of the Argentine.

Each of the tablets will measure about 4 ft. in height by 2½ ft. in width and will bear an inscription summarising Murray's engineering achievements. There will also be incorporated in the text a portrait of the engineer and an engraving of one of the four Blenkinsop locomotives.

Approximately £500 will be required to carry out the complete memorial scheme. If sufficient funds are available copies of models connected with Murray which are in the Science Museum, South Kensington, will be prepared for exhibition in the Leeds Museum along with letters and other items of interest connected with the engineer.

MECCANO WRITING PADS

These Writing Pads are just the thing to use when writing to your friends, for the special notepaper shows at once that you are a Meccano boy.

The pads are supplied in two sizes, each consisting of 50 printed sheets of tinted bank paper with cover. Prices—Large, 1/- each (post free); Small, 6d. each (post free), from Meccano Ltd., Binns Road, Liverpool.

"A Wild Night Ride"—*(continued from page 11)*

down the heavy mountain grades without a touch of the brake. On one sharp curve Billy could have sworn that her wheels were all in the air! A red signal, the speed still unchecked, and then the bright red lights of another freight train! There was no hope this time, they simply had to crash. Half fainting, and with a horrible sickly feeling, Billy sank to his knees and covered his face with his hands to await the end, which he felt could not be long delayed . . . . .

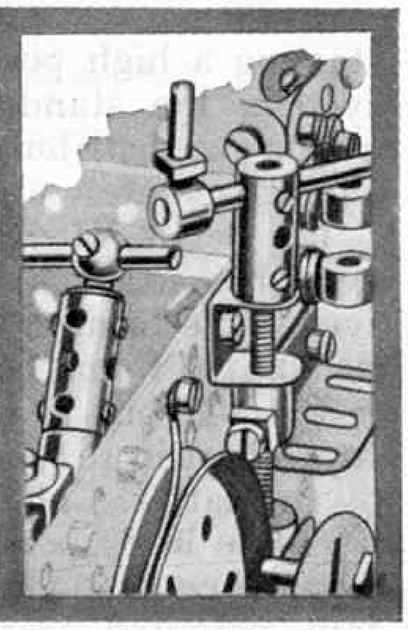
Somebody was shaking him violently. "Come on Weedon, my lad, sign on the dotted line. You're called for an extra freight west. You sleep like the dead, lad, I've been trying to waken you for about five minutes!"

It took Billy a few seconds to sort out his mental confusion. "That's a lesson for me," he said to himself softly. "I'll never eat pie again just before going to bed!"



HOW TO USE Meccano Parts

I.—STRIPS (CLASS A)



FIRST ARTICLE OF AN INTERESTING NEW SERIES

THIS article is the first of a series in which we propose to outline the principal functions of the Meccano parts. It would be quite impossible, of course, to enumerate every function of each part, but we believe that by pointing out the uses for which the parts have been specially designed, and mentioning a few others that have been suggested from time to time by Meccano boys themselves, we shall help *"M.M."* readers not only to build better models, but to construct them on really scientific lines.

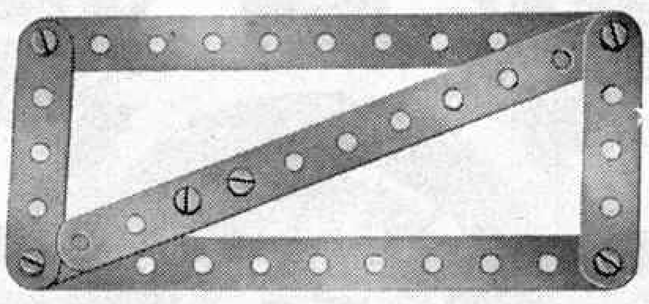


Fig. 1

Before proceeding it must be explained that we have grouped all the Meccano parts into two main Sections, which we have termed the "Structural Section" and the "Mechanical Section." Further, the Sections have been divided into a number of separate classes, and each class will be dealt with separately in this series of articles.

Classification of Meccano Parts

For the purposes of this series of articles the Meccano parts have been grouped under two main Sections and further divided into different Classes, as follows :

Structural Section	Mechanical Section
Class A—Strips	Class M—Rods, Cranks, and Couplings.
,, B—Girders.	,, N—Wheels, Pulleys, Bearings, etc.
,, C—Brackets, Trunnions, etc.	,, O—Gears and Toothed Parts.
,, D—Plates, Boilers, etc.	,, P—Special Parts (*i.e.*, designed for specific purposes).
,, E—Nuts and Bolts, Tools and Literature.	,, Q—Miscellaneous Mechanical Parts.

List of Parts in Class A : Strips

No.		Price s.	d.
1.	Perforated Strips, 12½" long... ... ½ doz.	1	0
1a.	,, ,, 9½" ,, ... ,,	0	9
1b.	,, ,, 7½" ,, ... ,,	0	8
2.	,, ,, 5½" ,, ... ,,	0	6
2a.	,, ,, 4½" ,, ... ,,	0	5
3.	,, ,, 3½" ,, ... ,,	0	4
4.	,, ,, 3" ,, ... ,,	0	3
5.	,, ,, 2½" ,, ... ,,	0	3
6.	,, ,, 2" ,, ... ,,	0	3
6a.	,, ,, 1½" ,, ... ,,	0	3
46.	Double Angle Strips, 2½" × 1" ... ,,	0	6
47.	,, ,, 2½" × 1½" ... ,,	0	9
47a.	,, ,, 3" × 1½" ... ,,	0	10
48.	,, ,, 1½" × ½" ... ,,	0	4
48a.	Double Angle Strips, 2½" × ½" ... ½ doz.	0	5
48b.	,, ,, 3½" × ½" ... ,,	0	6
48c.	,, ,, 4½" × ½" ... ,,	0	9
48d.	,, ,, 5½" × ½" ... ,,	0	9
55.	Perforated Strips, slotted, 5½" long... each	0	2
55a.	,, ,, ,, 2" ,, ... ,,	0	1
89.	5½" Curved Strips, 10" radius ... ,,	0	2
89a.	3" ,, ,, cranked, 1¾" radius, 4 to circle ... ... ,,	0	2
90.	2½" Curved Strips, 2⅜" radius, 8 to circle ,,	0	1
90a.	2½" ,, ,, cranked, 1⅜" radius, 4 to circle ... ... ,,	0	1
145.	Circular Strips, 7" diam. overall ... ,,	0	9

In the Structural Section we have endeavoured to group all those parts that are used principally for the construction of frames, beams, bases, supports, etc., as opposed to parts intended essentially for assembly in mechanical movements (gear boxes, driving mechanisms, etc.), which parts are grouped under the various classes in the Mechanical Section. The grouping of the parts under the different classes will become more obvious on reference to the table printed on this page.

Of course, this classification and grouping should not be taken too literally, for it is impossible to state definitely the functions of any one Meccano part, nor can we say that certain parts are used for frames, beams, girders, etc., and others for gear boxes, driving mechanisms, and other mechanical movements. Although the Meccano Strips, for example, are used principally in the construction of frames, they may also be used as levers, connecting rods, and for similar purposes, when of course they would more correctly be considered as mechanical parts and not structural. From this it will be seen that the grouping of Meccano parts is a difficult matter; nevertheless we think the method that we have adopted will enable anyone who is not already familiar with the numerous components of the system to see at a glance all the parts most likely to fulfil any required function. It should also be of assistance to Meccano boys who find the ever increasing

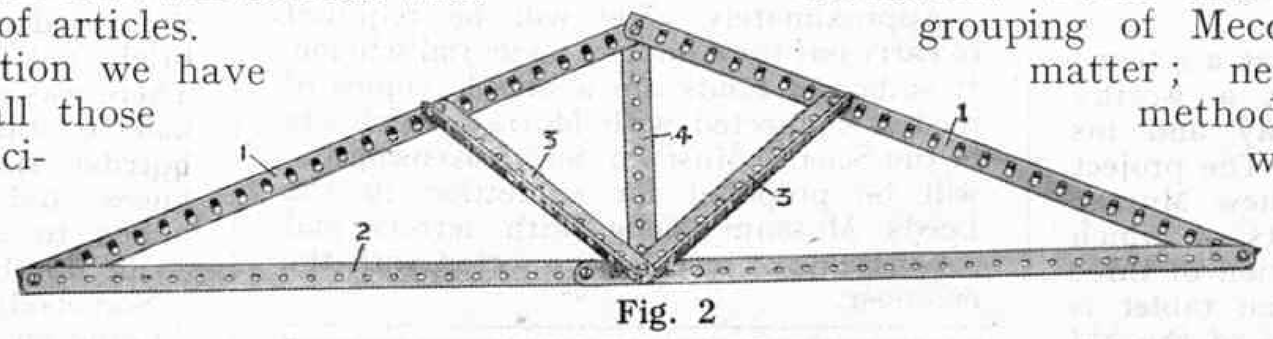


Fig. 2

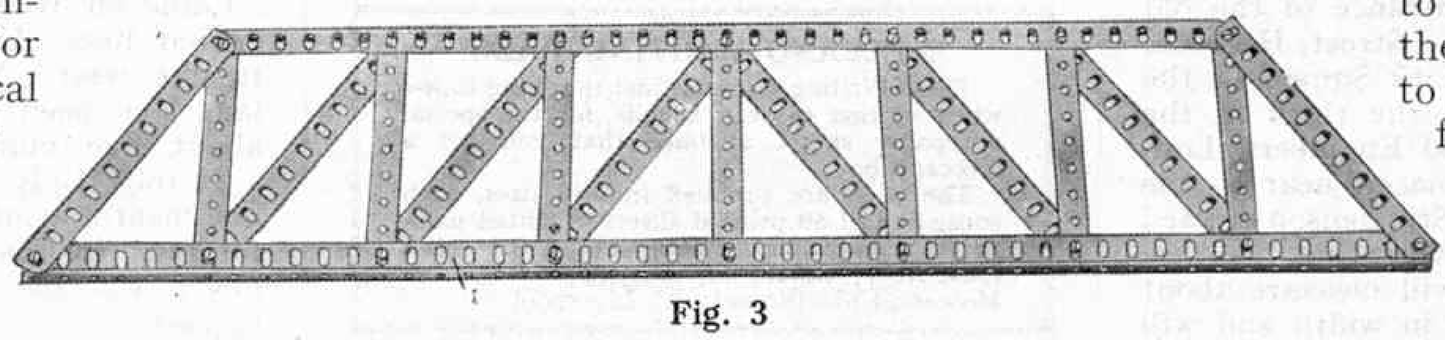


Fig. 3

list of Meccano parts difficult to memorise.

Structural Section, Class A

In this article we shall deal with Class A of the Structural Section. The parts included under this Section are enumerated in full in the accompanying list. They may be said to form the backbone of the Meccano system, for some of them are to be found in practically every model.

Parts Nos. 1 to 6a differ only in their lengths. Each is $\frac{1}{2}$ in. in width and is perforated at $\frac{1}{2}$ in. distances along its length. Hence it is a simple matter to tell the size of a Meccano Strip at a glance, without the use of a measure, simply by counting the number of holes. Similarly the sizes of Meccano Rods and almost any other part can be ascertained in a few seconds by comparing them with Strips.

Meccano Strips are used to construct the framework of towers, bridges, gear boxes, and almost any other type of structure. Provided that they are placed properly, a few Strips can be converted into a perfectly rigid frame, but it is always advisable to use Angle Girders for the larger Meccano structures. Indeed, the really conscientious Meccano boy makes a rule of using Strips only where a tensional stress has to be met, and Angle Girders when it is required to withstand a compressive force. In carrying out this rule he is, of course, following correct engineering practice.

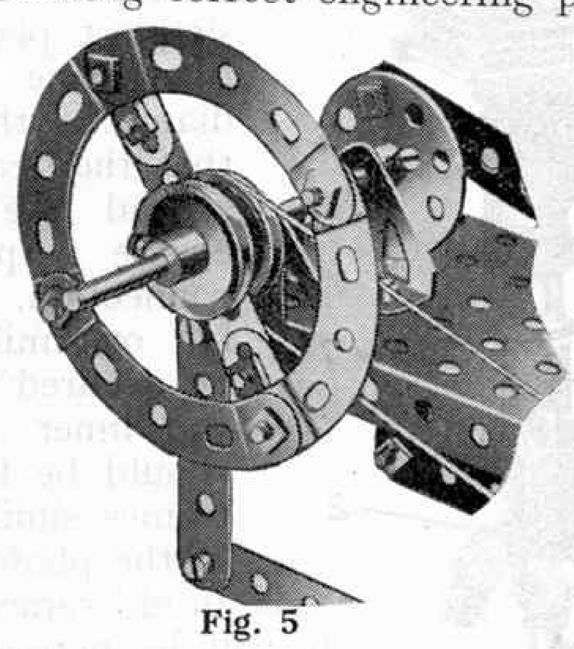


Fig. 5

Fig. 1 shows a simple rectangle built up from two $5\frac{1}{2}$" Strips and two 3" Strips. The framework so formed is made perfectly rigid by the addition of a single diagonal tie, which in this case is composed of two $3\frac{1}{2}$" Strips overlapped two holes and bolted together. The repetition of this figure in a Meccano structure will make the complete model perfectly rigid.

Fig. 2 is a Meccano model of a simple roof truss. It will be seen that the sides 1 of the truss, which have to withstand a compressive force, are constructed from Angle Girders, whilst the side 2, which is merely in tension, consists of two $12\frac{1}{2}$" Strips overlapped five holes and bolted together. The triangle so formed would be quite rigid for ordinary purposes, but in practice struts and ties are usually added at 3 and 4 respectively in order to obtain still greater rigidity. (It should be noted here that members in compression are known technically as "struts" and members withstanding tensional forces are termed "ties"). If the reader is able to examine the construction of an actual roof similar in shape to our illustration, he will probably find that the members corresponding to the sides 1 and 3 are all of girder form, resembling the Meccano Angle Girders, whilst the members 2 and 4 are smaller and possibly of flat section, or more probably round like the Meccano Axle Rods.

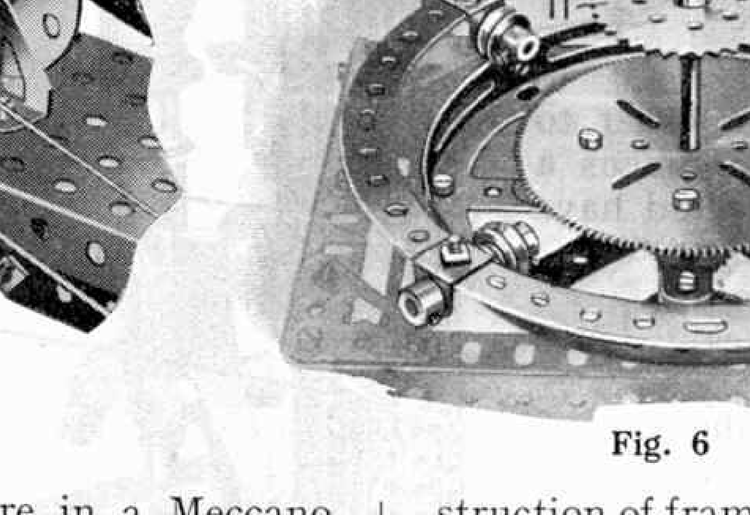


Fig. 7

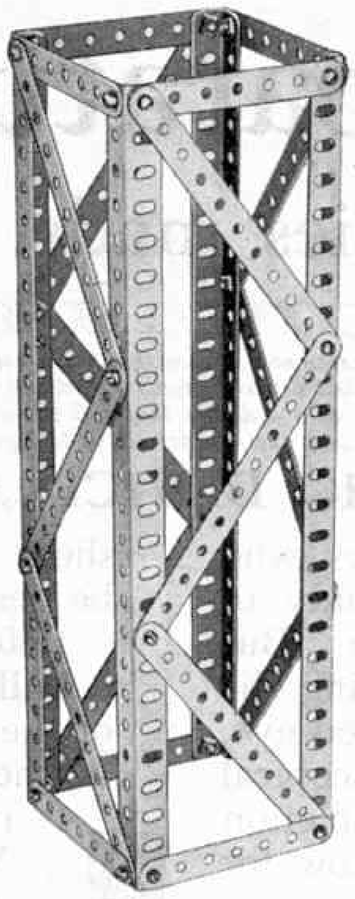


Fig. 4

Rigidity of the Triangle

Fig. 3 shows an openwork girder of the built-up truss type that is used to a large extent in the construction of bridges. It will be noticed that the various members are arranged so that a number of triangles are formed, and it is this arrangement that gives the girder its great rigidity and strength, for the triangle is the only figure that cannot be distorted without altering the length or form of the sides. In the model the ties are represented by $4\frac{1}{2}$" Strips and the struts by $5\frac{1}{2}$" Angle Girders. The main girder 1 represents the roadway of the bridge, and the stresses that it has to withstand are distributed over the various ties and struts.

Fig. 4 illustrates a braced tower such as might be used to support a crane, etc. The corner members are composed of Angle Girders, since they must withstand the compressive force exerted by the dead weight upon the structure. In order to make these girders rigid against any liability of bending or distortion, diagonal ties are added. These consist of $5\frac{1}{2}$" Strips, and it will be noted that they are staggered, or alternated, on each side of the tower.

An example of the great strength and rigidity that can be obtained in Meccano structures by exercising a little thought in placing the ties, struts, and various bracing members, is afforded by the illustration on this page showing a Meccano bridge supporting the combined weight of three people.

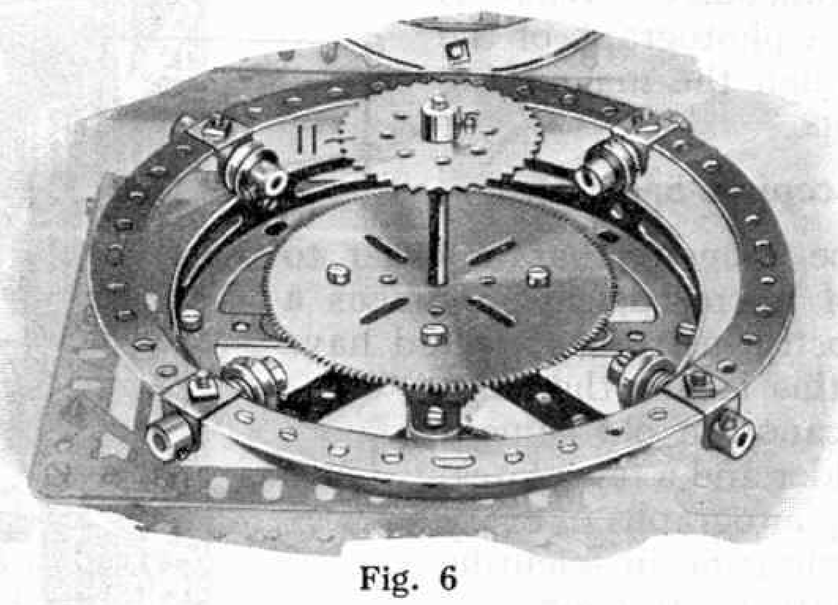


Fig. 6

Double Angle Strips

The Meccano Double Angle Strips (parts Nos. 46 to 48d) are similar to the ordinary Strips except that their ends are bent at right angles. They are extremely useful in the construction of frames and bearings for shafting, etc. A very important advantage of the Double Angle Strips having two or more holes in their turned ends lies in the fact that they can be bolted quite rigidly at right angles to other Meccano parts. Many Meccano boys, if they have not a sufficient number of Double Angle Strips, replace them by bolting the various types of Angle Brackets to the ends of ordinary Strips.

The $5\frac{1}{2}$" Slotted Strips are provided with three ordinary holes and two slots each $1\frac{1}{8}$" long, while the 2" Slotted Strip has two ordinary holes and a slot $\frac{5}{8}$" long. These slots may be used as guides for sliding mechanisms; they are also invaluable in obtaining small adjustments between parts that would be impossible with the $\frac{1}{2}$ in. standard holes.

Curved Strips

The Curved Strips—all fairly recent additions to the Meccano system—have played an important part in the production of the new and vastly improved style of model that characterises the modern

(*Continued on page* 81)

Scientific Apparatus in Meccano

Microscope Accessories made by Dr. Ernest Bade

This article is the second of a series in which we propose to describe some uses that have been found for Meccano in the field of science. In the November issue we described an instrument designed by Dr. Bade for electrocuting small aquatic animals for microscopical study. This month an apparatus for photographing objects through the microscope is dealt with, and also a device that will project microscope slides on to a screen in a similar manner to a magic lantern. In each case the apparatus is the work of Dr. Bade.

II.—PHOTO-MICROGRAPHIC DEVICE AND A SLIDE PROJECTOR

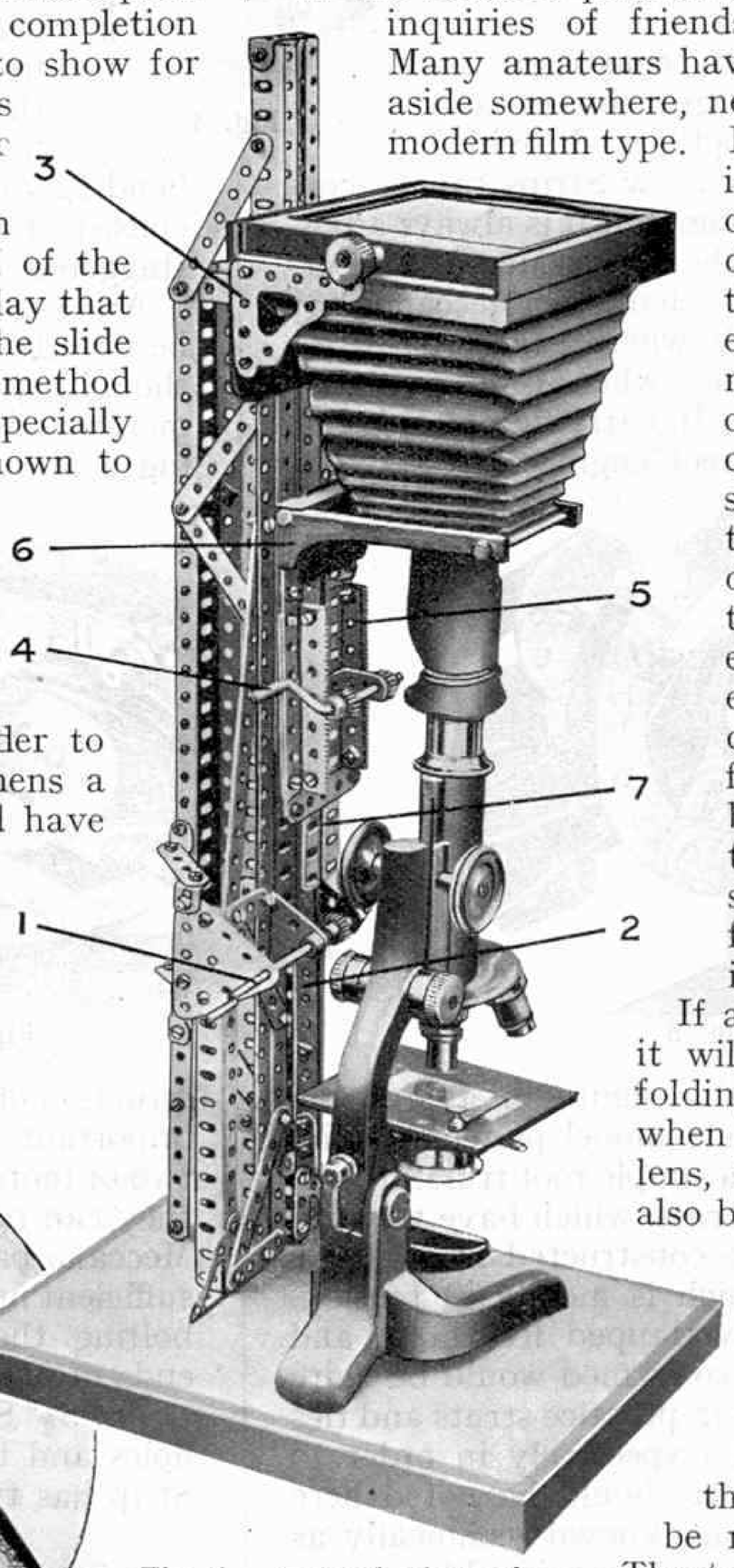
THERE must be hundreds of Meccano boys who obtain hours of enjoyment from the study of minute objects under the microscope. But while much pleasure can be derived from studying the wonders of nature that are hidden from the naked eye, there is one disadvantage concerned with microscopical study. Every "hobbyist" expects on the completion of his work to have some material result to show for his labour, which he can display to his friends and fellow enthusiasts when suitable occasions arise.

Objects mounted upon slips of glass form of course a more or less permanent record of the microscopist's work, but the trouble and delay that must necessarily be expended in finding the slide and focusing it in the microscope proves this method to be inconvenient and unsatisfactory, especially when the specimens are required to be shown to several people simultaneously. What is required, therefore, is a photograph of the specimen as seen through the magnifying lenses of the microscope.

Photographing Microscopical Specimens

At first it might be thought that in order to secure photographs of microscopical specimens a very elaborate and costly instrument would have to be obtained, but this is not the case. With the aid of Meccano, an old camera "bellows," a plate holder and a few plates, it is possible to take photographs in every way equal to those appearing in scientific publications dealing with microscopy.

Proof of this fact will be found upon glancing at the circular photograph reproduced upon this page. The photograph shows a section of the stem of a bulrush and the clarity with which the various minute cells are brought out will be noted. (We may mention here that the actual specimen from which the photograph was taken was cut with the aid of a Meccano microtome, an instrument used for cutting very fine slices of plant and animal tissue. This model will be described in detail in next month's issue).



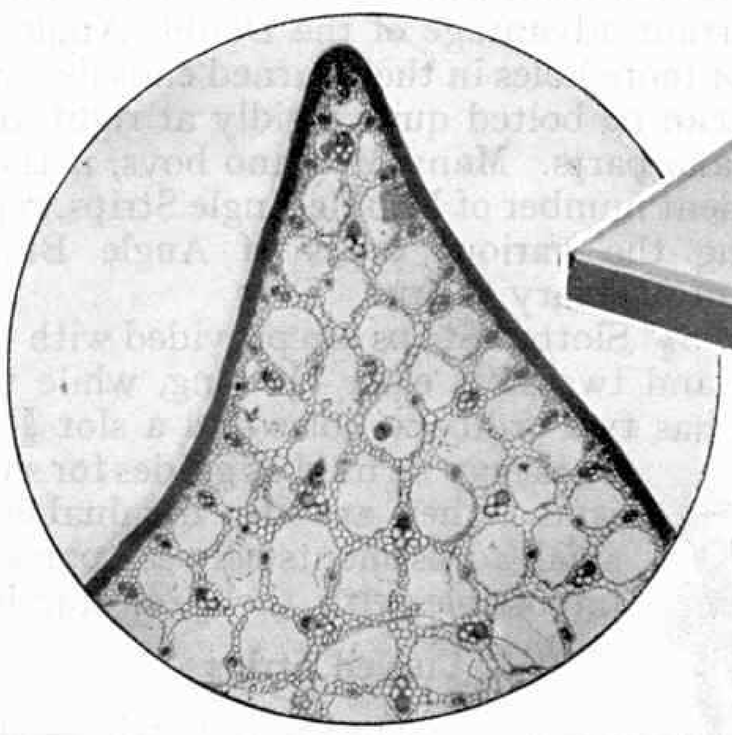


Fig. 1. General view of the photo-micrographic device, and (left) photograph of a bulrush section taken with the apparatus

Before commencing the construction of the apparatus it will be necessary first to obtain an old plate camera of the bellows type. In some cases this may already be in the reader's possession, but if not he should make inquiries of friends interested in photography. Many amateurs have a camera of this type lying aside somewhere, neglected in favour of the more modern film type. If one cannot be found, however, it should be possible to pick one up from any second-hand dealer who specialises in scientific apparatus. Again, if all else fails, it is not a difficult matter to substitute for the camera bellows a collapsible cardboard connection. The simplest plan is to make two tubes, one slightly smaller in diameter than the other, so that they can slide together or extend like a telescope. To ensure a perfectly light-tight connection, a piece of black felt or similar material should be secured round the end of the inner tube. The tubes should be fastened to wooden frames similar to those shown in the photograph.

If an old camera has been secured it will be necessary to remove the folding portion that acts as the base when the bellows are extended. The lens, if any is still present, should also be removed, as it is not required in photographing the objects. A short piece of rubber tubing serves to connect the camera to the eyepiece of the microscope. In making the connection to the camera, the end of the tubing should be rolled back to form a flange. The tubing may then be placed over the opening left after removing the lens, and secured by glue or a few tacks to the lens panel of the camera. Alternatively, a short cardboard tube may be glued into the aperture and the tubing tied over its projecting end in the same way as it is attached to the microscope eyepiece. In either case it is imperative that light-tight connections should be made when fastening the tubing.

As soon as the camera and connecting pieces have been

assembled the construction of the Meccano portion of the apparatus may be commenced.

It will be seen on referring to Fig. 1 that the main framework which supports the sliding members consists of 18½" Angle Girders fastened to a strong wooden base by means of Flanged Brackets held down by wood screws. Two other 18½" Girders (their upper ends can be seen projecting above the main framework) are held apart by means of a 1½" × ½" Double Angle Strip. This leaves a slot into which further Angle Girders bolted together can be passed. To these Girders the framework supporting the photographic plate is attached by means of the Architraves 3, the latter being bolted, in turn, to a Plate fastened to the sliding Girders.

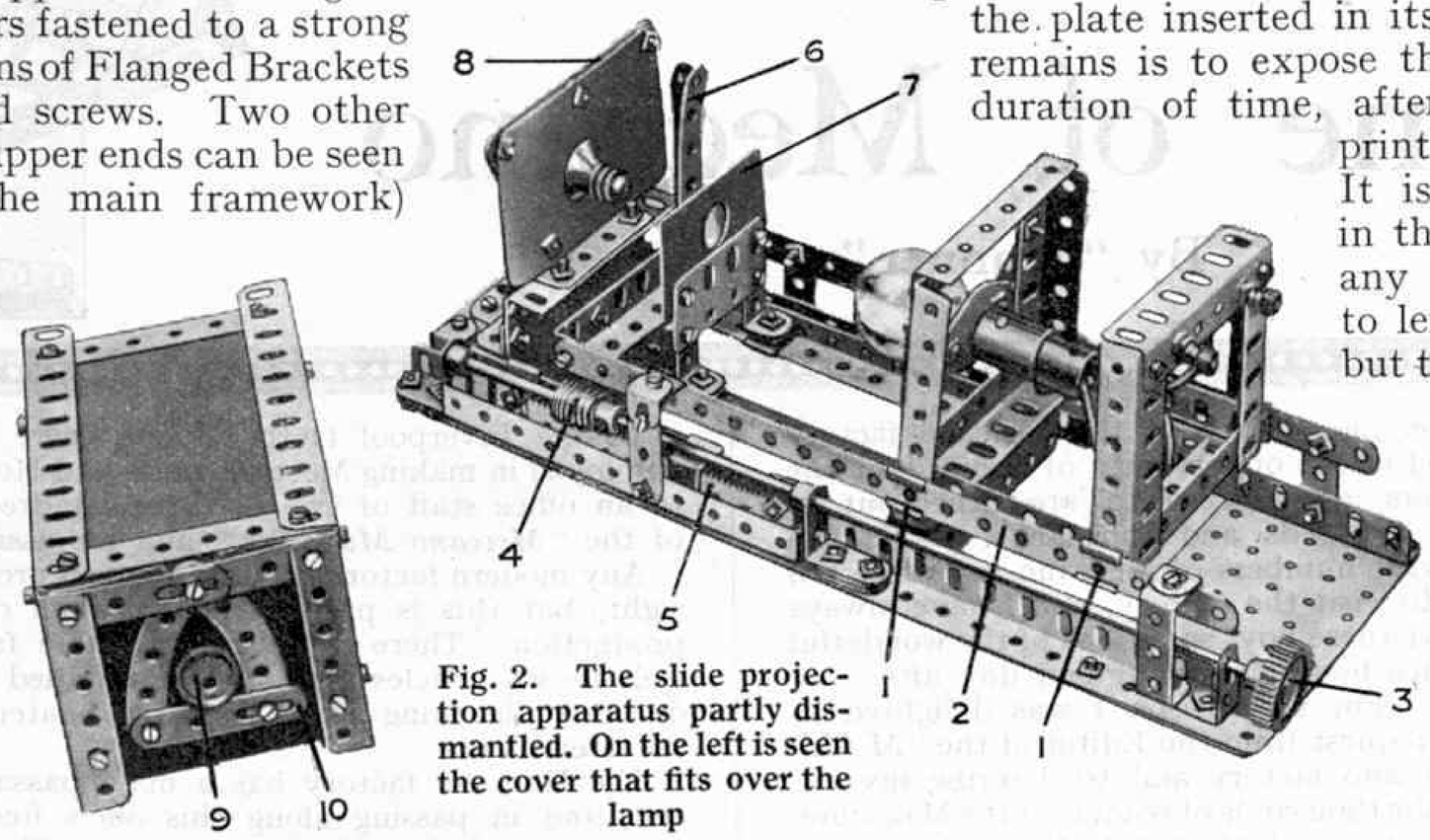


Fig. 2. The slide projection apparatus partly dismantled. On the left is seen the cover that fits over the lamp

Before sliding the Angle Girders into the slot the Rack Strip 2 should be bolted to them. The wooden portion 6 is bolted to a frame consisting of 5½" × 2½" Strips, which frame slides up and down the movable Girders 7 and carries two Rack Strips 5. The Crank Handle 4 should next be fitted in its journals, which consist of 1" × 1" Angle Brackets, and the ½" Pinions that mesh with the Rack Strips 5 should be secured to the Crank Handle.

After assembling the sliding members the Crank Handle 1 carrying a ½" Pinion that meshes with the Rack Strip 2 should be mounted in its journals, which consist of three 2½" Triangular Plates. It will be noted that two Collars are slipped on to the Crank Handle to hold it in place.

The framework is completed by attaching the various Strips seen in Fig. 1, which strengthen the whole and prevent any "shake" which might affect adjustments. The microscope itself can now be placed in position on the baseboard and the free end of the tubing tied over the eyepiece. The slide containing the specimen that is to be photographed is placed in position on the stage of the microscope and a plate of ground glass mounted in the plate frame of the camera.

The image of the specimen can be focussed on the ground glass screen by manipulating the Crank Handles 1 and 4 and also by the coarse and fine adjustments of the microscope itself. With a little practice the correct setting of the various controls will soon be found so that a clear picture of the specimen appears on the ground glass.

Provided that a photographic plate has been placed in the plate holder, the screen can be withdrawn and the plate inserted in its stead. All that now remains is to expose the plate for a suitable duration of time, afterward developing and printing in the usual manner. It is of course impossible in this short article to give any definite particulars as to length of exposure, etc., but the experimenter should have no difficulty in obtaining these after taking one or two trial photographs.

The Meccano Slide Projector

While photographs obtained in the manner just described form an excellent record for the microscopist, occasion may sometimes arise, such as on Meccano Club Night or at a party, when it is required to show to a number of persons the magnified specimens as seen under the microscope. It is on such occasions that the simple Meccano projector set illustrated in Fig. 3 will prove extremely useful.

With the aid of this apparatus microscope slides may be projected upon a screen, in a similar manner to a magic lantern slide. Fig. 3 is a general view of the projector and Fig. 2 shows it partly dismantled.

In the construction of the projector the following will be required in addition to standard Meccano parts: A 6-volt electric bulb and a bayonet cap holder to receive it (the holder shown in Fig. 2 is one actually taken from a motor car, but the standard S.B.C. lamp holder can be used quite effectively); two small condensing lenses 7 and 9 (the lens 7 can be dispensed with without any great loss in strength and definition of the resulting image, but the lens 9 must be fitted and may conveniently consist of a small double convex lens such as those fitted to "pocket magnifiers"); a low power objective taken from the microscope. The latter article will of course, be already in the possession of the constructor.

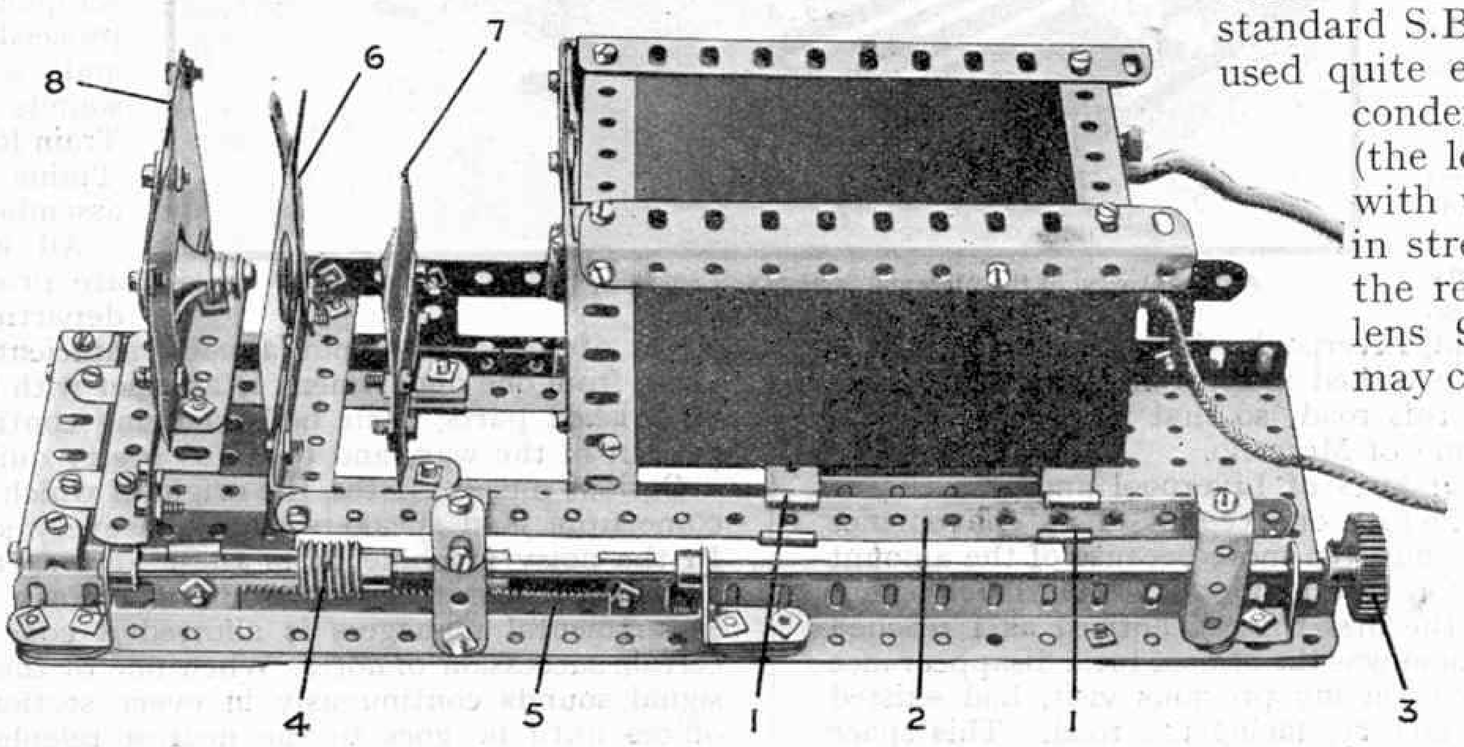


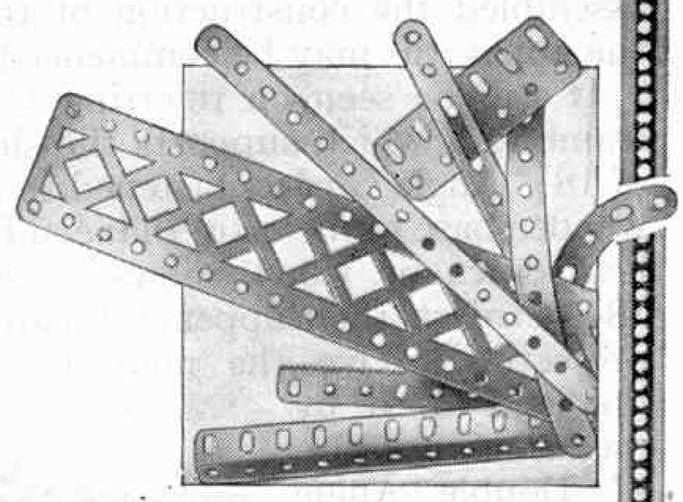
Fig. 3. General view of the projector set. The disposition of the various lenses can be seen clearly in this illustration

The framework of the instrument should first be built up. The base consists of 12½" Angle Girders spaced apart at each end by a 4½" × 2½" Flat Plate. The slide rails 2 are secured to these Girders by means of 1½" × ½" Double Angle Strips and Angle Brackets. It will be seen that at one end the Strips 2 are connected together by a 3½" Angle Girder, and two vertical Strips bolted to this form a clip in which can be slipped the slide containing the specimen that is to be projected.

The next portion to be assembled (*Continued on page* 81)

My Visit to the Home of Meccano

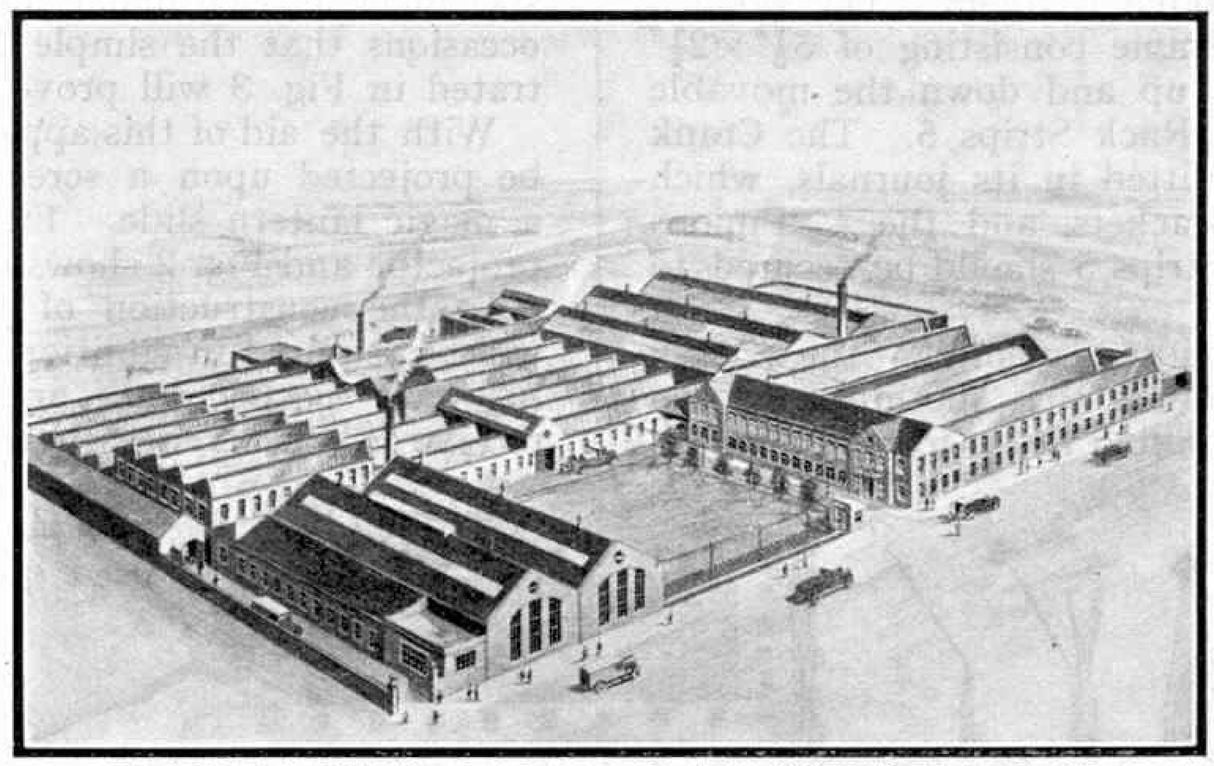
By "Spanner"



MANY hundreds of Meccano boys visit the Meccano factory every year and revel in the opportunity of seeing how the familiar strips, girders, gear wheels, etc., are turned out by high-speed machinery in hundreds and thousands. It is unfortunate, however, that vast numbers of Meccano boys live too far away from Liverpool to visit the factory, and I have always felt that I should like to give these boys some idea of the wonderful things that are taking place hour after hour and day after day in the Home of Meccano. For this reason I was delighted to receive a little while ago a request from the Editor of the "*M.M.*" to pay a visit to the Meccano factory and to describe my experiences for the benefit of the thousands of readers of the Magazine.

This was not by any means my first visit to the factory. On account of my close association with Meccano boys through the "Suggestions Section" of the "*M.M.*," and of the fact that every day I am the willing victim of a bombardment of criticisms and comments regarding all things Meccano, I am privileged to look round the factory at any time. Owing to various circumstances, however, I had not paid a visit to the factory for something like a year, and I found much that was entirely new and extremely interesting. More than ever I was impressed with the rapidity with which Meccano progresses and branches out continually into new and more interesting developments.

The names of many of the famous streets of London are familiar to English-speaking people all over the world. A few of the great provincial cities can boast a street that has achieved fame, but I doubt if any street in any English provincial city is so widely known as Binns Road, Liverpool. Hundreds of thousands of Meccano boys must have wished many times that they lived within a short distance of this road, so that they could pay an occasional visit to the Home of Meccano.



An aerial view of the Meccano factory and offices at Binns Road, Liverpool

Binns Road is on the outskirts of Liverpool and was chosen as a site for the Meccano factory on account of its convenience for road and rail transport, and even more because of the amount of open space available for development. This development goes on continuously, and the first thing I noticed as I reached the factory on this last occasion was the almost total disappearance of a large open space which, on my previous visit, had existed between two wings of the factory, facing the road. This space has now been swallowed up by new workshops and a great block of offices of the most modern type.

As I passed through an imposing entrance—also quite new—I had the good fortune to fall in with a small party that was being personally conducted round the factory by Mr. Frank Hornby, the inventor of Meccano and Managing Director of the firm. In the eyes of Meccano boys Mr. Hornby must surely be one of the most famous men in the world. Ever since Meccano came into being, some 26 years ago, he has been the invisible genius presiding over the happiest hours of two generations of Meccano boys. During these 26 years he has built up the great Meccano business from a tiny beginning in a small one-roomed workshop in the heart of Liverpool. To-day he controls not only the vast factory in Binns Road, but also one in Paris and still another in the United States.

In the Liverpool factory alone there are some 1,500 people employed in making Meccano parts and Hornby Trains, in addition to an office staff of two or three hundred, including the Editor of the "*Meccano Magazine*" and his assistants.

Any modern factory engaged in mass production is an impressive sight, but this is particularly so when one is familiar with its production. There is an indescribable fascination about seeing well-known articles that one has handled day by day being produced at lightning speed from raw material to which they bear no resemblance.

The Meccano factory has a main passage almost from end to end, and in passing along this one's first impression is one of amazing and bewildering activity. The various departments are separated from this passage by glass partitions and sliding doors which deaden to a considerable extent the noise of the machinery. The noise cannot be eliminated, however, and as one walks along the tangled commotion sorts itself out. First there is a deafening sound as though many pile drivers were at work, indicating the proximity of the Press Shop. Then a loud humming and whirring comes from the Automatic Shop, and the Wood-working Department makes itself evident by the intermittent shrieks of circular saws as they slice their way through great blocks of wood. Filing, scraping and hammering proceed from the Tool Shop, and a perfect medley of sounds greets us from the Train Room where the Hornby Trains and accessories are assembled and tested.

All kinds of lesser noises are produced by more silent departments and, as if the ocean of sound were not already sufficient, electric trucks race along from one department to another with loads of raw materials or finished parts, their bells clanging continually to warn us to get out of the way, and to do so pretty quickly!

Curious musical notes, the origin of which puzzles most visitors, come from loud speakers placed in every section of the factory. In the noisy machine room these loud speakers are replaced by electrically-operated Klaxon horns. Each of the directors and departmental managers is allotted a code sign consisting of a certain succession of notes. When one of them is wanted, his code signal sounds continuously in every section of the factory and offices until he goes to the nearest telephone and discloses his location, receiving the message that has been the cause of the call.

The first department to which Mr. Hornby conducted us was the Tool Shop. This is one of the most important departments in the factory, for in it are made innumerable tools, dies and patterns, that are used in the manufacture of Meccano and Hornby Train parts. The staff consists of highly-trained mechanics, upon the accuracy of whose work depends the finish and efficiency of the parts that later will be manufactured in enormous quantities. At the time of my visit almost every man had before him a "blue print," designed and prepared in the Meccano Drawing Office, and showing a new Meccano part or some minute mechanism that eventually would be incorporated in a Hornby locomotive or accessory.

The Tool Shop possesses many remarkable machines, some of which are capable of working to a margin equivalent to one

ten-thousandth part of an inch! Although the finished products are intended principally for the enjoyment of boys, the machinery in this department is as accurate as if the products were for some extremely important and delicate scientific operation. A visit to this department, perhaps more than to any other, impresses one with the extremely high standard of excellence of all the Meccano products and clearly establishes the claim of Meccano to be regarded as the world's greatest toy.

When the dies and tools have been made, examined and passed, they are fitted into the giant power presses and other automatic machines, from which subsequently appear continuous streams of finished parts, accurate to a very minute fraction of an inch.

In the Press Shop, which we visited next, there are rows upon rows of great presses at work, each one turning out a particular part. Everything in this department—and, indeed, throughout the factory—seems symbolical of speed and efficiency. The gangways between the rows of machines are plainly indicated by broad white lines, and before guiding us through the department Mr. Hornby gave us very strict instructions not to cross these lines on any account. I, for one, was very careful to carry out his instructions, for I had a horrible idea that if I were to place so much as one foot over the line I should immediately become entangled in the maze of machinery and be converted to Meccano parts! I had a terrible vision of the Editor writing to "*M.M.*" readers something after this fashion: "I regret that "Spanner" is unable to attend to your suggestions owing to an unfortunate accident in our factory . . . . . As a small memento I would ask you to accept the enclosed spanner, which is one of the thousands that were seen to emerge from the machine immediately after our esteemed contributor disappeared into it!"

Speaking of spanners, I should like to pass on to Meccano boys a piece of good news that I heard from Mr. Hornby. It appears that before very long a set of box spanners will be added to the Meccano system. The spanners will be in the form of cup-like receptacles of a size to fit the Meccano nuts and secured at various angles to their shafts, which will be designed to screw into a metal holder similar to the handle of the new Meccano all-metal screw driver. With these new spanners it will be a very easy matter to place nuts on bolts in even the most awkward positions.

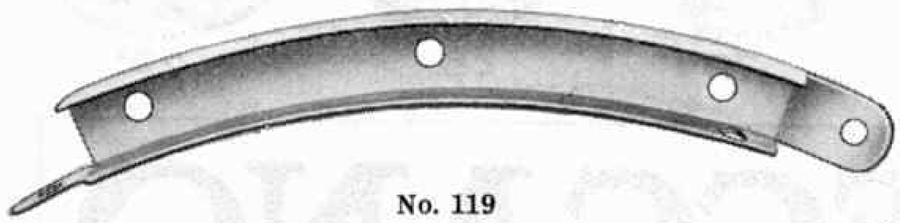
To return now to the Press Shop, Mr. Hornby told us that this department handles about nine tons of steel and two tons of brass every day. One machine, which was banging away like a quick-firing gun, is capable of turning out twelve thousand 12½ in. Strips in 8½ hours. This is a very large figure, but Meccano boys use more 5½ in. Strips than 12½ in. ones, however, so that we find the next machine produces 200,000 Strips of the smaller size in the same time! It is really thrilling to watch a broad plate of steel disappear into the machine and emerge as a mere skeleton of metal, showing clearly how the Strips have been cut out.

Another giant press was making Hornby Railway Sleepers at the rate of 48,000 a day. This machine not only cuts out the sleeper from the solid metal, but also shapes it, bending up the edges ready to receive the Rail Connecting Plates and cutting and shaping the small lugs that eventually will secure the rails in position.

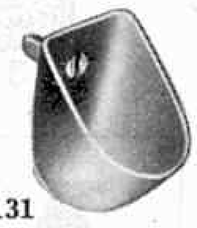
Close by we saw a particularly wonderful machine making Sprocket Chain. Steel wire was being fed into the machine and promptly ejected in the form of long lengths of chain, each link being perfectly formed, severed and coupled to the next entirely without human assistance. "We have to be very careful to see that this machine always works with absolute accuracy," said Mr. Hornby, making himself heard with difficulty above the din; "for if the links are the slightest bit out of truth the chain will not run smoothly over the Sprocket Wheels." While Mr. Hornby was speaking I watched enough Sprocket Chain come out of the machine to meet the requirements of two or three Meccano Ship Coalers!

A little further along a giant press was stamping out Meccano Channel Segments, and I was very interested to note that these parts have been considerably improved, in that they are now fitted with a lug at each end. They are also provided with several additional holes. The extra lugs enable a series of Segments to be bolted end to end very rigidly, and ensure the correct alignment of the pieces. Another part that has been improved recently, and which was being made in this department, is the Dredger Bucket. The contour of the bucket has been rounded, and the part is now an exact replica of the buckets used in actual practice. (*Continued on page* 34)

IMPROVED MECCANO PARTS



No. 119

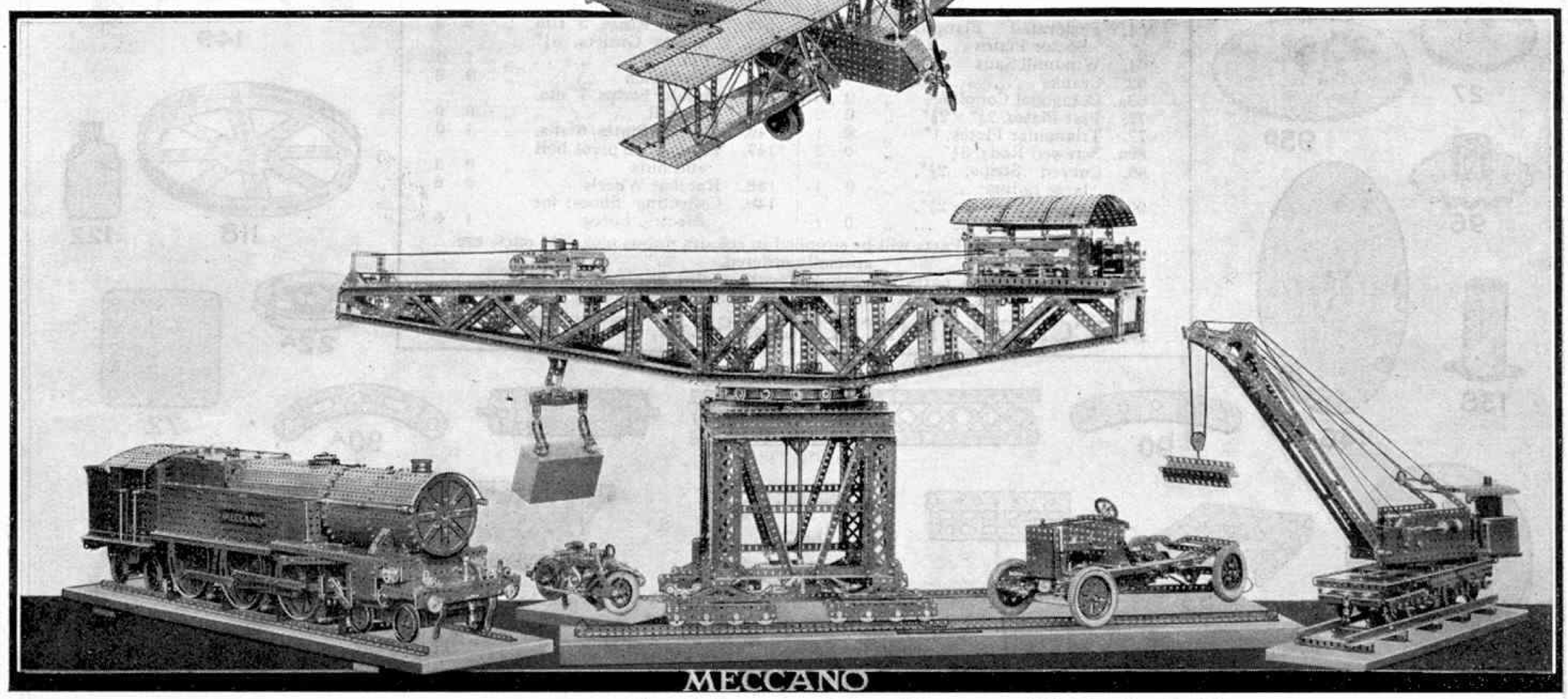


No. 131

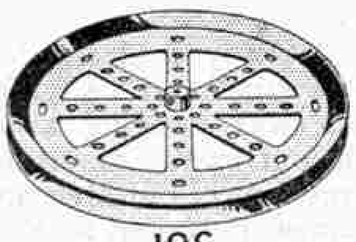
We illustrate the two recently improved parts mentioned in "Spanner's" article. The particulars of these parts are as follows:—

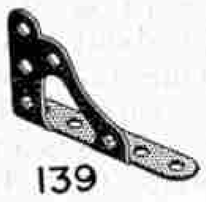
No. 119, Channel Segments, price 4d. each. These parts are invaluable for the construction of large flywheels, circular bases, and guide rails for roller bearings, etc. Eight Channel Segments bolted end to end form a circle 11½" in diameter.

No. 131, Dredger Buckets, price 1/- per half dozen. The Buckets are fitted with small lugs with which they may easily be attached to Meccano Sprocket Chain. A string of Buckets incorporated in a Meccano dredger or conveyor will enable the model to be put to practical use.

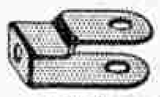


A group of new Meccano models. Each model forms the subject of a special Instruction Leaflet

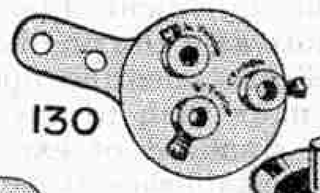

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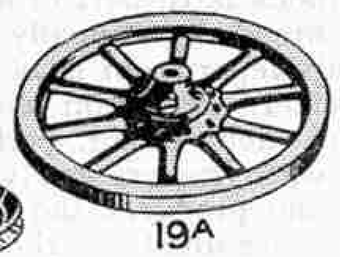

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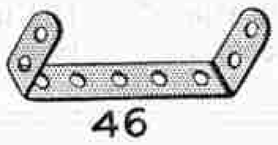

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19A

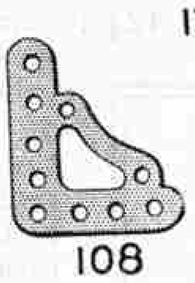

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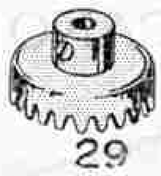

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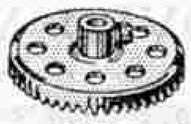

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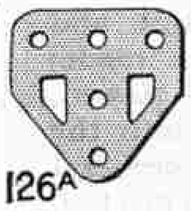

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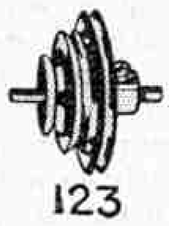

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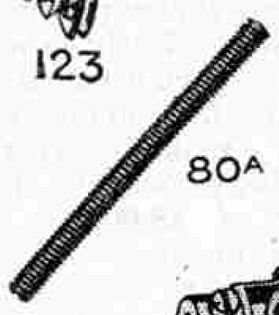

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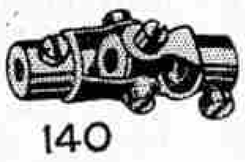

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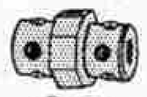

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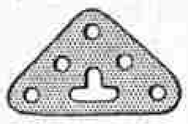

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80A


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63A


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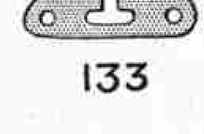

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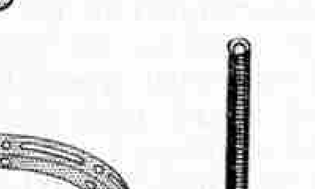

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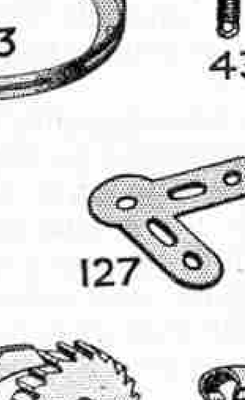

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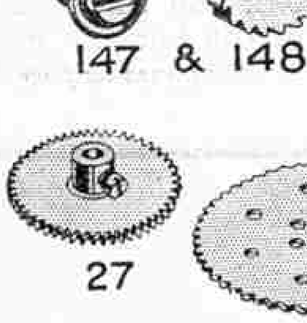

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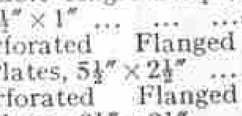

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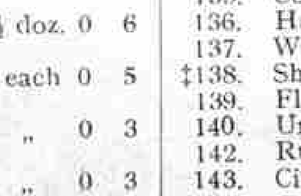

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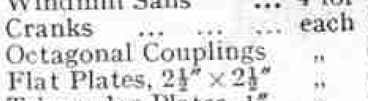

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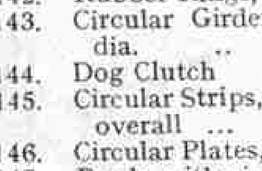

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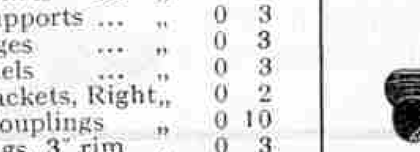

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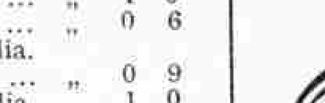

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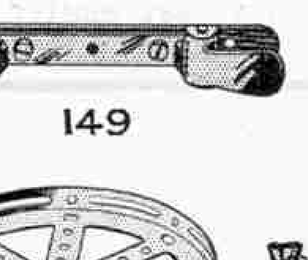

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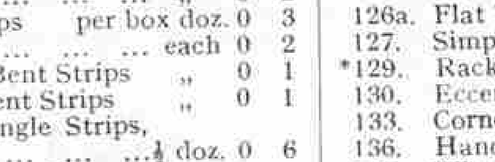

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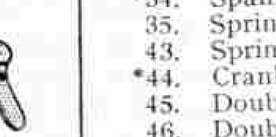

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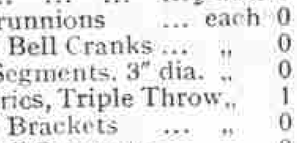

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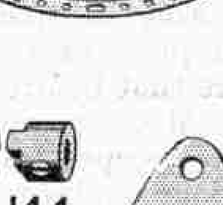

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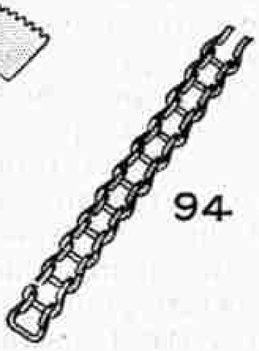

106A


90A


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22A

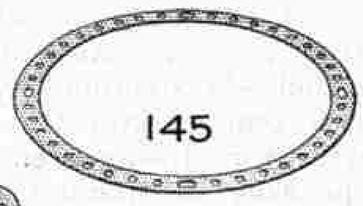

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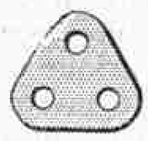

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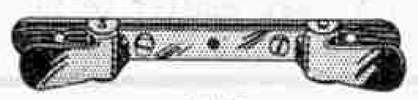

103D

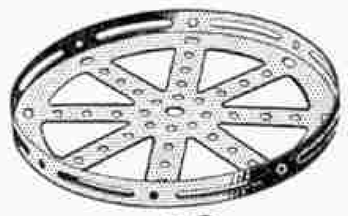

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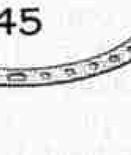

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MECCANO

Accessory Parts

ALL Meccano boys, and particularly those who have just taken up the hobby, are reminded that the model-building possibilities of their Outfits will be greatly increased by the addition of extra Meccano parts, which may be obtained from any Meccano dealer.

We illustrate a selection of parts that every Meccano boy will find useful in building the larger and more interesting models. Ask your dealer for a copy of the complete illustrated list of Meccano Accessory Parts, and keep it by you for reference.

No.		s.	d.
9b.	Angle Girders, 3½" long ½ doz.	0	8
*10.	Flat Brackets ... ... „	0	2
*11.	Double Brackets ... each	0	1
*12.	Angle Brackets, ½" × ½" doz.	0	3
17.	Axle Rods, 2" ... ... 3 for	0	1
19a.	Wheels, 3" with set screw each	0	6
	Pulley Wheels		
19c.	6" dia. with centre boss and set screw „	2	0
22.	1" „ „ „	0	3
22a.	1" without set screw „	0	2
23a.	½" with „ „ „	0	3
26.	Pinion Wheels, ½" diam. „	0	4
27.	Gear Wheels, 50 teeth „	0	6
27a.	„ „ 57 „ „	0	6
28.	1½" Contrate Wheels „	0	9
29.	¾" „ „ „	0	6
30.	Bevel Gears, ⅝", 26 teeth „	0	9
31.	1" Gear Wheels, 38 teeth „	1	0
*34.	Spanners ... ... „	0	2
35.	Spring Clips per box doz.	0	3
43.	Springs ... ... each	0	2
*44.	Cranked Bent Strips „	0	1
45.	Double Bent Strips „	0	1
46.	Double Angle Strips, 2½" × 1" ... ...½ doz.	0	6
52.	Perforated Flanged Plates, 5½" × 2½" ... each	0	5
53.	Perforated Flanged Plates, 3½" × 2½" ... „	0	3
54.	Perforated Flanged Sector Plates ... „	0	3
61.	Windmill Sails ... 4 for	0	6
62.	Cranks ... ... each	0	3
63a.	Octagonal Couplings „	0	8
72.	Flat Plates, 2½" × 2½" „	0	2
77.	Triangular Plates, 1" „	0	1
80a.	Screwed Rods, 3½" ... „	0	3
90.	Curved Strips, 2½", large radius ... ... „	0	1
90a.	Curved Strips, 2½", small radius ... ... „	0	1

No.		s.	d.
94.	Sprocket Chain, per 40" length	0	6
*95b.	Sprocket Wheels, 3" dia. each	0	6
*96	„ „ 1" „ „	0	3
99.	Braced Girders, 12½" „ ½ doz.	2	6
103d.	Flat Girders, 3½" ... „	0	7
*104.	Shuttles, for Looms each	7	6
106a.	Sand Rollers ... ... „	1	9
108.	Architraves ... ... „	0	2
109.	Face Plates, 2½" dia. „	0	4
*114.	Hinges ... ... per pair	0	4
*116.	Fork Pieces ... ... each	0	3
118.	Hub Discs, 5½" dia. „	1	3
119.	Channel Segments (8 to circle), 11½" dia. „	0	4
122.	Miniature Loaded Sacks ... ... „	0	2
123.	Cone Pulleys ... ... „	1	3
*124.	Revsd. Angle Brackets, 1" ... ...½ doz.	0	4
126a.	Flat Trunnions ... each	0	1
127.	Simple Bell Cranks ... „	0	1
*129.	Rack Segments, 3" dia. „	0	5
130.	Eccentrics, Triple Throw „	1	0
133.	Corner Brackets ... „	0	1
136.	Handrail Supports ... „	0	3
137.	Wheel Flanges ... „	0	3
‡138.	Ship's Funnels ... „	0	3
139.	Flanged Brackets, Right „	0	2
140.	Universal Couplings „	0	10
142.	Rubber Rings, 3" rim „	0	3
143.	Circular Girders, 5½" dia. .. .. „	1	0
144.	Dog Clutch ... ... „	0	6
145.	Circular Strips, 7" dia. overall ... ... „	0	9
146.	Circular Plates, 6" dia. „	1	0
*147.	Pawls, with pivot bolt and nuts ... .. „	0	3
148.	Ratchet Wheels	0	6
149.	Collecting Shoes, for Electric Locos	1	6

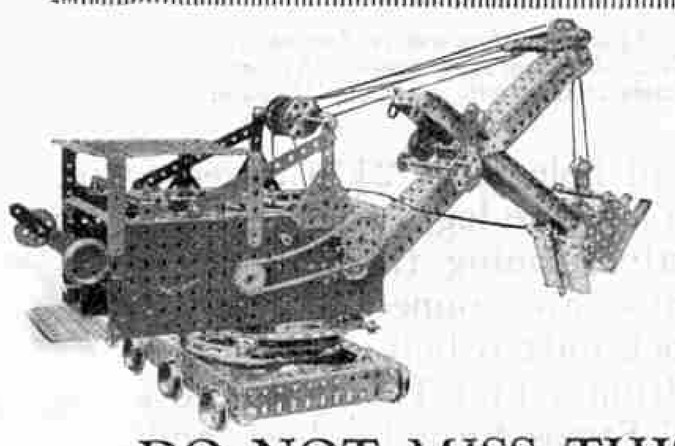
Meccano Accessory Parts will be supplied in colours unless nickelled parts are specially ordered.

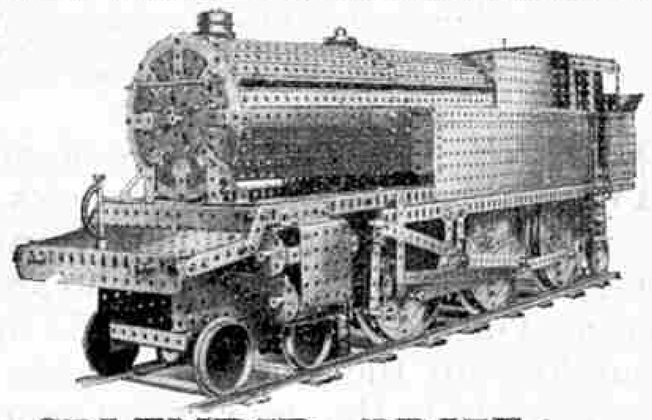
*These parts are supplied with nickel finish only.

‡This part is supplied with enamel finish only.

MECCANO LIMITED, Old Swan, LIVERPOOL

Model £100 Building Contest





DO NOT MISS THIS CHANCE OF WINNING A SPLENDID PRIZE!

THE first announcement of the Grand £100 Meccano Model-building Contest appeared in the December issue of the "*M.M.*," and many model-builders who read that number and have obtained their entry forms will now be occupied in putting the finishing touches to their models.

For those readers who have not already seen the announcement, we are again including full particulars of this splendid Contest so that every one will have an equal chance of entering. If there are any model-builders who saw the first announcement and have not yet started work on their entries, we hope they will hesitate no longer, but obtain an entry form and commence building their models straight away.

It is essential that every entry in the Contest should be accompanied by one of the special entry forms that can only be obtained from your dealer. If it so happens, however, that on application you are unable to obtain a form (many thousands of forms were given away during Meccano week), we will supply you with an entry form providing that you write to us enclosing 1½d. in stamps.

The closing date for the Home Sections of the Contest is 31st January, whilst Overseas entries may be received up till 30th April. There is plenty of time therefore in which you may complete your model and we strongly advise you to take advantage of this splendid opportunity of obtaining one of the large cash awards or any of the prizes consisting of Meccano or Hornby Train goods enumerated in the accompanying list.

An Equal Chance for Everyone

The Contest has been specially organised for Meccano boys and girls of all ages living in Great Britain or Overseas. No matter what your age is or wherever you live, you stand an equal chance of success. So send us the particulars of that new model right away!

You may submit as many models as you wish in the Contest, but it is only necessary to enclose one entry form along with the photographs and particulars of the models. All entries from any one competitor must be enclosed under the same cover.

A point to which competitors must pay particular attention is that their entry forms must be stamped or signed with the name and address of the dealer from whom they obtain their Meccano Outfits or parts.

Hints to Intending Entrants

All you have to do is to build an original Meccano model and send us a photograph or a neat sketch of it, together with an explanation of the original points in its mechanism and design if such are not shown clearly in the illustration. These details, together with your entry form should be attached to the photograph or sketch. Neither photograph or drawings need be your own work, *but the model itself must be the result of your own unaided efforts.*

Try to be as original as possible in the choice of your subject. Models that really "work," or that may be put to some practical use, will naturally attract the judges more than models that are not built to work or fail to reproduce the movements of their prototypes. Any number of parts may be used in your model, but it should be borne in mind that a simple model of straightforward design and construction stands a better chance of winning a prize than a "scrappy-looking" model, no matter how complicated its mechanism may be. Good, sturdy construction will weigh heavily in the favour of any model.

How the Entries will be Judged

In making the awards, the judges will pay special attention to the following points:—

ORIGINALITY:—Special points will be given to those models showing initiative and originality and which are not simple variations of those illustrated in the Manuals of Instructions.

CORRECT CONSTRUCTION:—Models which in their details are constructed on correct mechanical and engineering principles will receive higher marks than those that are built incorrectly or carelessly. No special knowledge is necessary to build models correctly, other than that which may be easily acquired from the Meccano Manuals of Instructions.

GENERAL INTEREST:—Preference will be given to those models that are likely to prove most interesting to Meccano users throughout the world.

Instructions for Overseas Competitors

Model-builders residing overseas may obtain their entry forms from their dealers or from the official Meccano Agents for their particular country.

Every overseas reader has an excellent chance of obtaining one of the valuable prizes offered in Sections D and E.

Closing Dates

Readers residing in Great Britain and Ireland must forward their entries not later than 31st January, 1929.

In order to give overseas entrants plenty of time in which to build the models we have extended the closing date for Sections D and E to 30th April, 1929.

All rules and any further particulars of the Contest will be found on the entry form. The results will be published in the "*M.M.*" as soon after the closing dates as possible.

LIST OF PRIZES

Section A : For Competitors over 16 years of age on 31st January, 1929.
First Prize £12. Second Prize £8. Third Prize £5.

Section B : For Competitors over 12 and under 16 years of age on 31st January, 1929.
First Prize £8. Second Prize £5. Third Prize £3.

Section C : For Competitors under 12 years of age on 31st January, 1929.
First Prize £5. Second Prize £3. Third Prize £2.

Section D : For Overseas Competitors who are over 16 years of age on 30th April, 1929.
First Prize £5. Second Prize £3. Third Prize £2.

Section E : For Overseas Competitors under 16 on 30th April, 1929.
First Prize £3. Second Prize £2. Third Prize £1.

For models showing special merit, there will also be 100 special prizes, consisting of Meccano Outfits, Hornby Train Sets, Electric Motors, Clockwork Motors, Inventor's Outfits, Meccano Radio Sets, and Earphones, etc., and 100 copies of the "Meccano Standard Mechanisms" Manual as Consolation Prizes, bringing the total value of the prizes up to ONE HUNDRED POUNDS.

New Meccano Models

"Bucking Broncho"—Locomotive—Island Platform—Extended Tip—Yacht, etc.

During 1928 the series of articles published in the "M.M." under the heading "New Meccano Models" was the means of placing before our readers no less than seventy-seven entirely new and original models. We intend to continue the series throughout 1929, and as far as possible we shall deal each month with several new and quite simple models, many of which will be suitable for the smaller Outfits. In addition, special articles from time to time will deal with Meccano "super" models.

MANY types and sizes of models have been described in previous articles in this series, and it is interesting to note from letters received that a number of Meccano boys who are in possession of quite large Outfits have obtained infinite pleasure from building up the simplest models. This has prompted us to include this month yet more models that require very few parts, and we have little doubt that they will meet with the approval of our readers.

A Miniature Locomotive (0-2-2 ?)

The base of the engine shown in Fig. 1 is formed from a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. A Bush Wheel carrying three Angle Brackets, to each of which a $2\frac{1}{2}''$ Strip is bolted, forms the boiler and is secured to one end of the Plate by means of a further Angle Bracket.

The "cab" is formed by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted vertically to the Plate with a $2\frac{1}{2}''$ Strip secured across their upper ends. Two $2\frac{1}{2}''$ Strips are bolted to the Double Angle Strips to form the front of the cab, and two further $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted to these to complete the boiler. The rear portion of the engine consists of two Flanged Trunnions, a $2\frac{1}{2}''$ Strip and a $2\frac{1}{2}''$ Curved Strip. The way in which these are secured will be understood from Fig. 1.

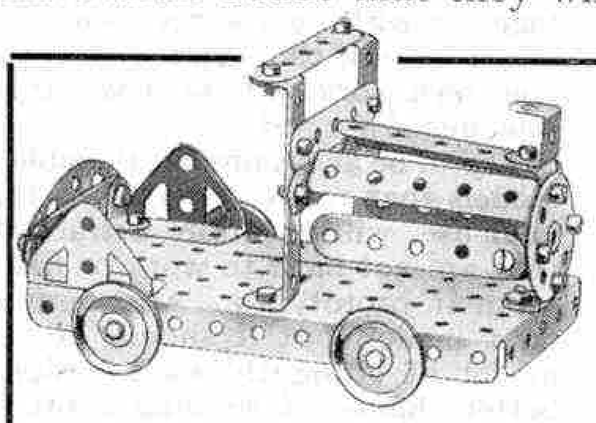


Fig. 1. An engine that will delight your younger brother or sister !

The following parts are required to build the model :— 7 of No. 5 ; 1 of No. 11 ; 6 of No. 12 ; 2 of No. 16 ; 4 of No. 22 ; 1 of No. 24 ; 24 of No. 37 ; 4 of No. 48a ; 1 of No. 52 ; 1 of No. 90 ; 2 of No. 126a.

The "Bucking Broncho"—A Working Model

The model of a "Bucking Broncho" (Fig. 2) is calculated to be a real mirth-provoker ! By moving the two $5\frac{1}{2}''$ Strips the "horse" can be made to perform all sorts of antics, the rider frequently being thrown headforemost to the ground. He always manages to return to his seat, however !

The $5\frac{1}{2}''$ Strips are pivotally connected by means of a Flat Bracket and the end holes of a $2\frac{1}{2}''$ Curved Strip. This Strip forms the horse's fore leg, being bolted at its upper end to a $2\frac{1}{2}''$ Strip forming the animal's neck. The hind legs ($2\frac{1}{2}''$ Strips) are connected pivotally to the horse's body by a lock-nutted bolt.

The rider is built up from a Flat Trunnion and a $2\frac{1}{2}''$ Strip. Two further $2\frac{1}{2}''$ Strips form his legs, and two $2\frac{1}{2}''$ Curved Strips comprise his arms. His arms and legs are lock-nutted to his body, and his arms are also lock-nutted to the horse's neck. Before using the model care should be taken to ensure that all bolts are firmly secured, and that those that are lock-nutted allow the moving parts to operate smoothly but without any "side-play."

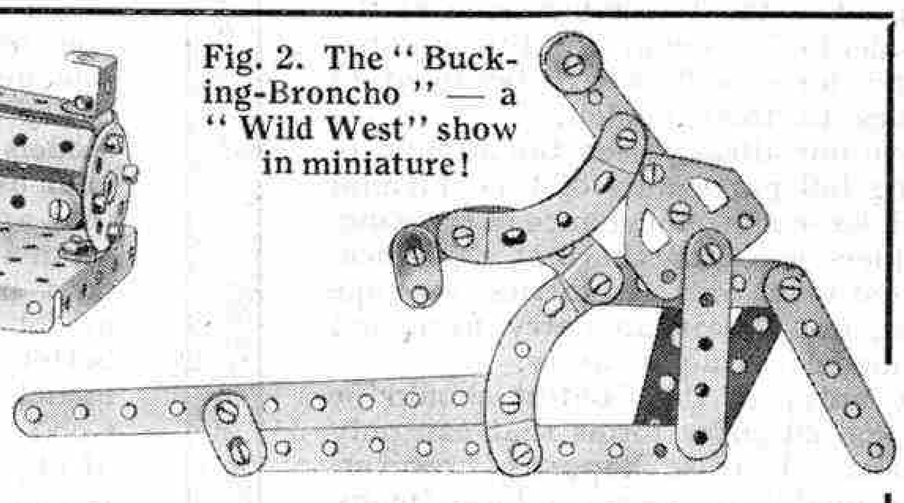


Fig. 2. The "Bucking-Broncho" — a "Wild West" show in miniature!

The parts required for this model are : 2 of No. 2 ; 6 of No. 5 ; 2 of No. 10 ; 1 of No. 23 ; 12 of No. 37 ; 9 of No. 37a ; 4 of No. 90a ; 1 of No. 111c ; 1 of No. 126a.

"Island" Railway Platform

Hornby enthusiasts will find the Island Platform shown in Fig. 3 a most useful addition to their layouts. The platform would be improved considerably by adding "ramps" at each end. These ramps can be constructed quite easily from standard parts.

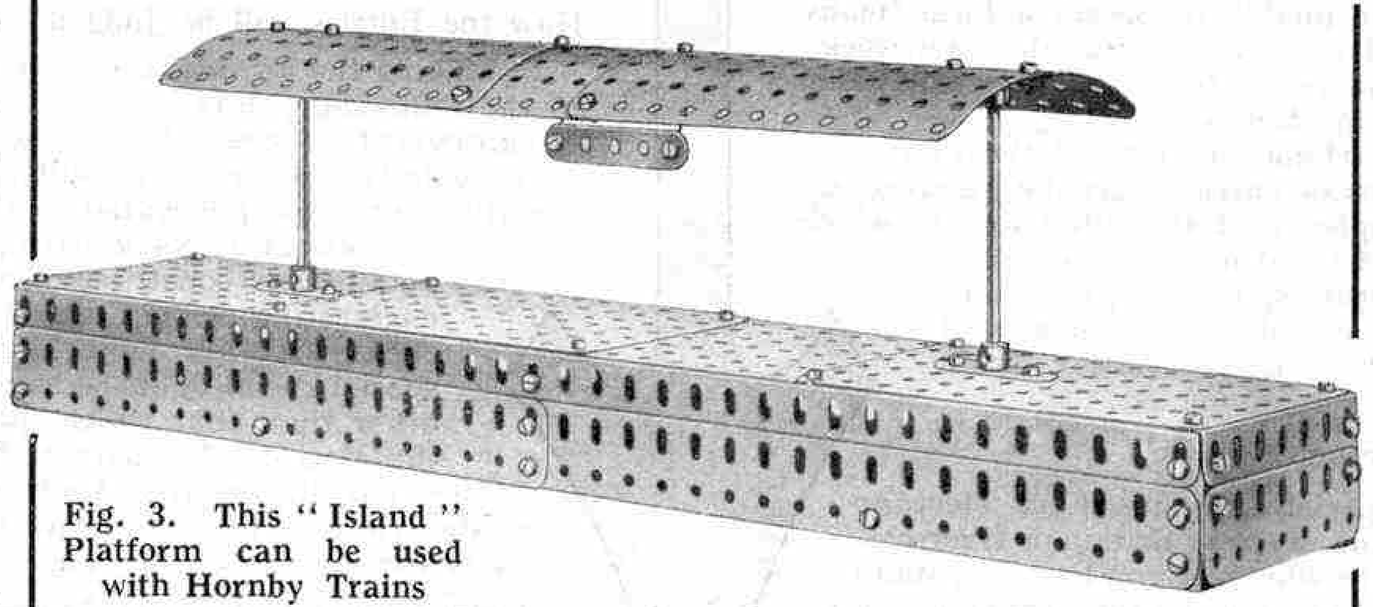


Fig. 3. This "Island" Platform can be used with Hornby Trains

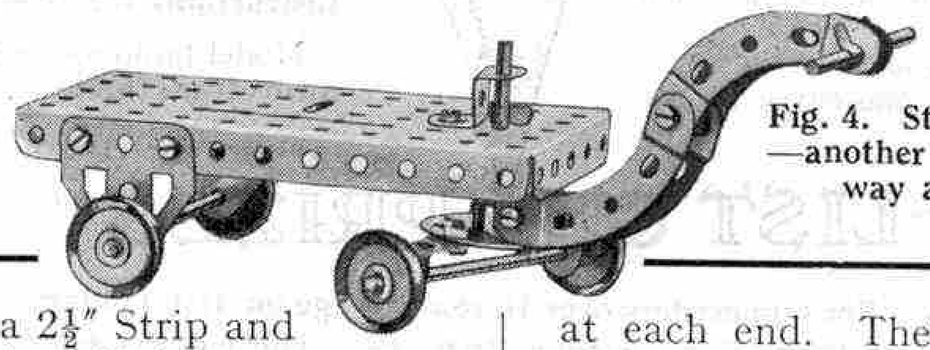


Fig. 4. Station Trolley —another useful railway accessory

The platform itself is built up as follows. Four $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates are overlapped and bolted together, the two centre Plates being overlapped three holes, whilst the outer ones are overlapped only two holes. An $18\frac{1}{2}''$ Angle Girder is bolted to each side of these Plates and a $3\frac{1}{2}''$ Girder is secured across each end. A $1\frac{1}{2}''$ Angle Girder is bolted to the Girders at each corner and Flat Girders are bolted between these as shown. Further $18\frac{1}{2}''$ Angle Girders are secured, with their flanges inward, to the lower edges of the Flat Girders forming the sides of the model.

The canopy is built up as follows : two pairs of $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates are overlapped and bolted together. They are then secured on either side of a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat

Plate, and two Axle Rods that are firmly secured by means of Double-arm Cranks form supports for the complete structure. A $2\frac{1}{2}$" Strip represents the station board name and is suspended from the centre of the canopy by means of cord.

The parts necessary to build the Island Platform are as follows: 1 of No. 5; 4 of No. 7a; 2 of No. 9d; 4 of No. 9f; 2 of No. 16; 54 of No. 37; 4 of No. 52a; 4 of No. 62b; 4 of No. 70; 2 of No. 103d; 4 of No. 103h.

A Useful Station Trolley

Another model that might prove useful as a model railway accessory—although it is perhaps a little too large for use in connection with Hornby Trains!—is the hand trolley shown in Fig. 4.

Two Flat Trunnions are secured to the flanges of a $5\frac{1}{2}$" $\times 2\frac{1}{2}$" Flanged Plate to form journals for a $3\frac{1}{2}$" Axle Rod carrying a 1" Pulley on each end. A $\frac{1}{2}$" Reversed Angle Bracket is bolted to the Plate and provides a suitable bearing for a 2" Rod carrying a Bush Wheel to which is secured a $2\frac{1}{2}$" $\times \frac{1}{2}$" Double Angle Strip. A Double Bracket also is bolted to the Bush Wheel and two $2\frac{1}{2}$" Curved Strips are fastened to the Double Bracket. The handle is completed by two further $2\frac{1}{2}$" Curved Strips and a 2" Axle Rod.

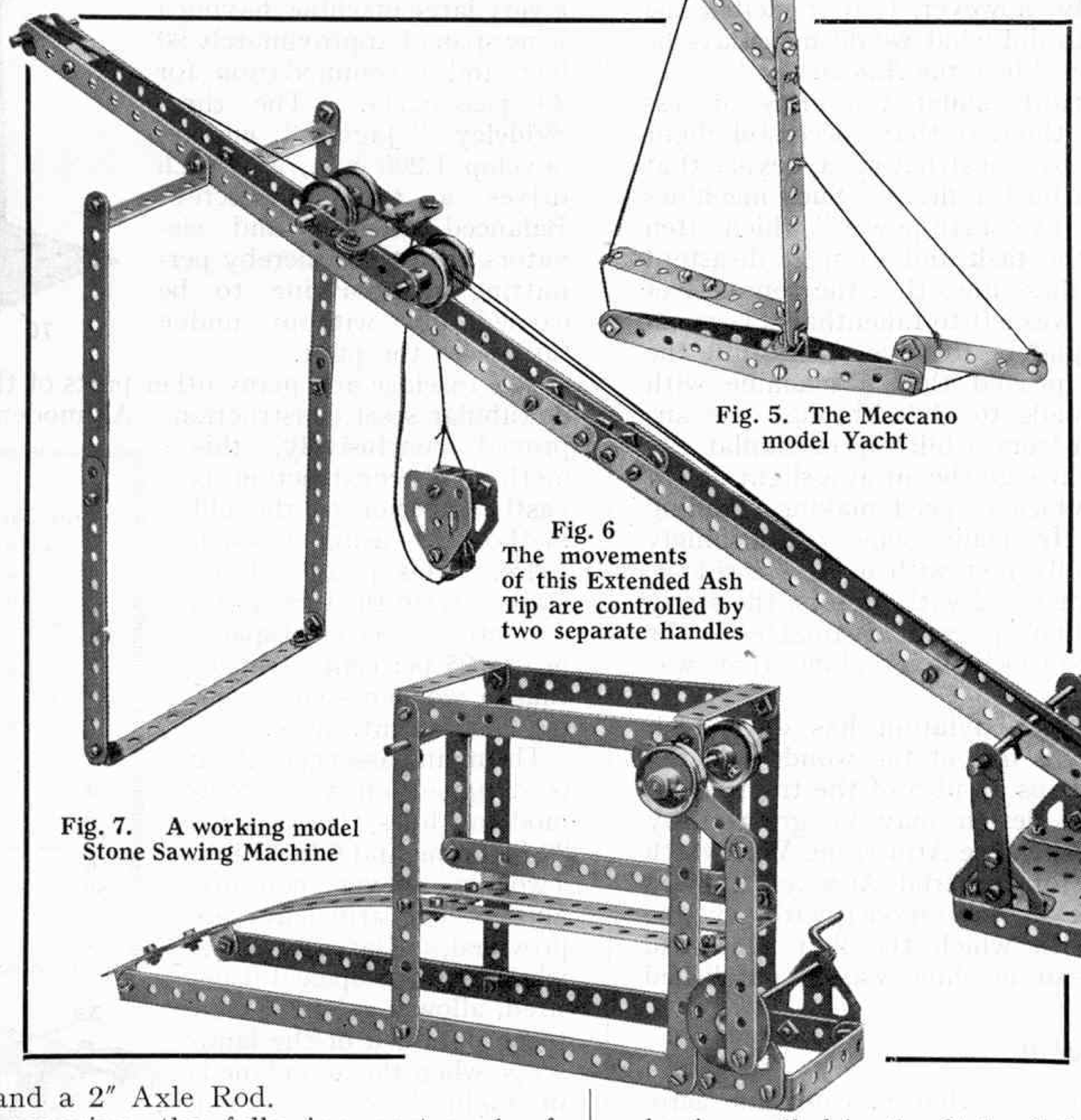


Fig. 6 The movements of this Extended Ash Tip are controlled by two separate handles

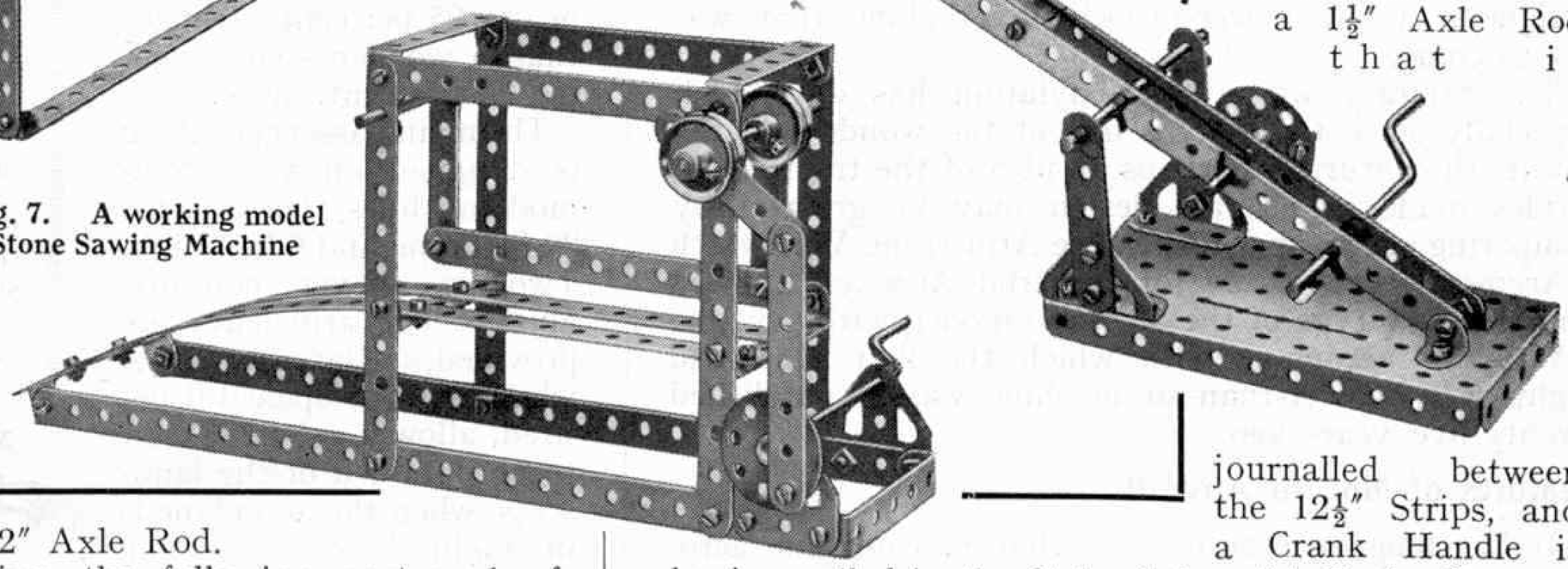


Fig. 7. A working model Stone Sawing Machine

This model comprises the following parts: 1 of No. 11; 2 of No. 16; 2 of No. 17; 4 of No. 22; 1 of No. 24; 3 of No. 35; 10 of No. 37; 1 of No. 48a; 1 of No. 52; 4 of No. 90a; 1 of No. 125; 2 of No. 126a.

A Graceful Little Racing Yacht

Fig. 5 shows a well-proportioned model Yacht. Two $5\frac{1}{2}$" Strips are spaced apart five holes from one end by means of a Double Bracket, and the ends of the Strips are bolted together. A Flat Bracket carrying a $2\frac{1}{2}$" Strip, which represents the bowsprit, is secured in the fore end. The mast is built up from a $5\frac{1}{2}$" and a $2\frac{1}{2}$" Strip, and is secured to the Double Bracket by means of an Angle Bracket. The boom, consisting of two $2\frac{1}{2}$" Strips overlapped and bolted together, is secured to this, and a $2\frac{1}{2}$" Strip forming the gaff is fastened to the mast by means of a Flat Bracket. Meccano Cord is tied as shown to add the "finishing touches" to the model.

The following parts are necessary to build the Yacht: 3 of No. 2; 5 of No. 5; 2 of No. 10; 1 of No. 11; 2 of No. 12; 13 of No. 37.

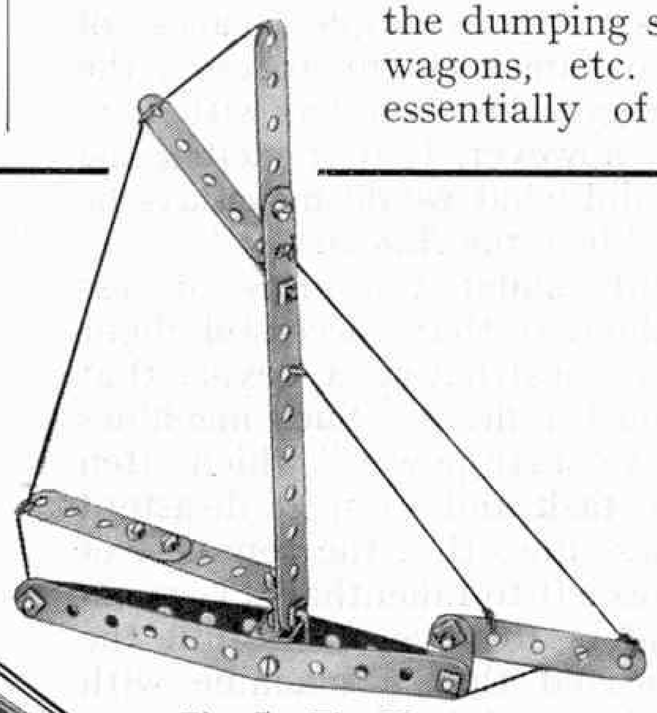


Fig. 5. The Meccano model Yacht

Extended Ash Tip

The prototype of the model shown in Fig. 6 may often be seen in coal storage yards, railway sidings, or connected to boiler houses. In the latter case the bucket carries the ashes direct from the furnaces to the dumping site or to waiting railway wagons, etc. The structure consists essentially of a gantry along which travels a trolley with a bucket suspended from it.

In the Meccano model the gantry consists of two pairs of $12\frac{1}{2}$" Strips spaced apart by means of Double Brackets. The $2\frac{1}{2}$" Strips connecting each pair at the centre are spaced from the $12\frac{1}{2}$" Strips by means of nuts, so as to allow the trolley wheels to pass over the joints smoothly.

A Bush Wheel carrying a $\frac{3}{8}$" Bolt, which serves as a handle, is mounted on a $1\frac{1}{2}$" Axle Rod that is journalled between the $12\frac{1}{2}$" Strips, and a Crank Handle is also journalled in the Strips below this Rod. One end of a length of cord is secured to the trolley, and the cord is passed over a $\frac{1}{2}$" loose Pulley journalled in the upper end of the gantry. It is then wound round the Axle Rod carrying the Bush Wheel and its other end is secured to the trolley, with the result that, by operating the Bush Wheel, the trolley can be made to travel up or down the runway.

The cord from the Crank Handle is passed over one of the Axle Rods of the trolley and secured to the bucket, the bottom of which is connected to the trolley by means of another cord. On rotating the Crank Handle the bucket can be lowered until this cord tightens and so tips the bucket.

The parts required to build the Ash Tip are as follows: 4 of No. 1; 5 of No. 2; 7 of No. 5; 2 of No. 11; 8 of No. 12; 1 of No. 16; 1 of No. 17; 2 of No. 18a; 1 of No. 19s; 4 of No. 22; 1 of No. 24; (*Continued on page* 81)

Another Striking New Meccano Model:

Three-Engine Biplane

THE desire to conquer the air has possessed man throughout the ages. For example, Icarus, of ancient Greek legend fame, sought to cross the Ægean Sea by fastening wings to his shoulders with wax. The sun shone so fiercely, however, that it melted the wax and Icarus forthwith did what would nowadays be described as a " nose dive " into the Ægean Sea !

Many would-be aeronauts suffered a more or less similar fate, for it was thought that successful flight could only be attained by constructing a device that imitated the actions of a bird in flight. Such machines were operated invariably by " man power," which often proved inadequate for the task and so spelt disaster !

But it was not along these lines that the conquest of the air was achieved ! It was left to Lilienthal, a German who experimented with gliders, to solve successfully the problem of flight. He proved that a machine with fixed planes could be made to glide through the air. The glider was launched from a hill top or similar elevated position and flew through the air at a slight downward angle to maintain sufficient speed, making a landing some distance away. He made some astonishingly long flights, but eventually met with a fatal accident. Although gliders were not fitted with motors, the study of their behaviour in flight proved invaluable to the designers of the power-propelled aeroplane that was yet to come.

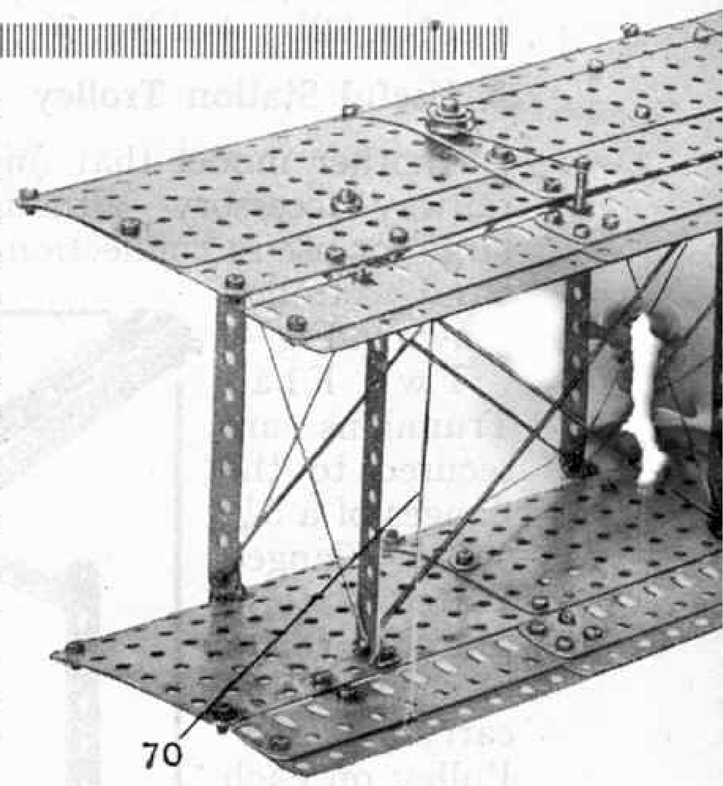
The rapidity with which aviation has developed, especially since the war, is one of the wonders of the twentieth century. Perhaps an idea of the tremendous strides made in aircraft design may be grasped by comparing such a machine as the Armstrong Whitworth " Argosy " type, made for Imperial Airways Limited and the prototype of the Meccano model, with say, the " Wright " aeroplane with which the first successful flight of a heavier-than-air machine was accomplished twenty-five years ago.

Features of Modern Aircraft

It has long been recognised that multi-engine aeroplanes possess a considerable advantage over the single-engine type. The former type can keep flying even if one engine stops : but the single engine machine has to come down in the event of engine failure.

The practical difficulties of employing multiple engines in aircraft are fast disappearing and it is evident that the multi-engine planes will be the aircraft of the future.

The three-engine " Argosy " aeroplane, for instance, represents one of the finest examples in modern aircraft design. It is a very large machine, having a wing span of approximately 90 feet and accommodation for 20 passengers. The three Siddeley " Jaguar " engines develop 1,200 h.p., and each drives a tractor airscrew. Balanced ailerons and elevators are fitted, thereby permitting manœuvring to be carried out without undue fatigue to the pilot.



The fuselage and many other parts of the machine are of tubular steel construction. As modern research has proved conclusively, this method of construction is vastly superior to the old method of using wooden spars. This point will be realised from the fact that a correctly shaped steel spar is nearly 25 per cent. stronger than a wooden spar weighing 20 per cent. more.

The main passenger saloon is designed on very commodious lines, being some 30 feet long and 6 feet high. Two rows of very comfortable wicker armchairs are provided, and large windows, which may be opened if desired, allow a splendid view to be obtained of the landscape when the aeroplane is in flight, besides making the saloon very light.

Parts required to build the

6	of No.	1	2	of No. 15A	2
2	„ „	1A	3	„ „ 16	46
14	„ „	2	2	„ „ 16A	15
2	„ „	3	1	„ „ 16B	8
6	„ „	4	2	„ „ 17	5
20	„ „	5	3	„ „ 18A	3
18	„ „	6	4	„ „ 20A	22
10	„ „	6A	5	„ „ 23	5
4	„ „	7A	6	„ „ 24	3
12	„ „	8	6	„ „ 30	2
4	„ „	9B	2	„ „ 31	12
4	„ „	9D	24	„ „ 32	18
2	„ „	9F	489	„ „ 37	2
12	„ „	10	74	„ „ 37A	4
6	„ „	11	2	„ „ 37B	11
86	„ „	12	42	„ „ 38	4
2	„ „	13A	6	„ „ 41	5
1	„ „	14	3	„ „ 48	3

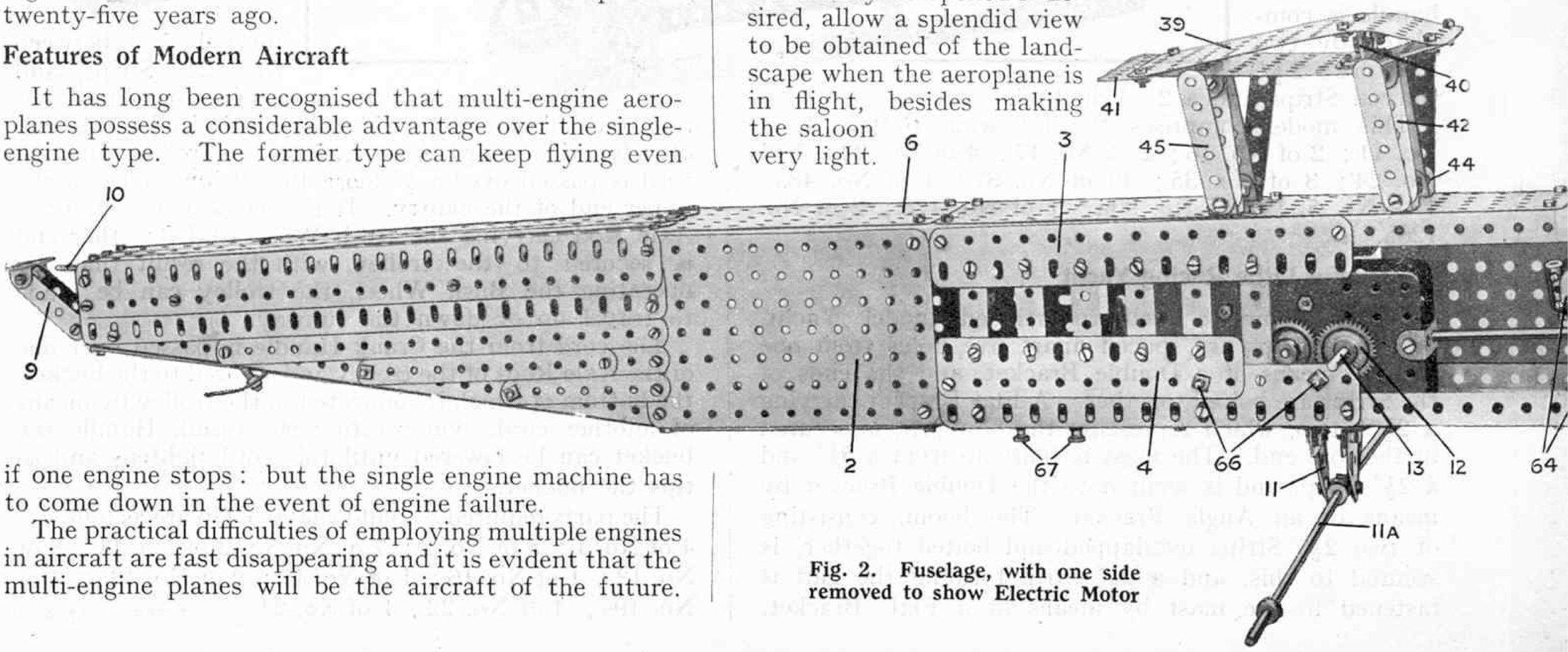


Fig. 2. Fuselage, with one side removed to show Electric Motor

A Copy of the Armstrong-Whitworth "Argosy" type Air Liner

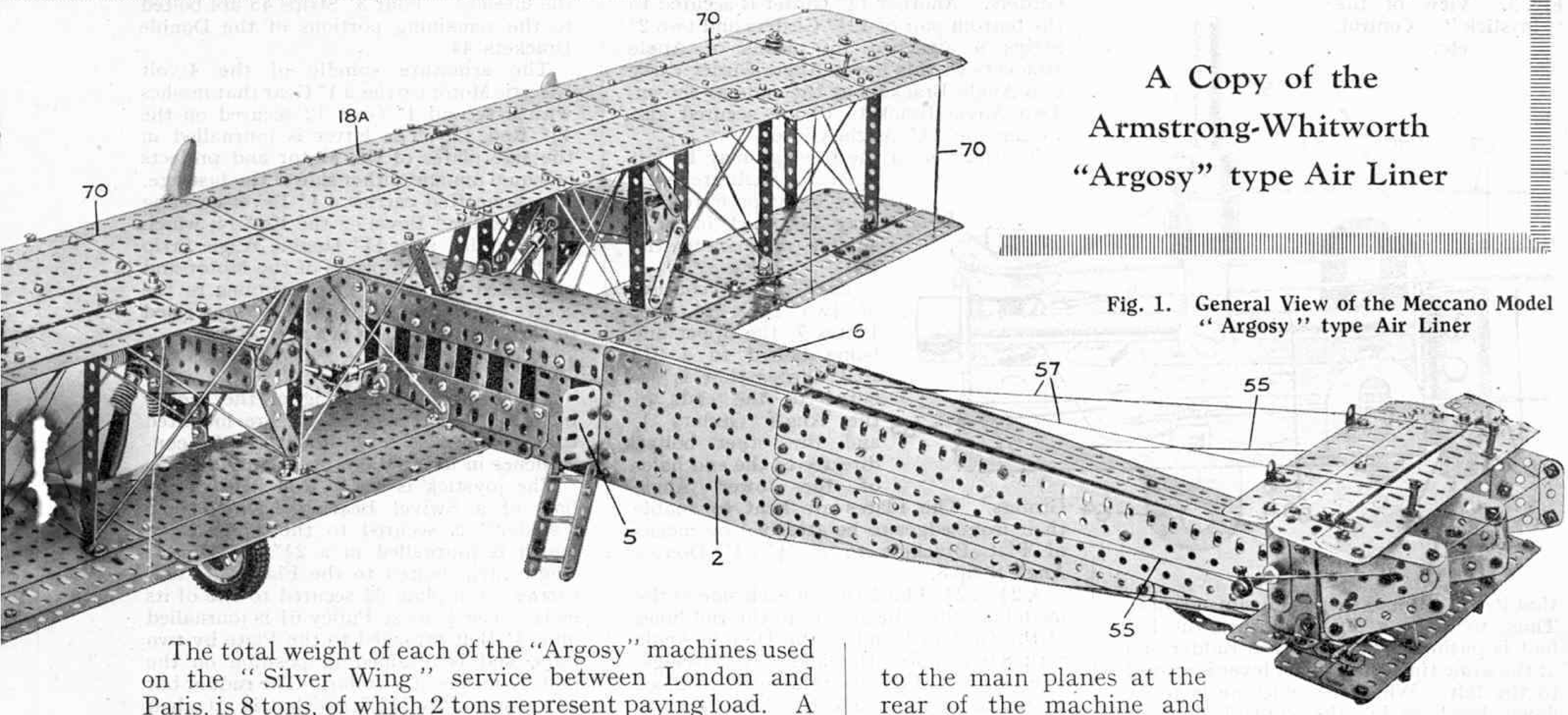


Fig. 1. General View of the Meccano Model "Argosy" type Air Liner

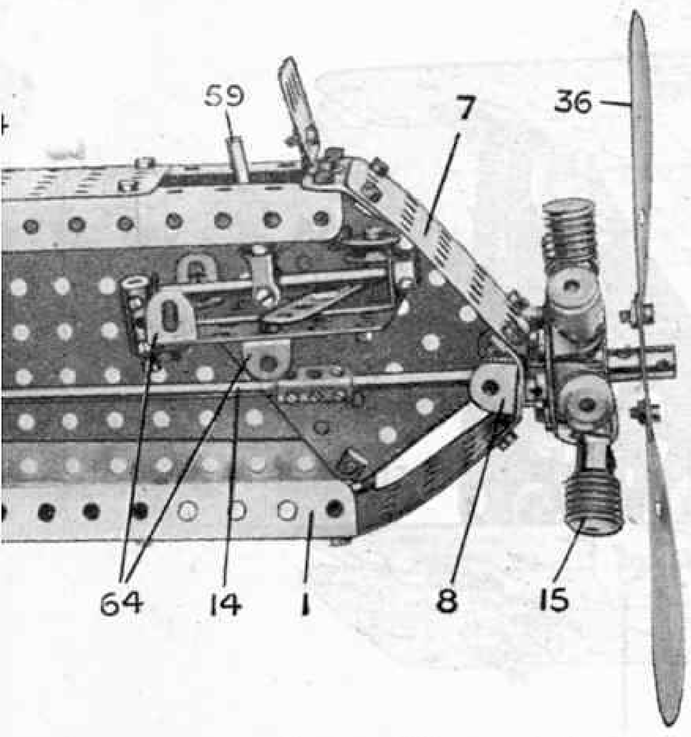
The total weight of each of the "Argosy" machines used on the "Silver Wing" service between London and Paris, is 8 tons, of which 2 tons represent paying load. A maximum speed of approximately 110 m.p.h. can be obtained, the normal cruising speed being in the neighbourhood of 95 m.p.h. This is truly a remarkable performance for so huge a machine.

The Meccano model of the "Argosy" has been designed to resemble the original as closely as possible. The ailerons, elevators and rudders are connected to their respective controls in the cockpit (in the nose of the machine) by wires, and work as in the prototype. One 4-volt Meccano Electric Motor concealed in the fuselage drives the three propellers at the armature speed of the Motor, no reduction being found necessary.

uild the Three-Engine Biplane

5A	2	of No.	48A
6	46	„ „	52A
6A	15ft.	„ „	58
6B	8	„ „	59
7	5	„ „	62B
8A	3	„ „	63
0A	22	„ „	70
3	5	„ „	72
4	3	„ „	76
0	2	„ „	82
1	12	„ „	101
2	18	„ „	103
7	2	„ „	103A
7A	4	„ „	103B
7B	11	„ „	103D
8	4	„ „	103F
1	5	„ „	103G
8	3	„ „	103H
7	of No.		103K
9	„ „		111
3	„ „		111A
56	„ „		111C
20	„ „		114
2	„ „		126A
4	„ „		140
1	„ „		165
2	„ „		302
2	„ „		303
2	„ „		304
2	„ „		305
2	„ „		306
8	„ „		312
1 Electric Motor			

How an Aeroplane is Controlled



At this juncture it would be well to give Meccano boys a brief description of the controls of an aeroplane and the manner in which they are used.

From the bottom of the fuselage in the pilot's seat there projects a vertical bar, called the control column, or "joystick." This is pivoted about three-quarters of the way down and can be moved backward and forward and from side to side from the pivoting point. The stick controls the elevator and ailerons. The elevator is a horizontal controlling flap set parallel to the main planes at the rear of the machine and hinged so that it can be moved upward and downward. It is connected to the control column by wires so that, when the stick is pushed forward, the elevator moves downward from its hinge, thus presenting more resistance to the air when the aeroplane is in flight and sending the nose of the machine downward. When the stick is pulled back the elevator flap is raised and the nose of the machine goes up.

The control column is also connected to the aileron flaps on each of the four wings. These flaps move upward or downward according to the movements of the control column. When the stick is moved to the left, the ailerons on the right side are pulled down, setting up an additional resistance on that side and causing that wing to rise. At the same time the ailerons on the left side are slightly pulled up, assisting the downward motion of the left wing. The movement of the ailerons is slight, but sufficient to cause the machine to bank and make an effective turn.

When the lever is pushed to the right, on the other hand, the left ailerons are depressed, and those on the right slightly raised, so that the machine banks to the right.

The rudder is controlled by wires connected to the rudder bar, which is a piece of wood or metal pivoted about its centre and arranged athwartships, so that the pilot can swing it about its centre with his feet. The rudder is parallel to the fore-and-aft line of the machine when the rudder bar is square, and the machine will then fly straight, but if one side is pushed forward the rudder is swung in the same direction. For example, if the left foot is pushed forward the rudder swings to the left, more resistance to the wind being thus given on that side, so that the tail of the machine is forced to the opposite direction and the nose of the machine turns to the left. To turn the machine to any side, therefore, the foot on that side is pushed forward on the rudder bar.

In order to make a turn, however, it is not sufficient to move the rudder bar in the required direction. If the rudder only is used the machine skids, or slips outward, an effect due to the difference in speed between the inner and outer wing tips. The aeroplane must be banked so

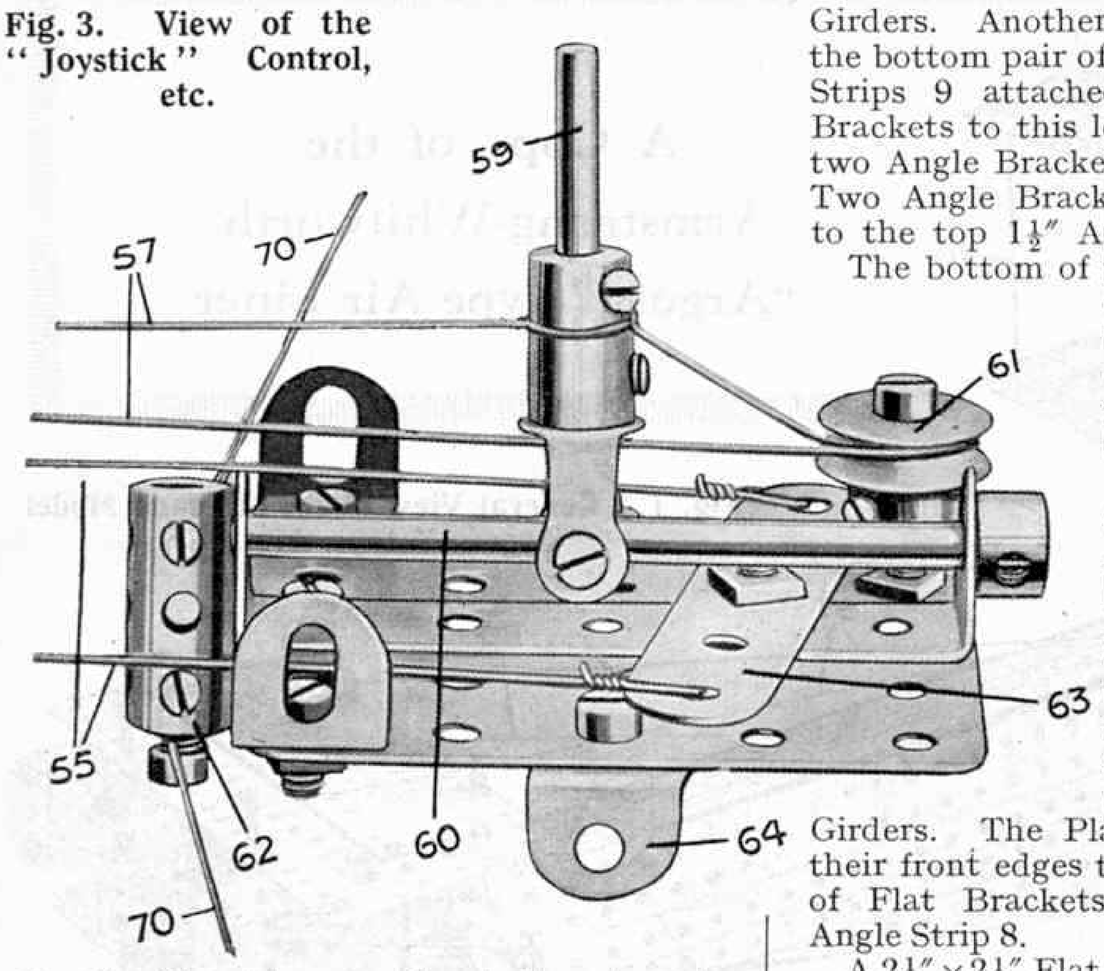


Fig. 3. View of the "Joystick" Control, etc.

that it will not lose speed and slip outward. Thus, to make a left-hand turn the left foot is pushed forward on the rudder and at the same time the control lever is moved to the left. When the machine is to be flown level again, the control lever is pushed across again and a little past the central position, and the right foot is pressed on the rudder. The controls are then centred so that the machine flies straight and level.

Construction of the Fuselage

The building of the body of the model, or "fuselage," should be proceeded with first. It consists essentially of four 18½" Angle Girders 1 with four 12½" Angle Girders bolted to their ends to form the sloping tail portion. Two 5½" × 3½" Flat Plates 2 are bolted at each end of the Girders 1. (In Fig. 2 the Plate at the front end has been removed to show the inside details of the fuselage). The saloon windows are represented by 2" Strips bolted to a 7½" Flat Girder 3 and also to a 5½" Flat Girder 4, the latter being secured to another 7½" Flat Girder that is attached to the bottom Girder 1. The construction of the windows on the opposite side of the saloon is similar to that just described, except that a door 5 (Fig. 1) consisting of a 2" Flat Girder, is hung from the Plate 2 by means of Hinges. To accommodate the door the Flat Girders on this side are moved forward four holes and also the rearmost 2" Strip is omitted, a 3½" Flat Girder taking its place.

The sides of the tapering tail portion of the fuselage formed by the 12½" Angle Girders are closed in by means of 12½" Flat Girders and Strips, disposed as indicated in Figs. 1 and 2. The upper and lower 12½" Angle Girders have their extreme ends held together by 1½" Angle Girders.

The top of the fuselage is composed of 5½" × 2½" Flat Plates 6 bolted to the Girders 1, a space being left at the front end for the cockpit. The top of the tapering portion consists of three 12½" Strips bolted at the rear end to a 1½" Angle Girder that is secured across the ends of the two top 12½" longitudinal Girders. Another 1½" Girder is secured to the bottom pair of 12½" Girders and two 2" Strips 9 attached by means of Angle Brackets to this lower Angle Girder carry two Angle Brackets at the ends as shown. Two Angle Brackets 10 are secured also to the top 1½" Angle Girder.

The bottom of the fuselage may be left open to facilitate erection, or, if preferred, it may be filled in in a similar manner to the top.

The "nose" consists of two 2½" × 2½" Flat Plates 7, the upper one being bolted to a 2½" Flat Girder that is secured to the ends of the Angle Girders 1, and the other bolted directly to the end holes of the lower Angle Girders. The Plates are bent to enable their front edges to be attached by means of Flat Brackets to a 2½" × ½" Double Angle Strip 8.

A 2½" × 2½" Flat Plate on each side of the model is bolted diagonally to the end holes of the Girders 1 and to the Double Angle Strip 8 to complete the sides of the fuselage. The controls (Fig. 3) are secured in place by means of the Angle Brackets 64: the position in which they are bolted to the Plates 2 is shown clearly in Fig. 2.

Two Flat Trunnions 11 secured to 2½" Angle Girders that are bolted across the bottom Girders 1 (Fig. 2) carry a Coupling, in the longitudinal bore of which two 8" Rods 11a are secured. The Coupling is secured to the Trunnion by means of bolts that are passed through the end holes of the Trunnions and inserted in the tapped centre holes of the Coupling. A Washer is placed on the shank of each bolt between the Coupling and the Trunnion, and the bolts tightened up securely.

The centre section (Fig. 2) is shaped to the streamline section of the main planes and consists of two 5½" × 3½" Flat Plates 39, with two 2½" Angle Girders 40 bolted between them in the form of a channel section girder. A 3½" Flat Girder 41 is attached to the trailing edge of these Plates. Four 2½" Strips 42 are bolted to two Double Brackets attached to the underside of the centre section and their other ends are bolted to two pairs of Double Brackets 44 that are secured to the top of the fuselage. Four 3" Strips 45 are bolted to the remaining portions of the Double Brackets 44.

The armature spindle of the 4-volt Electric Motor carries a 1" Gear that meshes with a second 1" Gear 12 secured on the 4½" Rod 13. The latter is journalled in the side plates of the Motor and projects an equal amount either side of the fuselage. The same Rod carries a 1" Bevel meshing with a second Bevel on the Rod 14, which is journalled in a 1½" Double Angle Strip bolted to the side plates of the Motor and connected by means of a Coupling to the centre engine in a manner to be described in the February issue of the "*M.M.*"

The Controls (Fig. 3)

The controls, consisting of the rudder bar 63 and the joystick 59, are mounted together on a 2½" × 2½" Flat Plate for convenience in fixing them in the fuselage.

The joystick is a 1½" Rod held in the boss of a Swivel Bearing. The latter's "spider" is secured to the 3" Rod 60, which is journalled in a 2½" × ½" Double Angle Strip bolted to the Flat Plate and carries a Coupling 62 secured to one of its ends. The ½" loose Pulley 61 is journalled on a ¾" Bolt attached to the Plate by two nuts, and is retained in position on the bolt by means of a Collar. The rudder bar 63 consists of a 2½" Strip that is attached pivotally by means of a lock-nutted bolt (see Standard Mechanism No. 262) to the 2½" × 2½" Flat Plate. The ½" × ½" Angle Brackets 64 are for the purpose of attaching the Flat Plate to the side Plates of the fuselage in the position indicated in Fig. 2.

The Tail Unit

As will be seen from Fig. 4 both the upper and lower elevators (fixed and moving) of the tail unit are exactly similar in construction: therefore the description of one should suffice to make the whole clear. The fixed portion of the elevator consists of a 7½" Flat Girder 47 and another Flat Girder 46 8½" in length (obtained by bolting a 1½" Flat Girder to one end of a 7½" Girder). The two Girders are laid side by side and connected together at each end by means of Flat Brackets, a 1½" Strip lending additional support in the centre. The longer Girder 46 overlaps the shorter one by one hole at each end.

The movable portion of each elevator consists of a 9½" Flat Girder with 2" Flat Girders at the ends. (*Continued on page* 81)

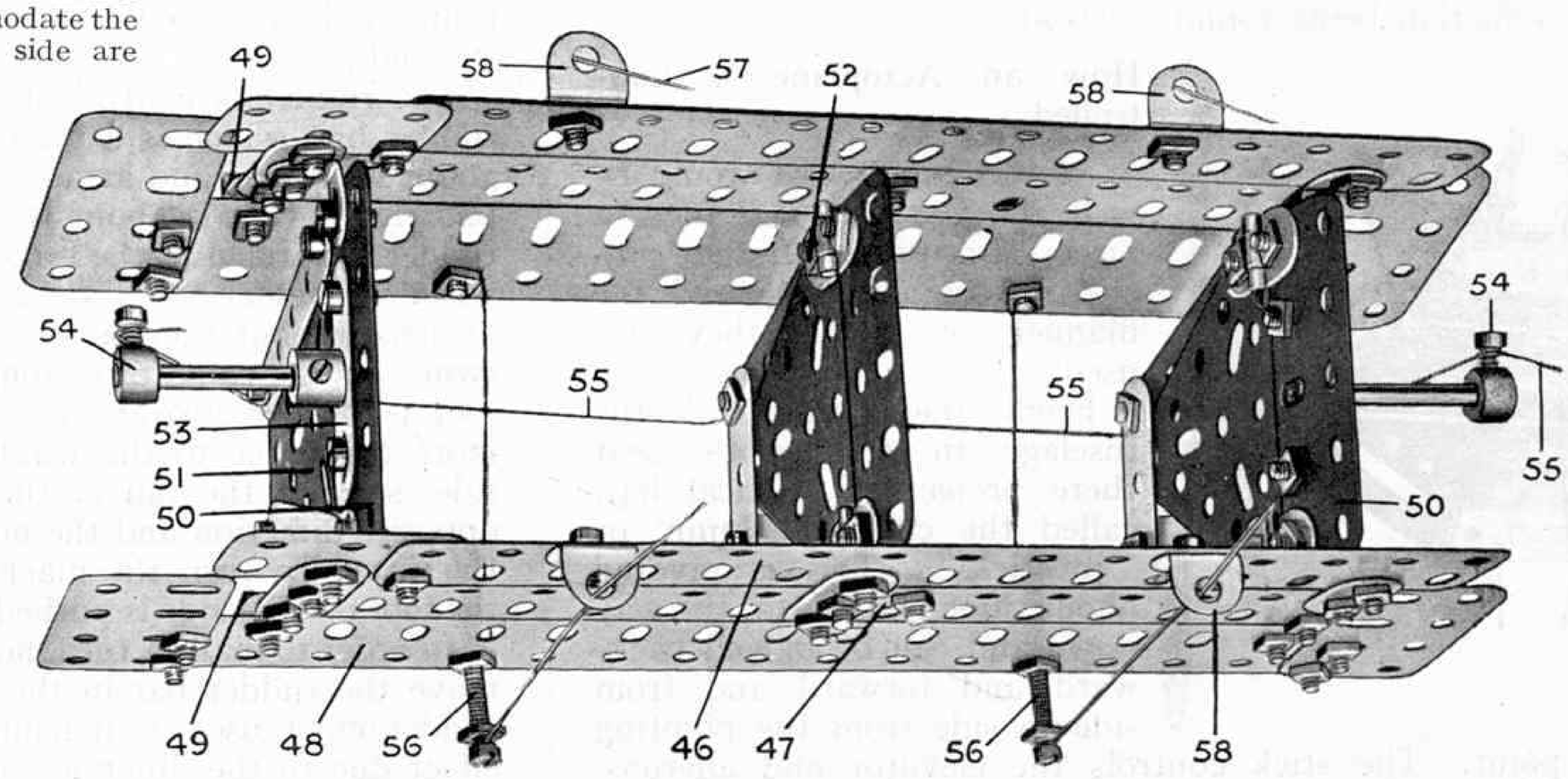
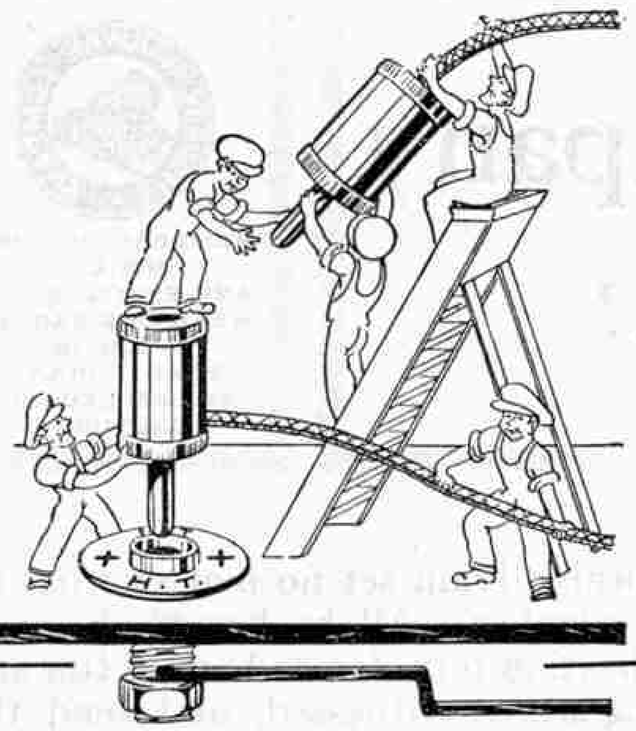
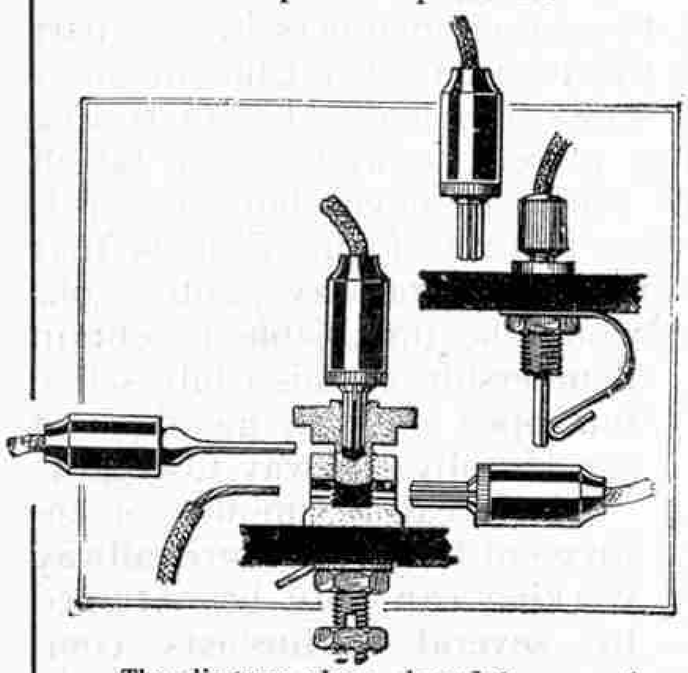


Fig. 4. Tail, showing hinged Rudders and Elevators, etc.



"Two into One will go!"

All Eelex accessories have multiple uses and above you see the Eelex gnomes of efficiency making two joints into a socket by means of Eelex plugs. It's surprising how the number of connections and wires can be reduced by using Eelex terminals, spades, plugs, pins and eyes, and how neat your set can be made to appear. Also the Eelex system of standardisation makes the possibility of a wrong or accidental connection practically impossible. All constructors should write for a copy of the new Eelex Booklet—K.63—which tells you about the Eelex gnomes of efficiency and describes all the Eelex Wireless accessories—free on receipt of a postcard.



The diagram above shows the use of a spring jack attached to a socket for use with 'phone or loud speaker tag ends or plugs. Also the famous

EELEX

TREBLE-DUTY TERMINAL

with its multiple uses. There are 40 different indicating tops and six colours available.

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Artificial Light Photography

IT appears to be a common belief among amateur photographers that indoor photography by artificial light is difficult and not worth while. This is a great mistake. The few small difficulties that exist are easily overcome after one or two attempts and when success is achieved the results are really excellent. There is no lack of suitable subjects at home during the long winter evenings, especially at the parties that are so jolly a feature of January; and everyone who possesses a camera will find it worth while to try his hand at this kind of work.

The majority of our readers will wish to try their skill on portraits, party groups, Meccano models and Hornby Train layouts, and the preliminary arrangements will be very much the same in each case.

The light is the first important detail that requires attention. This should be placed as near to the subject as possible and should be directed from an angle of 45 degrees to one side and from a height of not less than 4 ft. To avoid harsh contrasts of light and shadow a diffuser—white muslin will do nicely—should be placed between the subject and the light and, on the opposite side of the room, reflectors to throw light into the shadow parts should be employed.

The background should never be of striking pattern; a plain sheet or blanket, providing a contrast with the colouring of the subject, being best of all.

The length of exposure necessarily will vary according to the strength of the light. Incandescent gas is the weakest light, but using plates or films of high speed, and assuming that the supply of gas available is sufficient to provide a brilliant light, the exposure required will not be unduly long. A recent exposure was made upon a cluster of various kinds of fruit piled upon a stand, a type of subject eminently suitable for photographing by artificial light. Two incandescent gas burners were used, their position being 4 ft. above the fruit stand and slightly to the front. The plate used was of the type usually spoken of as "extra rapid" (about 300 H. & D.), and the exposure, using stop F/16 (U.S.8), was four minutes.

Electric light possesses many advantages over gas, particularly in regard to portability. By means of a length of flex the light can be placed just where it gives the best results from a photographic point of view. The exposure required depends very largely upon the type of lamp used, but as a rule it is not possible to have special lamps and we have to employ the variety in ordinary household use. It is impossible to give any pointers to the approximate exposures necessary, but after the first experiments the results will prove a definite guide.

The fastest exposures will be secured by using magnesium ribbon or flashlight powder. The powder is the faster and generally the more satisfactory. As its name suggests, the exposure is over in a "flash," and is almost—but not quite—instantaneous. A few hints on the use of the powder will guide those who are a little chary of its apparent explosive qualities. It is not at all dangerous to handle if common-sense precautions are employed.



Courtesy [*Johnson & Sons Ltd.*

The Family Jazz Band by Flashlight

Do not stand too close to the flash and do not allow this to take place near curtains or inflammable materials. The flashpowder should be laid in a little heap on a tin or tray elevated well above the camera level. When all is ready, the lights in the room should be extinguished, the camera shutter opened, and the powder ignited by means of a long taper or match fixed to the end of a stick.

The distance of the group or individual subject from the camera plays a large part in determining the length of the exposure. As a rough guide for experiments, the exposure on a subject between 5 ft. and 8 ft. from the camera, using a stop of F/11 and a plate speeded at 300 H. & D., the average film speed, might be secured with 50 grains of powder. If the distance is increased to 12 ft., 80 grains probably would be required.

Magnesium ribbon has only a small proportion of the speed of flashlight powder, but it is easier to handle, and beginners would do well to make their first experiments in this branch of photography with ribbon. By so doing they will gain some very useful information and will learn how to overcome the small difficulties that arise before they pass on to the more effective and speedy work with flashlight powder. The ribbon should be moved about gently as it burns to avoid creating hard shadows in the subject. A sheet of tin or cardboard should be placed below to catch the hot ash as it falls from the ribbon.

Several photographic firms run flashlight competitions during the winter, and Messrs. Johnson & Sons, whose advertisement appears upon another page, have one such competition closing at the end of this month. They will be pleased to supply full details and a copy of their small booklet "Winter Photography" to any reader who writes to them mentioning the "*M.M.*"

There is an artificial light photographic competition announced on our own Competition Page this month and we are looking forward to a bumper entry.

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

Are *You* a Member Yet?

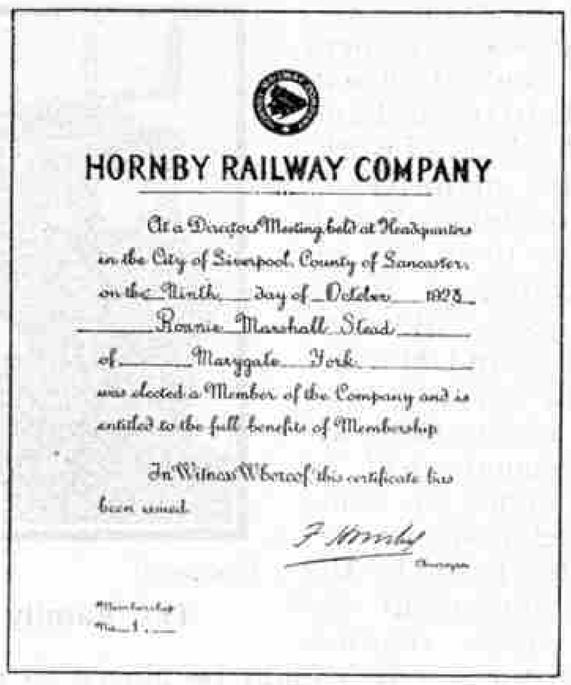
MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

IN the short space of three months the Hornby Railway Company has established itself firmly among model railway enthusiasts of all ages. The stream of applications for membership which commenced on the very day upon which the inauguration of the Company was announced (1st October last), has grown with remarkable rapidity. To-day, the H.R.C. staff, although numerous and efficient, are finding it extremely difficult to keep pace with their daily correspondence and to dispatch badges and certificates with sufficient rapidity.

The genuine and practical nature of the enthusiasm of H.R.C. members has been shown by their intense activity in carrying out the preliminary steps towards the formation of local Branches. Already many branches have been formed and these are settling down to steady work and becoming affiliated at the earliest possible moment. Other branches are in process of formation all over the country and in a very short time the H.R.C. will have taken its place as the greatest of all miniature railway organisations.

We are now receiving numbers of letters from new readers who missed the important preliminary announcement of the formation of the H.R.C. that appeared in the "*M.M.*" for October last. For the benefit of these new readers therefore we repeat here the essential and unique features of the scheme.

First of all the Hornby Railway Company was brought into being with the object of assisting the many thousands of Hornby Railway owners to obtain the best possible interest, fun and excitement from their hobby. The Founder and Chairman of the H.R.C. is Mr. Frank Hornby, the inventor of Meccano and Managing Director of Meccano Limited. This fact alone is sufficient to commend the new scheme to the affections of all Hornby Train and Meccano enthusiasts throughout the world. Mr. Hornby is assisted by our own staff of railway experts, who are trained men of long experience, full of enthusiasm for their subject and keen to make the new venture a brilliant success. They fill the executive offices at the Company Headquarters at Binns Road, Liverpool, and guide the affairs of the many associated branches of the Hornby Railway Company in local centres which are run by keen boy officials.



HORNBY RAILWAY COMPANY

At a Directors Meeting held at Headquarters in the City of Liverpool, County of Lancaster, on the Ninth day of October 1925

Ronnie Marshall Stead

of Margate York

was elected a Member of the Company and is entitled to the full benefits of Membership

In Witness Whereof this certificate has been issued

F. Hornby
Chairman

Membership No. 1

This is a reproduction of the H.R.C. Special Membership Certificate. R. M. Stead of York, was the first boy to enrol in the H.R.C., and the certificate above is a replica of the one issued to him

Any owner of a Hornby Train set no matter what its size, may become a member. All he has to do is to fill in the official application form for a share of fun and pleasure, have his signature witnessed, and send the form to Headquarters with 6d. in stamps in payment for the official badge, which he will wear in his buttonhole. This badge, which is illustrated in the top corners of this page, is beautifully finished in red and green enamel and bears the representation of a locomotive surrounded with the words "Hornby Railway Company." By means of this badge all members will be able to recognise each other when they meet. Whether in your own town, or at the seaside or in the country on holiday, always look out for the Hornby Railway Company badge.

Members of the Hornby Railway Company are also entitled to join the H.R. Correspondence Club. This Club has been formed with the sole object of enabling members of the H.R.C. to be placed in communication with one, or if desired, two other members in any part of the world. Through the medium of this Club members may exchange railway news and learn the interesting things that are taking place on railways in far-off countries that perhaps they can never hope to visit. An even more interesting feature of this Club is that it makes possible the exchange of railway photographs that in many cases it would be impossible to obtain in any other manner. Membership of this Club is free but open only to members of the Hornby Railway Company.



An illustration of the popular Hornby Railway Company booklet. Thousands of copies have been sent to boys all over the world !

The greatest amount of enjoyment from miniature railway working can only be obtained by several enthusiasts combining their resources and working together; and one of the main objects of the H.R.C. is to encourage such combination. Members in any town, village or district may meet together and form a Local Branch of the Hornby Railway Company. In organising this they will consult the staff at Headquarters, an important part of whose work consists in encouraging and helping in a practical manner in the formation of such branches. Each local branch is controlled by the members themselves who appoint from among their members, General Manager, Engineer, Traffic Superintendent, Stationmasters, Signalmen, Drivers and any other officials that

may be considered necessary for the adequate operation of the Branch.

When a local Branch Company has a membership of not less than four, in addition to a permanent Branch Chairman and a Branch Secretary elected by vote of the members, and is holding regular meetings, application is made for incorporation with the parent company. Every incorporated Branch will be given advice in regard to the best means of extracting the utmost fun from the material at its disposal. For example, special track layouts will be prepared by Headquarters and special working timetables drafted if so desired.

The details of each Local Branch are left entirely in the hands of members. Headquarters does not interfere in any way with such matters as the time and place of meeting, the subscription, or the rules that may be considered advisable for the successful working of the Branch. In addition, it is a matter for the consideration of each individual Branch as to whether it shall purchase material for the general use of its members, or whether members shall combine their own material to form a basis of the layouts, supplementing this from time to time by additions purchased out of Branch funds.

The duty of the Branch Chairman is to supervise the general organisation and operation of the Branch and to do his utmost to assist the members to secure the best possible results. Where possible he should be an adult—fathers or uncles generally make the best Chairmen! The duty of the Branch Secretary will be to communicate with the members of the Branch in regard to meetings and any other matters that may arise from time to time, and to forward to Headquarters on the first of each month a record of the operations of the Branch during that month, for which purpose special forms are provided by Headquarters.

The official organ of the H.R.C. is the "*Meccano Magazine*," which devotes a special section entirely to the Company every month. Layouts are illustrated and described in detail, with suggestions for their modification to suit special requirements, and reader's problems and difficulties are dealt with by experts.

A special booklet prepared in connection with the H.R.C. is illustrated here. It is sent free to all members of the H.R.C. or will be sent for 2d. post free to non-members. Every model railway enthusiast should have a copy of this booklet. It deals with the planning, laying out and operating of miniature railways on real railway-like principles, and shows how a practical working timetable may be prepared for any layout.

The operation of a real railway necessitates the use of certain forms and documents to be filled in by the various officials concerned. Many of these forms are, of course, unsuitable for miniature railway working, but the use of others greatly increases the excitement of operating the railway. A special selection of five of the most useful forms has been made and miniatures of them have been prepared. The method of using these forms is fully described in the H.R.C. booklet and all model railway enthusiasts will realise immediately the added interest that arises from their use.

The forms that are available are as follows:—

G.W.1 General Working Timetable.

S.D.4 Stationmaster's Arrivals and Departures.

E.J.5 Engineman's Job Card.

S.B.6 Signal Box Instructions.

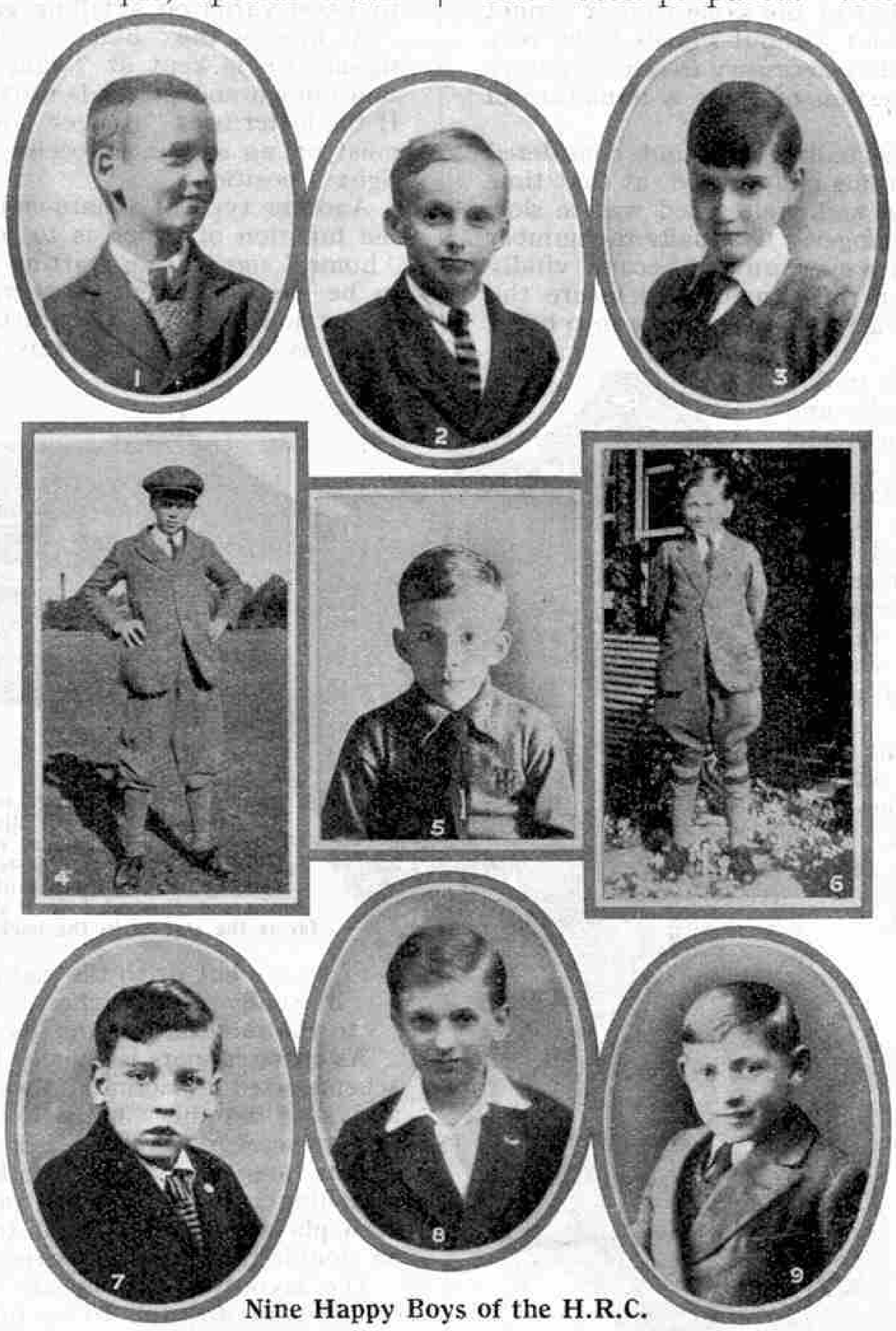
S.R.7 Stationmaster's Report Forms.

Each of these forms is made up in pads of 50 which may be obtained by members from Headquarters, price 5d. each, post free. The price of the complete set of five pads is 2/–, post free. Each type of form is printed on a distinctive shade of paper. When ordering separate pads the initials and reference number (to be found in the top right-hand corner of each form) only need be quoted.

Another booklet is being prepared for younger members of the H.R.C., and this will be known as the "H.R.C. Junior Section" booklet. It will be ready on 1st February and a copy will be sent post free on request. The special object of this booklet is to show beginners exactly how to commence miniature railway operations and to clear up all the little difficulties that are liable to arise in the early stages.

An interesting feature of the rapid growth of the H.R.C. is the keen interest aroused among affiliated Meccano Clubs. Several of the larger Clubs have for some time been carrying on model railway sections, and the members of these are now joining the H.R.C. in order that the sections may be re-organised as Branch Companies. Similar activity is being displayed also in a number of schools.

The H.R.C. has attracted a good deal of attention among Scout troops and in an early issue of the "*M.M.*" we hope to publish an article showing how model railway working may be carried on successfully out of doors.



Nine Happy Boys of the H.R.C.

1. A. S. Walker (21), Edinburgh; 2. Ian Wilson (100), Waterhouses, Durham; 3. E. W. L. Telfer (61a), Putney, S.W.15; 4. B. C. Bonsor (5), Broadstairs; 5. John Bull (71), Gerrard's Cross; 6. J. Fielder (77), Weston-super-Mare; 7. Ronnie Stead (1), York; 8. S. W. Brown (90), Stratford, E.15; 9. Jack Belton (70), Scunthorpe.

How to Get More Fun from your Hornby Railway

III.—SIGNALLING A LAYOUT

IT has been said that any gauge "O" model railway may be worked quite as safely without any signalling system at all as with one. It is quite true that there is no possibility of passengers being killed or injured but at the same time it cannot be denied that a model railway layout without signals looks very bare and unreal. Signals are absolutely necessary to any miniature railway if it is to convey the suggestion of being a miniature of the real thing.

In the early days of railways signalling was not considered necessary for the safe working of trains and, indeed, at that time trains were so few and far between and their speed was so slow that there was comparatively little danger. Gradually the number and the speed of trains increased, however, until it became vitally necessary to introduce some system of signalling to insure the safety of the travelling public. As a result there came into being the familiar semaphore signal.

The signalling systems employed to-day on actual railways are far too elaborate and complicated to be reproduced in a model railway without the expenditure of a great deal of time and money. An elaborate system of this kind, however, is totally unnecessary. All that is required is a simple arrangement of signals that can be operated in conjunction with the movement of trains in accordance with real railway practice but without involving complications that will make the operation of the layout too difficult to work.

While it is of great importance that the signalling system should be carried out on real railway principles it may be said at once that generally speaking the fewer the signals used the better. Every signal in the layout should have some specified purpose. A large number of signals scattered about a minaiture system may, at first sight, appear attractive but if they are not serving some railway-like purpose they are worse than useless.

The normal position of a semaphore signal arm in actual practice is horizontal. This position signifies "danger," and when the arm is at "danger" a red glass covers the light to enable the state of the signal to be determined at night. The "line clear" or "all right" indication is given by lowering the arm to an angle of about 60 degrees in the case of the lower quadrant signal, and bringing the arm perpendicular in the case of the upper quadrant type. In both cases a blue spectacle glass is brought in front of the light in the "all clear" position and the yellow light of the lamp seen through this blue glass appears green.

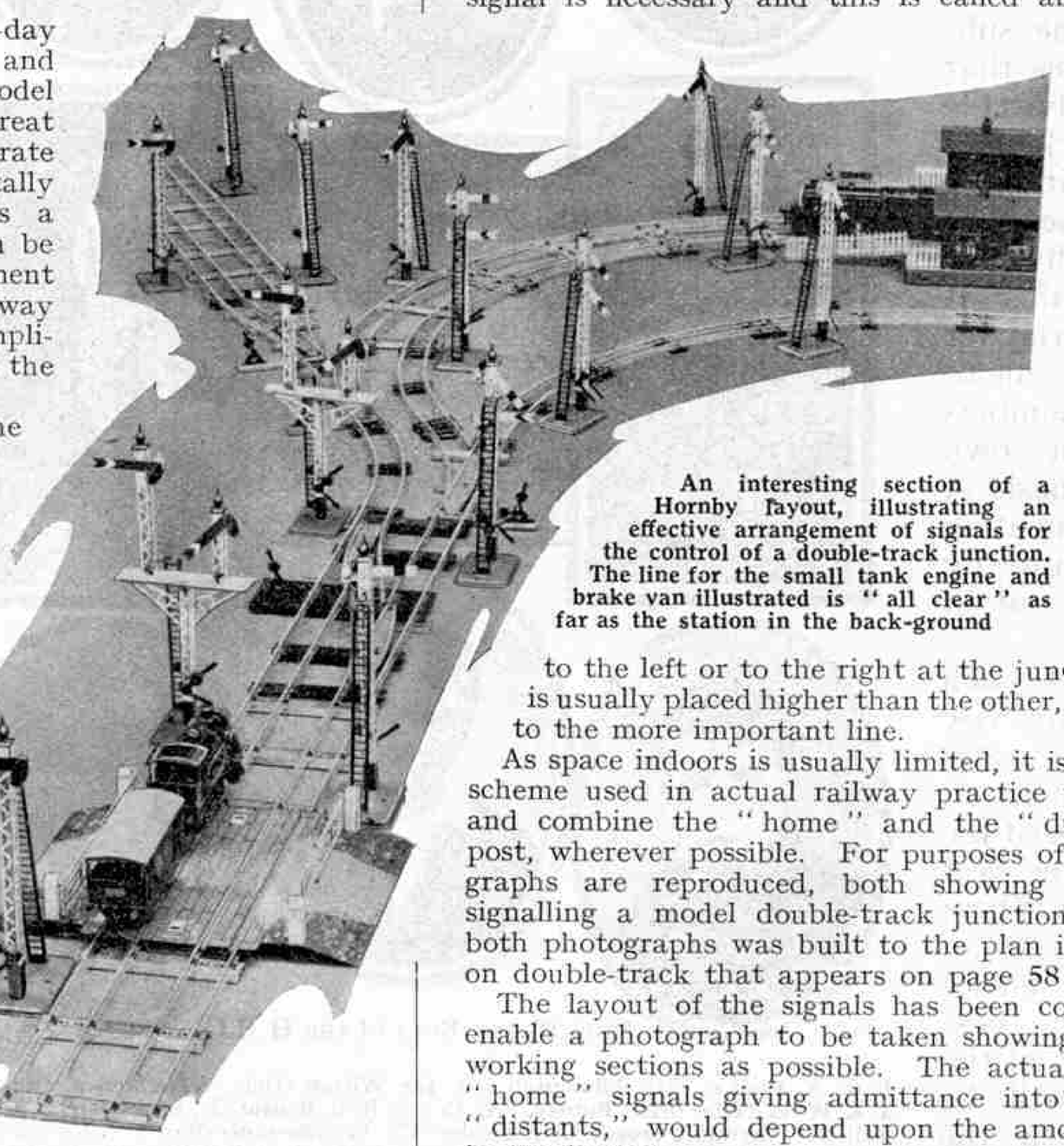
Functions of "Home" and "Distant" Signals

Signal arms are made either with square ends or fish-tailed ends. The square-ended arm is always a "stop" signal and when it is in the "danger" position it must not in any circumstances be passed by a driver. The fish-tailed or "distant" signal, on the other hand, is a cautionary signal.

The first signal seen by the driver of a train approaching a signal box is the fish-tailed "distant" signal which derives its name from the fact that it is the farthest away from the box. The object of the "distant" signal is to warn the driver when the next or "home" signal is likely to be at "danger" and so give him time to reduce the speed of his train ready to stop at the "home" signal if necessary. As the train is likely to be travelling at a high speed when the driver first sees the "distant" signal it is obviously necessary that this signal should be placed sufficiently far in advance of the "home" signal to allow the driver time to pull up at the latter if required. The standard distances from "distant" to "home" vary from 600 yards on a rising gradient to 1,000 yards on a falling gradient.

As long as the "home" signal is at "danger" the "distant" signal also is kept at "danger" and on seeing this the driver slows down and proceeds cautiously towards the "home" signal. If the latter is at "danger" when he reaches it he must stop and must on no account proceed until the signal moves to the "all right" position.

Another type of square-ended signal is the "starting" signal, the function of which is to prevent a train that has passed the "home" signal from starting away until the line ahead is known to be clear. Sometimes there is a crossover road or a siding connection ahead of the starting signal. In such cases a fourth signal is necessary and this is called an "advanced starting" signal. It should be clearly understood that the "home," "starting" and "advanced starting" signals are all square-ended and identical in appearance; the "distant" signal being the only one that has a fish-tailed arm.



An interesting section of a Hornby layout, illustrating an effective arrangement of signals for the control of a double-track junction. The line for the small tank engine and brake van illustrated is "all clear" as far as the station in the back-ground

Junctions are usually protected by two "distant" and two "home" signals. The two signal arms are arranged on a bracket, the left-hand and right-hand arms applying respectively to trains proceeding to the left or to the right at the junction. One of the arms is usually placed higher than the other, the higher arm applying to the more important line.

As space indoors is usually limited, it is advisable to adopt the scheme used in actual railway practice where blocks are short and combine the "home" and the "distant" signals on one post, wherever possible. For purposes of illustration two photographs are reproduced, both showing a convenient way of signalling a model double-track junction. The layout used in both photographs was built to the plan illustrated in the article on double-track that appears on page 58 of this issue.

The layout of the signals has been concentrated in order to enable a photograph to be taken showing as large a number of working sections as possible. The actual distance between the "home" signals giving admittance into each section, and the "distants," would depend upon the amount of space available in the layout.

Let us imagine that we are enjoying the happy privilege of a footplate trip on the small tank engine that may be seen running with a brake-van in the first illustration. The destination of this engine is a goods yard, situated somewhere off the photograph to the right, in the back-ground. As in actual railway practice, the signals on our left are those that concern us.

We have just passed the "home" signal. This was down of course, showing us that the level crossing gates were open and that our road was quite clear through the section following. This has now been pulled up to "danger" by the signalman in charge of the section, in order to cover us in the rear.

Our path lies to the right of the junction and therefore the next signal that interests us is that on the right of the bracket that shortly looms ahead. This is the "distant" signal for the "home" guarding the junction, and will tell us beforehand whether our road is clear through the junction. Our driver does not slacken speed but leaves the regulator just as it was, and we continue at our usual speed past the "distant," as this is down. Soon the junction bracket comes into sight. This is at the "all clear" position—we knew it would be by the "distant" signal that we passed a short while ago. The points ahead are correctly set for us and soon our locomotive has safely negotiated them.

At this point, if we glance round, we shall see that it is impossible for any other train to come in through the junction on our left and thus cause disaster, as the signal on the down line on our left is at "danger," showing that there is no way through.

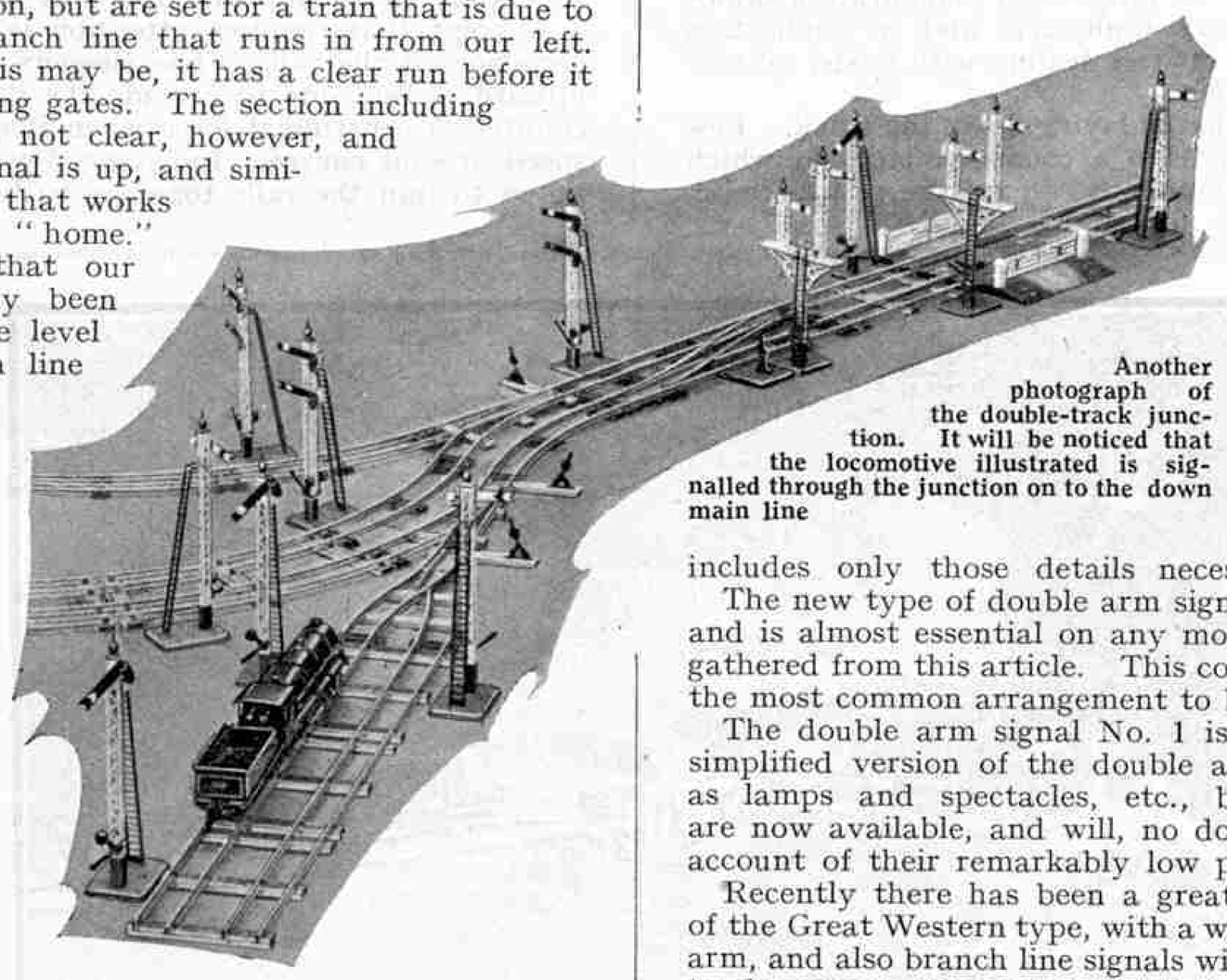
Now the junction is behind us and we gradually thread our way through to the end of the section and approach the station. The signal we pass on our left is the "distant" giving us the state of the station "home" signal that we shall shortly pass on our left. But as our business is not in the goods yard (the destination of the tank engine on which we are riding) we must ask our driver to shut off steam and slacken speed through the station to enable us to jump down. After a hasty goodbye, we run across the level just in time to climb on to the footplate of the big "Atlantic" express locomotive that is standing at the "down" platform.

The "Down" Express Checked by Adverse Signals

At a signal from the guard we start. Our run is only clear for one section ahead, however, and our locomotive is soon eased slightly. Our driver is proceeding with caution as he knows that, up to a moment or so ago, the next "home" signal was against us. Shortly, with a prolonged blast of the whistle, we come to a standstill before the junction "home."

Although we cannot see them actually, the junction points are not set for us at the junction, but are set for a train that is due to arrive from the single branch line that runs in from our left. Whatever class of train this may be, it has a clear run before it almost as far as the crossing gates. The section including the level crossing gates is not clear, however, and therefore the "home" signal is up, and similarly the "distant" signal that works in conjunction with this "home."

Now let us suppose that our "Atlantic" has eventually been signalled through past the level crossing, after the branch line train had passed. It has been rather a slow journey throughout, owing to the continuously adverse state of the signals, but eventually we have changed trains and taken a run up the line that leads to a town away to the left in the background of the first illustration. We have finished our business there, and the time has come for us to return. We find ourselves at the station once again, and fortunately we are once more in the happy position of being privileged to travel on the footplate with the driver.



Another photograph of the double-track junction. It will be noticed that the locomotive illustrated is signalled through the junction on to the down main line

Our old friend the "Atlantic" happens to be booked to run right to our destination, so without wasting a moment's time we hail the driver, climb up, and the second illustration shows us on our way. The line is clear through the junction—we have just passed the "distant" signal showing us that this is so. We negotiate the parallel points, and soon after the steady clanking of the coupling rods shows that our engine has safely passed over the right-hand points.

We now look round and find ourselves running down the main up line! At first we shall no doubt feel rather anxious as to whether we are on our correct running road, but on looking round our fears will immediately be calmed when we see that it is quite impossible for any disaster to take place, owing to the state of all the signals around us.

We run over the crossover and are once more on our correct line. A quick glance at the state of the signals on the down line shows that there is absolutely no danger of any train running into us from the branch line or from the main line. Every way of approach to the crossover is covered by signals at "danger," except perhaps the route upon which we have travelled, and probably by this time this will also have been closed. As we are signalled right over the level crossing down to our destination, our driver "lets her go," and before long we shall find ourselves back again at our original starting place.

Looking at signalling from the model railway signalman's point of view, one cannot fail to notice that there are a great many difficulties in the way when the operator has to operate his point and signal levers separately.

The Hornby Control System has been specially devised to overcome all these difficulties. This system is simplicity itself to instal, and it may be used on any Hornby railway. Once it is in operation it is possible to work signals and points in almost exactly the same way as a real signalman on an actual railway. In addition it is possible to stop, restart or reverse the locomotive from the signal-cabin.

The Hornby No. 2 signal cabin is all that can be desired as regards realism. It fits neatly over the lever frame and the back of the roof and the back wall are arranged to open outward so that the levers of the frame may be manipulated without any necessity for removing the cabin itself.

The number of separate points or signals that can be operated from one lever frame is, of course, limited by the number of levers in the frame. The Hornby lever frame is supplied with six levers, but by adding one or two additional lever frames at various places on any layout, the number of points and signals that can be operated may be extended almost indefinitely.

A new type of Hornby signal, known as signal No. 1, has recently appeared on the market and sells at almost half the price of the signal No. 2. Many boys have written to us asking the reason why there is so great a difference in the prices of these signals. The explanation lies in the fact that the No. 1 signal is far less detailed. For instance, as all Hornby Train owners are no doubt aware, the No. 2 signal is complete with a very attractive and realistic lamp casting and the top of the lattice post is separately adorned by a neat finial, similar to those used by many of the actual railway companies. In addition, an attractive and realistic ladder is fitted to all No. 2 signals. The No. 1 signals however, do not include any such details as finials, lamp castings, or ladders, nor are the spectacles made with transparent red and green windows. In short, the No. 1 signal is an extremely good model, but includes only those details necessary to make it attractive.

The new type of double arm signal will satisfy a distinct want, and is almost essential on any model railway layout, as may be gathered from this article. This combination of signals is perhaps the most common arrangement to be seen on the actual railways.

The double arm signal No. 1 is also an innovation, and is a simplified version of the double arm signal No. 2, details such as lamps and spectacles, etc., being omitted. These signals are now available, and will, no doubt, be extremely popular on account of their remarkably low price.

Recently there has been a great demand for shunting signals of the Great Western type, with a white metal "S" attached to the arm, and also branch line signals with white metal circles attached to the arms. As a matter of fact, it is hardly worth while producing models of this kind of signal owing to the fact that, with the exception of the metal attachments of the arms, they are identically the same as the ordinary type of "home" signal.

Branch Line and Shunting Signals

Where branch lines and shunting signals are required, it is a very simple matter to cut out of cardboard a letter "S," or a white ring, and to attach these to ordinary "home" signal arms by means of seccotine. A little white paint will give the finishing touches to a signal treated in this way and the result is very attractive. A good idea for converting any "home" signal into a branch line signal is to attach "reinforcing rings," which may be obtained from any stationer.

Model railway enthusiasts who have never really paid serious attention to the signalling of their layouts do not realise the amount of interest that they have missed in operating their systems. The enjoyment of working any layout is vastly increased if the operation of the trains, points and crossings is really controlled by the signals themselves instead of the signals merely being ornaments set by the side of the lines.

We are particularly anxious that all members of the Hornby Railway Company should take up seriously the study of signalling so far as it can be applied to model railways. In order to do this, they should make themselves thoroughly conversant with the general outline of signalling on the actual railways, the various types of signals used and their indications. Interesting articles on this subject will appear frequently in the *"M.M."*

Later on we hope to inaugurate some competitions in model railway signalling and to offer prizes of Hornby locomotives, points, or signals for the best solutions of the various problems.

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

JUNIOR SECTION

1.—First Steps with a Hornby Layout

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

THOUSANDS of boys all over the world will now be enjoying their first experience as owners of model railways, received as Christmas presents. It is our experience that a little friendly guidance is necessary at this stage if the utmost possible fun is to be obtained from the outfit. In very many cases this help is provided by a father, an uncle or an older brother, but there are large numbers of boys who have not the advantage of such help. For these boys we propose to inaugurate a junior section of the Hornby Railway Company, and in connection with this to publish a series of articles dealing with model railway working from the very beginning.

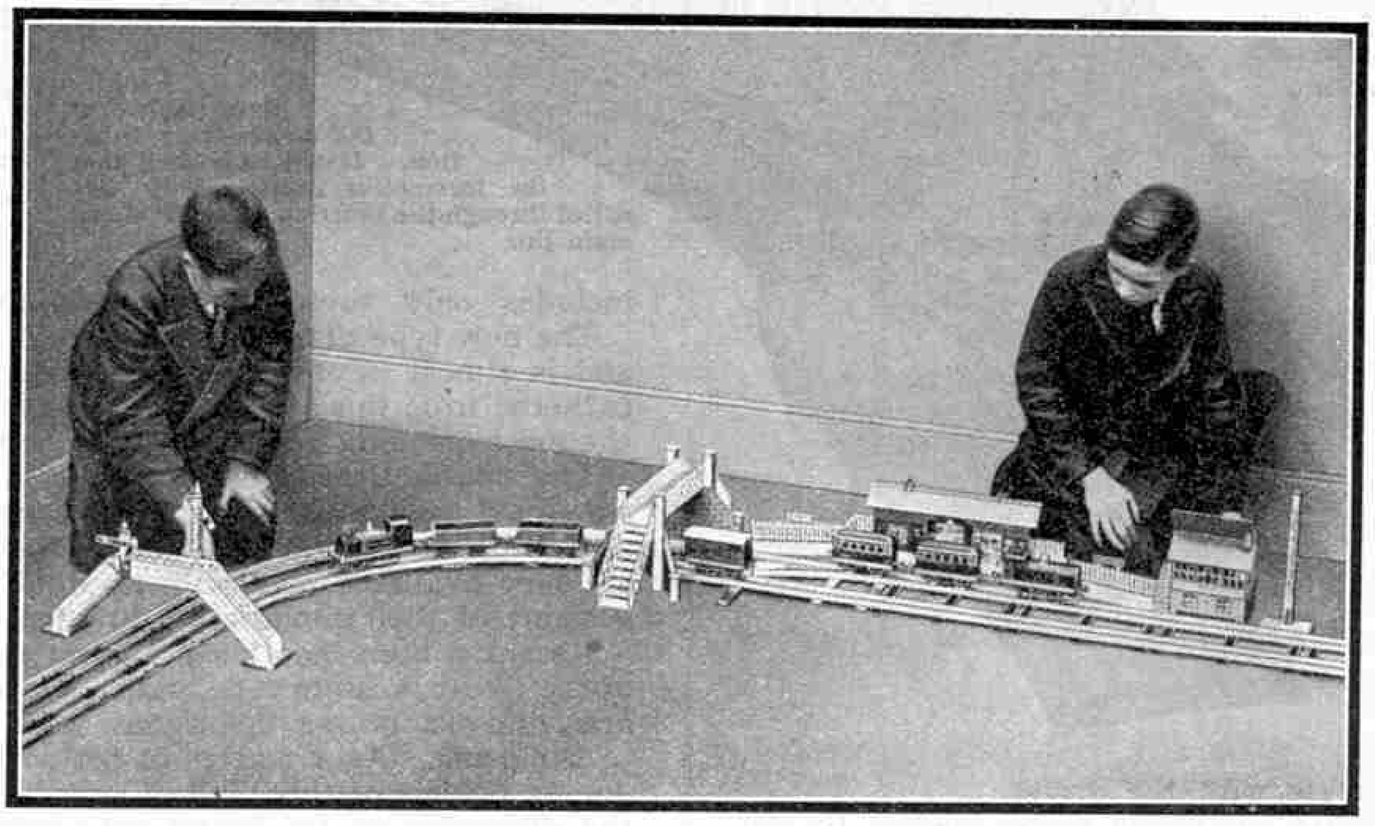
First of all there is the question of laying down the track. Few boys are fortunate enough to have a room available in which they can lay out a system permanently, on trestles or otherwise, and in the majority of cases the track can only be laid down on the floor when required and taken up after use.

It is difficult to give definite advice regarding the nature of the layout because this depends not only upon the material available but also upon the shape of the room and the distribution of the fixed articles of furniture. It is easy enough to move chairs about as required but any attempt to interfere with sideboards, etc., is apt to bring down the wrath of the domestic authorities upon the unfortunate model railway engineer! Perhaps the best method is to lay down first of all a simple oval of rails and to run the trains around this. Although a track of this kind soon becomes monotonous its simplicity makes it possible to concentrate one's attention upon the engines and to learn all about their mechanism. Half an hour spent in trying the effect of the brake and reversing gear and in winding up and starting an engine will result in a working knowledge that will be of great value later. Beginners are often rather worried by the fear of overwinding the clockwork motor of an engine. There is little danger of this with Hornby engines, however, on account of their robust construction. It is a good idea to commence by winding up the motor slowly and steadily to the full, at the same time counting the number of turns of the key that have been given. This number of turns is the maximum and for regular work it is wise to keep well within this limit. If, for instance, 17 turns of the key are required to wind up the motor to the full, it will be a safe rule to make a practice of giving only 16 turns, so that there is no danger of overstraining the spring by continually forcing it to its limits.

Hornby rails are fitted together by inserting the projecting peg at the end of one rail into the hollow railhead of the next rail. If the rails were only joined in this manner, however, any slight movement of the track or an accidental knock would be likely to cause some of them to spring apart and if this were to occur without being noticed at the time a really disastrous accident might occur when the train reached the gap! In order to avoid this possibility, ingenious connecting plates are provided with all Hornby rails. These plates grip the end sleepers of the rails firmly together and there is then no fear of the rails springing apart. The necessary supply of these connecting plates is included in every Hornby Train Set and they may also be purchased separately to replace any that may become lost or damaged.

A point that requires attention is the "banking" or super-elevation of the rails. The sleepers on each Hornby rail slope upward to one side to provide the banking that is necessary to counteract centrifugal force when the trains are running at high speed around curves. In laying down the track care should be taken to join the rails together with the sleepers all sloping in the same direction. In some exceptional cases it is not possible to do this but the rule should be observed in all ordinary cases.

Provided the track is laid carefully the trains should run along quite smoothly. If they do not do so there must be a defective place somewhere along the track and this must be searched for and put right. Often it will be found that the trouble is due to two rails having come apart on account of the accidental omission of the connecting plates; or one or more rails may have become bent through rough usage. It is sometimes necessary to give a hint to fathers and big brothers that the rails are not improved by being walked over. An ingenious arrangement has been adopted to make the examination of Hornby track a simple and at the same time accurate process. The top of the handle of the winding key is made the exact width between the track rails. The key thus forms a perfect track gauge and by sliding it carefully along the track defective places can be discovered immediately.



This photograph shows two young enthusiasts operating a Hornby Railway layout. As may be seen, the line is "all clear" for the goods train, but the Pullman Car express is waiting for the starting signal which will be given from the signal cabin in real railway-like fashion by means of the Hornby Control System

Sometimes points are found to be a little stiff when they are quite new. This stiffness quickly wears off, however, and unless it is absolutely necessary the points should not be oiled at first. In the great majority of cases it will be found that the lever and movable tongues will become quite loose enough after a short time without special treatment being required.

Next month we shall describe the best method of handling locomotives and various types of rolling stock and show how the simple oval layout may be developed into one of real railway interest.

Miniature Tarpaulins for Hornby Trucks

The appearance of a train of Hornby open wagons is always interesting, but it may be made still more realistic by means of the Hornby model Tarpaulins that are now available, price 6d. each.

In order to obtain the best possible results from the use of these

tarpaulins some light material such as tissue paper or cotton wool should be lightly packed into each truck before the cover is spread over it. This is necessary in order to prevent the tarpaulin from sagging in the centre.

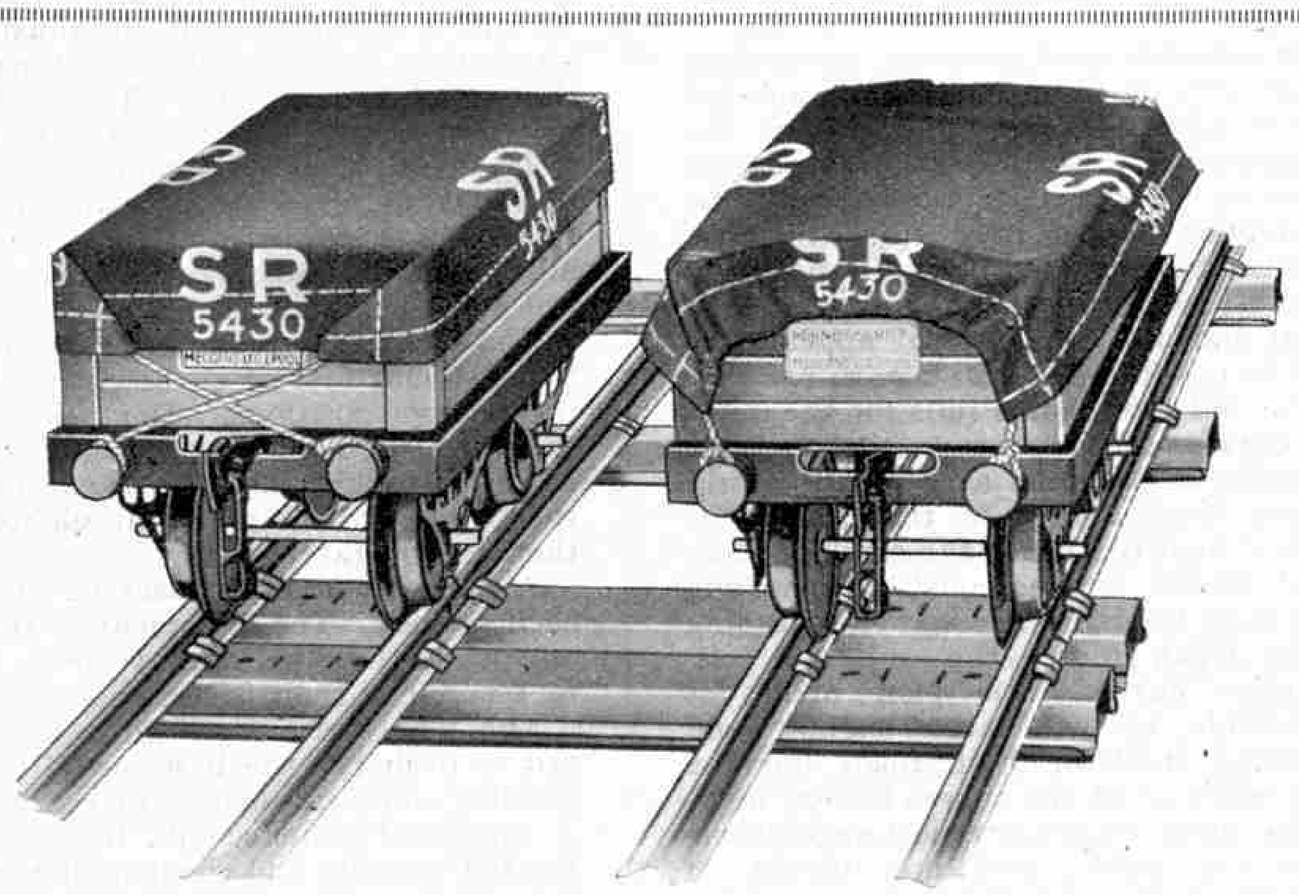
Most important of all, however, is the tying of the tarpaulin. In actual railway practice tarpaulins are usually folded as shown on the wagon on the left in the accompanying illustration. As will be seen, the corners are carefully folded over and the string is secured to the shoulder of the buffer in the opposite corner of the wagon-end. If this method of tying is adopted in model railway practice, the small Hornby tarpaulin sheets will be found to fit the open wagons perfectly.

The wagon on the right of the illustration shows the wrong way of covering over an open wagon with a tarpaulin. The result of this method of securing tarpaulins is a number of most unpleasant looking bulges in the sheet along the sides, and at both ends of the wagon.

Another point is that tarpaulins of one railway company should never be spread over trucks belonging to another company. Model tarpaulins are available correctly lettered as in S.R., G.W., L.N.E. and L.M.S. practice, and should therefore be purchased in accordance with the wagons for which they are intended.

Locomotive Wheel-slip

Few things are more distressing to the model railway owner than to see his locomotives losing all their reserve power through the driving wheels slipping. I have discussed this question with many experienced model railway enthusiasts and I find that their opinions as to the cause of the trouble vary greatly. Some say that wheel-slip is simply due to the presence of oil and grease on the running surface of the rails and on the treads of the wheels. Others, while admitting that an oily rail certainly does have a bad effect on the running of locomotives, do not attribute the mischief to these causes entirely, but rather to the faulty laying of the track. Others again blame the locomotives in question, saying that a good engine should be provided with sufficient adhesive weight to prevent skidding under any but the most adverse circumstances.



This illustration shows the correct and incorrect way of fastening Hornby miniature tarpaulins to model open wagons. As will be seen, the left hand wagon is by far the neater in appearance

In my opinion model locomotive driving wheel-slip is due to a number of causes combined. Greasy rails certainly contribute their fair share towards making the driving wheels of any locomotive, actual or model, lose their grip on the rails, but I consider that the improper laying of the track has an equally detrimental effect in this direction.

In most cases, experiment shows that on a well-ballasted track a locomotive will haul almost twice the weight that it does on uneven, loosely and hastily laid rails.

Certainly the weight of the locomotive is a considerable feature in this respect, but my experience, confirmed by that of reliable correspondents, shows that on really well-laid track only the very cheapest and poorest type of locomotives skid, even when attached to trains that are far too heavy for them—providing of course that the track is entirely free from all traces of oil.

Personally I do not hold with the practice of screwing down track directly to a base-board to obtain steadiness. Subsequent running on rails secured this way is anything but smooth, and hammer-blows at the rail joints are all too perceptible. I consider that the best all-round run, and one practically free from any skidding, will be obtained if the track is screwed indirectly to the base-board, the sleepers resting on small felt mats. These will be found to absorb all undue shocks and stresses, while giving a perfectly steady permanent way. In cases where this scheme is adopted, ballasting is to be recommended, as it finishes off the appearance of the line and adds greatly to the realism of the layout. The rails should be perfectly free from all dirt and rust and the treads of the wheels of the rolling stock should be cleaned very carefully, preferably with a rag soaked in petrol.

A friend of mine wrote to me the other day on this subject and claimed that he got an engine of his—a notorious skidding offender that would not pull its tender without a great deal of fuss—to haul a train of six bogie coaches twice round a 28 ft. oval, an astounding performance under the circumstances. His secret lay in the fact that he cut some tyres for his engine from insulating tape and stuck them to the treads of the driving wheels, afterwards smearing them over with powdered french chalk in order to allow them to run perfectly freely on the rails.

Cardboard Modelling

Many young readers are unable to afford more than one station for their model railways, but get over this difficulty by making cardboard models, and I have been greatly struck by the ingenuity some boys display in securing realistic effects. For instance, one young friend from Doncaster writes:—

"I enjoy making cardboard models of railway buildings immensely. I have a permanent railway and I find that these come in very useful for filling in odd corners and giving a general business-like appearance to the whole layout. I have discovered a particularly effective way of making roofs for all my model houses, and I think that the scheme will interest other members of the Hornby Railway Company.

"First of all I obtain a sheet of cardboard, preferably the kind sold by art dealers, known as "White board." (not Bristol board, which is far too expensive for this kind of work). On this I draw with a soft pencil a series of parallel lines at distances apart equal to the width of scale roof tiles. I then impress these lines with a very sharp penknife, without cutting right through the cardboard.

"Next I rule a similar series of lines at right angles to the first set, but this time cutting completely through the board with the penknife. The resulting strips represent neat rows of tiles, which I stick to the plain cardboard roof of the buildings, commencing at the bottom, and arranging the perpendicular cuts, or the edges of the tiles, to come just over the centres of the tiles of the row below.

"To finish off the roofs and give them a neat and tidy appearance after "tiling," gutters and a ridge should then be manufactured. These I always make from the same type of white board as the roofs themselves.

"Then comes the question of painting. I find that Reeve's showcard paint is by far the most suitable for this kind of work, as it is opaque and does not run, if mixed to the correct density. It is very important not to apply the colour too thickly, however, as this is liable to fill in the joints of the tiles, and a great deal of their effectiveness will then be lost. Again, in painting, great care should be taken not to allow the board to become soaked, otherwise all the rows of tiles are liable to become unstuck and will warp and assume the most awkward shapes when drying."

The closing paragraph of my friend's letter strikes a similar note of warning when describing the way in which he expended a great deal of patience and almost two months' spare time in constructing a fine set of model station buildings. Eventually he finished the constructional work and set to work one Saturday afternoon to paint the buildings. He finished his work, and was particularly satisfied with the general realistic appearance.

Unfortunately, however, the paint he had used was too thin, and he had applied it in large quantities to get the desired effect. His horror and distress were beyond measure when he saw on Sunday morning the disastrous way in which all his careful work had been ruined by the white board buckling beyond repair!

The Hornby Double Track

New Possibilities for Model Railway Layouts

By "Tommy Dodd"

I THINK it is quite safe to say that the great majority of model railways in this country make use of Hornby or other tinplate track. For single road layouts Hornby tinplate track is all that could be desired. Year by year the usefulness of this track has been developed and extended to enable more realistic and railway-like schemes to be laid down and operated, and to-day the Hornby Railway user has at his disposal a unique series of rails, points, crossings and crossovers—all miniatures based on real railway practice.

When it is desired to lay out a double road, however, one serious difficulty is immediately encountered with tinplate track, and that is the impossibility of laying down parallel curves. Various methods may be adopted to get over this difficulty, but not one of them is really successful and they all have an ugly, unsymmetrical and almost deformed appearance. It is possible, for instance, to use 1 ft. radius rails for the inner curve and 2 ft. radius rails for the outer curve. In this case the two curves certainly are parallel, but the distance between the two tracks is so great as to look utterly absurd. Another very serious disadvantage of this scheme is that it bars the use of the inner road to all but the smallest locomotives and rolling stock. A second scheme consists in making the outer straight road longer than the inner one and then leading the track round the ordinary 2 ft. radius curve. This plan makes it possible to use large engines and rolling stock on both roads but the appearance of the curves is very ugly. The outer curve has a most unpleasant-looking bulge, and no amount of manipulation of half-length or quarter-length rails will do away with it. Still another method is to break the outer curve half way and introduce a straight section. Here again the result is a most unsymmetrical effect and on account of the continuity of the outer curve being broken a train receives quite a nasty jar in rounding the bend.

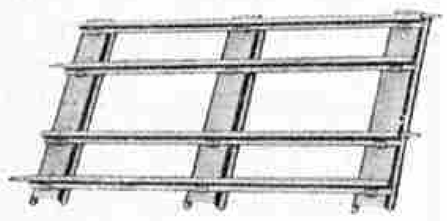


Fig. 1

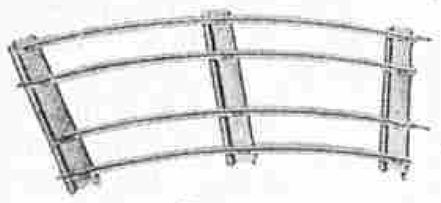


Fig. 2

Following out their steady policy of adding to the enjoyment and doing away with the difficulties of Hornby Railway users, Meccano Ltd. have now introduced special double road track in both straight lengths and in curves. The introduction of this track places in the hands of all users of tinplate rails an entirely new power and makes easy the laying out of railway-like schemes that previously were impossible.

As will be seen from the accompanying illustration (Fig. 1) the new Hornby double straight track consists of two sections of ordinary Hornby track clamped securely to three strong, newly-designed tinplate sleepers. The result is a very neat section of permanent double track, which gives far steadier running than any tinplate track previously obtainable. In the case of the double curves (Fig. 2) the inner road is of the standard 2 ft. radius, while the outer road rails have a correspondingly larger radius. Both the double straight and double curved rails are packed in half-dozens, the curves costing 5/- per half-dozen and the straights 4/6 per half-dozen.

New crossovers and level crossings will soon be in the course of construction and are to be manufactured to the same standard measurements as the present type of 2 ft. radius parallel points and double track. At present, the production of points for double track turnouts is not contemplated, but Fig. 3 illustrates a simple method of overcoming the turnout difficulty.

Take for example a train travelling on the up line from A to B. As will be seen from the plan it traverses the new type of level crossing first of all, after which it runs over the up straight line of one of the new Hornby crossovers, turns slightly to the left by means of a section of standard 2 ft. radius single track and is turned out by means of one of the ordinary 2 ft. radius right hand points on to single track. The single track, however, is immediately duplicated by means of a pair of standard 2 ft. radius parallel points. The train then finds itself on the correct running road of the double track once again. In the case of a train travelling from B to A, after negotiating the parallel points it travels on to the small section of single track, traverses the up line after passing over the right hand points, and is switched over by means of the new crossovers on to the correct down line, whence it travels to its destination after crossing over the new level crossing. As will be gathered from the illustration, the layout is extremely interesting, and it is only one of many that can be thought out for the use of double track. The illustration shows how a turntable can also be included on a tinplate track layout such as this.

The new Hornby double track lends itself particularly well to ballasting and I strongly advise boys who are fortunate enough to possess a permanent railway to try the experiment of relaying all their most important sections of line with this new type of rail and then ballasting them.

The section of the line that is to be re-laid with Hornby double track should first of all be cleared and double rails fixed in their prospective positions. The next step is to procure some felt—the kind used under table cloths or carpets suits this purpose admirably. This should be cut into sections the same shape as the sleepers of the rails, but slightly larger all round, to fit under them comfortably.

A perfectly flat felt packing of this kind should be laid under each sleeper. The alignment of the rails should then be checked, and when these points have been attended to the new lines may be secured in their correct positions by means of tacks or staples.

The new section will then be ready for ballasting. Chicken grit is probably the best model track ballast obtainable, though possibly some enthusiasts may prefer screened brown pebble-dash. A supply of either should be obtained and carefully laid around the felt packing and sleepers almost up to the bottom of the rails themselves. If possible, small pieces of wood should be nailed outside the tracks to prevent the ballast from spreading all over the baseboard to which the lines are attached, as it may do in time. If this is done, the whole section of new track will be very much more finished and tidy in appearance.

In cases where ballast shows a tendency to spread, and it is not convenient to lay the small laths to hold it in position, I have found the following scheme to work very successfully.

First obtain a bucket and fill it with ballast, which has been well washed to remove all traces of dust. Pour over it approximately half a pint of hot glue, about the density of pure glycerine, and stir thoroughly so as to ensure that the glue and ballast are well mixed.

Then bank the track with this preparation, which I find should be left for a couple of days to solidify. There are many advantages to be gained by using this kind of ballast on any model Railway. Track ballasted in this way is particularly steady, and the running of the trains is considerably improved through it. In addition to this, there is absolutely no difficulty in keeping the whole layout clean and free from dust. Dust is bound to accumulate on any layout, but in cases where solid ballast is used, it is easily removed with a soft brush.

Solid ballast should of course be inspected at regular intervals for any signs of looseness.

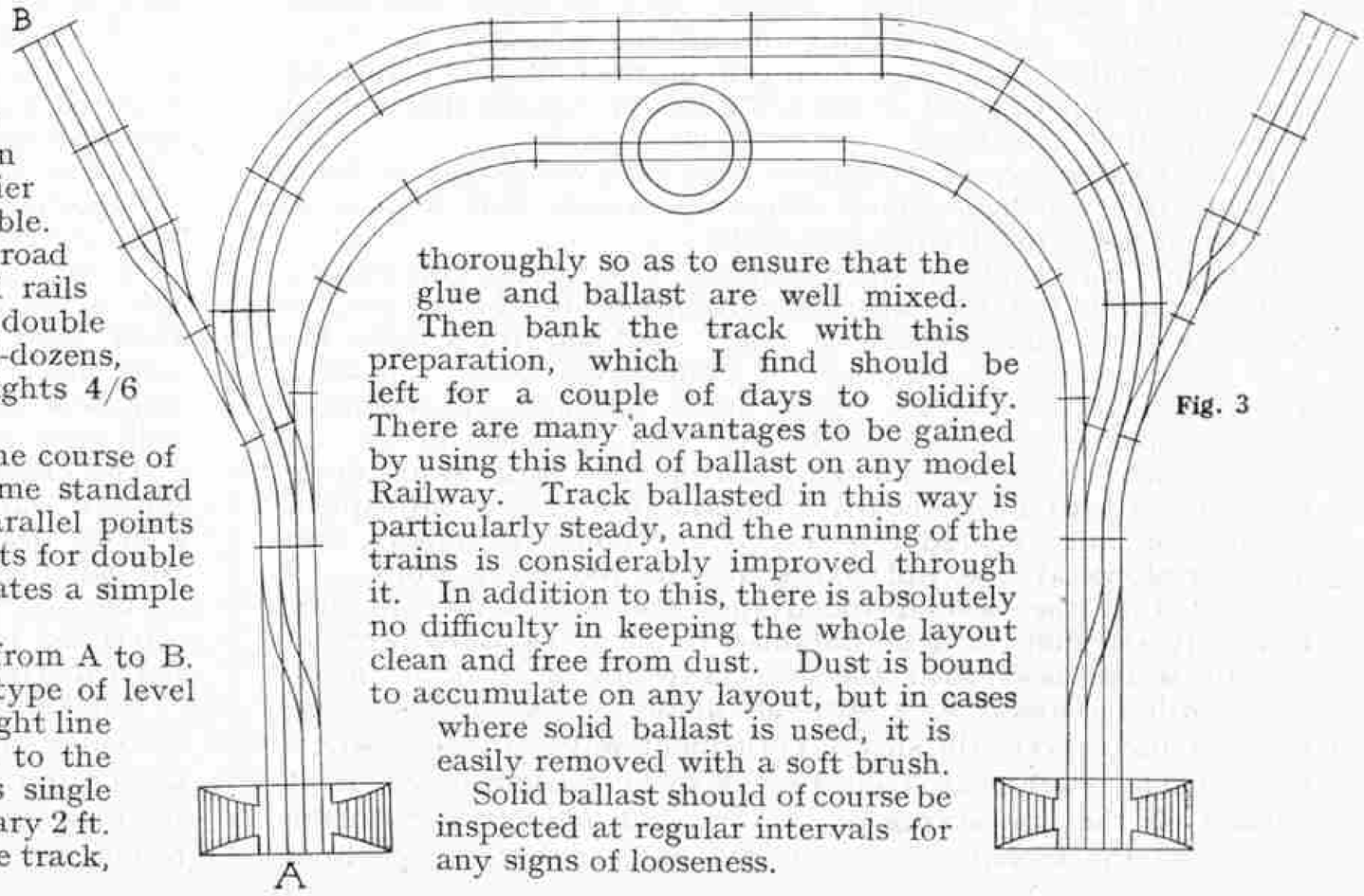


Fig. 3

H. R. C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

A NOVEL COMPETITION.



PRIZES
Cash: £1/1/–, 15/–, 10/6, 5/–
and a number of consolation prizes.

The pressure upon the layout section of the Hornby Railway Company in recent weeks has been so amazing that it is not surprising that the experts should live and sleep in an atmosphere of layout problems. The culminating point arrived when one expert retired for the night and sank into troubled sleep.

Before his eyes there appeared an elaborate railway track with trains working but, to his horror, he saw that there were gaps between the rails ; points set for wrong tracks ; buffer stops in the path of express trains ; and lots of other equally awful mistakes ! Quickly he set to work to save the situation, but as fast as he put one thing right another went wrong. An awful crash was imminent—and then our expert woke up !

Next morning he reconstructed the terrible scene as well as he could remember it, and photographed it, just to find out exactly how many things were wrong. The above photograph shows the awful nightmare layout and affords an excellent opportunity of testing our readers' railway knowledge and sharpness of eye.

We offer prizes of Hornby Railway goods, or Meccano if preferred, to the value of one guinea, 15/–, 10/6, and 5/– respectively to the senders of the four longest lists of genuine errors discovered in the picture. In addition, there will be a number of consolation prizes. At the foot of the list, the total number of errors found should be noted. For convenience in judging, the description of each mistake should be kept as short as possible. Closing date 31st January. Overseas, 30th April. Envelopes should be marked " Railway Errors " in the top left-hand corner.

AN INTERESTING SHUNTING PROBLEM

Some members of the "Manchpool" Branch of the Hornby Railway Company met together recently and were enjoying themselves immensely by running a short timetable. Included in the number of trains in service were two goods trains each consisting of a No. 2 Tank Goods Engine, 11 open wagons and a brake van. Owing to one of these trains being rather late, and also to an unpardonable error on the part of the signalman on duty, both the trains met on a section of single track under his control. At first neither of the engine drivers would consent to go back, and a heated argument ensued.

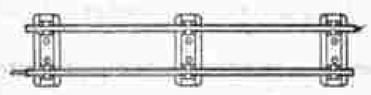
For a time there was a complete deadlock and ultimately the Chairman of the Branch was called upon to give a decision in the matter. After careful consideration his ruling was that as neither of the engine drivers was at fault, the best method of overcoming the difficulty would be to arrange for the trains to pass each other without either of them going back !

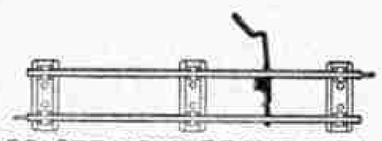
Fortunately between the two trains there was a siding running off the main line. On inspecting this, one of the guards found that it would just accommodate 11 open wagons and a guard's van. Eventually the trains passed each other and shunting operations were so arranged that they passed without even splitting up ! Moreover only one locomotive was uncoupled. How was it done ?

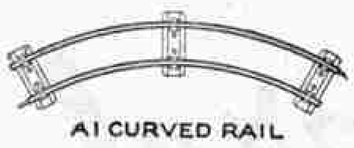
Hornby goods (or Meccano goods if preferred) to the value of 15/– will be awarded to the competitor who sends in a practical solution of this problem in the least possible number of moves. Other prizes of goods to the value of 10/6, 5/–, and 2/6 respectively, will also be awarded to the senders of the three entries that come next in order of merit. In the event of a tie for any prize the award will be made to the neatest entry.

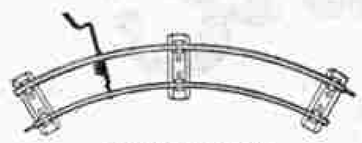
Envelopes should have the words "Shunting Problem" written in the top left-hand corner.

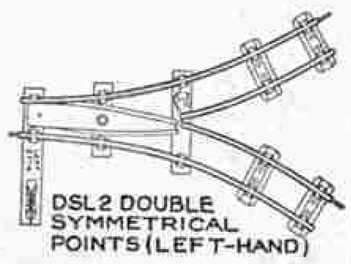
Hornby Rails, Points and Crossings

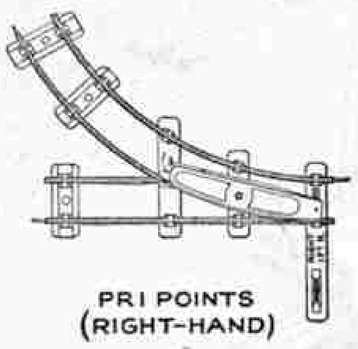

B1 STRAIGHT RAIL

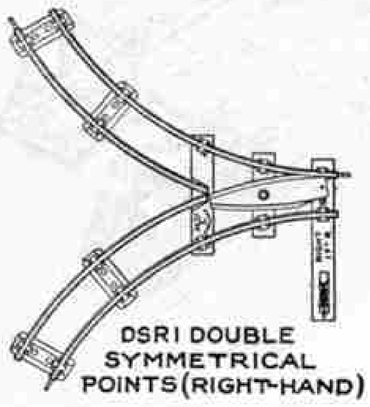

BB1 STRAIGHT BRAKE RAIL

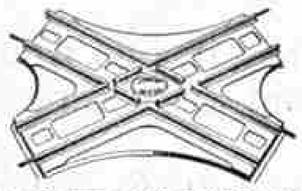

A1 CURVED RAIL


AB1 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


CA1 ACUTE-ANGLE CROSSING

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. An almost endless number of realistic and railway-like layouts can be constructed with them. Only the finest materials obtainable are used in their manufacture. They are rigid, strong and durable and will give every satisfaction.

RAILS FOR CLOCKWORK AND STEAM TRAINS, GAUGE 0, 1¼″

CURVED RAILS

(1-ft. radius)

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/–
AB1	Curved brake rails	each	6d.

(2-ft. radius)

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/–
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track	½ doz.	5/–

STRAIGHT RAILS

B1	Straight rails	per doz.	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track	½ doz.	4/6

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	1/6
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/6
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	1/6
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/6

POINTS

For 1-ft. Radius Curves

PR1	Right-hand points	per pair	4/–
PL1	Left-hand points		

For 2-ft. Radius Curves

PR2	Right-hand points	per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base, with ground disc and lamp, and adapted for Hornby control, right hand	per pair	7/6
PSL2	Points on solid base, with ground disc and lamp, and adapted for Hornby control, left hand		

PARALLEL POINTS

For 2-ft. Radius Curves

PPR2	Parallel points, right	per pair	5/–
PPL2	Parallel points, left		
RCP	Rail Connecting Plates	½ doz.	4d.

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double symmetrical points, right	per pair	5/–
DSL1	Double symmetrical points, left		

For 2-ft. Radius Curves

DSR2	Double symmetrical points, right	per pair	5/–
DSL2	Double symmetrical points, left		

CROSSOVERS

COR2	Crossovers, right hand	per pair	12/–
COL2	„ left hand		

RAILS FOR ELECTRIC TRAINS. GAUGE 0, 1¼″

CURVED RAILS

(1-ft. radius)

EA1	Curved rails	per doz.	8/–
EA1½	Curved half rails	„	5/–
EA1¼	Curved quarter rails	„	4/6

(2-ft. radius)

EA2	Curved rails	per doz.	8/–
EA2½	Curved half rails	„	5/–
EA2¼	Curved quarter rails	„	4/6

STRAIGHT RAILS

EB1	Straight rails	per doz.	7/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–

POINTS

For 2-ft. Radius Curves

EPR2	Right-hand points	per pair	10/–
EPL2	Left-hand points		

CROSSINGS

ECA	Acute-angle crossings	each	4/–
ECR	Right-angle crossings	„	4/–

DOUELE SYMMETRICAL POINTS

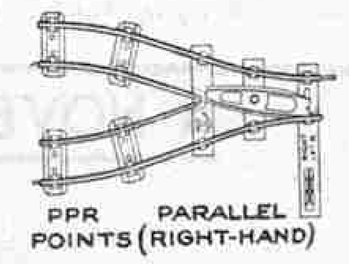
For 2-ft. Radius Curves

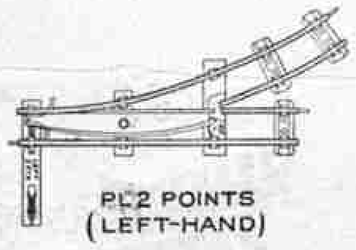
EDSR2	Double symmetrical points, right	per pair	12/–
EDSL2	Double symmetrical points, left		

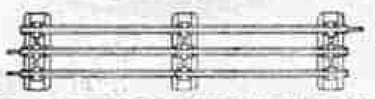
PARALLEL POINTS

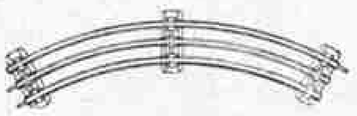
EPPR2	Parallel points, right	per pair	12/–
EPPL2	Parallel points, left		
TCPL	Terminal Connecting Plates (low voltage)	each	1/6
TCPH	Terminal Connecting Plates (high voltage)	„	1/6

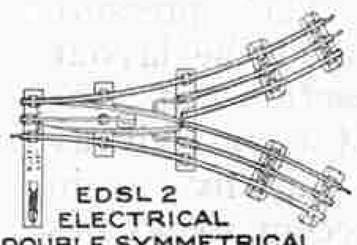
Electrical Points for 1-ft. radius curves are not supplied.

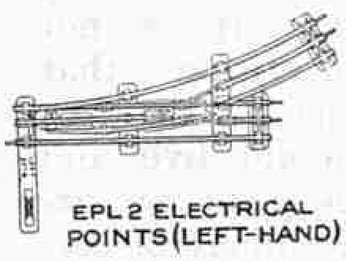

PPR PARALLEL POINTS (RIGHT-HAND)

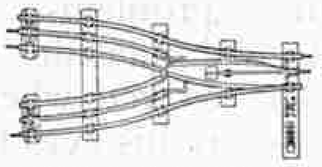

PL2 POINTS (LEFT-HAND)

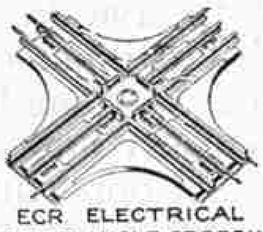

EB1 ELECTRICAL STRAIGHT RAIL


EA1 ELECTRICAL CURVED RAIL

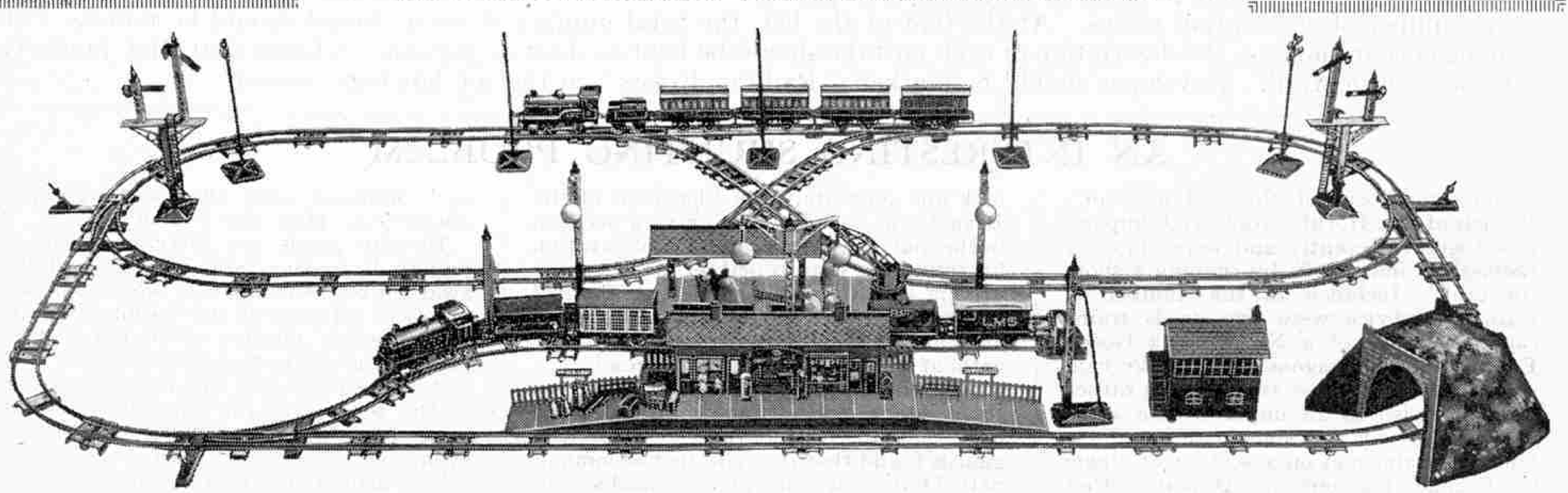

EDSL2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


EPL2 ELECTRICAL POINTS (LEFT-HAND)

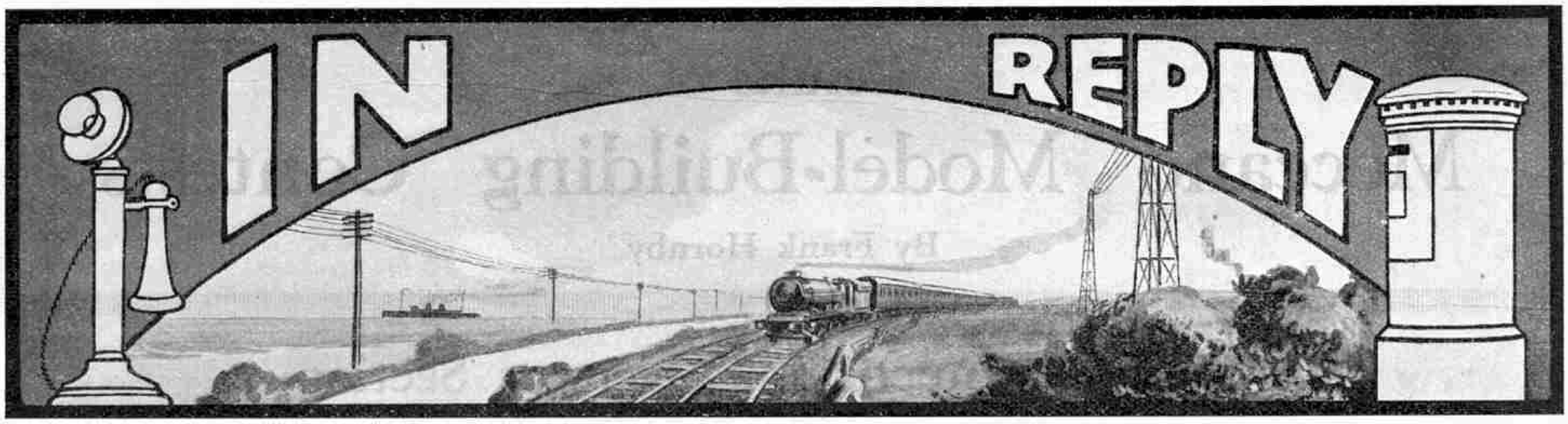

EPPR2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)


ECR ELECTRICAL RIGHT-ANGLE CROSSING

The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many similar illustrations and much useful information is given in a booklet entitled "How to get more fun out of Hornby Trains." This booklet is obtainable from your dealer, price 3d., or from Meccano Ltd., Old Swan, Liverpool, price 3d. post free.



Manufactured by MECCANO LIMITED - OLD SWAN - LIVERPOOL



Suggested Hornby Train Improvements

COLOUR-LIGHT SIGNALS.—We do not think a layout fitted up with colour-light signals would look anything like as attractive as one fitted with the more usual semaphore signals. In addition, colour-light signals would be much more complicated and expensive. (*Reply to P. Nicholl, Christchurch, New Zealand*).

BRAKE AND REVERSE LEVER.—Your suggestion that we should revise the design of the brake and reverse levers of Hornby locomotives and lead them through the roof of the cabs is unsuitable. We feel sure that we should be inundated with letters of protest from Hornby Train enthusiasts if we were to adopt your idea. (*Reply L. Whitmore, Kensington, London, W.C.*).

NEW 2 ft. CROSSOVER.—Your crossover will not fit the double-track because it is of the old design. A new type of crossover has been produced for use in conjunction with the new double-track, and this will, of course, fit the parallel points. In connection with the new double-track, you will probably be interested to hear that a revised design of level crossing is now on the market. The new crossing fits the parallel points and double-track perfectly. (*Reply to P. Wilkinson, Dartmouth, and M. Searle, Plymouth*).

SIX-WHEELED PASSENGER VEHICLES.—Vehicles of this type are quite out of date on actual railways and for this reason we are sure that models of them would not prove popular. (*Reply to G. W Aggleton, Coventry*).

CORRIDOR COACHES.—The introduction of a model of this type of coach will be one of the first matters to receive our consideration. (*Reply to D. A. Heaps, Hastings*).

ELECTRIC BELLS IN STATIONS.—Your idea regarding a model station fitted with an electric bell that is rung automatically by on-coming trains is certainly interesting. It should not be difficult for you to rig up the necessary apparatus for yourself, however. A station specially fitted as you suggest would cost a great deal to manufacture. (*Reply to M. J. French, Epsom*).

TWO-CURVE POINTS.—The introduction of two-curve points is certainly of sufficient interest to merit very careful consideration and we are filing your suggestion for reference. Just at present, however, we are unable to deal with this matter. (*Reply to H. Pettifer, London, S.E.3*).

COVERED-IN STATION.—We are considering the introduction of a covered-in through station similar to many in use on the actual railways. When interesting developments occur, an announcement will be made in the "*M.M.*" (*Reply to P. Williamson, Longsight, Manchester*).

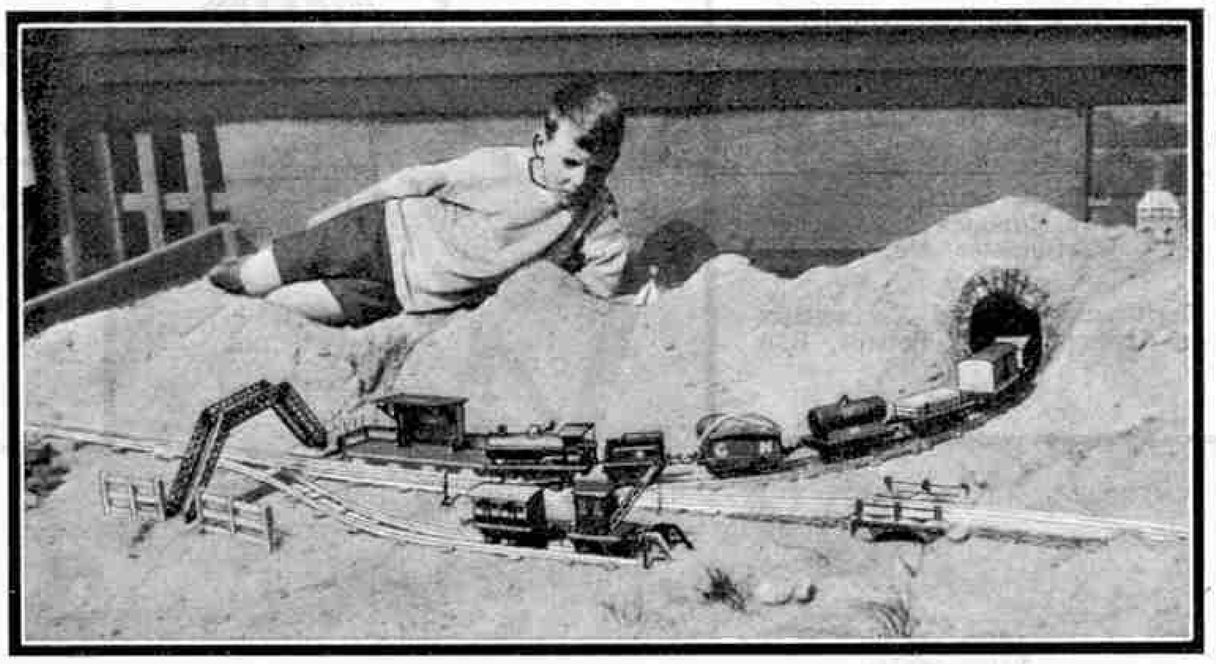
MOTOR CAR TRUCK.—As stated previously in these pages, we propose to give the introduction of this type of wagon careful consideration when we make the next additions to our rolling stock. We agree with you that this kind of truck would be quite popular. (*Reply to J. Glennie, Dumfries*).

OUTSIDE CYLINDERS FOR TANK ENGINES.—We fail to see that there would be any special advantage to be gained by altering our No. 2 Tank locomotive as you suggest. On the other hand, it is possible that when we introduce a new design of locomotive it will be fitted with cylinders placed outside the frames. (*Reply to J. B. Egerton, Manchester, and P. Smith, Llangollen, N.W.*).

ELECTRIC POINTS FITTED FOR CONTROL.—Electric points fitted for control are now on the market. These sell at 12/- per pair (R.H. and L.H.) and are suitable for use in layouts including curves of 2 ft. radius. (*Reply to K. A. Key, Paisley*).

PERMANENT MAGNET MOTORS.—We are experimenting with a locomotive fitted with a new type of permanent magnet electric motor. If the results prove successful, and it is decided to take any further steps in the matter, an announcement will appear in these pages. (*Reply to G. S. Jerrett, London*)

DESTINATION BOARDS.—Destination boards and name boards, such as those used on the actual "Royal Scot" and "Flying Scotsman" expresses, would certainly improve the appearance of a model train considerably. For this reason, we will file your idea for further consideration. (*Reply to G. W. Barnes, London, N.W.3*).



Our illustration shows how H. Stable, of Birmingham, spent an interesting afternoon last summer arranging a small model railway system out of doors. Sand lends itself particularly well to the modelling of various railway features, such as embankments, cuttings and tunnels, but it is necessary to take the greatest of care to avoid the possibility of grit entering into the mechanisms of the locomotives or between the wheels and axles of the rolling stock.

RECTANGULAR TAR WAGONS.—The popularity of this suggestion is increasing rapidly. We will take further steps in this direction as soon as possible. (*Reply to M. Prichard, Edinburgh*).

OVAL-HEADED BUFFERS.—Most of the Hornby locomotives are already fitted with oval-headed buffers. While agreeing with you that buffers of this kind tend to prevent wagons interlocking with the engine to a certain extent, we are of opinion that little advantage would be gained by fitting these buffers to all our rolling stock. In any case, most coaches and wagons on the actual railways have round-headed buffers fitted. (*Reply to R. F. Mitchell, Crawley*).

A TOOL TRUCK.—We cannot consider the introduction of a tool truck to be used in conjunction with our Breakdown Van and Crane at present. This would not serve any definitely useful purpose on a model railway. (*Reply to G. Jarrett, Clevedon*).

No. 2 PULLMAN GUARD'S VAN.—You have probably not noticed an announcement that has appeared to the effect that a new Pullman Composite Coach is now available. This new coach should satisfy your requirements. (*Reply to H. E. Deister, Durban, S.A.*).

MAIL VAN.—We continue to receive suggestions for the introduction of Mail Vans with the necessary pick-up apparatus. As we have already stated, we are experimenting with possible types of apparatus, and we shall make an announcement as soon as we have reached a definite decision. This is not likely to be in the near future, however, as we have so many other railway schemes on hand. (*Reply to G. E. J. Hales, Brighton, and P. R. Patterson, Warrington*).

OPEN BOGIE GOODS WAGON.—We agree with you that a wagon of this kind would fill a deficiency in the Hornby series. We are therefore filing your idea with a view to giving it further consideration at a later date. (*Reply to S. Glass, Woodford Green, Essex*).

MODEL RAILWAY 'BUSES.—We hardly think that models of this kind would be suitable for introduction into the Hornby Railway system. Fortunately, up to the present, the Hornby Railway Company has not been troubled by road transport rivalry! (*Reply to J. Johnstone, Paisley*).

ENGINE SHEDS.—We suggest that you obtain the larger type of shed (price 17/6) for your railway. This is larger than the 11/- model that you saw, and it will accommodate any No. 2 or No. 3 locomotive comfortably. (*Reply to J. Young, London, N.4*).

NEW TURNTABLE.—A scale model turntable such as you describe would certainly be an interesting addition. The trouble is that it would be very awkward to fit such a turntable into the average gauge 0 temporary layout on account of the deep well that is required to accommodate the revolving platform. (*Reply to G. Davies, Lincoln*).

CONTROL LEVEL CROSSING.—We do not think that your proposed control level crossing would be by any means as popular as you imagine. For the moment, at any rate, we cannot adopt the idea. (*Reply to G. R. Webb, Bishop Stortford*).

MODEL TARPAULINS.—You will no doubt be interested to hear that we have introduced model wagon tarpaulins. These may be obtained lettered in correct accordance with actual L.M.S., L.N.E., G.W. or S.R. practice, price 6d. each. (*Reply to K. R. Swan, Aintree, Liverpool*).

RAILWAY UNDERBRIDGE.—It would be awkward to include an underbridge in most model railway layouts, as this would necessitate a long inclined lead to the bridge and subsequent long decline from it. Where boys are particularly keen on possessing a bridge of this kind, however, some very excellent models may be constructed from Meccano. (*Reply to S. Wilkinson, Newcastle-on-Tyne*).

"GARRATT" LOCOMOTIVES.—We thank you for your drawing illustrating a proposed type of "Garratt" 0–4–0, 0–4–0 locomotive. We are afraid, however, that in spite of your expectation, this kind of locomotive would not meet with a generally enthusiastic reception. (*Reply to D. Lauder, Kent*).

COLOURING OF 'DISTANT' SIGNALS.—You will doubtless be interested to hear that the new type of 'distant' signal is finished with a fishtail white band instead of a straight white band. As regards yellow 'distant' signals, as mentioned previously in these pages we do not propose to consider their introduction until all the actual railways definitely decide upon yellow as the standard colour for this type of signal. (*Reply to H. Johnstone, Glasgow; J. Marsh, Blackpool; and H. Bruce, Winchester*).

Results of Meccano Model-Building Contests

By Frank Hornby

"May" Competition, Overseas Section

WITH the commencement of a New Year I always make a practice of glancing back over the results of all the Model-building Competitions that appeared during the preceding year. On this occasion the inspection will certainly show that the 1928 Contests have produced many truly remarkable models, and the average standard of merit displayed by the competition entries throughout the year is undoubtedly much higher than ever before. I shall look forward to the closing of our big £100 Contest, and also of the various other contests to be announced in 1929, with keen interest, for I feel sure that if Meccano boys keep on at their present rate of building, we shall be inundated with wonderful new models and mechanisms.

The Overseas entries in the "May" contest are described below, and some very interesting models are to be found amongst them. The names of the prize-winners are as follows:—

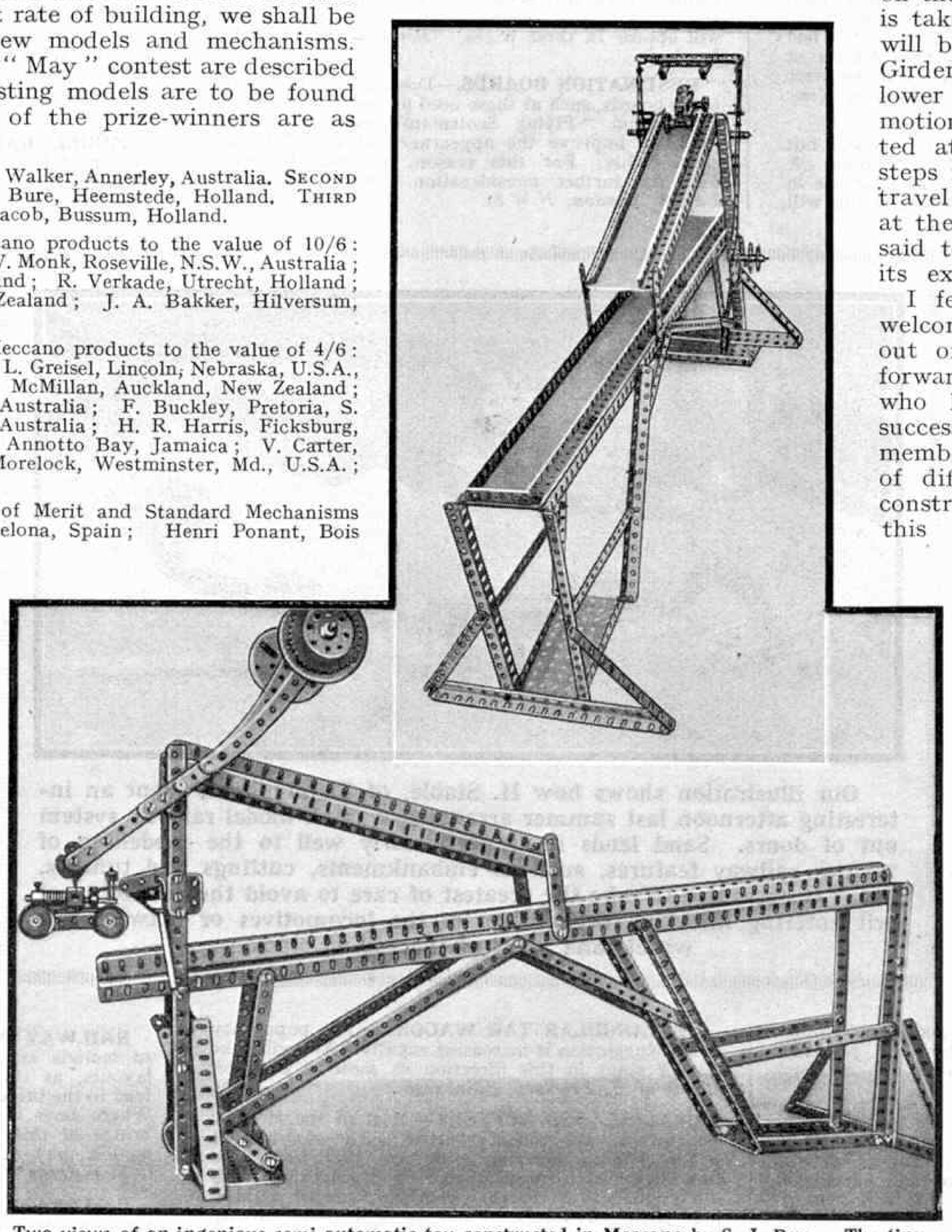
FIRST PRIZE (cheque for £3-3s.): R. E. Walker, Annerley, Australia. SECOND PRIZE (cheque for £2-2s.): S. J. Bure, Heemstede, Holland. THIRD PRIZE (cheque for £1-1s.): F. B. Jacob, Bussum, Holland.

SIX PRIZES, each consisting of Meccano products to the value of 10/6: S. F. Desai, Navsari, India; Clive W. Monk, Roseville, N.S.W., Australia; Douglas Angus, Napier, New Zealand; R. Verkade, Utrecht, Holland; R. O. Jukes, Christchurch, New Zealand; J. A. Bakker, Hilversum, Holland.

TWELVE PRIZES, each consisting of Meccano products to the value of 4/6: L. Fisher, Johannesburg, S.Africa; L. Greisel, Lincoln, Nebraska, U.S.A., W. Müller, Bâle, Switzerland; J. McMillan, Auckland, New Zealand; F. H. Ogier, Hurstville, N.S.W., Australia; F. Buckley, Pretoria, S. Africa; Nelson Eustis, Alberton, Australia; H. R. Harris, Ficksburg, O.F.S., S. Africa; K. McDonald, Annotto Bay, Jamaica; V. Carter, Gisborne, New Zealand; S. P. Morelock, Westminster, Md., U.S.A.; E. Wood, Pretoria, S. Africa.

SPECIALLY COMMENDED (Certificate of Merit and Standard Mechanisms Manual): Ramon Collado, Barcelona, Spain; Henri Ponant, Bois Colombes, Seine, France; W. D. H. Graham, Esk, Queensland, Australia; G. R. Cartledge, Durban, S. Africa; K. Muchlig, Ann Arbor, Michigan, U.S.A.; J. Denny, Melbourne, Victoria, Australia; H. Fraser, Elwood, Victoria, Australia; Donald Malcolm, Premier Mine, Transvaal, S. Africa: Andrew Garriock, Sydney, N.S.W., Australia.

The First Prize winner, R. E. Walker, submitted a model dragline. His model is not simply a replica of the standard Meccano dragline, as might at first be supposed, but an excellent, well-proportioned structure that includes much of the builder's "free-lance" designs. Boom, drag bucket, luffing and hoisting mechanisms, and travelling base have all been carefully and accurately constructed and the complete model has that effect of realism that can only be attained by the exercise of much patience and study.



Two views of an ingenious semi-automatic toy constructed in Meccano by S. J. Bure. The tiny engine races down the "chutes" at a great speed

On first glancing at the illustration on this page one might wonder just exactly what the photographs are intended to represent. Although the caption helps to clear matters up, a more complete explanation will doubtless be appreciated! The model constitutes a most ingenious toy of semi-automatic type, for the tiny locomotive, once started, performs some remarkable antics before finally coming to rest!

To start the "cycle of operations" the pivoted arm is first drawn into a vertical position with the weighted end (the "ballast" consists of Sprocket Wheels and Face Plates) uppermost. This done, the miniature engine is hooked on to the clips at the lower end of the arm, and the whole held in position by a catch formed from a Curved Strip and a Spring. When it is required to operate the toy the catch is drawn down and the locomotive is pulled round by the weighted portion into a position at the top of the "chute" where the engine is released and travels down the first incline, gradually gathering momentum. On reaching the end of this incline the locomotive takes a "leap into space" and lands on the bottom chute, up which it is taken by its own velocity. It will be noticed that a 2½" Angle Girder closes the top end of the lower chute and the engine's motion will consequently be arrested at this point. Gravity then steps in and forces the engine to travel back along the lower chute, at the bottom of which it can be said to have reached the end of its exciting journey!

I feel sure model-builders will welcome this effort as something out of the ordinary and I look forward to hearing from readers who have built similar models successfully. It is well to remember that there are hundreds of different ways in which the constructor can employ a toy of this description, and its construction offers endless possibilities for the ingenious boy.

A clever representation of an army tank will be seen amongst the illustrations on the opposite page. Glancing at the photograph of this little model and noticing the multitude of toothed wheels included in it, one cannot help thinking that although the phrase "armed to the teeth" is more usually applied to pirates, brigands, and suchlike romantic figures of fiction, it would qualify the model tank remarkably well! The novel constructional features of the tank cannot be overlooked, and I congratulate its builder, F. B. Jacob, on his success.

The construction of aeroplanes, seaplanes, airships, etc., is extremely popular with Meccano boys, and many hundreds of models of flying machines are received in each contest. It will be understood, therefore, that any model aeroplane submitted by a competitor must include features of outstanding merit to enable him to carry off a prize. Two particularly interesting examples of miniature aeronautical engineering were submitted by competitors, one being a model "Hercules" air liner constructed by C. W. Monk, and the other an ingenious representation, by D. Angus, of a "flying bicycle."

The most interesting feature of Monk's air liner is the fact that

it can be called a " working model." The model does not of course actually fly (the weight of the Meccano parts would never permit this !) but when moved along a floor or table top the propeller rotates. The method by which this motion has been achieved is as follows. The " propeller shaft," carrying at one end a Bush Wheel to which is attached a pair of Propeller Blades, extends the complete length of the model and carries at its rearmost extremity a ¾" Pinion that meshes with a ¾" Contrate Wheel fastened to a 2" Rod. The latter is journalled vertically in the framework of the machine and carries on its lower end a ⅞" Bevel, and this is rotated by a similar wheel that is fastened to a Rod on which is held a Bush Wheel. This Bush Wheel rests on the ground, forming the " tail skid," and causes the rotation of the propeller.

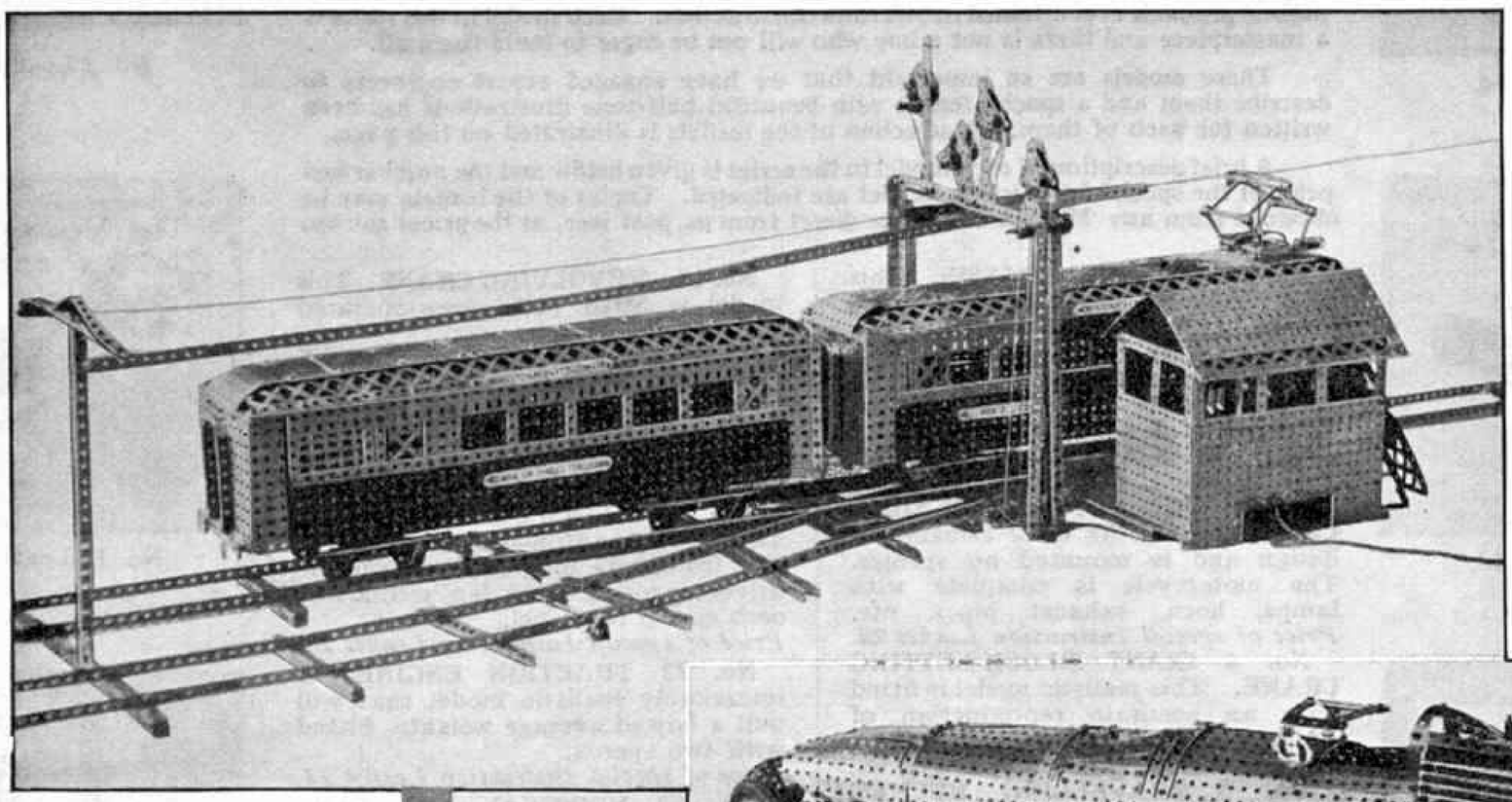
The " flying bicycle " is based upon a remarkable machine devised by a Viennese inventor some time ago. Incidentally, an illustration of the invention was incorporated in the heading " Our Busy Inventors " on page 909 of the November, 1928, *"M.M."* Readers who have this issue available should compare the illustration in question with the Meccano model.

The invention, I may add, has not up to the present been put to a practical test, although a quarter size model is stated to have acquitted itself remarkably well ! The actual machine constitutes a bicycle frame of rather heavy construction and is fitted with the usual pedals, cranks, and chain drive. Auxiliary gearing enables a " pusher " propeller placed at the rear of the bicycle to be rotated with considerable velocity and this, it is claimed, will cause the machine to rise in the air ! Its ascent would of course be assisted by adjustable planes that can be controlled from the rider's seat. On attaining a sufficient altitude, the aviator lowers the planes to a horizontal position and glides along above the clouds untroubled by policemen, motor cars, pedestrians and the other " bugbears " of the less adventurous terrestial cyclist ! It is always refreshing to receive models such as this, for they show that the Meccano boy takes a lively and intelligent interest in the progress and invention of the world of to-day.

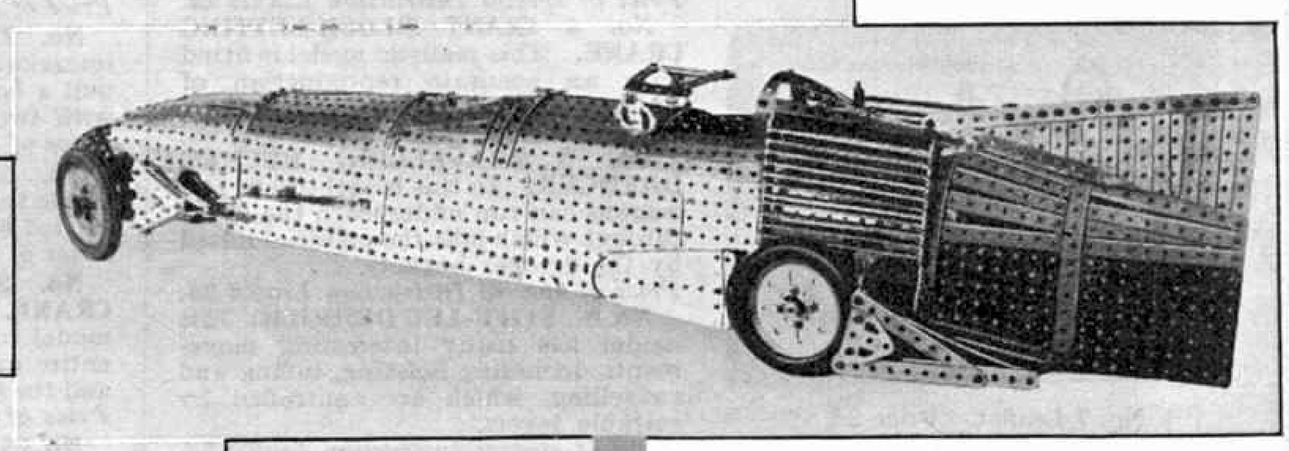
A complete electric railway formed R. O. Jukes' entry and the illustration on this page of a portion of the track will show that the builder has completed the various portions of the layout remarkably well. Of the two cars shown in the illustration, the right-hand one contains a Meccano high voltage Motor, and can therefore be termed the motor car. The other car is designed principally for passenger conveyance, but a portion has been divided off for luggage. The appearance of the cars is excellent, and the " corridor connections " help to add realism to the finished model, which is one of the finest received recently.

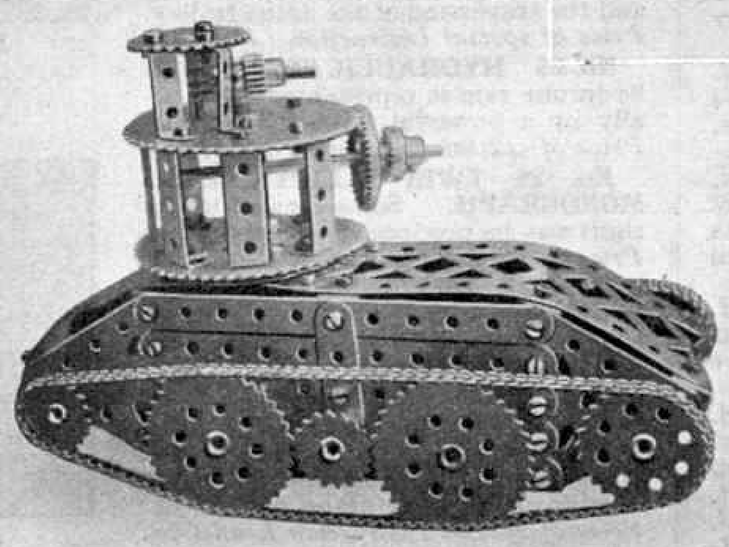
Jukes has adopted the overhead wire system of current collection in this railway, and the small " pantograph " for conducting one pole of the main supply to the Motor may be seen fitted on the roof of the motor coach. The other pole of the current is, of course, connected to the other Motor terminal through the rails and the bogie wheels. This method of wiring, although it complicates matters considerably, has much to commend it, for in addition to giving the complete layout a most realistic appearance, it dispenses with the " third " or " live " rail and consequently standard unelectrified track can be used with an electric locomotive.

The model is fitted with an ingenious control mechanism consisting of a " trip lever " mounted on the rear of the passenger coach and connected by a flexible coupling to the reversing lever of the Motor in the motor coach. When the train reaches a certain specified point on the track, an arm that is normally held down by a spring in the centre of the rails, is released by a control wire operated from the signal box (the box can be seen in the illustration) and engages with the trip lever on the passenger car, so reversing the motion of the train.



Above: R. O. JUKES' ELECTRIC RAILWAY

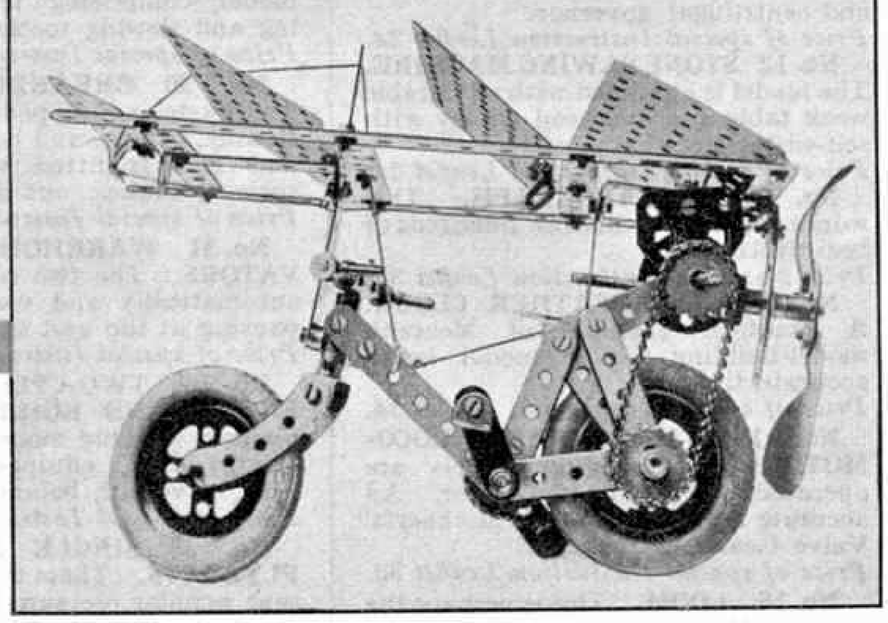




Above: A fine model of CAPTAIN CAMPBELL'S world-famed racing car, by R. Verkade.

Left: F. R. Jacob's Army Tank, complete with "crawlers".

Below: The FLYING(?) BICYCLE, a model of a remarkable invention. Sent in by Douglas Angus.



It would be difficult to name any recently-devised object connected with engineering that has aroused more enthusiasm amongst model builders than Captain Malcolm Campbell's racing car " Bluebird," which created a world's speed record early last year. Although the record that was set up was almost immediately broken again, the car enjoys almost universal popularity, and many fine reproductions of it have been entered in the Meccano Contests. I think readers will agree, however, that for careful and accurate constructional work it would be difficult to find a better model of the actual car than that sent in by B. Verkade, an illustration of which appears herewith. The construction of a model of this type is no simple task, for innumerable difficulties are met with when an attempt is made to build up the peculiarly shaped body work from standard Meccano parts. Great credit is due therefore to Verkade.

In these days of motor transport, accidents to large and heavy vehicles are bound to occur, and the auto breakdown crane is gradually becoming a common sight. J. A. Bakker's cleverly-designed model represents a crane of this type.

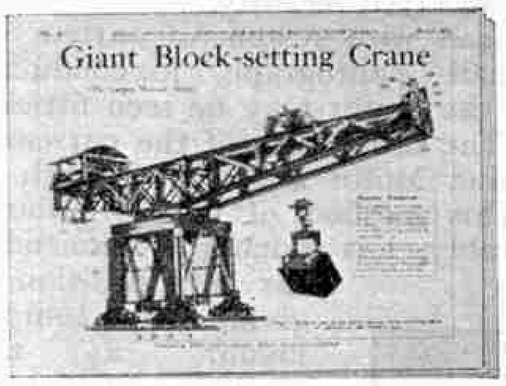
MECCANO

SUPER MODELS

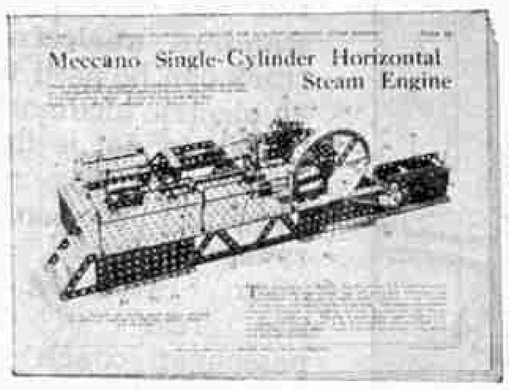
Our expert designers have produced for us 34 super models that reach the highest pinnacle ever attained in Meccano construction. Each model in this series is a masterpiece and there is not a boy who will not be eager to build them all.

These models are so important that we have engaged expert engineers to describe them and a special leaflet with beautiful half-tone illustrations has been written for each of them. A selection of the leaflets is illustrated on this page.

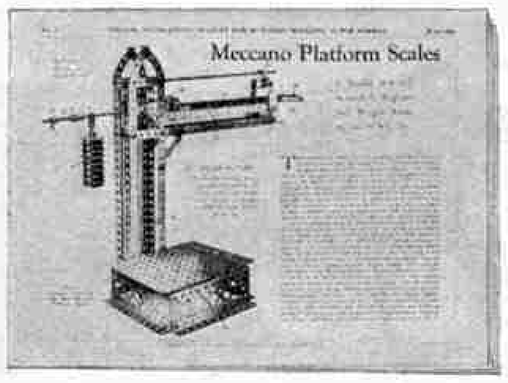
A brief description of each model in the series is given below and the number and price of the special Instruction Leaflet are indicated. Copies of the leaflets may be obtained from any Meccano dealer or direct from us, post free, at the prices shown.



No. 4 Leaflet. Price 6d.



No. 11 Leaflet. Price 2d.



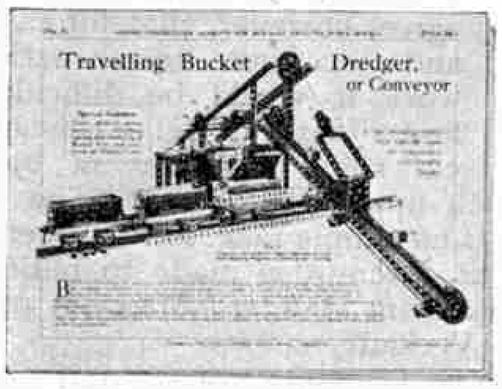
No. 7 Leaflet. Price 2d.



No. 1 Leaflet. Price 3d.



No. 25 Leaflet. Price 2d.



No. 5 Leaflet. Price 2d.

No. 1 MOTOR CHASSIS. This model runs perfectly under its own power. It has Ackermann Steering, Differential, Gear Box and Clutch, etc.
Price of special Instruction Leaflet 3d.

No. 2 SHIP COALER. All the movements of a real ship-coaler are reproduced in this model.
Price of special Instruction Leaflet 3d.

No. 3 MOTORCYCLE AND SIDE-CAR. The sidecar is of stream-line design and is mounted on springs. The motorcycle is complete with lamps, horn, exhaust pipes, etc.
Price of special Instruction Leaflet 2d.

No. 4 GIANT BLOCK-SETTING CRANE. This realistic model is fitted with an accurate reproduction of Fidler's blocksetting gear.
Price of special Instruction Leaflet 6d.

No. 5 TRAVELLING BUCKET DREDGER. In this model trucks and wagons can run underneath the chute through which falls the material raised by the dredger buckets.
Price of special Instruction Leaflet 2d.

No. 6 STIFF-LEG DERRICK. This model has many interesting movements, including hoisting, luffing and swivelling, which are controlled by suitable levers.
Price of special Instruction Leaflet 2d.

No. 7 PLATFORM SCALES. This model will weigh articles up to 4½ lbs. with remarkable accuracy.
Price of special Instruction Leaflet 2d.

No. 8 ROUNDABOUT. This model is most attractive when in motion. As the roundabout rotates the cars spin round and the horses rise and fall.
Price of special Instruction Leaflet 2d.

No. 9 BAGATELLE TABLE. This is an interesting model that will give hours of fun to the players.
Price of special Instruction Leaflet 2d.

No. 10 LOG SAW. In this model the saw is driven rapidly to and fro while the work table travels beneath it.
Price of special Instruction Leaflet 2d.

No. 11 SINGLE-CYLINDER HORIZONTAL STEAM ENGINE. Fitted with balanced crankshaft, crosshead, and centrifugal governor.
Price of special Instruction Leaflet 2d.

No. 12 STONE SAWING MACHINE. The model is equipped with adjustable work table and overhead trolley with self-sustaining chain hoist.
Price of special Instruction Leaflet 2d.

No. 13 MECCANOGRAPH. This wonderful model will draw hundreds of beautiful designs.
Price of special Instruction Leaflet 3d.

No. 14 GRANDFATHER CLOCK. A practical example of Meccano model-building. The model keeps accurate time.
Price of special Instruction Leaflet 3d.

No. 15 BALTIC TANK LOCOMOTIVE. The driving wheels are operated by an Electric Motor. An accurate reproduction of Walschaerts' Valve Gear is fitted.
Price of special Instruction Leaflet 3d.

No. 16 LOOM. This is perhaps the greatest Meccano success. The model weaves beautiful material.
Price of special Instruction Leaflet 3d.

No. 17 PLANING MACHINE. Fitted with quick-return motion.
Price of special Instruction Leaflet 2d.

No. 18 REVOLVING CRANE. This model is fitted with screw-operated luffing gear.
Price of special Instruction Leaflet 2d.

No. 19 STEAM SHOVEL. This model embodies travelling and rotating mechanisms and jib hoisting and lowering gear.
Price of special Instruction Leaflet 2d.

No. 21 TRANSPORTER BRIDGE. The carriage automatically travels to and fro for as long as the motor is driven, pausing for a few seconds at each end of its travel.
Price of special Instruction Leaflet 2d.

No. 22 TRACTION ENGINE. A remarkably realistic model that will pull a boy of average weight. Fitted with two speeds.
Price of special Instruction Leaflet 2d.

No. 23 VERTICAL LOG SAW. While the saws are in motion, the logs are fed slowly to them.
Price of special Instruction Leaflet 2d.

No. 24 TRAVELLING GANTRY CRANE. The movements of this model comprise the traversing of the entire gantry, hoisting and lowering, and the traversing of the crane trolley.
Price of special Instruction Leaflet 2d.

No. 25 HYDRAULIC CRANE. The hydraulic ram is represented realistically by a powerful screw mechanism.
Price of special Instruction Leaflet 2d.

No. 26 TWIN ELLIPTIC HARMONOGRAPH. Some beautiful designs may be produced with this model.
Price of special Instruction Leaflet 2d.

No. 27 DRAGLINE. This imposing model of a giant excavator is fitted with travelling, luffing, slewing, and dragging movements.
Price of special Instruction Leaflet 3d.

No. 28 PONTOON CRANE. The movements of this model include the operation of the two hoisting blocks, slewing of the entire crane, and luffing.
Price of special Instruction Leaflet 2d.

No. 29 HAMMERHEAD CRANE. This is a very realistic and powerful model, comprising traversing, hoisting and slewing motions.
Price of special Instruction Leaflet 2d.

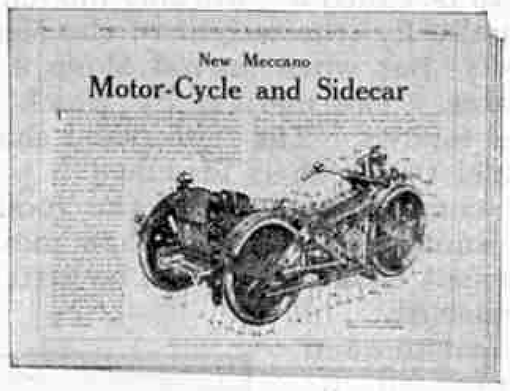
No. 30 BREAKDOWN CRANE. This model is equipped with travelling, slewing, luffing, and hoisting motions, and also is fitted with laminated springs, brakes, out-riggers, etc.
Price of special Instruction Leaflet 3d.

No. 31 WAREHOUSE WITH ELEVATORS. The two cages are driven automatically and work alternately, pausing at top and bottom positions.
Price of special Instruction Leaflet 3d.

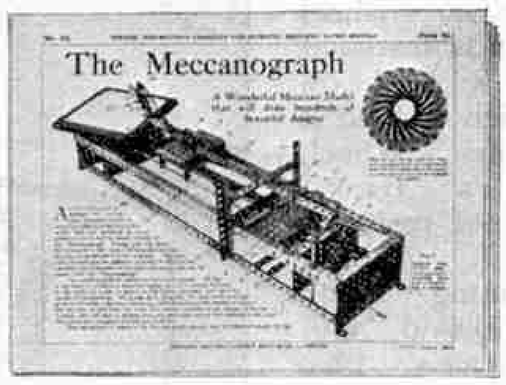
No. 32 TWO-CYLINDER STEAM ENGINE AND BOILER. This is a realistic working model of a complete steam plant, equipped with valve gear, governor, balanced cranks, etc.
Price of special Instruction Leaflet 3d.

No. 33 SINGLE AND DOUBLE FLYBOATS. These two models represent popular pleasure-fair attractions.
Price of special Instruction Leaflet 3d.

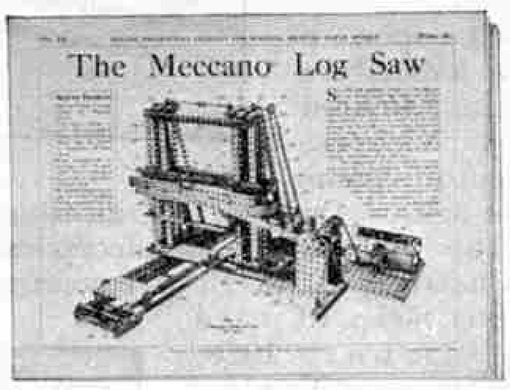
No. 34 THREE-ENGINE BIPLANE. This is a realistic model of an "Argosy" machine, and is fitted with ailerons, elevators and rudders.
Price of special Instruction Leaflet 3d.



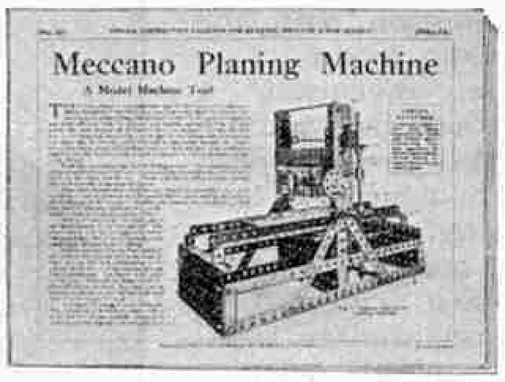
No. 3 Leaflet. Price 2d.



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No. 10 Leaflet. Price 2d.



No. 17 Leaflet. Price 2d.



No. 6 Leaflet. Price 2d.



No. 19 Leaflet. Price 2d.

MECCANO LIMITED
OLD SWAN, LIVERPOOL

Suggestions Section Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(145)—Three-lever Interlocking Frame for Railway Signals

(By W. Pantin, Blackheath, S.E.2)

TRAVELLING in the very early days of the railways must have been an adventurous and thrilling affair, for no proper signalling system was then in use to control the trains, which were thus entirely dependent on the skill of the pointsmen and the men who attended to the working of the crude appliances that were the forerunners of the modern semaphore signal. Such an unsatisfactory arrangement could not last, however, and in 1866 Messrs. J. J., J. J. F., and W. A. Stevens patented a locking device the purpose of which was to prevent conflicting points and signals being moved. So excellent was the principle underlying the invention that it is used, practically unaltered, in nearly every modern signalling installation, however complicated.

The Meccano model interlocking frame shown in Fig. 145 is based on the Stevens system and it is very simple to construct. It is shown complete with the necessary levers, but it will work equally well if connected to a Hornby Control Lever Frame. The addition of the device to any model railway layout will increase enormously the amount of interest to be derived from manipulating the railway.

The model demonstrates the locking that is necessary for a simple main and branch line junction for a single track. Reduced to the simplest possible arrangement, three levers are required, viz., one (M H) for working the main home signal (the taller of the two signals of a bracket signal); another (P) for the points; and a third (B H) for the branch home signal (the short bracket signal).

In the illustration the P lever is set for the branch line. In consequence of this the branch home signal should be "off" and the main home signal at "danger," thus indicating to the approaching train that the points are set for the branch. In order to fulfil the conditions of the interlocking system the points must remain immovable so long as the branch home signal remains "off," and also the main home signal must be locked in the "on" position. On the other hand, when the points are to be set for a main line train, they must first be placed in the correct direction before the main home signal lever can be pulled. As soon as this is done, both the points and branch home signal are locked, until such time as the main home signal is returned to "danger." With the model interlocking frame the conditions outlined above are fulfilled correctly. It is impossible to pull the levers other than in their correct order unless the adjustment of the tappets is interfered with or great force is used. (Tampering with the mechanism may be prevented by securing a second $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate over the Plate that contains the locking gear).

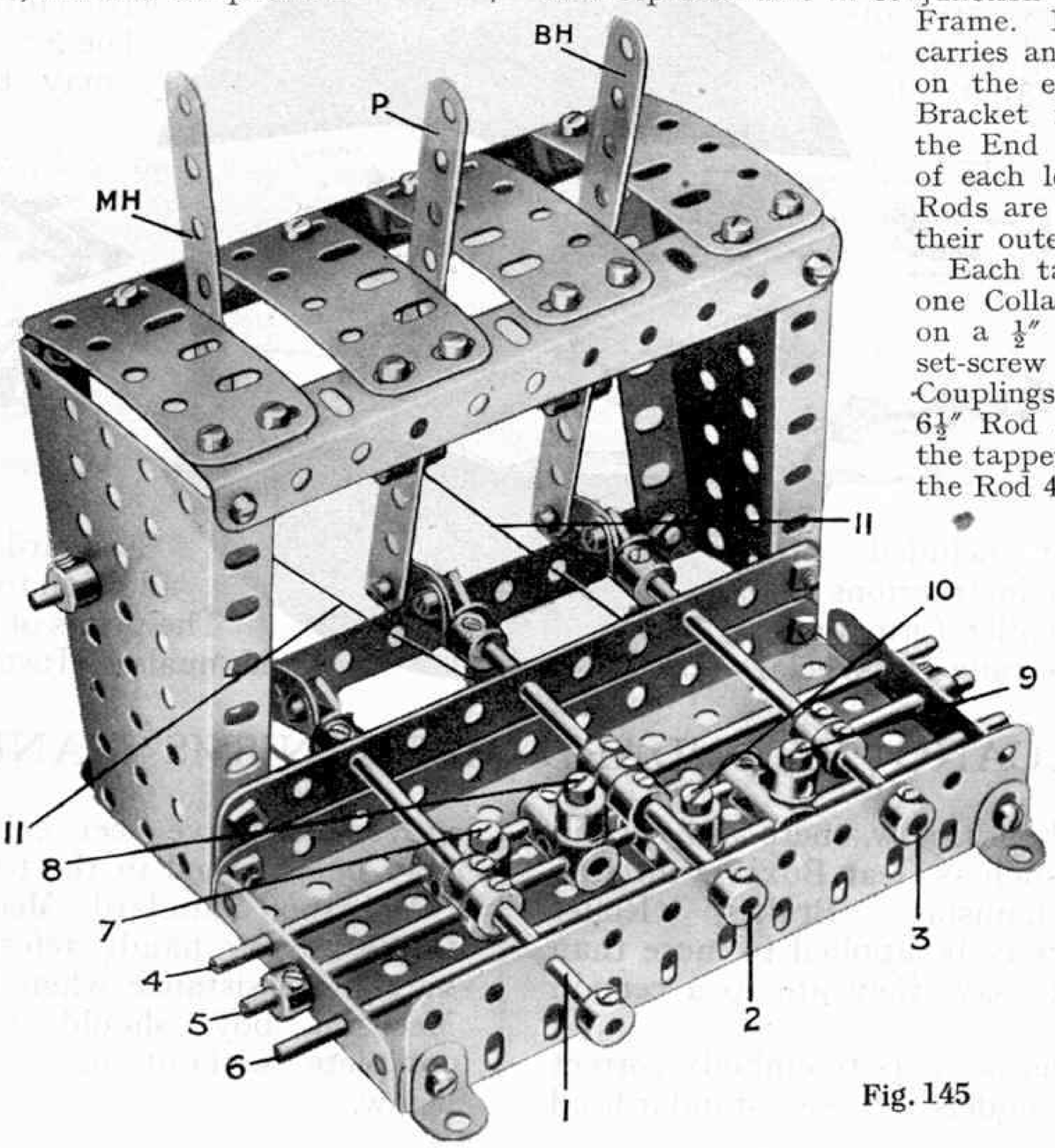


Fig. 145

The levers consist of $5\frac{1}{2}''$ Strips mounted on a Rod and retained in position by Collars. The sides of the lever frame consist of Sector Plates that are joined together at their top ends by two $5\frac{1}{2}''$ Angle Girders, across which are bolted four $2\frac{1}{2}''$ Flat Girders.

Construction of the Locking Mechanism

As will be seen from the illustration the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate containing the locking mechanism, is attached to the lower edges of the Sector Plates together with a $5\frac{1}{2}''$ Flat Girder; the latter forms part of the bearings for the Rods 1, 2, 3. The Plate may readily be detached from the rest of the model and used as a separate unit in conjunction with a Hornby Control Lever Frame. Each of the 3" Rods 1, 2, 3, carries an End Bearing that is secured on the end of the Rod, and a Flat Bracket forms a connection between the End Bearing and the bottom end of each lever. The movements of the Rods are limited by Collars secured on their outer ends.

Each tappet (7, 8, 9, 10) consists of one Collar and two Washers mounted on a $\frac{1}{2}''$ Bolt that is inserted in the set-screw hole of a Coupling. All four Couplings slide freely on the central $6\frac{1}{2}''$ Rod 5, but the Couplings carrying the tappets 7 and 8 are secured rigidly to the Rod 4, whilst the remaining two are secured to the Rod 6. This arrangement ensures that the respective groups of tappets move as one. Careful attention should be paid to the position of the tappets on their supporting Couplings.

Each pair of tappets has a limited sideways movement which is controlled by the Collars on the Rods 1, 2, 3. For example, in moving the P lever to the position shown in the illustration the tappet 8 has been moved to the left (by riding up the Collars on the Rod 2 as the latter moves towards the front of the photograph) and the tappet 7 is forced into the "step" formed by the end of a Collar and the Rod 1. Thus the M H lever becomes immovable as soon as the P lever is moved. Now the B H lever may be pulled, thus forcing the tappets 9 and 10 to the left and locking the P lever as shown. It is impossible to shift the B H lever before the P lever, for the Collars on the Rod 2 normally keep the tappets 9 and 10 forced to the right in the "step" on the Rod 3.

With the P and B H levers in their normal positions the M H lever may be pulled, as the tappet 8 is now free to slide into the "upper step" on the Rod 2 locking the latter (and also the P lever) until the M H lever is placed in the normal or "danger" position once more.

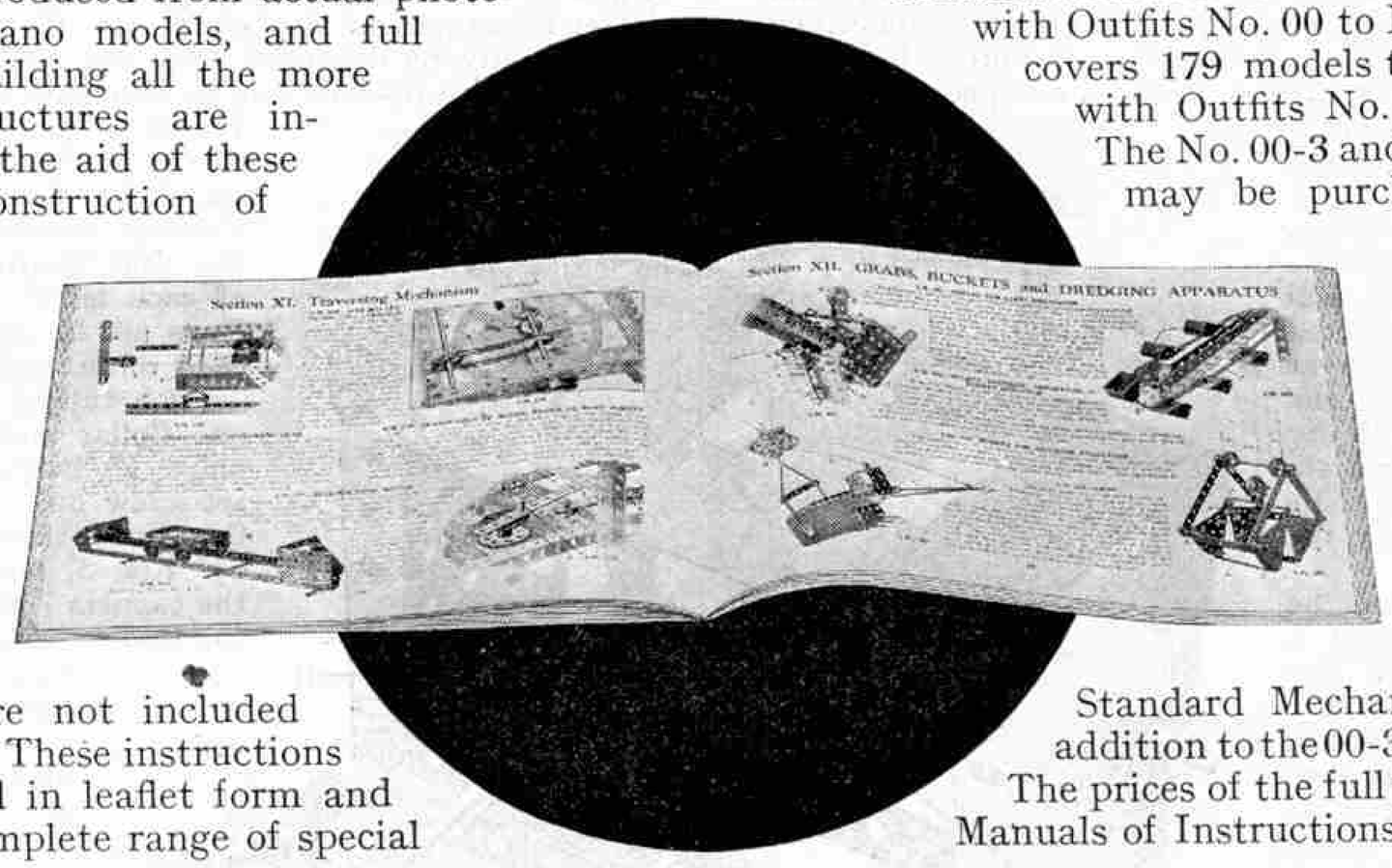
The lengths of Control Wire 11 are attached to $\frac{3}{8}''$ Bolts inserted in the set-screw holes of the End Bearings on the Rods 1, 2, 3.

MECCANO MANUALS OF INSTRUCTIONS





The Meccano Manuals of Instructions are the most remarkable publications of their kind. They are packed with hundreds of beautiful half-tone illustrations, reproduced from actual photographs of Meccano models, and full directions for building all the more complicated structures are included. With the aid of these Manuals the construction of the most intricate Meccano models is made quite simple for even the youngest boy. It should be noted that full instructions for building the Meccano super models are not included in the Manuals. These instructions may be obtained in leaflet form and details of the complete range of special leaflets are given on page 64 of this magazine.



Every boy should possess a copy of each of the No. 00-3 and No. 4-7 Manuals, the first of which contains instructions for building 447 models with Outfits No. 00 to No. 3. The latter covers 179 models that may be built with Outfits No. 4 to No. 7.

The No. 00-3 and No. 4-7 Manuals may be purchased separately or, if desired, they may be obtained attractively bound in full cloth cover lettered in gold. This bound volume includes a copy of the Standard Mechanisms Manual in addition to the 00-3 and 4-7 Manuals. The prices of the full range of Meccano Manuals of Instructions are given below.

MECCANO "STANDARD MECHANISMS MANUAL"

As most Meccano boys know, there are certain Meccano movements, such as Gear Boxes, Clutches, Drive-changing Mechanisms, Brakes, Roller Bearings, etc., which may be applied to more than one model; that is to say, they are to a certain extent standardised.

To enable keen model-builders to embody correct principles in their models, these standardised movements have been collected and classified and may be obtained in the form of a Manual entitled "Meccano Standard Mechanisms." This book forms a very handy reference and is of such invaluable assistance when building models that no Meccano boy should consider his equipment complete without it. The price is indicated below.

PRICES OF MECCANO MANUALS

	United Kingdom	Overseas N.Z. & S.A.	Australia	Canada
No. 0 Manual of Intructions	4d.	6d.	6d.	10 cents.
No. 00-3 „ „	1/6	2/–	2/3	50 „
No. 4-7 „ „	1/6	2/–	2/3	50 „
Standard Mechanisms Manual	1/–	1/6	1/6	35 „
Bound Manual of Instructions	7/6	9/6	11/–	$2.50
Meccano Book of New Models	6d.	9d.	9d.	15 cents.

HOW TO OBTAIN THE MANUALS

The Manuals may be obtained from any Meccano dealer in the United Kingdom or direct from Meccano Ltd., Binns Road, Old Swan, Liverpool. Boys living in Australia, New Zealand, South Africa, or Canada may obtain the Manuals from any Meccano dealer, or from their agents whose names are given on page 96 of this issue.

MECCANO LIMITED - OLD SWAN - LIVERPOOL



In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

Suggested Meccano Improvements

MINIATURE AMMETER.—Miniature electric measuring instruments would doubtless give certain Meccano models a most realistic touch. With the aid of this instrument many interesting comparisons could be made between the load placed upon the electric motor and the current consumed. We will consider your suggestion further, and would remind you that if this article is specially required it can be obtained from an electrical dealer. You might, however, experience difficulty in making a secure fastening for one of these meters in your model. (*Reply to L. Surridge, Wandsworth, London, S.W.*17).

DOUBLE WIDTH RATCHET WHEEL.—We are afraid that the addition of a Double Width Ratchet Wheel to the Meccano range would in no way constitute an improvement. We note that you intend using two Pawls with the suggested Ratchet so as to obtain greater strength, but we do not think that occasions, where the Ratchet mechanism has to be strengthened, are ever met with in general model-building. (*Reply to R.MacC, Burton-on-Trent*).

A NEW ELECTRIC MOTOR.—The existing 4-volt Electric Motor is manufactured as cheaply as possible, without sacrificing any efficiency, and it would not therefore be advisable to attempt producing a cheap electric motor as much of the good qualities of the existing motor would necessarily be lost. (*Reply to W Bolland, Rugby*).

NEW HOOK.—We were particularly interested in your suggestion that we should manufacture a hook having its shank threaded so that standard nuts, Threaded Bosses, etc., could be fastened to it. There appears to be distinct possibilities in your idea and we are therefore making special note of it. (*Reply to A. E. F. Spence, Manchester*).

IMPROVED DESIGNING TABLE.—Your suggestion that the Designing Table (part No. 107) (which is of course used in the Meccanograph) should be manufactured circular, is quite interesting. We do not think, however, that many advantages would result from this alteration as it is found that the corners of the existing table are most useful for placing drawing pins when securing a sheet of paper to it. (*Reply to A. H. Chapman, London, S.E.*5).

MODEL MUDGUARDS.—We find it totally impossible to consider the introduction of motor car accessories such as mudguards, lamps, horns, etc. Such articles can only be classified as ornaments to a model, and where specially required it should be possible for the constructor to improvise them himself from tin plate, etc. (*Reply to R. Sullivan, South Melbourne, Victoria, Australia*).

"MALTESE CROSS" MECHANISM.—Your proposal that a "Maltese Cross" mechanism (sometimes known as the "Geneva Stop" gear) should be introduced to the Meccano system, is interesting. Some of our readers will know that this gear is a standard fitment in cinematograph machines, it being used to create the intermittent motion of the film. The gear operates as follows. In Fig. 1, the pin D secured to an arm C which, in turn, is fastened to the "bight" wheel A, is just entering one of the slots in the Maltese Cross wheel B. As wheel A travels round in an anti-clockwise direction, the pin D moves up the slot in wheel B and consequently rotates the wheel B. In Fig. 2 the pin D has reached the bottom of one of the slots in the Maltese Cross wheel, and the wheel has moved through an angle of 45 degrees. Further rotation of the wheel A will cause the pin D to eventually leave the slot in wheel B after giving it a quarter turn. Thus, while the bight wheel moves four times wheel B moves only once. Although this gear is a most ingenious one, we do not think it is applicable to the system, but we will keep your suggestion before us for further consideration. (*Reply to F. Oakes, Manchester*).

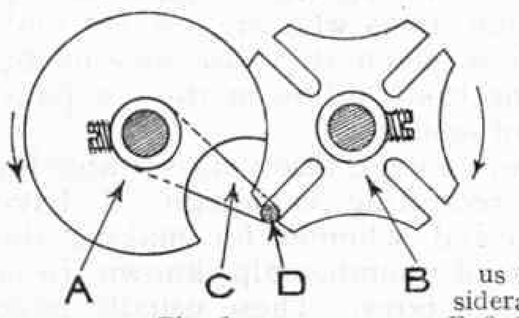
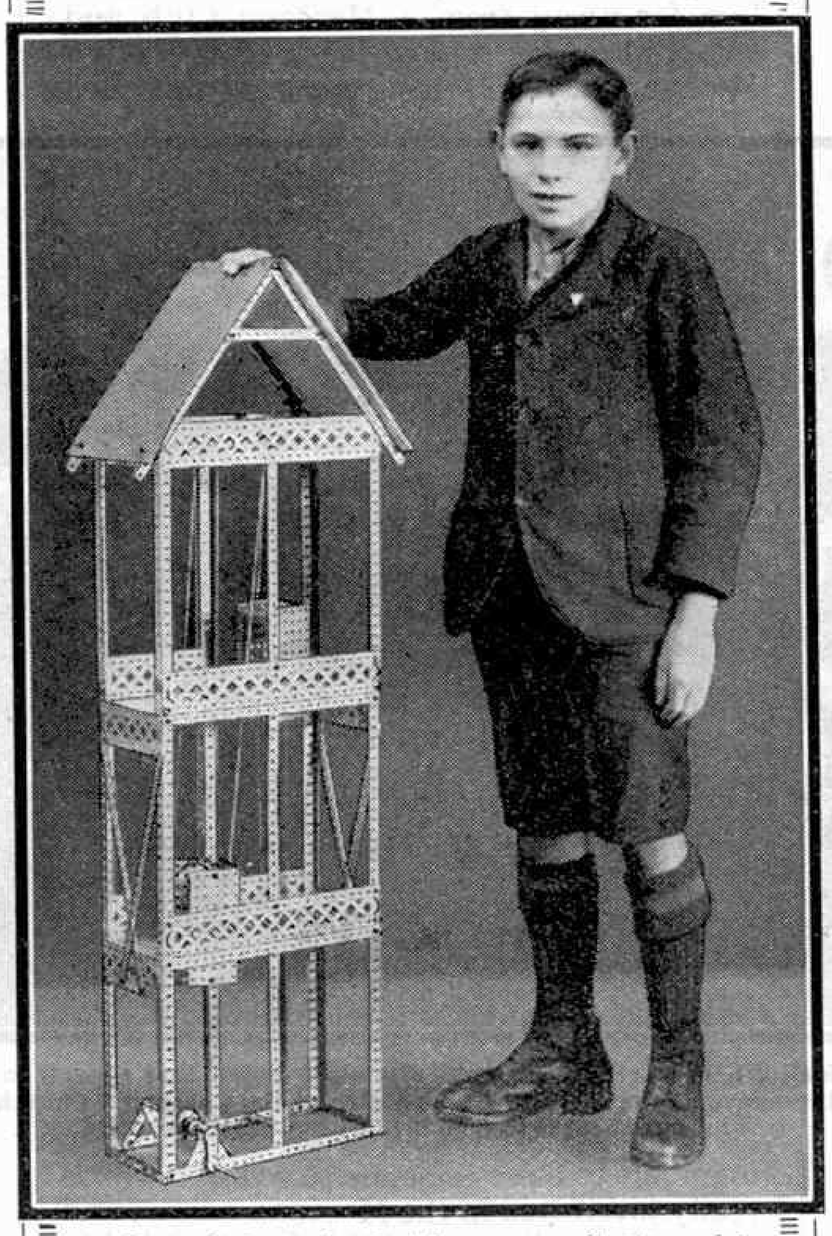


Fig. 1

GREY ENAMEL.—Tins of grey enamel, in addition to the red and green, have already been introduced (see announcement in December "*M.M.*"). (*Reply to R. Cordon, West Bridgford*).

A Clever Model Warehouse



Our photograph depicts an excellent model Warehouse together with its clever young constructor. The model was entered in a Model-building Contest some time ago, but unfortunately the photograph was separated from the covering letter and we are unable to state the builder's name. We should be glad therefore if he will communicate with us.

AN INTERESTING COUPLING.—A Coupling having a square slot in one end and a standard Meccano hole in the other, would doubtless form a solution to the problem of winding the Clockwork Motor in awkward places. We are afraid, however, that the introduction of this part is not a practical consideration, as considerable difficulty would be experienced in tightening up the set screw firmly in the round hole portion of the Coupling in order to withstand the tremendous torque that is set up when the Clockwork Spring is contracted. (*Reply to F. Lawton, Leyland, Lancs.*).

INSULATED PLATE.—We have noted your suggestion that a number of the standard plates should be duplicated in fibre or ebonite. This is an interesting idea and we are giving it careful attention. These plates would of course be found most useful in the Radio Receiving Set described in last month's issue. (*Reply to J. Ager, Isleworth*).

RUBBER TUBING.—Rubber tubing for covering the bare Copper Wire would certainly be useful in many electrical models as the different leads could be efficiently insulated from each other by means of the tubing. We are keeping your idea before us and in the meantime we would suggest that you obtain a length of "Sistoflex" tubing, as this will suit your purpose admirably, and can be obtained from any electrical store. (*Reply to E. J. Myers, Pontiac, Illinois, U.S.A.*).

DUST COVERS.—We have considered carefully your suggestion that thin metal covers should be supplied for completely enclosing the Electric Motors. While we agree that most motors are completely enclosed so as to protect the armature and brushes from dust, etc., we consider that the Meccano Electric Motors are far too sturdily constructed to be affected by these elements, and special covers are therefore unnecessary. (*Reply to E. A. Brendon, Taunton*).

IMPROVED CLOCKWORK MOTOR.—To manufacture the Clockwork Motor with two flanges in a similar manner to the Electric Motor, would be an excellent idea. We are keeping your suggestion in mind and will comment upon it later. (*Reply to M. Driver, Thornton*).

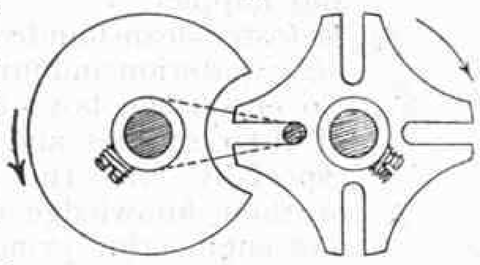
CATERPILLAR TRACK.—Your suggestion that a number of small rectangular plates fitted alternately with hooks and eyes, so that they might be hinged together, for caterpillar track is a most interesting one. You suggest that the centre of each plate should be serrated so that the plates might be rotated by means of Pinions, and we have no doubt that quite a positive drive could be obtained by this means. We will consider your idea carefully. (*Reply to L. Hale, West Bromwich*).

IMPROVED LOADED HOOK.—We were interested to hear that you consider an increase in the adaptability of the Loaded Hook, part No. 57b, would be made if the ring at present attached were fashioned in the shape of a small hook. This would, of course, allow the accessory to be moved rapidly from one cord to another and would also enable it to be fastened to the Sprocket Chain. Your idea is quite sound and we will give it further attention. (*Reply to S. K. O'Hara, Dublin*).

CONICAL DISC.—Some time ago in these columns we asked readers to forward their suggestions as to how a conical disc could be employed in the Meccano system in addition to its use as a disc cover for the Pulley Wheels in model motor cars. Numerous suggestions have been received that conical discs could be used most effectively, in conjunction with a Pulley Wheel fitted with a rubber ring, as a cone clutch. This is an interesting idea, but we would point out that the conical disc, in order that it might be used on the Motor Chassis, would necessarily have to be 3" in diameter, and this would mean that a cone clutch incorporating it would be of rather clumsy dimensions. (*Reply to G. R. Webb, Bishop's Stortford; A. G. Egerton, Buckingham; and others*).

SEPARATE PARTS OF CLOCKWORK MOTOR.—Although the separate components of the Clockwork Motor are not listed in our catalogues, etc., they can be obtained separately on application to our Returns Department. (*Reply to G. A. Walton, Tenuka, New Zealand*).

THAT ELUSIVE SCREWDRIVER!—We have noted your idea that the Screwdrivers and Spanners should be painted in bright colours so that they would be seen easily amongst other Meccano parts. This alteration would doubtless go a long way to help the absent-minded builder in constructing his models but a simpler and more effective method of preventing his tools from always being mislaid, is the following. Tie a length of cord to the Screwdriver or Spanner and to the free end of the cord fasten a Hook (part No. 57). The Hook should then be slipped into a screw eye on the work-table, or may even be attached to the model under construction. In this way the implement can never be lost. (*Reply to A. R. Brown, Wimbledon, London, S.W.*).


Fig. 2

A Brotherhood of Boys

Why You Should Join the Meccano Guild

The really happy boys throughout the world to-day are those who have a hobby in which they take an enthusiastic and lasting interest, and the happiest of all are Meccano boys, for their's is the greatest of all hobbies. When a boy takes up a hobby, whatever it may be, he feels a great desire to meet other boys having interests similar to his own, and to compare notes and talk things over with them. This is particularly the case with Meccano. No Meccano boy is content to "play a lone hand" for long. He very soon wants to meet other Meccano boys, to see their models and to show them his own, and to discuss plans and schemes for other and bigger models.

It is more than 20 years since Meccano began to take its place as the greatest of all hobbies, and even in those early days Meccano boys were forming themselves into little clubs and societies. Presently we at Meccano Headquarters began to receive letters asking us to set up some form of central organisation to which all the individual clubs and societies might look for guidance and which would weld them all into one great body. We realised that the desire for a central organisation was genuine and widespread and felt it our duty to do everything we could to satisfy the demand.

A Unique Brotherhood

So the Meccano Guild, the most remarkable brotherhood of boys in the world, came into being in the year 1919, with Mr. Frank Hornby, the inventor of Meccano, as its President. The announcement of its birth was received with the utmost enthusiasm throughout the great army of Meccano boys of all nations, and applications for membership began to come in immediately in large numbers. Since that time the membership of the Guild has grown enormously, and a special feature of its growth has been its steadiness.

Objects of the Guild

The three objects of the Guild, set forth in the form of application for membership, are as follows:—

(1) To make every boy's life brighter and happier.

(2) To foster clean-mindedness, truthfulness, ambition and initiative in boys.

3) To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

In order to join the Meccano Guild it is necessary for the form of application to be filled up, signed and witnessed. This form is then sent to the Secretary with a remittance to pay for a badge. The applicant is then duly enrolled as a member of the Guild and his badge and membership certificate are sent to him. The neat little triangular badge—its three corners representing the three objects of the Guild—and the handsome certificate are always received with enthusiasm. The price of the Guild badge is 7d., or 1/– if sent overseas.

The Correspondence Club

Although the Guild was originated for the benefit of Meccano Clubs it includes to-day a very large number of "lone" members. In many cases these members live far away from a Meccano Club and sometimes far away from any other Meccano boy. It is a great joy to such members to have someone to write to who is really interested in the Meccano hobby, and it was the realisation of this fact that led to the inauguration of a Guild Correspondence Club. Through the medium of the Correspondence Club boys living in the remotest parts of the world are placed in touch with other boys of their own age and of similar interests.

The "*Meccano Magazine*" is the official organ of the Guild, and each month two or three pages are devoted to Guild matters, including brief reports of club progress. Thus, by its means each club is kept acquainted with the progress of all other clubs.

Every Meccano boy should be a member of the Guild. As soon as he receives his badge and certificate of membership he has the right of entry into the innermost circles of Meccanoland. His pleasure in his hobby is increased enormously and he has the keen satisfaction of knowing that, instead of being an isolated unit, he belongs to a great brotherhood of boys with members in every country in the world.



Meccano clubs include in their programmes practically every hobby that appeals to boys. An instance of this is shown in the above photograph of the orchestra of the Chalmer's Church (Alloa) M.C. This orchestra has performed in public with great success



A Happy New Year!

Once again I have the pleasure of wishing A Happy New Year to the members of the Meccano Guild, and to Meccano clubs in all parts of the world. This year my good wishes will reach a larger number of Meccano boys than ever, for during 1928 the Guild showed wonderful progress and Meccano clubs also were remarkably active. The growing strength of the clubs is in fact the most remarkable feature of the past year, and it is particularly gratifying to note a great increase in the number of clubs that have been established in schools. Without exception clubs of this kind are strong in numbers and the members are full of enthusiasm. Reports of past events and programmes for the future show generally that Leaders and officials have organised their clubs on a very firm basis. In many places an Exhibition or Concert by the Meccano club is now a recognised social event, and the work of the club receives its fair share of notice in the local press.

Good Resolutions

Although progress in 1928 has been satisfactory, I hope to see a record increase in numbers and enthusiasm during 1929. This will follow if every member resolves to add at least one recruit to the growing army of Meccano boys. A great opportunity of starting the good work presents itself at this time of the year, when a very large number of boys have received Meccano Outfits or Hornby Train Sets as Christmas presents, and have thus become eligible for membership of the Guild.

As this is the season for good resolutions, I should like every club member also to make one. This is to make his club better known among his friends, and to show Meccano boys who are not yet club members how much they are missing by not enjoying their hobby in the company of other enthusiasts.

The present time is also very suitable for a general recruiting campaign. I have often suggested schemes for making the advantages of membership known to a wider circle of boys. These usually have proved very successful, but they should

be supplemented by what may be described as "direct action" on the part of the members. In one club this has taken a very interesting and pleasant form. A deputation headed by the Leader called at the homes of a number of boys who were likely to make good members. At every house visited they were greeted very kindly, and their explanation of the aims of the club was received with great interest. Without exception the parents of the boys interviewed were very pleased to find that somebody was willing to take an interest in their sons, and gave them every encouragement to join. The results of the campaign were very satisfactory. Not only were new members added to the club roll, but their parents and friends were convinced that the club was worthy of their support.

An Annual Conference?

Some of my readers may remember that a few years ago I suggested that a conference of Meccano clubs should be held, but for certain reasons this proved impossible. During the past few months I have been interested to receive suggestions from several quarters for a similar conference. Many of the difficulties that arose when I first proposed the scheme have been removed in the meantime, but I should like to have the opinion of Leaders and secretaries before taking any definite steps.

A conference would be useless if it were not fully representative. It has been suggested that the expense of sending delegates would be too heavy for many of the smaller clubs, so that only the larger and more prosperous clubs would benefit. Because of this it seems to me that a better plan might be to arrange local or area conferences. Representatives of the clubs in a large city such as London, for instance, could meet together in order to discuss matters of particular interest to themselves and to make arrangements for joint meetings or Exhibitions. Alternatively, Leaders and secretaries could form themselves into a district council to make plans for the general welfare of the clubs they represent. This has been done in an informal manner in some instances and the resulting co-operation has greatly improved the standing of the clubs concerned. I should like to emphasise the fact that such area conferences are possible also in overseas countries, even where clubs are separated by larger distances.

I think the time has come when these suggestions should be discussed seriously, and I hope the Leaders and secretaries will give me the benefit of their thoughts on them.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:—

ABINGDON—L. E. Carter, 4, Bostock Avenue, Abingdon, Berks.

DERBY—R. Farrow, 50, Arthur Street, Derby.

DUBLIN—J. Conran, 32, Thomas Street, Dublin.

FEDERATED MALAY STATES—Arthur Nunn, 2, Hope Bungalow, Main Road, Taiping, Perak, Federated Malay States.

GLASGOW—A. Clark, 3, Kelvinside Terrace, N. Glasgow.

Affiliated Meccano Clubs:—Second List

Town	Club	Secretary
CREDITON	QUEEN ELIZABETH'S SC. M.C.	A. J. Sprague, Queen Elizabeth's School.
CROMER	CROMER M.C.	C. Carter, " Grenadahr," Holt Road.
CROWLE	CROWLE M.C.	M. Boardman, North Street Stores.
CROYDON	WHITGIFT MIDDLE SCHOOL M.C.	F. T. Brockes, 14, Addiscombe Court Road.
DALMUIR	MORISON MEMORIAL M.C.	G. Gerrard, Yarrow, Montrose St., Clydebank.
DARLINGTON	DARLINGTON M.C.	Mr. W. J. Lawson, 15, Peel Street.
DERBY	MUNICIPAL SEC. SCHOOL M.C.	W. P. Smith, 435, Uttoxeter Road.
DISS	DISS CHURCH M.C.	Mr. W. J. Hunt, 38, Mount Pleasant.
DUBLIN	DUBLIN No. 1 M.C.	Mr. G. Seymour, 48, Eccles Street.
,,	SOUTH DUBLIN M.C.	G. M. Foley, 44, Eaton Square, Terenure.
DUDLEY	DUDLEY M.C.	Mr. A. Darby, 93, Queen's Cross.
EASTBOURNE	MEADS M.C.	A. A. Moore, 7, Rodmill Road.
EASTHAM	EASTHAM M.C.	F. Taylor, Bye-pass Road.
EDINBURGH	EDINBURGH M.C.	G. Wood, 6, Taylor Gardens, Leith.
,,	LOANHEAD M.C.	B. Warnock, R.P. Manse, Loanhead.
EXETER	HEAVITREE M.C.	W. G. Wills, 3, Park Street, Heavitree.
,,	POLSLOE RANGERS M.C.	W. Bastin, 190, Pinhoe Road.
,,	PRIORY ATHLETIC M.C.	A. Willocks, 5, Brunswick Place, Paris Street.
,,	ST. PETER'S & ST. PAUL'S M.C.	Mr. M. C. Hodder, 60, Elmside.
FALMOUTH	ST. THOMAS CHOIR M.C.	E. Williams, 39, Okehampton Road.
,,	FALMOUTH WESLEY M.C.	Mr. J. H. Jordan, Langton Terrace.
FOLKESTONE	SELWOOD HOUSE SCHOOL M.C.	Mr. L. A. Kneebone, Selwood House School.
FRIMLEY GREEN	HARVEY STREET MISSION M.C.	Mr. R. Pope, Rosedene, Capel-le-Ferne.
GALASHIELS	SOUTH FARNBOROUGH M.C.	E. P. Canham, 98, Peabody Road.
GARSTANG	GALASHIELS M.C.	D. Richmond, 58, St. John Street.
GLASGOW	GARSTANG & DISTRICT M.C.	J. T. Berry, Victoria Street.
,,	AUCHINAIRN M.C.	J. Brown, The Grove, Old Auchinairn.
	VICTORIA M.C.	H. C. Thompson, 4, Montgomerie Gardens, Scotstoun.
GRANTHAM	EARLSFIELDS M.C.	H. Stevens, 2, The Grove, Earlsfields.
GRAVESEND	CECIL ROAD M.C.	G. N. Cottle, 53, Cecil Road.
,,	ST. JAMES M.C.	E. Jones, 14, Granville Road.
GREAT BADDOW	GREAT BADDOW M.C.	Mr. J. Pitts, Hills Chantry.
GRIMSBY	GRIMSBY CENTRAL M.C.	L. Yarborough, 387, Cleethorpe Road.
GUILDFORD	GUILDFORD M.C.	J. E. C. Moorey, Mardyke, Shalford Road.
HADLEIGH	MERELANDS M.C.	E. Stroud, Lindsey Vicarage.
HALIFAX	HALIFAX M.C.	C. Walton, 22, Milton Street.
HARROGATE	HARROGATE AND DISTRICT M.C.	Mr. C. Crausaz, 30, Lowther Arcade.
HARTLEPOOL	WEST HARTLEPOOL M.C.	Mr. J. Taylor, 71, Arncliffe Gardens.
HARWICH	HARWICH M.C.	A. E. Ward, Osborne House, Pepys Street.
HERNE BAY	H. B. MECCANO & HOBBIES M.C.	C. W. Russell, 4, Clifton Villas, South Road.
HESSLE	HESSLE M.C.	T. A. Fillingham, Red Lea, Marlborough Av.
HIGH WYCOMBE	ROYAL GRAMMAR SCHOOL M.C.	T. W. Earis, 18, Dashwood Avenue.
HOLBEACH	HOLBEACH WESLEYAN M.C.	W. Clarke, The Tenters.
HOYLAKE	THE LEAS M.C.	J. A. Leathart, The Leas.
HUDDERSFIELD	SKELMANTHORPE M.C.	Mr. R. G. Field, Pilling House.
HULL	HOLY TRINITY CENTRAL M.C.	J. Adams, 2, Mary's Terrace, Porter Street.
,,	MEMORIAL M.C.	P. Jackson, 68, Westbourne Avenue.
ILFORD	SOUTH PARK M.C.	D. Bradford, 26, Guildford Rd., Seven Kings.
ILFRACOMBE	ILFRACOMBE M.C.	R. Trawin, 33, Victoria Road.
IPSWICH	HEMINGSTONE M.C.	Lewis Offord, Post Office, Hemingstone.
JERSEY	ST. LAWRENCE M.C.	J. Langlois, Ville-au-Veslet, St. Lawrence.
KEIGHLEY	LUND PARK M.C.	H. S. Holmes, 56, Manneville Road.
KIDDERMINSTER	WOLVERLEY SCHOOL M.C.	W. F. G. Gadsby, Wolverley School.
KILCREGGAN	GREENOCK ACADEMY M.C.	R. Calder, 73, Brisbane Street.
LARNE	LARNE M.C.	H. Rutherford, Main Street.
LEEDS	HAREHILLS M.C.	R. K. Fourness, 1, Berkeley Street, Harehills.
,,	VICTORIA COUNCIL SCHOOL M.C.	R. Clayton, The Cottage, Osmondthorpe.
LEEK	ST. JAMES M.C.	W. Armstrong, 4, Gaunt Bldgs., Derby St.
LEICESTER	WESTCOTES M.C.	S. Phipps, 292, Narborough Road.
,,	WINCHESTER AVENUE M.C.	E. Ingles, 16, Lambert Road.
,,	WYGGESTON BOYS M.C.	P. H. Kendal, Wyggeston Grammar School.
LETCHWORTH	WESTBURY M.C.	E. Moye, 24, Burnell Rise.
LICHFIELD	LICHFIELD M.C.	W. H. Johnson, 58, Beacon Street.
LIVERPOOL	GARSTON M.C.	R. Hogg, 11, Moss Street, Garston.
,,	LIVERPOOL M.C.	G. Ibbotson, 30, Redvers Drive, Orrell Park.
,,	ST. MARY'S M.C.	F. Joyce, 47, Northdale Road, Wavertree.
LLANDRINDOD WLS.	LLANYRE HALL M.C.	R. Cave-Brown-Cave, Llanyre Hall.
LONDON	BELGRAVIA M.C.	R. A. Woolidge, 29, Rosenthal Road, S.E.6.
,,	BRIXTON HILL M.C.	J. Morton, 17, Ostade Road, S.W.2.
,,	CENTRAL HACKNEY M.C.	H. Michel, 49, Middleton Road, E.8.
,,	CHRIST CHURCH M.C.	R. H. Bentley, 81, Abbey La., Stratford, E.15.
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,,	MALL SCHOOL M.C.	B. S. Harvey, 14, Sandy Lane, Teddington.
,,	MARSH STREET CONWAY M.C.	W. O. Knight, 22, Howard Rd., Church Hill.
,,	MEESON M.C.	A. Baker, 4, Bristol Road, West Ham, E.15.
,,	ST. GEORGE'S M.C.	C. Jerram, 63, Boundary Road, E.13.
,,	ST. MARK'S M.C.	G. C. Green, 21, Hafton Rd., Catford, S.E.6.
,,	STATIONER'S SCHOOL M.C.	G. H. Dunkling, Stationer's School, N.8.
,,	WIMBLEDON M.C.	M. O'Carroll, " Dairin," Drax Av., S.W.20.
,,	WOOLWICH & PLUMSTEAD M.C.	S. Weller, 22, Woodhurst Road, S.E.18.
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LUDLOW	LUDLOW M.C.	A. J. Chester, 8, Castle View.
LUTON	LUTON M.C.	L. Goldsmith, 69, Tennyson Road.
MANCHESTER	BENTCLIFF M.C.	E. Shorrock, 27, Trafalgar Road, Pendleton.
,,	HASLINGDEN M.C.	K. G. Tupling, 16, Alexandra Ter., Rossendale.
,,	PENDLETON M.C.	E. Gibson, 20, Grosvenor Place, Salford.
,,	SALE MOOR M.C.	F. Leigh, Myrtle Croft, Sale Road, Northenden.
,,	SEDGLEY PARK M.C.	W. Robinson, Queens Drive, Sedgley Park.
,,	WITHINGTON KIM M.C.	C. Ball, 45, Davenport Avenue, Withington.
MELTON MOWBRAY	UNITED SCHOOLS M.C.	G. L. Wilson, 11, Cromwell Road, Burton Hill.
MIDDLESBROUGH	MIDDLESBROUGH M.C.	A. Bradley, 95, Deepdale Av., Marton Grove.
NEWCASTLE	NEWCASTLE M.C.	H. Levin, 6, Windsor Street, Byker, Wallsend.
NORWICH	ST. PETER MANCROFT M.C.	L. Oates, Bonfire, Blofield.
NORTHWOOD	NORTHWOOD M.C.	F. Brown, 27, Hallowell Road.
,,	RUISLIP COMMON M.C.	L. Ive, Chestnut House, Ruislip Common.
NOTTINGHAM	NOTTINGHAM Y.M.C.A. M.C.	Mr. E. A. Oldham, Y.M.C.A.
,,	WEST VIEW M.C.	Mr. H. W. R. Cousens, 494, Mansfield Road, Sherwood.
NUNEATON	NUNEATON GRAMMAR SC. M.C.	Mr. A. H. Pyne, King Edward VI School.
,,	ATTLEBOROUGH BAPTIST M.C.	R. Denny, 114, Queens Road.
OBAN	OBAN M.C.	I. MacLean, Hamilton Park Terrace.
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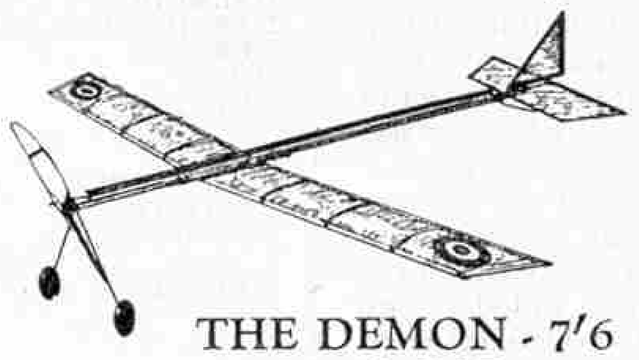


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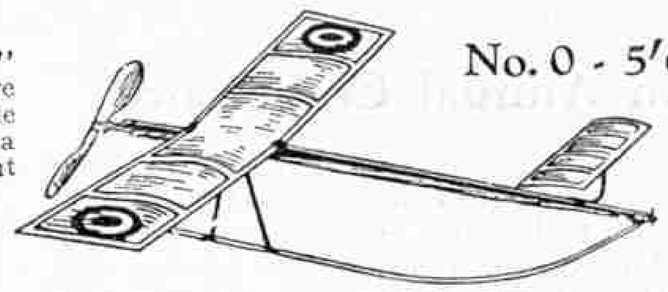
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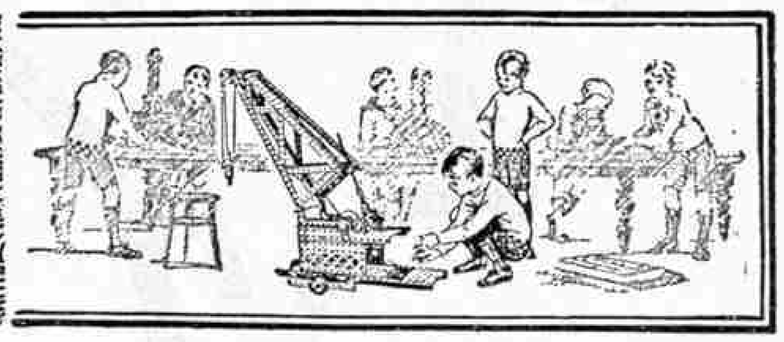
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CLUB NOTES



St. Michael's (Teignmouth) M.C.—Hornby Train Nights are particularly enjoyed by members. Trains are often run on a large track with the room in darkness, thus reproducing night conditions, and signalmen are kept busy. It is expected that every member will join the Hornby Railway Company and a local branch will be formed. Copies of the "*M.M.*" and other interesting literature are always available on club nights. *Secretary*: Donald Harris, 4, Wellington Street, Teignmouth, Devon.

Plymouth M.C.—The excellent programme being followed includes Model-building and Debates. One evening was devoted to the discussion of Motor Transport, illustrated by models of cars and lorries. Interesting Lantern Lectures also have been given, one of the most successful being on "*London's Underground Railway*" The Mayor of Plymouth has been asked to become President of the club. Club roll: 22. *Secretary*: K. Wills, 8, Beechwood Avenue, Mutley, Plymouth.

United Schools (Melton Mowbray) M.C.—Meetings have been very successful and members look forward to club nights with eagerness. A Concert and Social is being arranged in order to raise money for the Summer Outing Fund. Model-building is the chief feature of the syllabus and the Meccano Electric Motor owned by the club is in great demand. Club roll: 24. *Secretary*: G. L. Wilson, 11, Cromwell Road, Burton Hill, Melton Mowbray.

The Leas (Hoylake) M.C.—A most interesting lecture on "*Military Signalling*" was given by Mr. Dealtry, who gave practical demonstrations of methods of fixing telephone and telegraph wires. A film kindly lent by Shell-Mex Limited has been exhibited. The Leader, Mr. Bigland, gave a Lecture on the "*Two-stroke Motor Cycle Engine*" and showed the parts of an engine as illustrations. A novel Competition caused a great deal of fun. Several advertisements were cut up, each into ten pieces, and the fragments put into envelopes marked with the name of the advertiser. Competitors were required to fit them together again. A No. 3 Meccano Outfit has been purchased for club use, and one of the members has presented a Meccano Clockwork Motor. Club roll: 46. *Secretary*: C. Ollerenshaw, The Leas, Hoylake.

Elm Road (Beckenham) M.C.—Is again making good headway. Model-building Nights are well attended and the models constructed show great originality. One evening was spent in building Model Ships, the problem set being how to design bows suitable for large vessels. One member read a most interesting paper on the "*Surrey Iron Railroad.*" Hornby Train Nights are frequently held. Club roll: 21. *Secretary*: C. W. Price, 52, Queen's Road, Beckenham, Kent.

Diss Church M.C.—Fortnightly meetings are held and every third meeting is either a Meccano or Hornby Train Night. An excellent Lantern Lecture on "*London*" was given by the President, Mr. W. Golding. Model-building Competitions have been arranged, in addition to one for the best Hornby Train Layout. The last meeting before Christmas was a Story Evening, and concluded with a very amusing Mock Parliament. Club roll: 32. *Secretary*: Mr. W. J. Hunt, 38, Mount Pleasant, Diss.

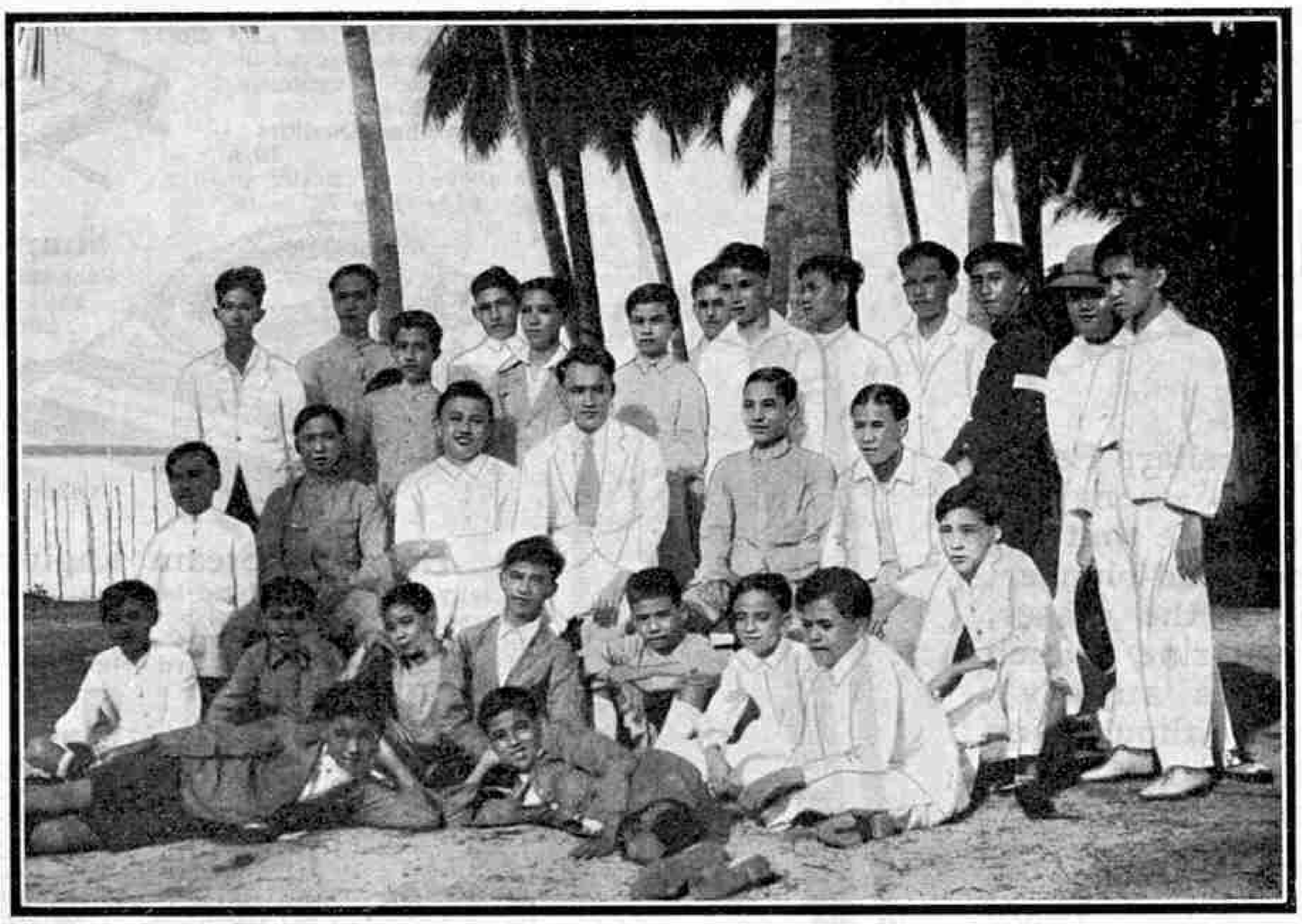
Albion (Portsmouth) M.C.—A large model is being made of the heavy Radial Transporter described on pages 718, 719 of the "*M.M.*" for last September. The members were divided into sections, each of which submitted designs for various parts of the machine. Contracts for the construction were then awarded, and work commenced. Members are greatly interested in this original scheme, and work on the Transporter will continue until it is satisfactorily completed. Club roll: 9. *Secretary*: J. V. L. Kemp, Albion House, Mile End, Portsmouth.

Holy Trinity (Barnsbury) M.C.—The Tenth Annual Exhibition was a great success. Almost every member exhibited an original model and entered for the various competitions that were organised. Models loaned from Headquarters were also on view, and Lott's Bricks Ltd. very kindly lent a few model houses for use in connection with the Electric Railway Layout. The Model-building and Handicrafts Competitions were judged by Mr. Percival Marshall, Editor of the "*Model Engineer.*" An interesting feature was the number of visitors from other Meccano clubs, five of these being represented. Club roll: 50. *Secretary*: Mr. F. W. Johnson, 23, Market Street, Edgeware Road, London, W.2.

Holbeach Wesleyan M.C.—Interest is very keen and several new members have been enrolled. Model-building and Hornby Train Nights appear frequently on the syllabus, and Story Evenings and Lantern Lectures also have been arranged. A Lecture on "*Famous Bridges*" was greatly appreciated and many excellent models of the bridges described have been constructed. Club roll: 18. *Secretary*: W. Cook, Stukeley Road, Holbeach, Lincs.

Galashiels M.C.—The remarkably varied syllabus includes Games Nights, Debates, Lantern Lectures, Surprise Nights and a Whist Drive, in addition to Hornby Train Nights and Model-building Competitions. The club possesses a No. 7 Meccano Outfit, and the Eiffel Tower and Horizontal Engine have been constructed with it. A Lantern also has been purchased and Lectures will now be frequent. The club had a stall at a Market Fair in aid of charity, held in Galashiels Town Hall, and collected £1 5s. 0d. The display of models received very favourable notice in the local press. Club roll: 24. *Secretary*: D. Richmond, 58, St. John Street, Galashiels.

Singapore Chinese M.C.



The Singapore M.C. has the distinction of being the nearest Meccano club to the Equator, which explains the light clothing of the members, and also the palms waving over their heads. This interesting club continues to make good progress under the enthusiastic Leadership of Mr. Choo Teck Hong, who is seen in the centre of the group, and the standard of the models constructed is now very high.

Liverpool M.C.—A club room has now been secured and the enthusiasm of the members runs high. An excellent programme is being arranged, including Model-building Contests for which good prizes will be offered. New members are being enrolled at each meeting, but further recruits will be welcomed. Club roll: 17. *Secretary*: G. Ibbotson, 30, Redvers Drive, Orrell Park.

Lichfield Central School M.C.—In a "Historic Patents Competition" members were required to produce a model of a famous invention in its earliest form. This proved very successful. Games Evenings are frequently held and a Table Tennis Tournament has been decided. Plans for the second Annual Exhibition are now being made. Club roll: 12. *Secretary*: William Johnson, 58, Beacon Street, Lichfield, Staffs.

Halifax M.C.—Members have been very industrious in Model-building, noteworthy models including a Safe and several novel Cranes. On Reading Nights articles from the "*M.M.*" have aroused great interest. Club roll: 20. Leader: H. Ramsbottom, 155, Warley Road, West End, Halifax.

Bentcliff (Pendleton) M.C.—Is unfortunately without a club room, and the secretary will be pleased to hear from anyone who has a room available. The members are very enthusiastic and anxious to get to work. Plans are being discussed by the committee and meetings will be held regularly as soon as possible. Club roll: 17. *Secretary*: E. K. Shorrock, 27, Trafalgar Road. Pendleton, Manchester.

King Edward's High School (Birmingham) M.C.—A Library has been formed and a large Model Railway Track constructed, the parts required having been contributed by members who possess Model Railways of their own. An interesting Paper on "*Iron and Steel*" has been read, and it is hoped to follow this up by a visit to an iron works. A visit to the rubber works of Dunlop Ltd. also is to be arranged. Club roll: 8. *Secretary*: D. H. Lewis, 8, Marchant Road, Bilston, Staffs.

Bridport Grammar School M.C.—A series of interesting Lectures on "*The Motor Car*" has been given by the Leader. Lectures and Model-building Nights alternate with each other. Models built during the last session were judged shortly before Christmas by the local Meccano dealer, who gave prizes for the most original. The prize-winning models and many others were exhibited in the dealer's window. Club roll: 31. *Secretary*: E. Lawrence, 161, St. Andrew's Road, Bridport, Dorset.

Braintree County High School M.C.—Good progress is reported and the members show great keenness in all directions. Points are awarded for punctuality and recruiting, as well as for Model-building. Meetings are held on Saturday mornings and are mostly devoted to Competitions, the Science Master of the school acting as judge. The Leader, Mr. H. McLaren, gave a splendid talk on "*The Motor Car*" Club roll: 16. *Secretary*: E. P. R. Allen, St. Edmunds, Bocking, Braintree, Essex.

3/6

A pencil for boys that is mechanically Perfect!



THE new Eversharp Pencil for boys is so strong and beautifully made that you can remove the lead-plunger, remove the cap for the eraser, open the lead magazine (which contains a year's supply), thousands of times without doing the pencil any harm, and every part is interchangeable!

These Eversharp Pencils only cost 3/6 each and come in bright red or navy blue. You will be proud of your Eversharp—proud to show your friends the way it is made.

What a wonderful opportunity the new term offers to make an Eversharp present to your favourite teacher or best school chum. And there is a smaller sized Eversharp, same model, for sister, or your girl friend.

EVERSHARP

PENS AND PENCILS

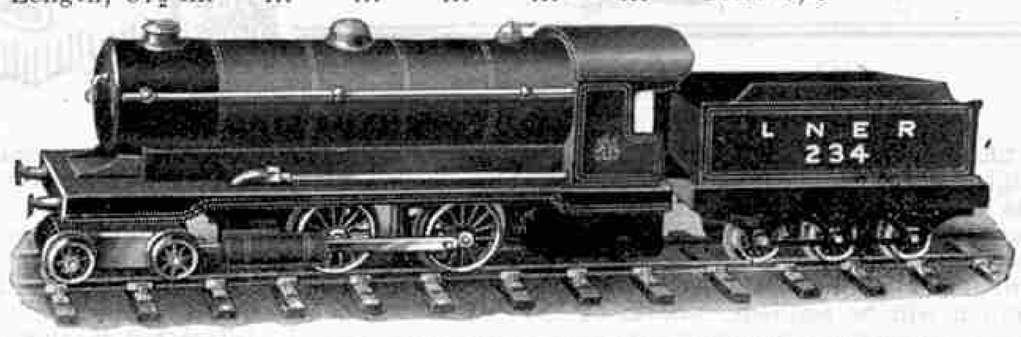
The Wahl-Eversharp Co., Ltd., 197 Gt. Portland Street. London, W. 1.

Suggestions from Treasureland



Daisy Repeater No. 11

Here's a very sturdy, gun-like Rifle with lever action and magazine to hold 350 shots. The single piece steel barrel is highly finished nickel plate, with a stock of black walnut. Length, 31½ in. ... ... Price **9/6**



EXPRESS STEAM LOCO AND TENDER (Mod. 234) 35/- Post Free. The same size and power as usual **£6** models. Solid brass and steel throughout. Drawn brass cylinders and brass pistons ⅜" × ⅞", turned steel bogies and driving wheels. For 2' Rails. Length 1' 8". Weight 5 lbs. The largest "O" gauge on the market. Loco only **27/6.** Pulls six large coaches 1½ miles on a filling. Extra strong rails for this loco **6/-** per dozen.

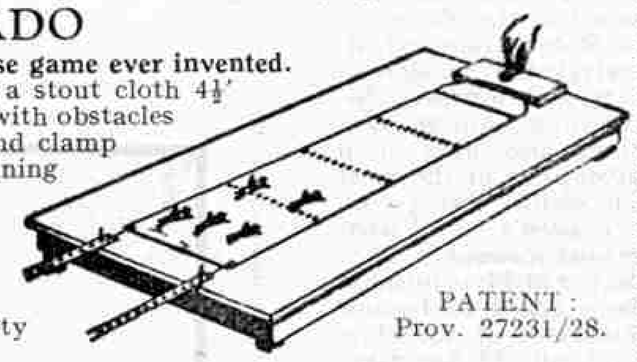
ESCALADO

The most exciting Steeplechase game ever invented. The Race Course comprises a stout cloth 4½' long and 21" wide, provided with obstacles or fences, and with spring and clamp ends adjustable for any dining table. Horses are cut in metal and variously coloured.

Made in Three Qualities :—

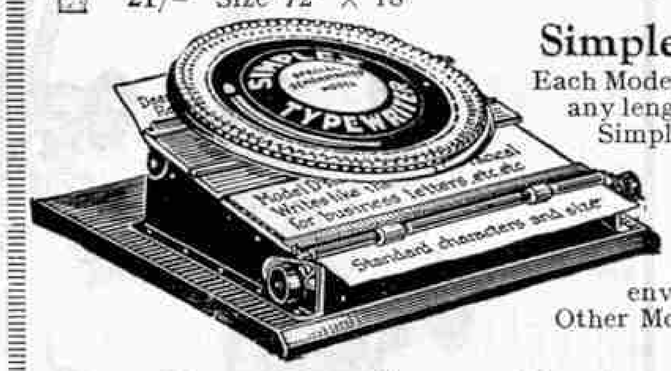
7/6 As above **10/6** Better Quality

21/- Size 72" × 18"



PATENT : Prov. 27231/28.

Simplex Typewriters

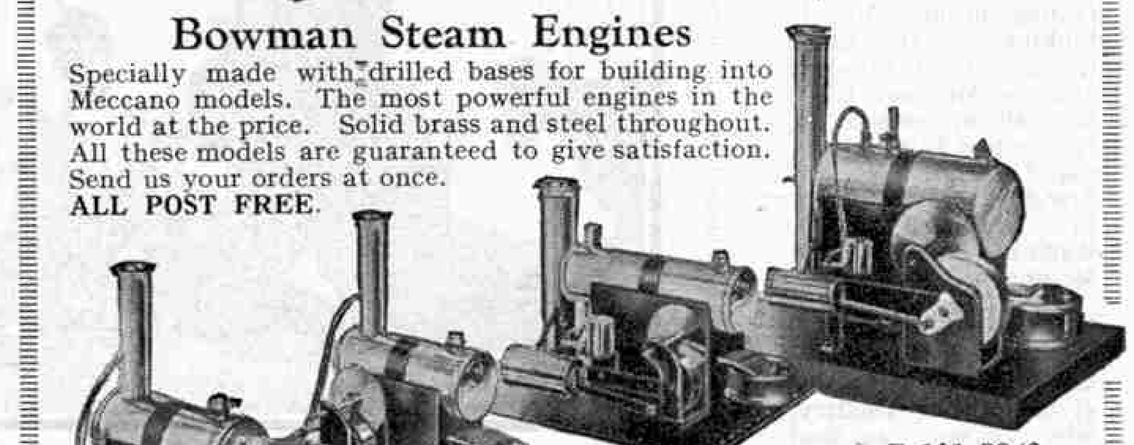


Each Model writes in sight and each takes any length paper, card or envelope. Simplex Model E, 36 characters. Takes 5 inch width paper, card or envelope. Simple and practical for the beginner, for school-work, for home or business uses, addressing envelopes, tags, etc. Price **5/-** Other Models **F 10/-, G 15/-, H 20/-, C 12/6.**

Bowman Steam Engines

Specially made with drilled bases for building into Meccano models. The most powerful engines in the world at the price. Solid brass and steel throughout. All these models are guaranteed to give satisfaction. Send us your orders at once.

ALL POST FREE.



M 167 7/6 6/6 without chimney.

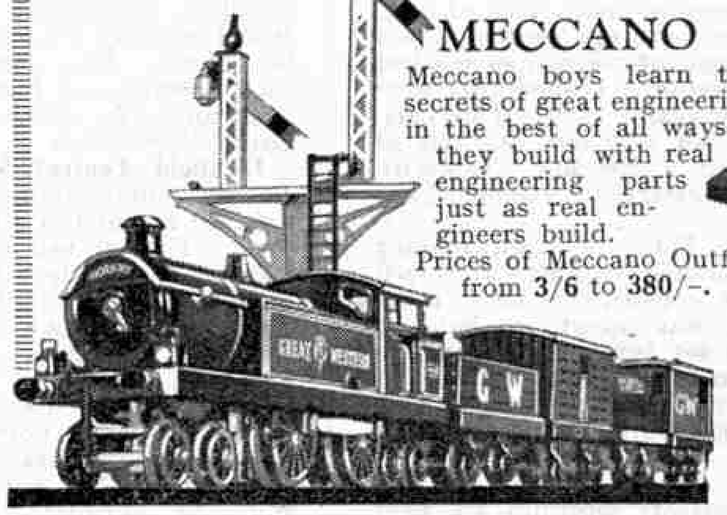
M 158 11/6 10/6 without chimney.

M 135 15/6 2-speed gear.

E 101 32/6 A very massive and powerful model. Weighs 7 lb.

MECCANO

Meccano boys learn the secrets of great engineering in the best of all ways—they build with real engineering parts just as real engineers build. Prices of Meccano Outfits from **3/6** to **380/-**.



Hornby Trains

Only when you've got a real train like the Hornby can you enjoy the fun of running your own railway system. Prices **7/6** to **110/-**

W. H. HULL & SON

NORTH WESTERN ARCADE

BIRMINGHAM

Competition Page

If I Were Not Myself, Whom Would I Like To Be?

Every boy, no matter how contented he may be with his own lot, indulges at times in the really pleasant occupation of building "castles in the air." He dreams of the day when he may become a prominent figure in the business or profession of his choice, and inevitably his mind focusses itself upon some great man who has worked his way to the top and stands prominent among his fellows. With this idea in mind it occurred to us recently that it would be extremely interesting to know who are the men whom the vast army of "*M.M.*" readers regard as heroes in their own particular sphere of activity.

The only way of ascertaining this was to devise a voting contest and for this purpose we give in the panel in the centre of this page a list of twelve famous men who may be regarded as outstanding and representative figures in their own walk of life. The object of the competition is to decide which of these men you would prefer to be if you were not yourself. We look forward to the result with interest.

Aviation	–	**Sir Alan Cobham**
Science	–	**Sir Oliver Lodge**
Motoring	–	**Captain Campbell**
Statesman	–	**Stanley Baldwin**
Railways	–	**Sir Felix Pole**
Royalty	–	**Prince of Wales**
Literature	–	**H. G. Wells**
Cricket	–	**A. P. F. Chapman**
Rugby	–	**R. Cove-Smith**
Navy	–	**Earl Beatty**
Army	–	**Lord Allenby**
Musician	–	**Sir Edward Elgar**

The rules of the contest are very simple. Each competitor is required to set out on a postcard each of two things :—

(1) Which of the men named he would like to be.

(2) Which he considers will be the 12 most popular men in the order of their popularity.

Cash prizes of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors who give the most accurate forecasts of the final order of voting. In addition, there will be a number of consolation prizes.

Entries should be addressed to "Vocation Vote, Meccano Magazine, Old Swan, Liverpool," and must reach this office not later than 31st January. Overseas closing date, 30th April.

No reader may submit more than one entry.

Animal Story Competition

From time to time we receive letters from readers telling us of some incident that has occurred in connection with one of their pet animals. Many of these stories are extremely interesting and we should like to have more of them with a view to publishing a selection of the best for the benefit of all readers. This month therefore we are offering prizes for the best stories concerning pet animals. The competition is not confined to purely domestic animals such as cats and dogs but includes any animal, indoor or outdoor, that can fairly be called a pet. In case any doubt should arise it may be added that this includes birds and fishes. The range of the contest therefore is very wide and we shall hope to receive a big entry.

The prizes will consist of Meccano or Hornby Trains (to be chosen by the winners) to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, for the four best anecdotes in order of merit. Entries should be addressed to "Pets Competition, Meccano Magazine, Binns Road, Liverpool." Closing date, 31st January. Overseas, 30th April.

38th Photographic Contest

Artificial light photography at home is one of the most fascinating branches of a fascinating hobby and this month, probably more than any other, affords excellent opportunities for this work. There are party groups to be taken and Meccano Models or Hornby Railway layouts—constructed from Christmas gifts—to be photographed so that Uncle or Aunt who gave the outfit may see how greatly it is appreciated. There is indeed more than enough to keep the amateur photographer busy at this season.

To encourage readers to try their skill at this branch of photography we offer prizes this month for the best artificial light photographs of (1) A Meccano Model or Hornby Railway Layout, or (2) Any Subject. The two groups will be treated as separate competitions and it should be made clear that any form of lighting is eligible, whether it be gas, electricity, flashpowder or magnesium ribbon. Readers who have not previously tried their hands at artificial light photography will find the article on page 51 very helpful.

Each competition will be divided into the usual two sections, A for those aged 16 and over, B for those under 16. Prizes of photographic material, or Meccano products if preferred, to be chosen by the winners to the value of 10/6 and 5/– respectively, will be awarded to the senders of the two best photographs in each section. Competitors may enter for either or both groups.

Entries should be addressed to "38th Photo Contest, Meccano Magazine, Binns Road, Liverpool, and must be sent to reach this office not later than 31st January. Overseas closing date, 30th April.

COMPETITION RESULTS

HOME

My Favourite Bridge.—First Prizes: Section A, S. T. Wills (Devonport); Section B, A. M. Johnston (Dunstable). Second Prizes: Section A, J. H. Angel (North Finchley, N.12); Section B, A. Davis (Gloucester). Consolation Prizes: R. A. Beatty (Teddington, Middx.); F. Birbeck (Hornsey Rise, N.19); R. K. Boustred (Bowes Park, N.22); E. Jones (Bedford); H. Weaver (Sheffield).

Sketchograms No. 2.—First Prizes: Section A, P. Walbourn (Theydon Bois, Essex); Section B, C. A. Moreton (Bushey, Herts.). Second Prizes: Section A, G. E. Owen (Bristol); Section B, R. J. Blackwell (Cambridge). Consolation Prizes: R. Bowden (Richmond); H. M. Doyle (Liverpool); J. Lee (Wigan); W. D. Marsh (Waterloo); J. W. Percivall (Birmingham); W. Wakeford (Ashbourne); A. Wood (Cleethorpes).

November Painting Competition.—The subject of the November Painting Competition, "Guy Fawkes Night," allowed plenty of scope for the use of vivid colouring, and the majority of the competitors made full use of their liberty. Some wonderful effects were produced with the dazzling contrast of lurid flame, deep blue starry sky, and flashes of yellow that represent exploding fireworks. The successful competitors were :—First Prizes: Section A, H. Henshaw (Bolton); Section B, R. K. Boustred (Bowes Park, N.22). Second Prizes: Section A, S. Howson (Workington); Section B, J. E. Moncrieff (Perth). Consolation Prizes: J. Rodriguez (Maida Vale, W.9); A. Saunders (Walpole, Halesworth); H. Towle (Long Eaton); J. Smith (Kendal).

Initial Sentences.—Considerable difficulty was experienced in judging this competition, for so many excellent sentences were submitted. Several were exceedingly ingenious.

It was, perhaps, inevitable that the letters NBY at the end of the word "Hornby" should suggest the words "Never Beaten Yet" and altogether just over 100 entrants concluded their Hornby sentence with those words. The awards were as follows:—First Prizes: Section A, A. Petrie (Arbroath); Section B, A. J. Tarper (Stroud Green, N.4). Second Prizes: Section A, R. Tidder (Plaistow, E.13); Section B, A. R. Gill (Birmingham). Consolation Prizes: J. Rodriguez (Maida Vale, W.9); G. Sproit (Dagenham); H. V. Morgan (Bath); A. Byford (Hyde Park, W.2); G. W. Young (Elham).

Famous Trains Voting Contest.—As the Overseas section of this contest is still open the result is withheld. No boy succeeded in accurately forecasting the final order of voting but the winner had a 90 per cent. correct entry, and was closely followed by the remainder of the prizewinners whose names are as follows:—1. G. Hollway (Rosyth), 2. A. G. Williamson (Coatbridge), 3. R. W. Lotinga (Birmingham), 4. J. E. Moncrieff (Perth). Consolation Prizes: A. Brown (Glasgow); O. P. Dinnick (London, S.W.7); A. McKerrell (Portobello, Midlothian); E. Parker (Liverpool); L. White (Clapton, E.5).

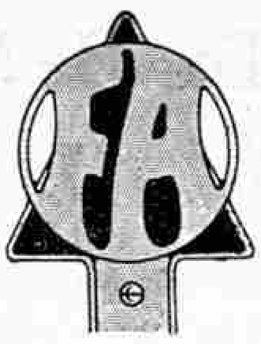
OVERSEAS

Sketchograms No. 1.—First Prizes: Section A, G. Bettesworth (Camps Bay, S.A.); Section B, J. D. Wilson (Johannesburg, S.A.). Second Prizes: Section A, S. F. Desai (Navsari, India); Section B, G. Brown (Taranaki, N.Z.); A. J. McPherson (Western Australia); Wm. D. Nicoll (New Plymouth, N.Z.); D. Shores (Winnipeg, Canada); D. A. Walker (Temuka, N.Z.).

34th Photographic Contest.—The Prizewinners were:—First Prizes: Section A, F. Van Bulck (Paris); Section B, N. Eustis (Alberton, South Australia). Second Prizes: Section A, M. A. Frith (Winnipeg, Canada); Section B, C. A. Fisher (Winnipeg, Canada). Consolation Prize: Section A, F Worthington (S. Vancouver, B.C.).

The No. 8 Fairycycle

REGD TRADE MARK



"Fairycycle" Association

All "Fairycycle" owners are eligible for membership without fee. Every "Fairycycle" has a badge attached. The membership forms, which are given with every "Fairycycle," should be filled up and sent to Lines Bros. Ltd.



"Fairycycles"

are obtainable from all high-class Toy Dealers everywhere. If you are interested in model Motor Cars, Cranes, etc., ask for free folder illustrated in colours.

Fun on a "Fairycycle"

CHAPTER FIVE

One evening during the holidays, Johnny's big brother Ralph (who is a Scout Master) and Johnny's Uncle Henry (who was a major in the Indian Army) came into the garden to Johnny and his friends and said : "Boys, would you like to play in an interesting battle called the "Relief of Calcutta ?"

All the boys shouted "Yes-yes," and gathered around to hear Uncle Henry's plan.

"Now boys," said Uncle Henry, "let's imagine St. Peter's Square, which is a quarter-of-a mile away, as the Indian City of Calcutta where hundreds of British soldiers and white women and babies are besieged by native soldiery."

"Six of you will be the Indian soldiers and the other six British soldiers. I will be in charge of the natives and Ralph will head the British."

"Now the object is to relieve Calcutta. I shall hide my native soldiers in streets between here and St. Peter's Square. Ralph will send one of his army out every five minutes. If anyone succeeds in reaching St. Peter's Square his side will have won the battle.

Then Uncle Henry took his six native soldiers and placed them behind his friends garden gates and told each to depend on his ears. "No one," he said, "can approach you without noise, for the road and pathway are of gravel. When steps are heard be ready to spring out."

Johnny was very proud. He remained in the garden listening to brother Ralph's instructions ; and he meant to do his best to save the mothers and babies.

Brother Ralph sent off his first soldier by the shortest cut, telling him to run as fast as he could.

But the soldier never came back.

So Ralph sent another telling him to creep along quietly by the garden walls.

But the soldier never came back.

So Ralph disguised a soldier as a grocer's boy and told him to go along whistling in the middle of the road.

But the soldier never returned.

And so it continued till Johnny was the only British soldier left.

Johnny was all excitement. But his big brother Ralph was in despair. "Oh dear, Johnny," said he, "I don't think a British soldier can get to Calcutta after all. You see it requires absolute silence and rapid speed. Can you suggest how we can combine them ?"

Then Johnny jumped up into the air.

"Of course !" he said. "Those are the very things for which my "Fairycycle" is noted. Please let me try on that."

Johnny set off. Silent and swift as a hare he moved along under the tall red walls ; one street, two streets, three streets he crept quietly along until he was in sight of the square ; when alas, a lady came out of a gate, and called out "Good evening, Johnny," and up jumped Peter Perkins from behind Mr. Ferguson's gate and dashed after Johnny. Oh ! how Johnny flew ! (Did you ever see a "Fairycycle" at top speed ?) Peter ran his hardest but he was outdistanced, and Calcutta was saved.

"Well done Johnny, well done !" said Uncle Henry. "You are the only one who has reached me. My first soldiers seem neither to have seen nor heard you. Have you a fairy godmother ?"

"Oh no," said Johnny, "but I have a "Fairycycle."

"Johnny, my boy," said Uncle Henry, "if I was Commander-in-chief in India, I'd equip the whole dashed army with "Fairycycles."

"A Topping Present"

It Has Real Dunlop Balloon Tyres

SPECIFICATION

(No. 8 Model)

The illustration above is of the No. 8 model. It has real Dunlop Balloon pneumatic Tyres, with $2\frac{1}{4}$" buttressed treads, special tubular forks, large domed mudguards, chain guard, stand and carrier. Ball bearings throughout, plated rims and rim brake. Finished Black, Orange or Blue. Price 87/6

OTHER MODELS

No. 1, with tangent spoke wheels, $\frac{7}{8}$" ribbed tyres, stand and carrier	39/6
No. 2, with stand and carrier, $\frac{7}{8}$" ribbed tyres, rim brake, upturned handlebars, tangent spoke wheels	49/6
No. 3, De Luxe Model, with ball bearing wheels, 1" ribbed tyres, plated rims, etc.	59/6
No. 4, Super "Fairycycle" with ball bearings throughout and spring saddle, 1" cushion tyres	65/-
No. 6, Senior Model with 16" wheels, 1" ribbed tyres, ball bearings throughout	70/-
No. 7, as Model 6, but with 16" × $1\frac{3}{8}$" pneumatic tyres	75/-

L. BROS. LTD. LONDON BROS. ENGLAND

Regd. Trade Mark.

The Red Triangle Trade Mark on the "head" makes a genuine "FAIRYCYCLE" easily distinguishable.

"Fairycycles" are made by

LINES BROS. LTD.

114, Morden Rd., Merton, S.W.19



Fireside Fun

A GARDENER'S TALE

Two amateur gardeners were coming to town one morning.

"Say, Bill," said one, "what's good to kill slugs? They are eating up all my radishes."

"That's easy," said the other. "Get a couple of bags of salt and sprinkle it in between the rows."

The next morning the two met again.

"How did the salt work?" Bill asked.

"It didn't," replied the other. "When I went out to look at the garden this morning the slugs were pulling up the radishes, dipping them in the salt, and eating them."

* * * *

Vicar: "I was surprised to see your husband leave the church in the middle of my sermon on Sunday morning, Mrs. Jones!"

Mrs. Jones: "You must excuse him, sir, he often walks in his sleep."

* * * *

Barber: "Will you have anything on your face when I've finished?"

Victim: "I don't know, but I hope you'll at least leave my nose."

* * * *

Doctor: "I've left you some pills to take after meals."

Patient: "I suppose you couldn't leave me the meals to take before the pills, doctor?"

* * * *

Coloured Soldier: "I'd lahk to have a new pair o' shoes, sur!"

Sergeant: "Are you sure your old shoes are worn out?"

Coloured Soldier: "Worn out! Man, the bottums of mah shoes are so thin Ah can step on a penny and tell whether it's heads or tails!"

* * * *

PAYMENT IN ADVANCE

"What are you thrashing your little son for?"

"He will get his school report to-morrow, and I must go away to-night."

* * * *

A man hurrying to his office bumped into an acquaintance of his who lived in another part of the country. "Hullo," he said, "what motive brought you here?"

"A locomotive," replied his friend.

* * * *

REAL LION TAMING



A notorious boaster was silenced by a little man, who said: "I'm afraid I haven't much to relate. I once had a nasty time in Africa. A lion sprang out at me and I was unarmed."

"What on earth did you do?" asked his hearers.

"Oh, I just seized his upper jaw with my right hand and his lower jaw with my left, and held his mouth open till he starved."

THE TASKMASTER

Teacher: "Napoleon once said that there was no such word as 'can't.'"

Voice from the back of the class: "Please, Miss, I wonder what he would have said if he had tried to strike a match on a piece of soap!"

* * * *

Police Sergeant (to Loiterer): "We don't get these stripes for hanging about street corners, you know."

Urchin: "No, if you did you'd look like a bloomin' zebra by now."

* * * *

THE MANAGER'S PRIVILEGE!



The manager had reason to interview his office boy for arriving late. The office boy, as so frequently happens, resented the reproof and forgot his position.

"What I'd like to know," said the youngster, "is whether I get here later than you."

"That's nothing to do with the question," replied the chief.

"Yes it has," muttered the boy.

The manager's ire was aroused.

"Look here, young man, are you the manager of this business?" he said.

The boy felt his position was growing dangerous.

"No, sir."

"Then," replied the chief, "why on earth are you talking like an idiot?"

* * * *

A gang of navvies were at work on a deep trench during road-mending operations. There was a Scotch foreman on the job, and he was far from popular on account of his hustle and keenness.

"Jump oot of that trench, there!" he suddenly ordered an Irish navvy, and the latter did so.

"Noo jump back again!" said the foreman, and back went the Irishman.

"Oot-again-quick!" exclaimed the foreman.

This out-and-in performance went on for some time until the Irishman, exasperated, asked what it was all about.

"Well, if you want to know," said the foreman, "I'll tell ye. Yer bringing mair muck oot on yer boots than ye've done wi' yer spade for the last hour."

* * * *

The old traveller had returned to his native village, and was gazing round with sad eyes when he saw a small, rosy-cheeked lad coming towards him.

"Ah, a new face, I see!" he exclaimed.

"No, it's not, sir," was the prompt reply. "It's just been washed—that's all!"

* * * *

Policeman: "Now, then, come on. What's your name?"

Speed Fiend: "Demetrius Aloysius Fortescue."

Policeman: "None o' that now. It's your name I want, not the family motto."

* * * *

Tourist: "To what do you attribute your great age?"

Oldest Inhabitant: "I don't know yet, there's several o' them patent medicine companies bargaining with me."

* * * *

An insurance official has just died, aged 82, leaving a fortune of £150,000, due entirely to strict attention to his duties, a never-failing desire to oblige his corporation's clients, his endless patience in trying circumstances, his ever-readiness to work early and late, and a bequest of £149,950 from an uncle in Australia. (*Licenses and General Quarterly Review.*)

THE LULLABY

For a full half-hour the after-dinner speaker had been on his feet. There were signs that he was becoming exhausted; the patience of his listeners was exhausted long ago.

"Speaking is nothing to me," he boasted, and hoping to raise a laugh he added, "Why, as a boy I used to talk in my sleep."

"And now," a drowsy voice at the far end of the room was heard to exclaim, "you talk in ours."

* * * *

Elsie (after first day at new school): "Our teacher's not very clever."

Mother: "What makes you think that?"

Elsie: "Well, I showed her my dictation, but she couldn't read my writing, although she tried ever so hard."

* * * *

Teacher (after science lesson): "Now John Smith, can you give me a definition of mercury?"

Smith: "Yes, sir. Mercury is a solid liquid!"

* * * *

"I know a man who looks so much like you that one could scarcely tell you apart."

"You haven't paid him that fiver I lent you three months ago, have you?"

* * * *

Sloan: "Did you ever meet a fellow down there with one leg named Sanders?"

Doan (pondering): "What was the name of the other leg?"

* * * *

Beryl had pleaded for an ice-cream. "No dear, it's too cold for ice-cream now," said mother.

"Well," replied Beryl, "I can put my coat on, mummie."

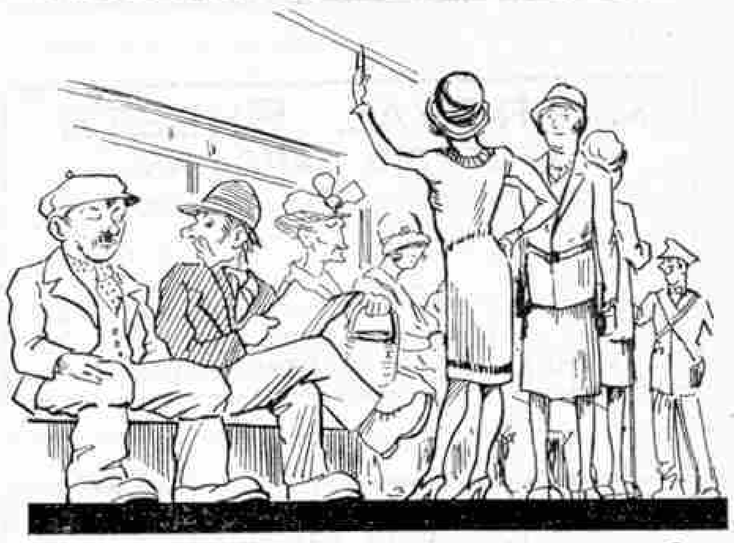
* * * *

Visitor to lunatic asylum: "I say, is that clock right?"

Inmate: "It can't be, or it wouldn't be here."

* * * *

COULDN'T BEAR THE SIGHT!



Two men were seated in a crowded tramcar. One noticed that the other had his eyes closed.

"Say, Bill, ain't you well?" he said.

"I'm all right," replied Bill, "but I do 'ate to see ladies standin'!"

* * * *

"What made the teacher so angry?" asked Johnnie's father.

"Oh!" said Johnnie, "he was talking about trees, and I asked him if he had ever seen a pink palm. He said 'No,' and I showed him my hand!"

* * * *

Proud parent who served in the war: "What I've told you my boy, is the story of the Great War."

Son: "But, papa, what did they need the rest of the army for?"

* * * *

The Maid (at the telephone): "Oh, mum, do come home. I've mixed up the terminuses. The wireless is all covered with frost, and the electric refrigerator is singing 'Constantinople.'"

* * * *

First Landlady: "I keep my lodgers longer than you do."

Second Landlady: "No, you don't; but they're so thin they look longer."

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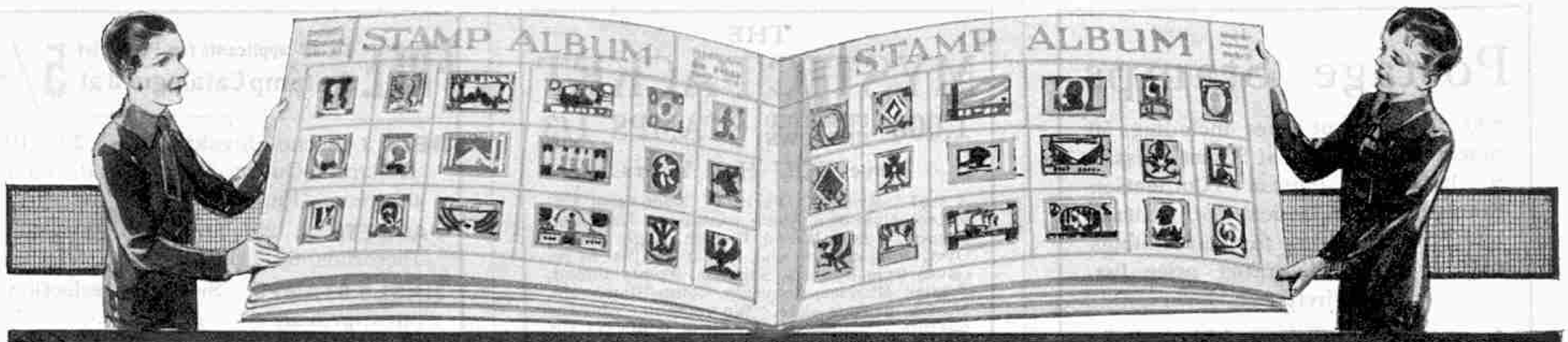
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STAMP COLLECTING

ENGINEERING STAMPS (II): BRIDGES

IN our last article we drew attention to the very strong engineering interest that can be found in a stamp collection. The subject was dealt with then in a general way but, as we suggested, several of the specialised subjects offer interesting scope for an article to themselves. This month, therefore, we propose to examine several specimens of bridge stamps.



The earliest bridges constructed by our ancestors would consist of the trunk of a tree or a slab of stone thrown across a narrow stream, the choice of material depending upon its easy availability. Still another primitive form of bridge that was employed in tropical countries consisted of a kind of rope formed of strong creepers.

Such bridges, were, of course, only suitable for narrow streams and light traffic and by degrees longer bridges were evolved, the principle of which might be described as huge stepping stones planted in the river bed and surmounted by tree trunks or slabs of stone. Bridges of this type gradually developed into the girder bridge, while the primitive bridge of creepers led to the evolution of suspension spans. The arch bridge is of great antiquity but the origin of the arch itself is unknown. The Egyptians employed bridges of this type and the Romans were quite successful in arch-building. The history of bridge-building is, in fact, full of interest, and stamps depicting bridges are therefore well worth the attention of all collectors. Fortunately, few of the specimens are expensive.



It is not possible to trace the actual development of bridge building with the aid of stamps, because the designs used are almost solely drawn from modern structures. An interesting illustration of primitive suspension bridge building is to be found on the higher values of the current Cameroons (French Colonial) issue. The structure consists of wooden logs bound with ropes of vegetable fibres, probably creepers or vines, to form the deck, with stronger cables of similar material leading from the towers to take the weight of the bridge. It is interesting to compare this primitive bridge with the great modern suspension bridge at Paucartambo, Peru, which is shown on the 1c. denomination of the Peruvian 1897 Postal Building commemorative issue.





Several of the bridge stamps that have made their appearance depict bridges that are not either distinctive or famous, but these designs serve a useful purpose as illustrations of types. For example, we have the arch bridge with a central suspended span across the Rio Lempa, the principal river in Salvador, shown on the 6c. value of the 1924 issue from that country. This bridge is specially interesting as a prototype of the great bridge that is being thrown across Sydney Harbour, which will be the largest arch bridge in the world, with a total span of 3,770 ft. Readers of the *"M.M."* are already familiar with the details of the Sydney Bridge.



Strangely enough, our next illustration, the 20 para. value of the Turkish postal dues 1926 issue, depicting a girder railway bridge crossing the Kizil-Irmak in Asia Minor, displays excellently the design of another great Australian bridge, which spans the Hawkesbury River in New South Wales. As the stamp shows, the bridge consists of simple trussed girders laid over stone piers. In the Hawkesbury bridge there are seven spans between piers, each approximately 416 ft. in length. The Australian bridge, like the Kizil-Irmak bridge, is for railway work, and connects the two railway systems of New South Wales.

The pontoon bridge illustrated on the 5 bani value of the Roumania 1914 issue, commemorating the re-acquisition of Silistria, is a typical example of a military bridge. The design shows the Roumanian army marching over the bridge in the course of their victorious campaign. It will be seen that the bridge has been formed by anchoring boats in midstream and laying planking across from boat to boat. The principle has been employed right through the ages, and there are records of the passage of the army of Darius Hystapes, 600,000 strong, across the Bosphorus about 530 B.C. The pontoon bridge in that instance was 3,000 ft. in length! An even earlier record is mentioned by Homer, who tells of a pontoon bridge constructed in 800 B.C. by Cyrus, King of the Persians. In this instance stuffed skins were used as floats!

Pontoon bridges are not necessarily temporary affairs, neither are they designed solely for light traffic. At several places in America railways cross rivers by means of such bridges, using big water-tight tanks as floats. Nearer home, on the River Mersey, pontoon bridges carry the cross river traffic from the river banks to the landing stages, which are themselves floated on pontoons.

Among the most interesting of our bridge stamps is the 5c. value of the U.S.A. 1901 issue in commemoration of the Pan-American Exhibition at Buffalo, which was also illustrated last month. This stamp shows the Niagara-Clifton steel centre arch bridge spanning the river 1,000 ft. below the Niagara Falls. This bridge is the third to occupy the same site, and was opened in August, 1893, to replace a suspension bridge that had stood for 40 years. The present bridge crosses the gorge at a height of 190 ft. above the water. The deck or floor of the bridge (*Continued on page 79*)



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9, AUDLEY ROAD, FOLKESTONE, KENT.

4/- WORTH SUPERIOR STAMPS FREE Have **YOU** responded to my offer which appeared in "*M.M.*" for December? If you haven't yet secured your specimen, better send a P.C. to-day and make sure of receiving A FINE CORONATION PERSIA—HIGH VALUE—(Catalogued at 1/6)—FREE AND POST FREE.
Ask for my Approvals. Enclose 2d. for postage (Abroad 4d.) and in addition I will send a packet of select **BRITISH COLONIALS,** worth 2/6.
L. STUART, 15, The Crescent, Highbury, Bath.

Stamp Collecting—(*continued from page 77*)

is 47 ft. in width and carries two car tracks. It has a total span of 1,240 ft.

The 1 franc denomination of the French Somali Coast issue of 1915 illustrates a typical trestle bridge. These bridges are employed for short spans in well-wooded mountainous areas where considerable difficulty and heavy expense would be encountered in transporting into position material for other types of bridges. An abundant supply of big timber—a natural bridge-building material—being easily accessible, the popularity of the trestle



bridge in Canada and the United States is readily understood. The frequency with which such bridges are encountered makes them almost a national feature of the two great North American countries.

Our remaining illustration shows the 10c. stamp of Panama's 1915 issue, on which is depicted the suspension bridge that spans the famous Culebra Cut on the Panama Canal.

Although in the space at our disposal this month it is impossible to illustrate or describe in detail all the bridges that appear on stamps, there are several others besides those we have illustrated that are well worth inclusion in a bridge stamp collection. Probably the most interesting of these is the $2 value of the U.S.A. trans-Mississippi Exposition commemorative issue that made its appearance in 1896. This stamp shows the St. Louis bridge across the Mississippi, and is the highest value in the set.

The St. Louis bridge is particularly interesting because its construction marked what might be termed the commencement of the era of the steel bridge. Although



steel had been used in bridge-building prior to 1867, the year in which the St. Louis bridge was commenced, nothing extensive had been attempted. The total span of this bridge is 1,700 ft., including approaches, and it has three main arches crossing the river, the centre one being 520 ft. in length and those on either side 502 ft. The bridge has two decks, the lower carrying a double railway track and the upper a roadway 54 ft. in width for vehicular traffic and pedestrians.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with this article have been prepared.

Stamp Gossip

New Japanese Commemorative

The recent enthronement of the new Emperor of Japan has provided the occasion for the issue of another of Japan's popular commemorative sets. We are indebted to Mr. K. Yoshida, of Tokyo, for the specimen of the 1½ sen value of the new series that we illustrate here. The set consists of four values, 1½, 3, 6 and 10 sen.



Mr. Yoshida comments on the recent reports of the "crowning" of the new Emperor thus:—"There is no crowning in our enthronement ceremonies. I suppose the Emperor does not need it. He just stands before what you call "urns" and declares himself as formally enthroned by his own right."

* * * *

Filiberto Commemoratives

In joint commemoration of the fourth centenary of Emanuele Filiberto of Savoia and of the tenth anniversary of the signing of the Armistice in the great European War, Italy recently issued a new commemorative set as an addition to the earlier Turin Exhibition set. The new set has four values, 50c., 75c., 11.75c., and 10 lire.

Emanuele Filiberto of Savoia was the famous hero of the battle of St. Quentin, in Flanders, where the French army was defeated by the Spanish troops. The date of the battle of St. Quentin was the 10th of August, 1557.

Filiberto by his military and political merits succeeded in restoring the fortunes of the Savoia dynasty after a period of about 30 years of foreign domination. He subsequently transferred the capital of his territory from Chambery to Turin and adopted the Italian language as the official tongue of his State. He was a very clever and wise prince and succeeded in governing pacifically, though he is known as the originator of modern military organisation. He was popularly called the prince "Testa di Ferro" or "Iron Head" and is considered as "the providential second founder of the Monarchy of Savoia."

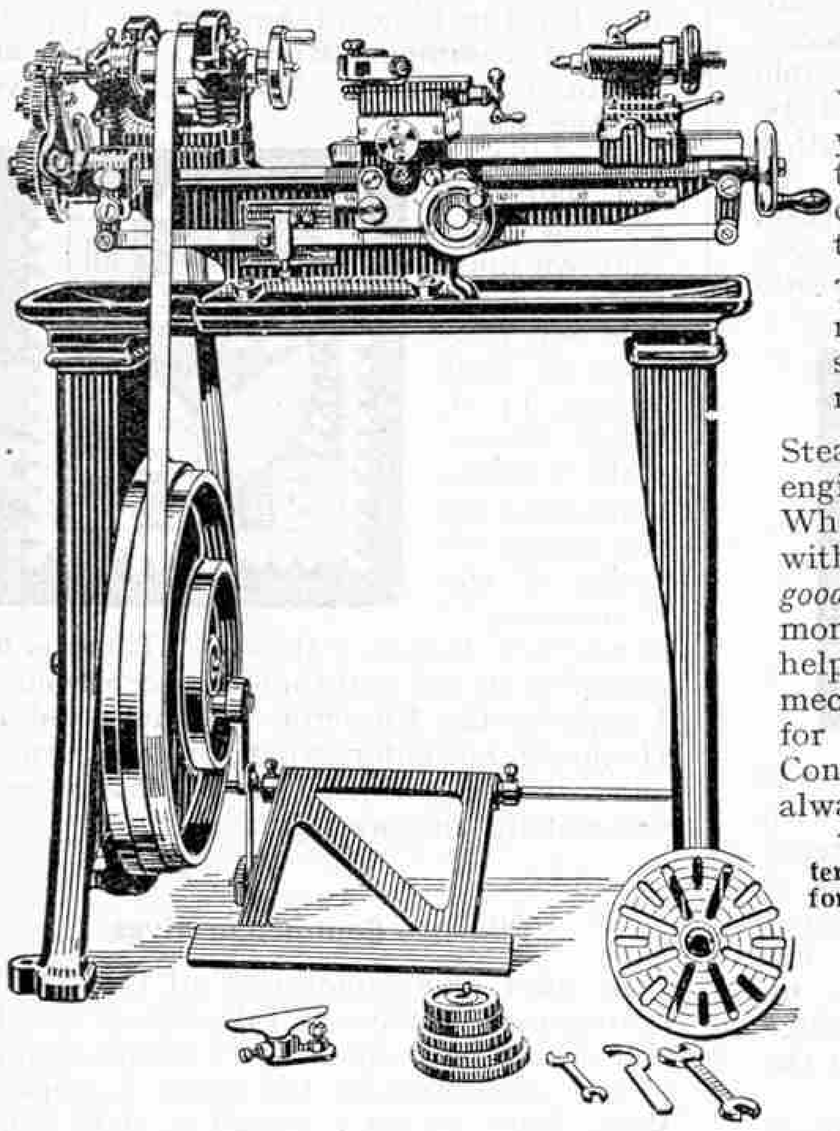


* * * *

The highest price ever paid by a philatelist for a single postage stamp is £7,000. This huge sum was paid by an American collector, Mr. Arthur Hind, who purchased a copy of a British Guiana 1856 one cent, black on magenta. There is only one copy of this stamp in existence and it was purchased when a famous collection was recently put on auction in Paris.

Own a fine Drummond Lathe

Make real scale models on proper engineering lines.



The Drummond 3½-inch Treadle Lathe. Opposite, the Lathe is shown at work on a casting held between centres.

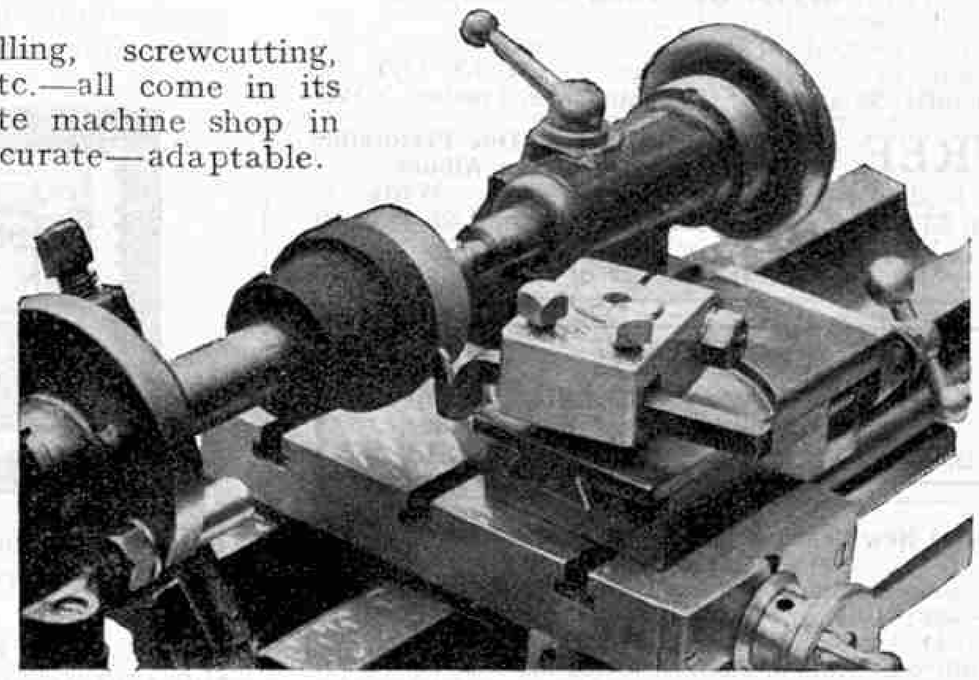
The lathe makes a workshop. You can muddle along without one, but for real, engineer-made models, a lathe is essential.

You can be proud of your Drummond—it's a tool you can enthuse about. It can be your very valuable assistant, too. There is no sense in spending all your time and trouble pottering about without proper tools—get a good lathe to start with, and you can use your skill to best advantage. The Drummond will see you through the trickiest job.

Turning, boring, drilling, screwcutting, milling, coil-winding, etc.—all come in its scope. It is a complete machine shop in miniature! Strong—accurate—adaptable.

Steam engines, petrol engines, cranes, locos! What a field you can cover with a lathe! But get a *good* lathe. The Drummond lathes have been helping thousands of mechanics to do good work for twenty-four years. Continually improved—always the best obtainable.

Why not get our interesting lists with full information? Sent post free.



Please send me lists of your 4-in. and 3½-in. lathes and copy of booklet "Lathe Work," post free.
(Please print distinctly. If without letter, send unsealed, for ½d.

Post this Coupon

To **DRUMMOND Bros. Ltd., East Hill, Guildford.**

Name.....

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Let the Electric Light Drive your Hornby Train

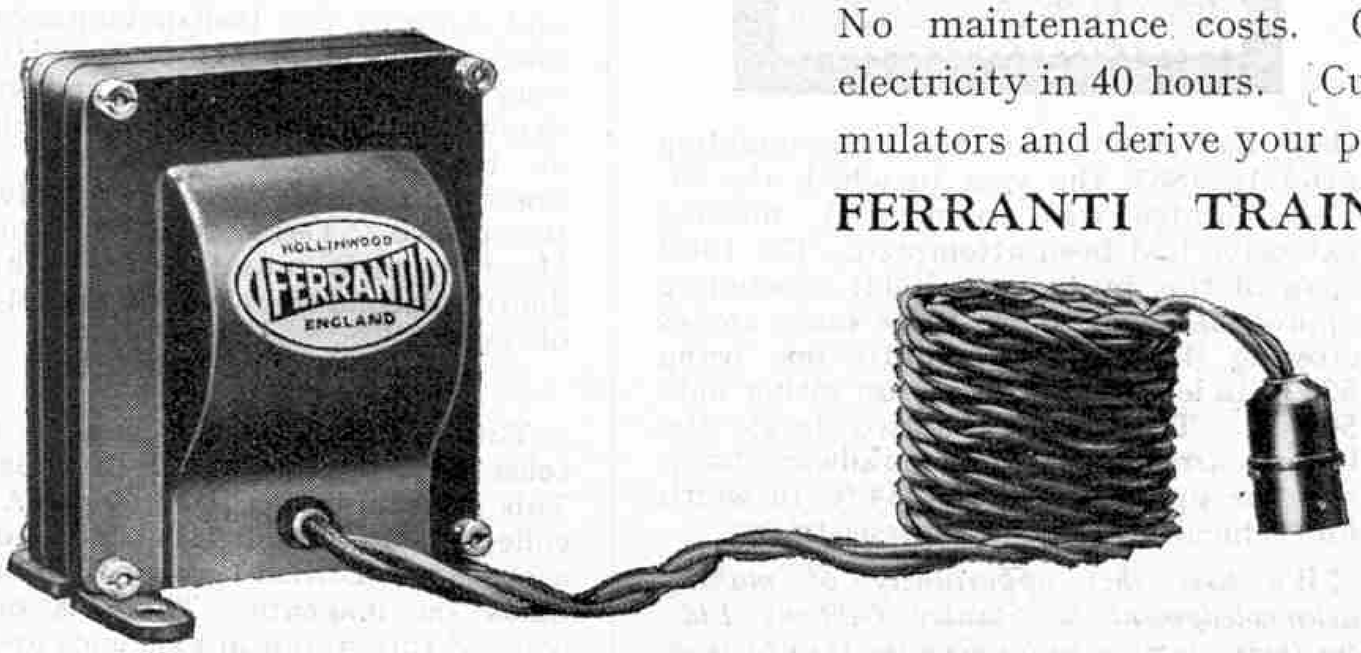
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Simple, safe, nothing to get out of order

No maintenance costs. Consumption: 1 unit of electricity in 40 hours. Cut out the nuisance of accumulators and derive your power from the mains with a

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FERRANTI LTD.
HOLLINWOOD
LANCASHIRE

Scientific Apparatus in Meccano

(*Continued from page 41*)

is the framework holding the lamp bulb; as will be seen this consists of two square end pieces composed of 3″ Angle Girders bolted together. The support for the lamp holder may consist of either a piece of stout cardboard on tin plate having a hole cut in it sufficiently large to admit the screwed portion of the holder. Wires from the two poles of the holder are taken to terminals bolted to, but insulated from the frame.

The objective taken from the microscope is held between two pieces of stout cardboard or sheet tin 8. These are secured by 2½″ Strips that are bolted to short Angle Girders which, in turn, are secured to two 5½″ Strips. These Strips are bolted at one end to the framework holding the lamp and at the other end to a 3″ Angle Girder, the ends of which are fastened by Angle Brackets to further Strips that slide in Eye Pieces bolted to the inner sides of the base Angle Girders.

The Rack Strip 5 is attached to one of these Strips by means of a Double Bracket. It is kept in mesh with the Worm 4 which is carried on an 11½″ Rod. On turning the 1″ Gear Wheel 3, the framework carrying the objective holder 8 and the lamp frame will move backward or forward while the slide holder 6 remains stationary. The holder carrying the condensing lens 7 is mounted on Eye Pieces so that it may be pushed to and fro on the 5½″ Strips that are secured to the lamp framework, and the light focussed accordingly.

It now remains to construct the cover that is fitted over the lamp and incorporates the second condensing lens 9. Heavy cardboard should be used for the cover, so that all light is excluded except that issuing from the lens.

Operation of the instrument is very simple. A screen should first be arranged in the room where the demonstration is to take place. It may consist of a white sheet or a portion of the wall if it is of a plain white colour. The lamp having been coupled to an accumulator or transformer, etc., the slide is placed in its holder 6 and the wheel 3 rotated backward or forward until the specimen is seen to be in focus on the screen. The condensing lens 7 should then be adjusted.

How to Use Meccano Parts—

(*Continued from page 39*)

Meccano. Curved lines are not often required in mechanical engineering, but since Meccano is equally at home in the civil branch of the profession, arcs and circles, etc., are almost essential adjuncts to the system.

In mechanical engineering the Curved Strips prove useful in the construction of rotating mechanisms. Fig. 5 shows a useful flywheel built up from four 2½″ small radius Curved Strips. The diameter of the circle so formed is not standard with the system, and therefore, in order to form spokes for such a wheel, it is necessary to connect 2½″ Strips between the Curved Strips by means of Flat Brackets, the slotted holes of which allow the Strips to be secured centrally.

Complete circles suitable for flywheels, etc., may also be built up from eight 2½″ large radius Curved Strips or from four 3″ Curved Strips.

Fig. 6 shows how the Circular Strip may be used in a built-up roller bearing.

Flat Brackets, which are really two-hole Strips, will be dealt with in Class C, as also will Single, Double, and Cranked Bent Strips. Rack Strips are in Class O.

Meccano Biplane—

(*continued from page 50*)

It is attached to its respective fixed portion by Hinges 49. The two units—consisting of one fixed and moving plane—are spaced apart by 2½″ Flat Girders 50 attached by means of ½″ × ½″ Angle Brackets to the Flat Girders 47. Bolted to the Flat Girders 50 are Hinges to which the rudders 51 are attached. The rudders each consist of a 2½″ Triangular Plate, along the edges of which two 2½″ Strips and a 1½″ Strip are bolted.

Double-arm Cranks 53 are bolted to the two outside 2½″ Flat Girders 50, and Collars 54 are secured on the ends of 1½″ Rods held in the bosses of the Double-arm Cranks. The rudder wires 55 are to be taken round the shanks of ordinary bolts that are inserted in the set-screw holes of the Collars 54.

Two ¾″ Bolts 56 are attached to the moving portion of each elevator at the extreme trailing edge. The control wires 57 are secured to these bolts, and are led through guides 58 consisting of Angle Brackets bolted to the leading edges of the Flat Girders 46.

The remainder of the instructions for completing this model will appear in next month's "M.M." In that number we shall publish illustrations of the wings, engines, landing wheels and a splendid front view of the complete model. Each part will be described in detail and full instructions will be given for assembling the various units.

Famous Inventions—

(*continued from page 20*)

The "Fire Suds" pump has two entirely separate gunmetal pump chambers, of positive action type, driven at engine speed by an extension of the first motion shaft through the change speed gearbox. One pump chamber takes its supply from either of the alkaline solution tanks and the other from one of the acid solution tanks. The suction pipes leading to the tanks are controlled by a group of gunmetal valves with copper pipes arranged conveniently for operation from the footboards of the engine.

The delivery from each pump chamber is taken to a hydraulic hose reel having two separate extensive lines of rubber hose, jointed together at the extreme end by a short length of rubber delivery hose with branch-pipe and nozzle. The acid and the alkaline solutions are pumped through the separate lines of hose, and mix at the base of the branch-pipe, thus forming "Fire Suds."

All the tanks are kept charged ready for immediate use on arrival at a fire. With the engine running, either or both the pumps are put into gear by a single lever to the left of the driver, and the clutch is then let in, bringing the pumps into operation. By means of control valves the outlets of one alkaline and of one acid tank are opened and the solutions are pumped through the hoses, the resulting mixture being directed on to the fire.

When the first solution tanks are exhausted, as indicated by a pressure gauge, the outlets are closed and those of the second two tanks are opened by the manipulation of the control valves. Before there is time for the latter to be exhausted, the first tank can be recharged with alkaline solution, and the process repeated until all six acid tanks have been emptied, by which time 1,800 gallons of "Fire Suds" will have been produced.

Our Daily Bread—

(*continued from page 23*)

and causes the grain to lose its starch. The risk of an outbreak of the disease is greatest at the end of a rainy growing season, for the fungus flourishes in damp weather. There have been no widespread epidemics since 1816, however, when the districts of Lorraine and Burgundy were ravaged by the disease at the end of a particularly wet summer, and now that wheat is displacing rye, further outbreaks on a large scale are very unlikely.

New Meccano Models—

(*continued from page 47*)

5 of No. 35; 36 of No. 37; 1 of No. 40; 2 of No. 48a; 1 of No. 52; 6 of No. 111c; 2 of No. 125; 2 of No. 126; 2 of No. 126a.

Stone Sawing Machine

No doubt many Meccano boys have watched giant stone sawing machines cutting their way slowly but surely through huge blocks of stone that sometimes weigh several tons. The designer of the Meccano model shown in Fig. 7 has endeavoured to reproduce one of these machines with the aid of a small Outfit, and we think readers will agree that he has succeeded remarkably well.

The swinging saw consists of a 5½″ Strip lock-nutted to a 2½″ Strip at each end, and these 2½″ Strips are supported on 3½″ Axle Rods journalled in the vertical members of the model. One of the Rods carries two 1″ Pulleys that are clamped firmly against the 2½″ Strips, and two further Pulleys are secured on the end of this Rod and clamped against another 2½″ Strip, which is connected pivotally to a Bush Wheel by means of a 5½″ Strip. The Bush Wheel is secured to a Crank Handle journalled in two Flat Trunnions bolted to the side frames of the model. Hence on rotation of the Handle the saw swings to and fro in a very realistic manner.

The Stone Sawing Machine comprises the following parts: 4 of No. 1; 7 of No. 2; 1 of No. 3; 3 of No. 5; 2 of No. 16; 1 of No. 19s; 4 of No. 22; 1 of No. 24; 6 of No. 35; 38 of No. 37; 4 of No. 37a; 1 of No. 48a; 2 of No. 126a.

Chocolates for New Year

The House of Cadbury have recently brought out many new chocolates of quality, the new assortments including Lady Betty, Bermuda, Riverside and the new Prince of Wales chocolates in their richly coloured box. We take this opportunity to remind our readers that Cadbury's cater for those who like hard centres by an assortment of that name, and for those who prefer soft centres there are such assortments as Esmond and Countess Cremes. Most Meccano boys have a little extra pocket money at this time of the year and we have no doubt that after carefully balancing the attractions of new Meccano parts and chocolates, they will manage to arrange matters so as to allow of a visit to the tuckshop!

A Pocket Surveying Instrument

An instrument that will be of interest to all boys is the Pocket Surveyor designed by Mr. G. C. Sherrin, and produced by George Philip & Son Ltd., 32, Fleet Street, London, E.C.4. Although it is simply made and costs only 2/6, it is very practical and may be used for an astonishing variety of measurements. With its aid the widths of rivers and the heights of hills and buildings are easily found, and even complete surveys may be made with fair accuracy.

The Surveyor will be especially valuable to Meccano boys who wish to reproduce a large engineering structure, such as a bridge, for they will be able to measure its dimensions and plan an exact scale model. Other interesting uses are suggested in the booklet that accompanies the instrument. Among these may be mentioned the levelling and correct marking out of football fields, tennis courts and camp sites.

The instrument is made of oxidised steel, and is rustless and unbreakable. It is only five inches in length, and when closed occupies little more space than a pocket knife.

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on the following four pages carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

E. J. RILEY LTD.,
28, Blackburn Road,
ACCRINGTON.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

A. E. WILKINSON & SON,
Bank Street, ASHFORD, KENT.
57, High Street, MAIDSTONE.

BENNETT WATTS,
10, Silver Street,
Tel. 229 AYLESBURY.

BUTTERFIELDS & MASSIES Ltd.
Church Street,
Tel. 141 BARNSLEY.

J. BELL,
10, Lower Garfield St.,
Royal Avenue, BELFAST.

SPORTS DEPOT,
57, Victoria Street,
Tel. 4554 (Nr. Albert Memorial) BELFAST.

J. WOODHALL,
256, Grange Road,
Tel.: B'head 621 BIRKENHEAD.

H. A. CLEWS & SON,
404/5, Monument Road,
BIRMINGHAM.

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Tel.: Mid. 869 BIRMINGHAM.

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Aston, BIRMINGHAM.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
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J. MORRIS, F.C.O.,
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BOSTON.

BROWN, MUFF & CO. LTD.,
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W. CARTER,
British Sports Depot, 15, Bridge Street,
Opposite Mechanics' Institute BRADFORD.

MAURICE COHEN & SON,
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BRADFORD.

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Kirkgate,
BRADFORD.

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ECONOMIC LIMITED,
288, 290, 292, Lodge Causeway,
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Tel. 2888 24, Bridge Street, BRISTOL.
188, Whiteladies Road, Clifton, BRISTOL.
Tel. 143

JOHN HALL (TOOLS) LTD.,
BRISTOL. NEWPORT.
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20, High Street, BRISTOL.
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A. CURRIE,
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MARTINS',
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PHINS LIMITED,
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Tel. 344 ECCLES.

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8, Bank Parade,
Tel. 0303 EDGWARE.

BASSETT-LOWKE LTD.,
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HOWARDS,
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& 246, Lordship Lane, N.22.

Devon & Somerset Stores Ltd.,
Toy & Sports Dealers,
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Telegrams : Stores, Exeter
EXETER.

ROBERT BALLANTINE,
103½, St. Vincent Street,
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CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, the Railway Coys., etc.

COPLAND & LYE LTD.,
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Lumley House, Sauchiehall Street,
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LYON LTD.,
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GLASGOW.

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110, West Nile Street,
GLASGOW.

Pettigrew & Stephens Ltd.,
Sauchiehall Street,
GLASGOW.

POLLOCK & CO., 36, Bridge Street,
222, Argyle Street
(Under Railway Bridge),
GLASGOW.

ROWANS LIMITED,
70, Buchanan Street,
GLASGOW.

R. WYLIE HILL & CO. LTD.,
20, Buchanan St. & Argyll Arcade,
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FLETCHER'S TOYLAND,
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Grand Building, RAWTENSTALL.

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The Hove Hornby Train Store,
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HUDDERSFIELD.

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YE OLDE TOY SHOPPE,
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Complete Sports Outfitters,
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PEARSON & DENHAM (PHOTO) LTD., 6, Bond Street,
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Sports House, Briggate,
LEEDS.

A. WRIGHT, The Garage,
200/2, Dewsbury Road,
Tel. 22719
LEEDS.

ROBOTHAM'S LIMITED,
"Baby's Kingdom,"
Tel. 4809
Belvoir St., LEICESTER.

J. T. WEIGHTMAN,
198, Charnwood Street,
Tel. 58804
LEICESTER.

BYCROFTS EMPORIUM,
366, High Street,
LINCOLN.

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S.W.17.

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Stratford, LONDON, E.

W. HUMPHRYS & SON,
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PECKHAM, S.E.15.

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WILLIAM W. LANK,
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H. V. PALIN,
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Tel.: Chingford 104
CHINGFORD, E.4.

PIGGOTT BROS. & CO. LTD.,
220/226, Bishopsgate,
Tel.: Bis. 4351
LONDON, E.C.2.

Meccano & Hornby Train Supplies

All the dealers whose names appear on this page, on the preceding two pages, and in the twenty-two announcements on the opposite page, carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

PERCIVAL & CO.,
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F. J. WAIN & SON,
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Tel. : Clissold 9269 LONDON, E.8.

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43, Market Place,
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H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

The BERKSHIRE RUBBER Co.,
51, Queen Street,
MAIDENHEAD.

BARRS, Children's Paradise,
49, Deansgate,
Tel. 165 City MANCHESTER.

A. FRANKS LTD.,
95 & 97, Deansgate, MANCHESTER
90, Bradshawgate, BOLTON.

HENRY'S Toy & Game Stores,
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Tel. 3004 Central MANCHESTER.

A. INMAN, MANCHESTER.
105, Lapwing Lane, Didsbury. Tel. 1518.
179, Dickenson Rd., Rusholme. Tel. 2241.

EDWARD LLOYD & SON,
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Tel. 613 Chorlton MANCHESTER, S.W.

JOHN NESBITT LTD.,
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City 2284 MANCHESTER.

H. J. ROFE,
93, Piccadilly,
Tel.: Central 2945 MANCHESTER.

ALEC. WATSON LIMITED,
39, Piccadilly & 35, Oxford Street,
MANCHESTER.

H. WILES LTD.,
124, Market Street,
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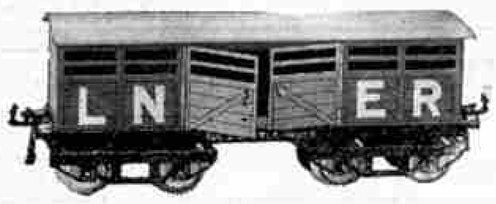
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HORNBY ROLLING STOCK

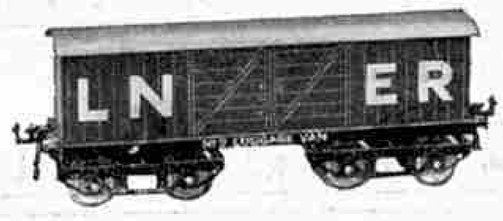
GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines and are beautifully enamelled, mostly in the correct colours of the L.N.E., L.M.S., G.W. or Southern Railways.

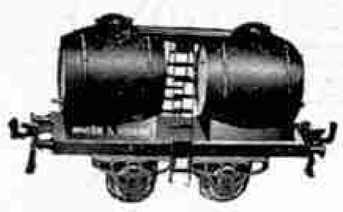
Ask your dealer to show you the full range of Hornby Rolling Stock.



***CATTLE TRUCK No. 2**
Splendid model fitted with double doors. Suitable for 2 ft. radius rails only. Price **5/9**



***LUGGAGE VAN No. 2**
Fitted with double doors. Suitable for 2 ft. radius rails only. Price **5/9**



WINE WAGON
An attractive model, artistically enamelled in red and black. Price **3/9**



SECCOTINE VAN
Beautifully finished in blue, with opening doors. Price **3/6**



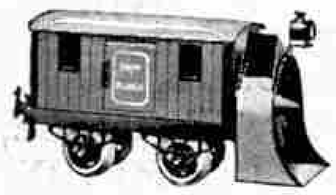
***TROLLEY WAGON**
Finished in brown and blue. Suitable for 2 ft. radius rails only. Price **5/6**



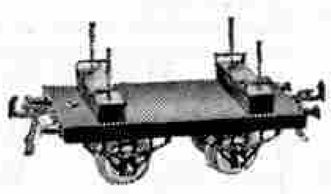
***GUNPOWDER VAN**
Finished in red, with opening doors. Price **3/9**



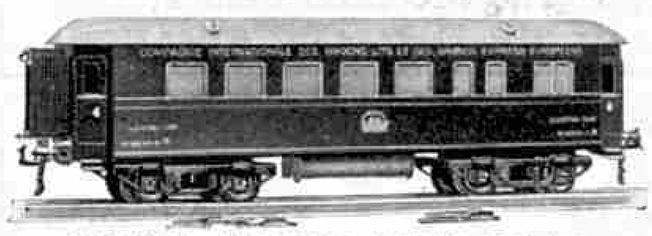
PETROL TANK WAGON "REDLINE"
Finished in blue and red. Price **2/6**



***SNOW PLOUGH**
With revolving plough driven from front axle. Price **5/6**



***LUMBER WAGON No. 1**
Fitted with bolsters and stanchions for log transport. Price **2/–**



RIVIERA "BLUE" TRAIN COACH
(Dining or Sleeping).
This is a beautiful model, substantially built and well finished. Suitable for 2 ft. radius rails only. Price **12/6**



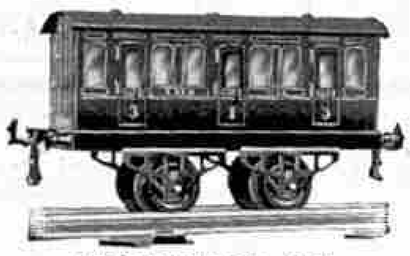
***TIMBER WAGON No. 1**
Beautifully enamelled in green and red. Price **1/9**



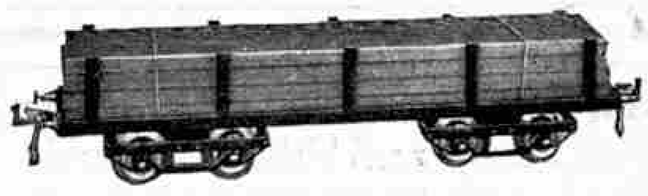
BRAKE VAN (French Type)
Lettered Nord. Beautifully finished in colours. Opening doors. Price **4/–**



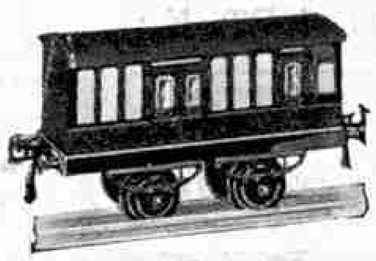
***HORNBY WAGON No. 0-1-2**
As supplied with Hornby Goods Sets. Price **2/6**



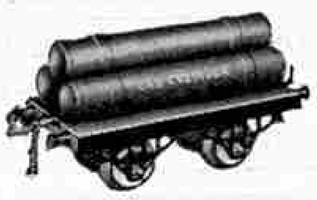
***HORNBY No. 0-1 PASSENGER COACH**
Realistic in design and fitted each side with opening doors. Price **2/6**



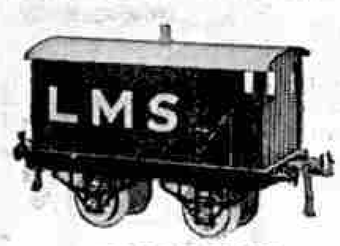
***TIMBER WAGON No. 2**
Beautifully enamelled in green and red. Suitable for 2 ft. radius rails only. Price **3/6**



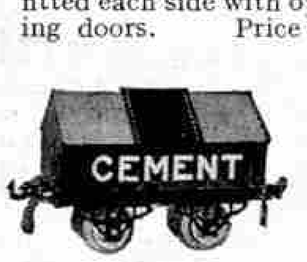
***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **2/6**



***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price **2/6**



BRAKE VAN
Finished in grey, with opening doors. Obtainable with L.M.S. or G.W. lettering. Price **3/6**



***CEMENT WAGON**
Finished in red. Price **3/–**



CRAWFORD'S BISCUIT VAN
Finished in red, with opening doors. Price **3/6**



***LUGGAGE VAN No. 1**
With opening doors. Price **3/6**



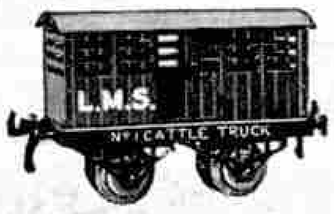
***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **4/–**



BRAKE VAN
Finished in brown, with opening doors. Obtainable in N.E. or S.R. lettering. Price **3/6**



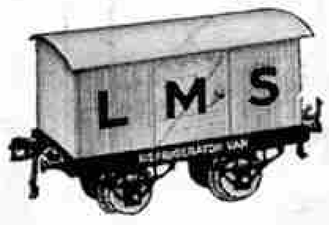
SIDE TIPPING WAGON
Excellent design and finish. Price **2/6**



***CATTLE TRUCK No. 1**
Fitted with sliding door. Very realistic design. Price **3/6**



***LUMBER WAGON No. 2**
Fitted with bolsters and stanchions for log transport. Suitable for 2 ft. radius rails only. Price **4/–**



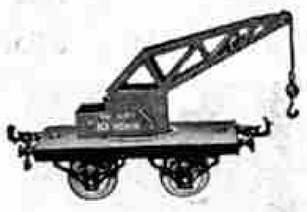
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with sliding doors. Price **3/9**



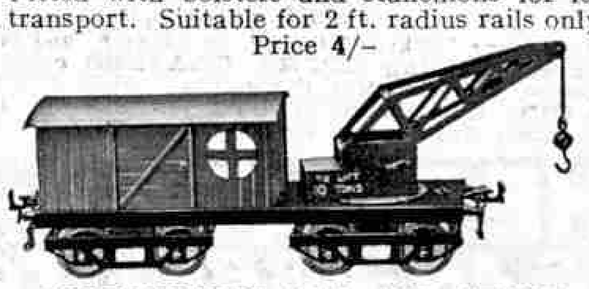
ROTARY TIPPING WAGON
Finished in orange. Price **3/–**



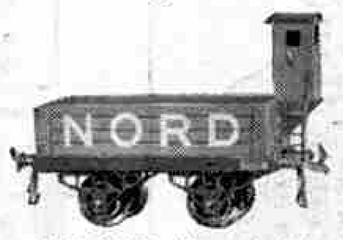
***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans. Price **3/6**



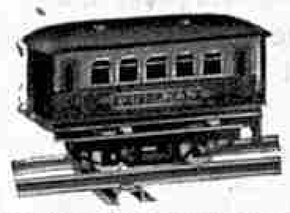
***CRANE TRUCK**
Finished in brown and blue. Price **3/6**



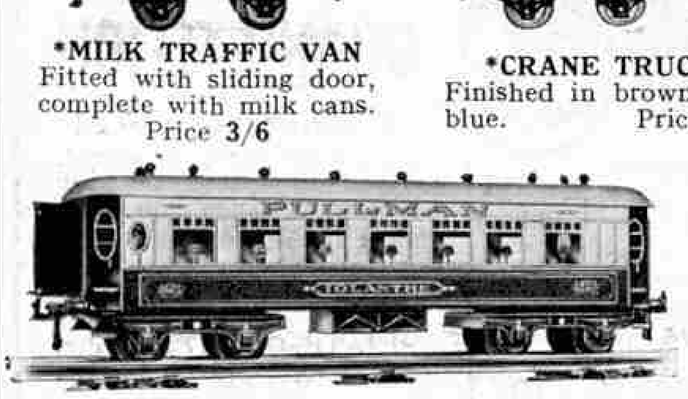
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2 ft. radius rails only. Price **6/3**



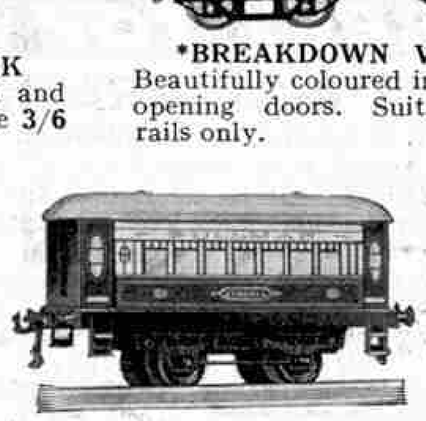
WAGON (French Type)
Lettered Nord. Highly finished in colours. Price **3/3**



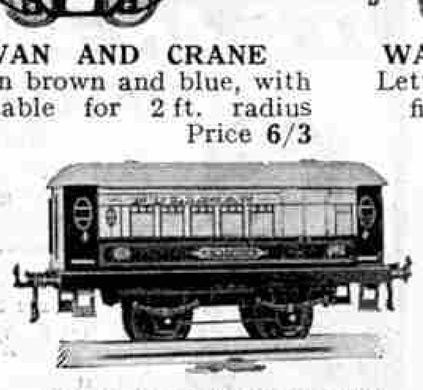
"M" PULLMAN COACH
Strong and well finished, in colours. Price **1/–**



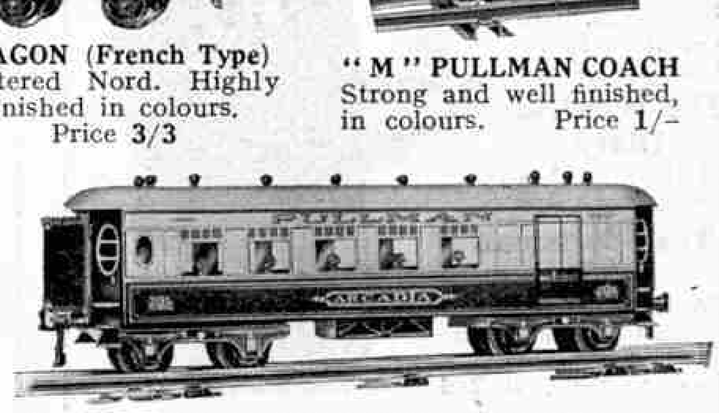
HORNBY PULLMAN COACH No. 2-3
As supplied with Nos. 2 and 3 Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2 ft. radius rails only. Price **11/6**



No. 1 PULLMAN COACH
Distinctive in design and beautifully finished in colours. Price **3/–**



No. 1 PULLMAN COACH COMPOSITE
Special type. One part designed for passenger accommodation and the other for conveyance of luggage. Price **3/–**



HORNBY PULLMAN COACH COMPOSITE No. 2-3
As supplied with Nos. 2 and 3 Train Sets. One part is designed for passenger accommodation and the other for conveyance of luggage. Suitable for 2 ft. radius rails only. Price **11/6**

**Lettered L.M.S., N.E., G.W. or S.R.*

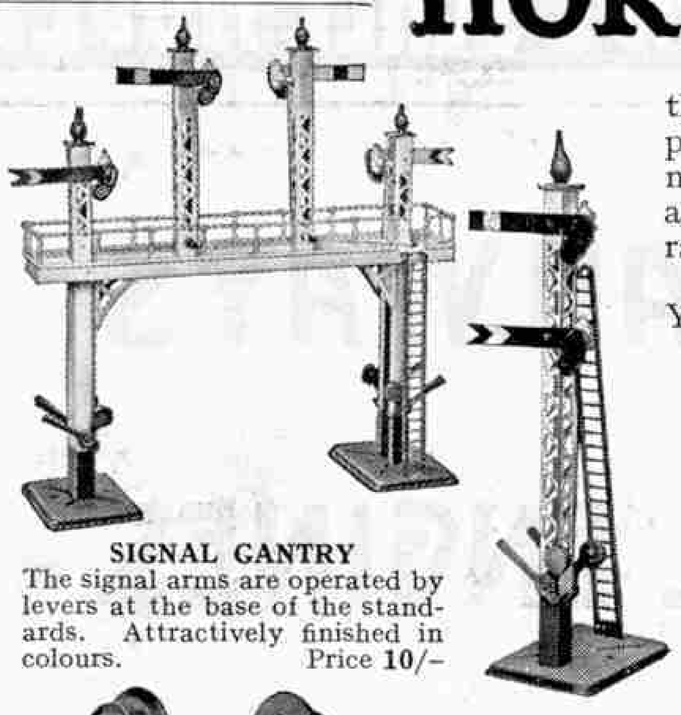
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HORNBY SERIES

There is a splendid range of Hornby Accessories in the Hornby Series, all built in exact proportion and all perfectly designed. With these realistic Accessories the most elaborate railway system may be constructed and operated in exactly the same manner as a real railway in actual practice.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



SIGNAL GANTRY
The signal arms are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

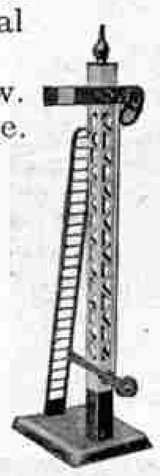
DOUBLE ARM SIGNAL No. 1
Price 3/9 per pair
DOUBLE ARM SIGNAL No. 2
(as illustrated)
Price 3/- each



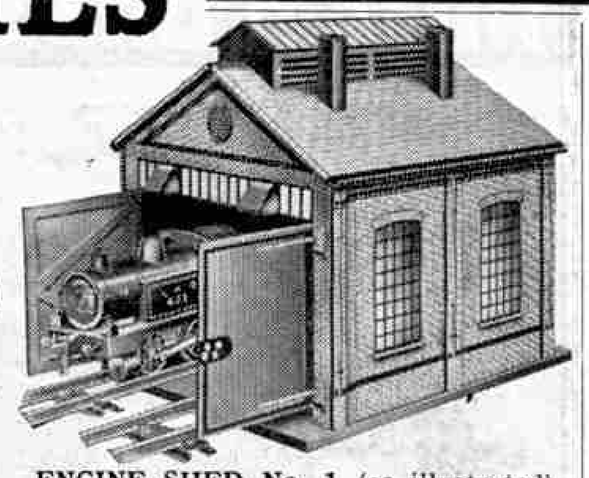
MANSELL WHEELS
These wheels are die cast. Price per pair **4d.**



RAILWAY STATION No. 1 (as illustrated). A well-made model, richly finished in bright colours. Dimensions: Length 16¾ in., width 6 in., height 6 in. Price **5/-**
RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Dimensions: Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/-**



SIGNAL No. 1
Price 3/- per pair
One "Home" and One "Distant."
SIGNAL No. 2
(as illustrated)
Price **2/6** each "Home" or "Distant"



ENGINE SHED No. 1 (as illustrated) This Shed will accommodate Locomotives and Tenders of the M Series, No. 0 and No. 1 types. Price **11/-**
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This Shed will accommodate two of any type of Hornby Locomotive and Tender. Price **17/6**



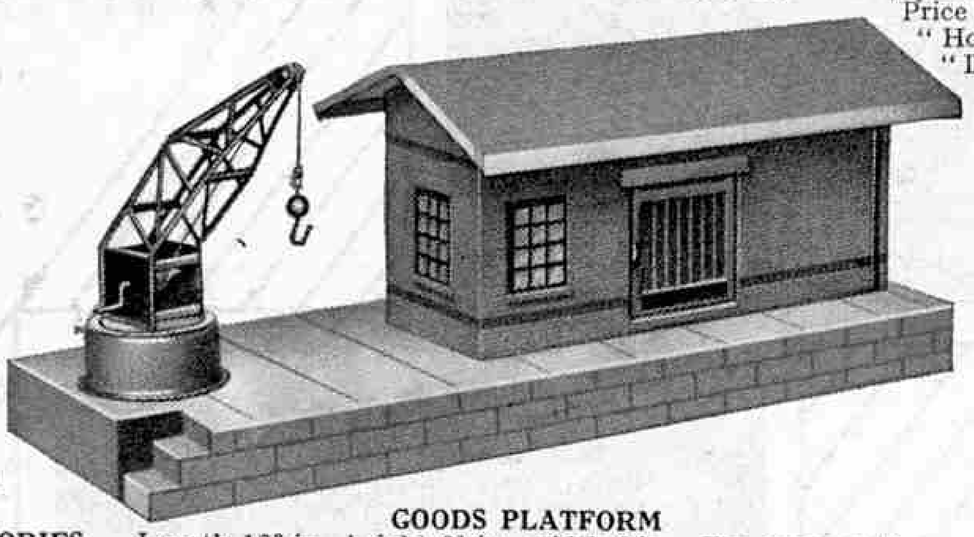
TUNNEL
Realistic and finished in colours. Price **7/6**



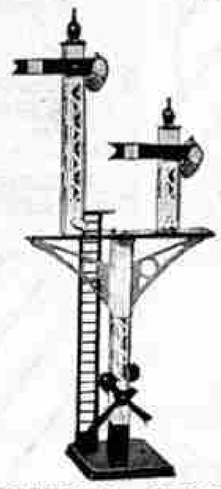
LOADING GAUGE
Price **1/9**



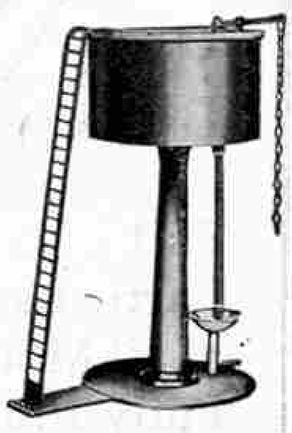
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker. Price **1/6**



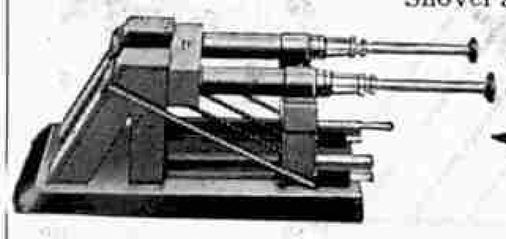
GOODS PLATFORM
Length 16¾ in., height 6½ in., width 6 in. The crane at the end of the platform revolves on its base Price **10/6**



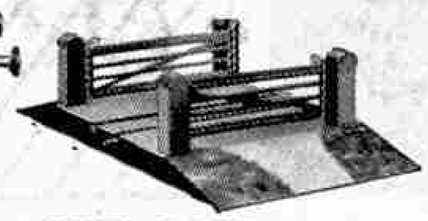
JUNCTION SIGNAL
"Home" or "Distant" Signal arms operated by levers at base. Price **5/6**



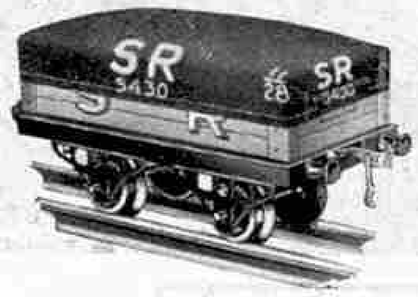
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Fitted with flexible tube and valve lever. Price **6/6**



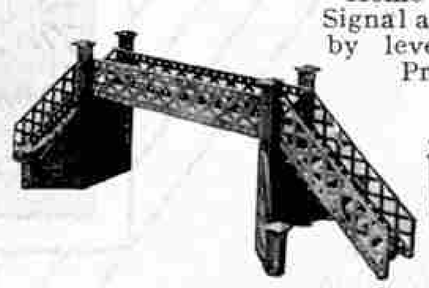
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Price **5/-**



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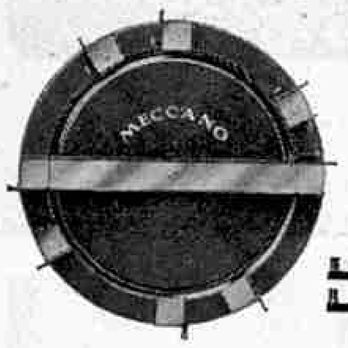
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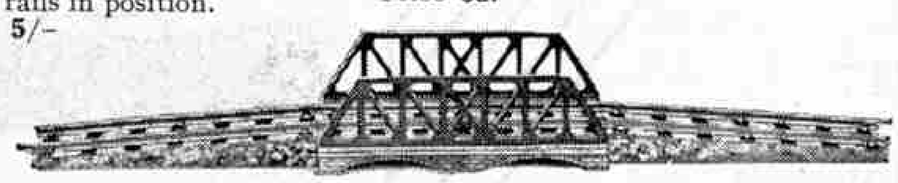
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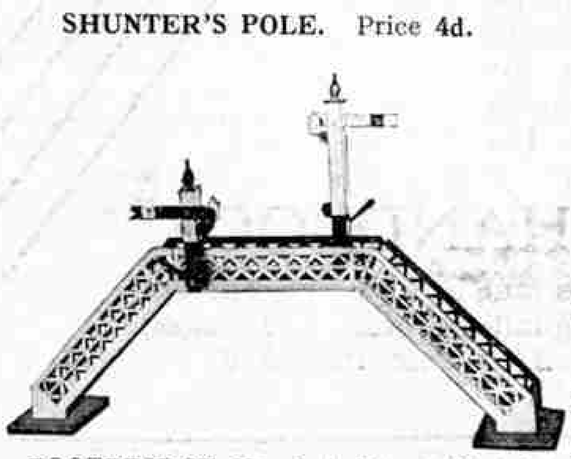
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Price per pair **3/6**



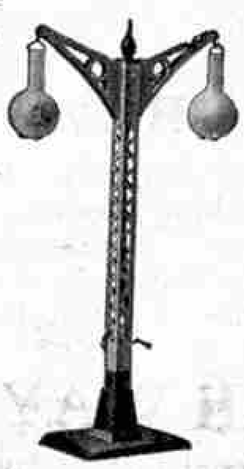
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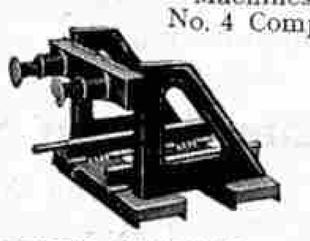
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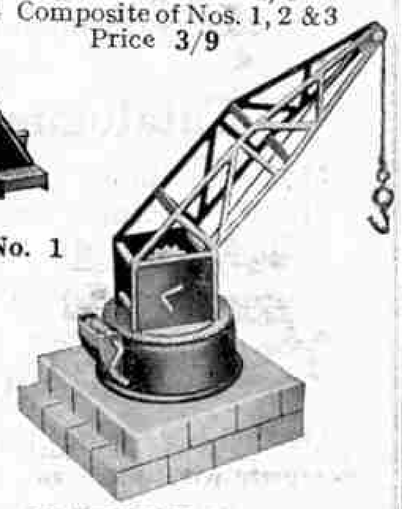
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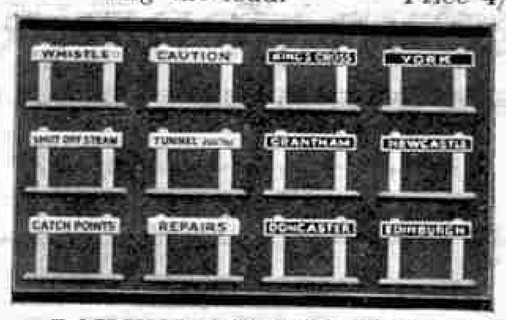
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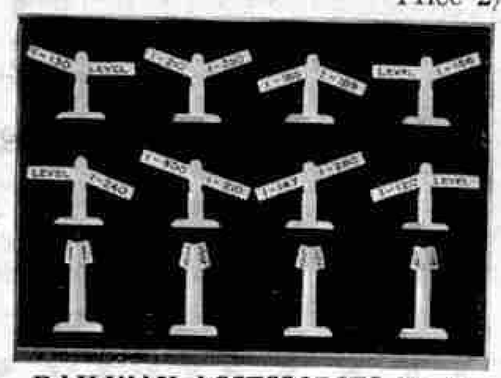
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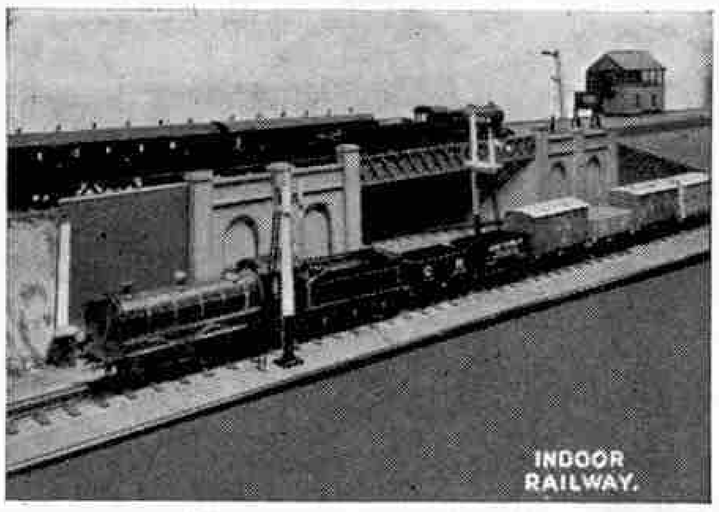


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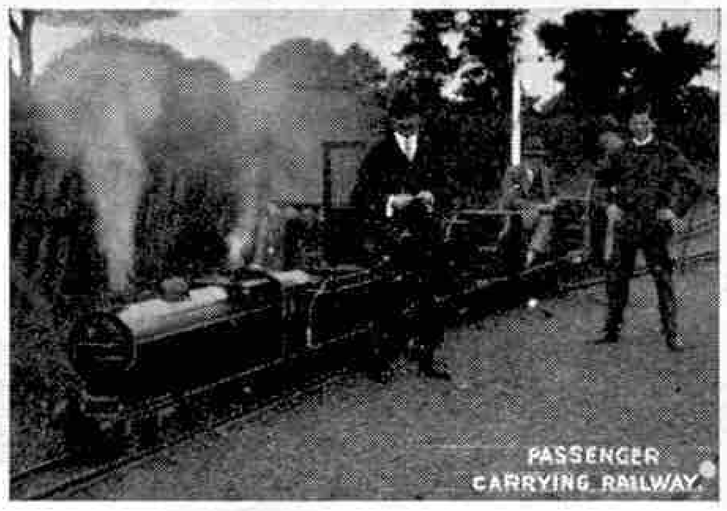

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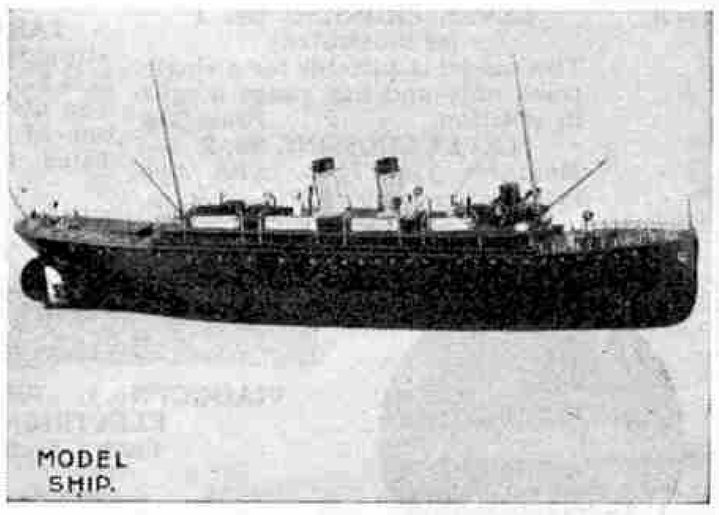
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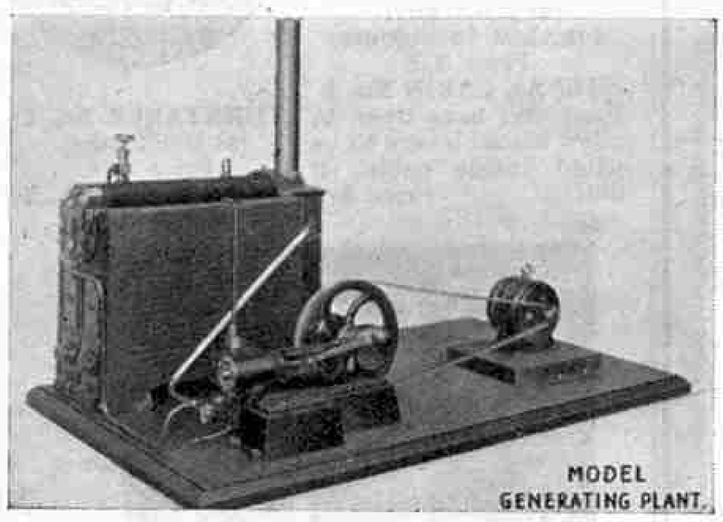

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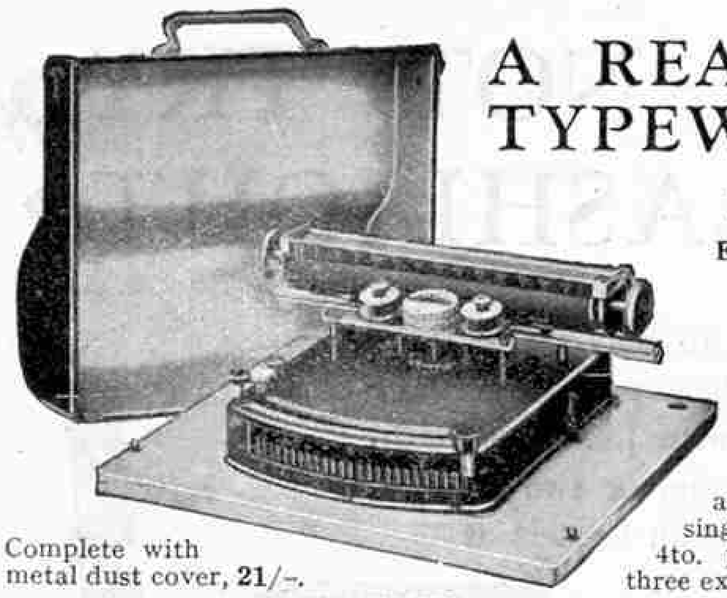
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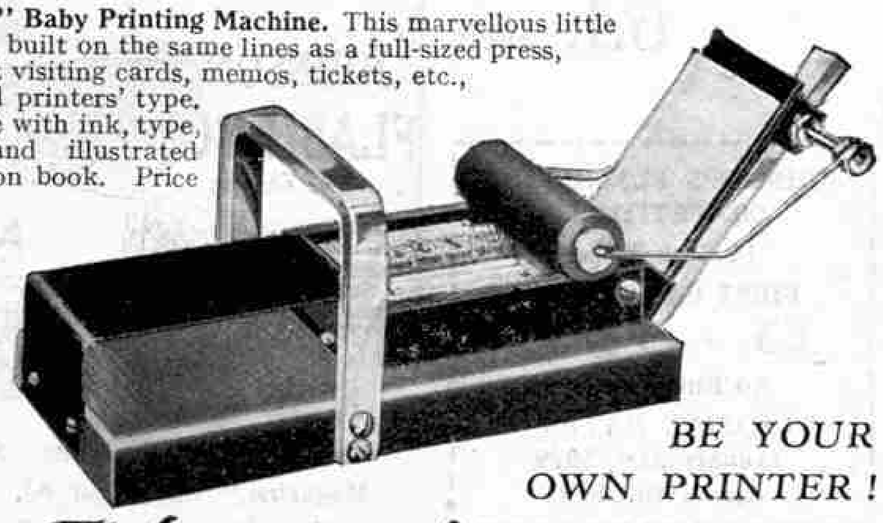
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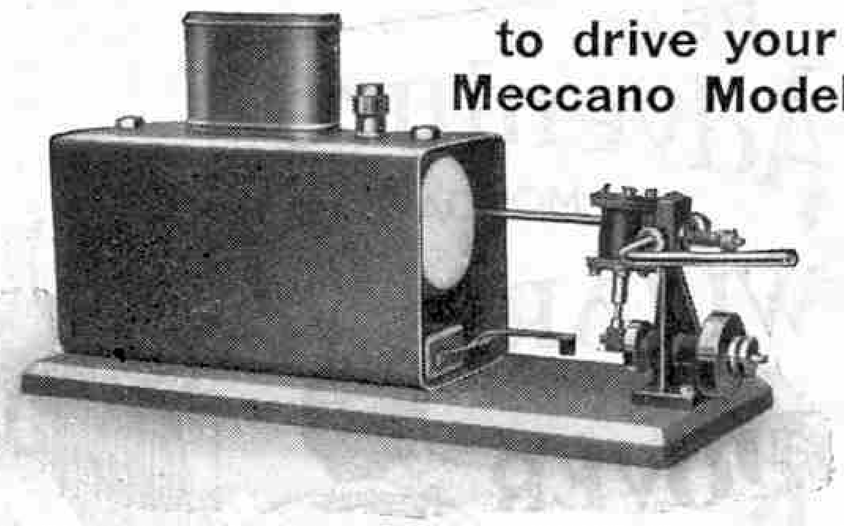


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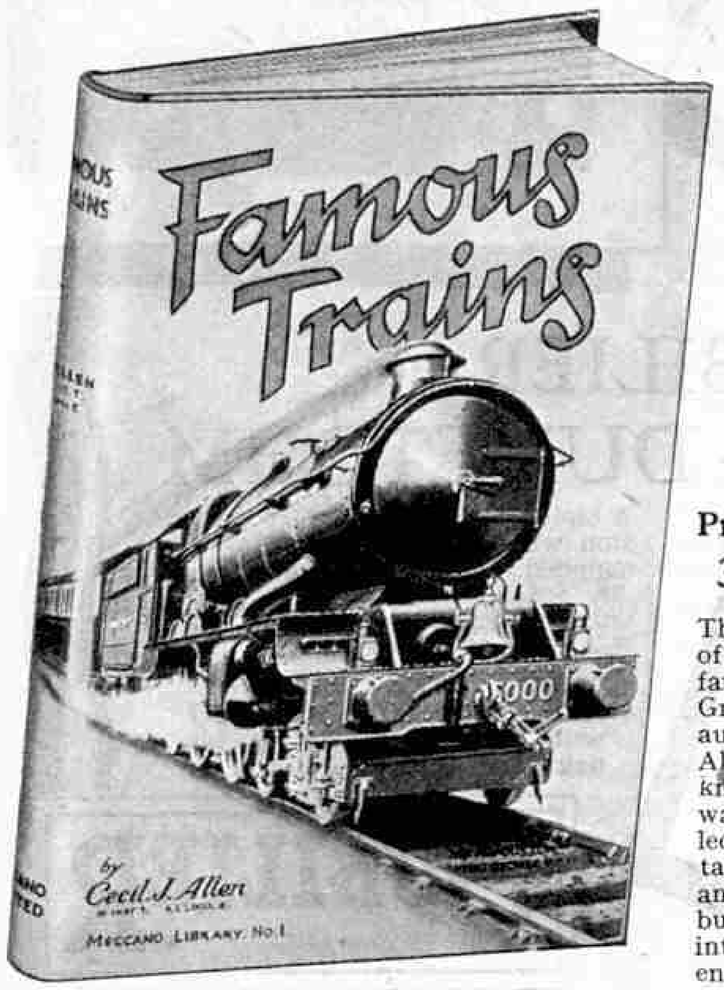


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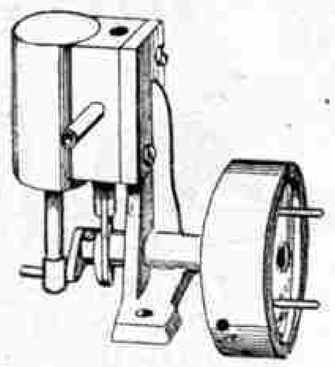
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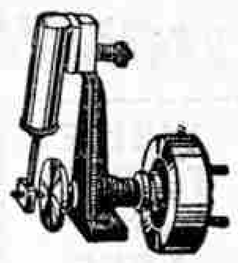
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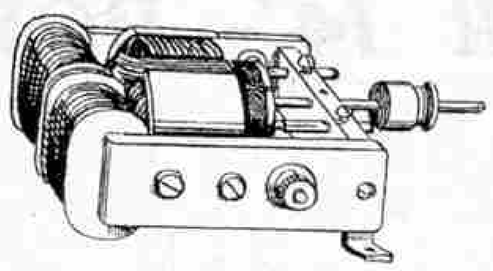


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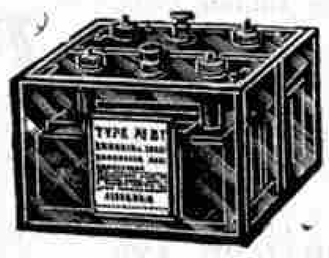
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If unobtainable from your dealer write direct to us giving his name and address.

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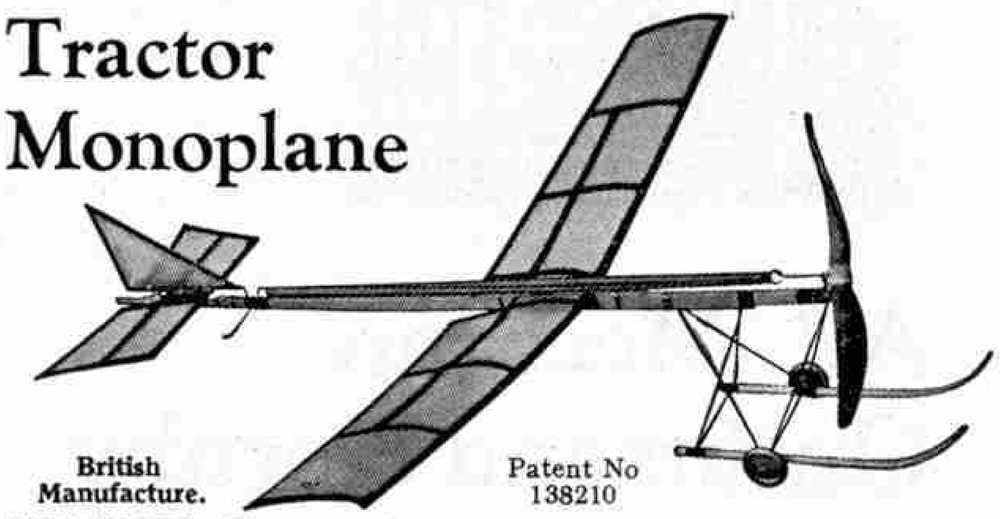
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The Best Gift! for every Boy

The Most Popular Flying Model

THE FAMOUS "SKISAIL"

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British Manufacture. Patent No 138210

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SPECIFICATION.—Silver Spruce Fuselage, Silk-covered Planes, Aluminium Wheels, Polished Propeller. Nos. 0, 1, 2 and 3 fitted with our **Famous Patent Safety Chassis with Bamboo Runners.**

Wing Span of 18/6 Model 33 in. Length 31 in.
Fitted with **Patent Safety Chassis with Landing Skids.**
Wing span of our 4/6 model 21 in. Length 20 in.

The "Skisail Model de Luxe"

Wing Span 43 ins. Price 27/6 carr. paid.

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„	4	„ 6/6
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The "Skisail" Monoplanes are designed on correct aeronautical lines, constructed with highest quality materials and the prices are ranged to suit all pockets.

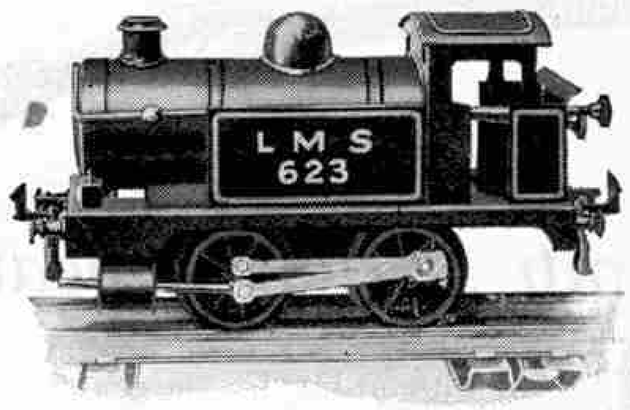
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The "SKISAIL" PATENT MODELS are still the best.
Purchase direct from the PIONEER INVENTORS.

PATENT MODEL MANUFACTURERS

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Strong and durable loco capable of any amount of hard work; richly enamelled and highly finished; fitted with reversing gear, brake and governor.

Gauge 0, in colours to represent L.M.S., L.N.E. or G.W. Railway Companies' Locos ... ... Price **12/6**
Hornby No. 1 Tank Loco, fitted for Hornby Control ... „ **15/-**



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Powerful model embodying all the splendid Hornby characteristics. It is 10½" in length and is fitted at both ends with a four-wheeled bogey. Beautifully finished in colours to represent L.M.S., L.N.E. or G.W. Railway Companies' Locos, and suitably lettered. Fitted with reversing gear, brake and governor. Suitable for 2-ft. radius rails only. Price **22/6**
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Binding the "M.M."

In response to many requests, we have arranged for binding cases for back numbers of the Magazine to be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases supplied in two sizes (1) for six copies, price 3/6 and (2) for twelve copies, price 5/3 post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth



and the back and a quarter of the sides are dark crimson leather as shown below. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

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These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

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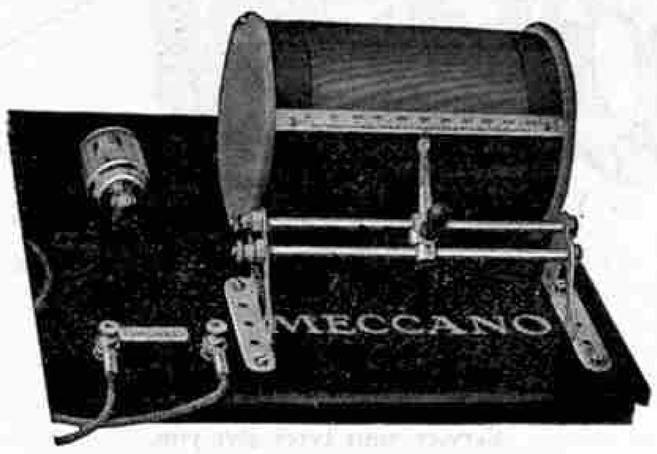
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All "Meccano Magazines" prior to December, 1923, are out of print. Each of the 1924 issues, with the exception of January, February and September, are in stock. Only the May, June, July, October and November, 1925, issues are available. All the 1926, 1927 and 1928 issues are in stock, with the exception of January, February and September, 1926, and January and March, 1927.

Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues, 1925 and 1926, and all the issues of 1927 and 1928, 8d.

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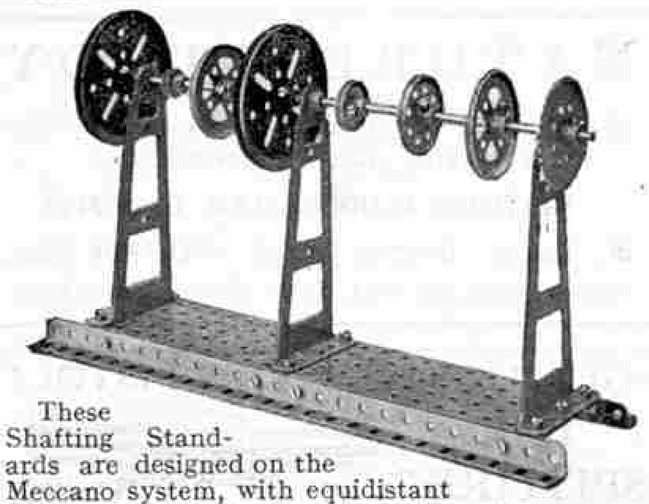
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DICK'S VISIT TO MECCANOLAND

We are pleased to announce that the popular booklet "Dick's Visit to Meccanoland" has been reprinted and is available for boys who have not already had the pleasure of reading this interesting story of a Meccano boy's visit to the Meccano factory.

The price of the booklet s 2d. post free. All applications should be accompanied by stamps for this amount, and addressed to **Meccano Ltd., Binns Road, Old Swan, Liverpool**

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Standard only, Large ... ... Price 1/–
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Every owner of a Hornby Train should have a copy of this splendid new book entitled "How to get more fun out of Hornby Trains," for it contains much useful information concerning miniature railways.

The price of the booklet is 3d. and if you cannot obtain it at your dealers it will be sent post free on receipt of 3d. in stamps. All applications should be addressed to Meccano Ltd., Old Swan, Liverpool.

MECCANO CARTONS

We are frequently asked to quote prices of empty Meccano Cartons by boys who have damaged their own, or who, having purchased an Accessory Outfit, require a single carton or Wood Cabinet to hold all their parts. We therefore give below a full list of both Cartons and Cabinets with prices.

Carton	Price	Postage
No. 00	4d.	4d.
" 0	4d.	4d.
" 1	1/–	6d.
" 2	1/4	6d.
" 3	1/8	9d.
" 4	2/11	1/–
" 5	7/9	1/–
" 6	10/10	1/3
" 00A	4d.	3d.
" 0A	8d.	3d.
" 1A	8d.	4d.
" 2A	1/4	6d.
" 3A	1/5	6d.
" 4A	1/2	6d.
" 5A	2/5	9d.
Special Inventors	6d.	5d.

WOOD CABINETS (with lock & key)

	Price	Postage
No. 5	35/–	1/–
" 5A	35/–	1/–
" 6	42/–	1/3
" 6A	60/–	*
" 7	125/–	*

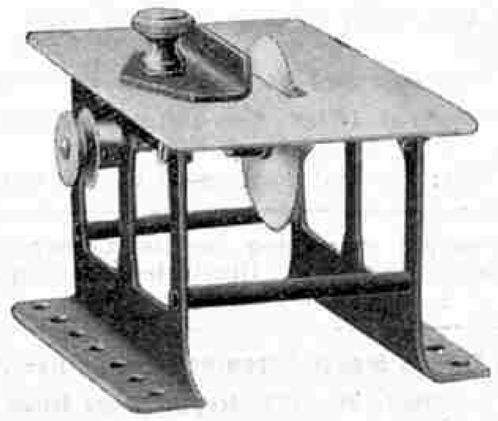
* Carriage Forward.

Old style cartons that were used for Outfits issued prior to 1st October, 1928, may still be obtained if required. The prices are as follows:

Carton	Price	Postage
No. 00	4d.	4d.
" 0	4d.	4d.
" 1	11d.	6d.
" 2	11d.	6d.
" 3	1/9	6d.
" 4	2/6	9d.
" 5	4/3	9d.
" 6	9/3	1/–
" 00A	3d.	3d.
" 0A	7d.	3d.
" 1A	8d.	4d.
" 2A	9d.	4½d.
" 3A	9d.	4½d.
" 4A	11d.	6d.
" 5A	2/–	9d.

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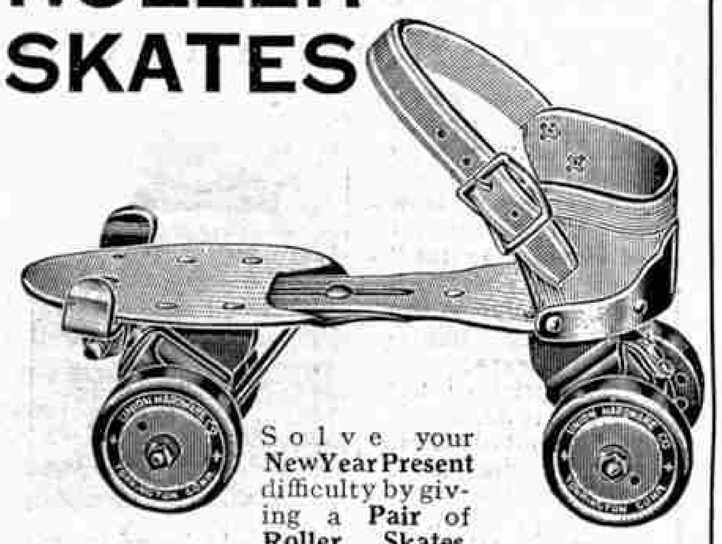
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No. 3 with Threaded Clamps and Case-hardened Steel Wheels ...	5/-	pair
No. 5 with Best Ball-Bearing Wheels	10/-	,,
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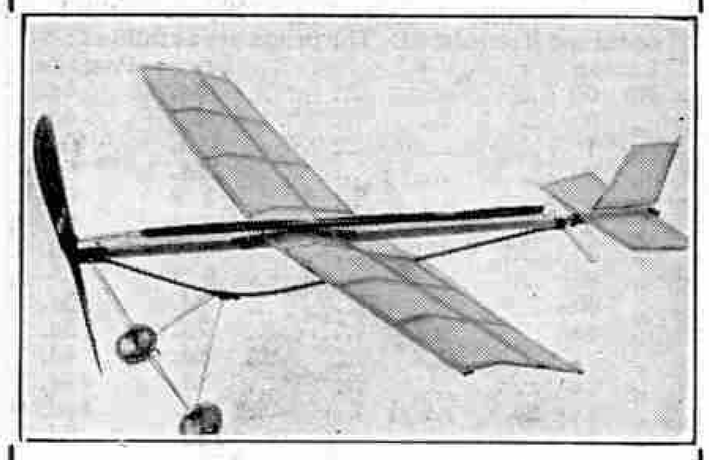
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We supply everything for the Construction of Model Aeroplanes. Illustrated Catalogue 4d. post free.

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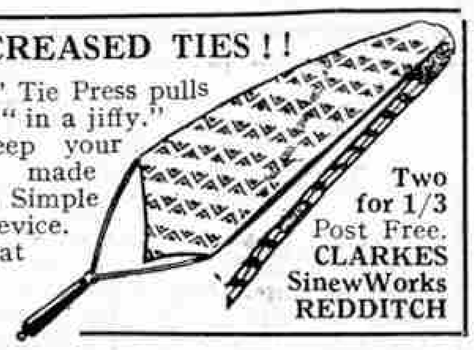
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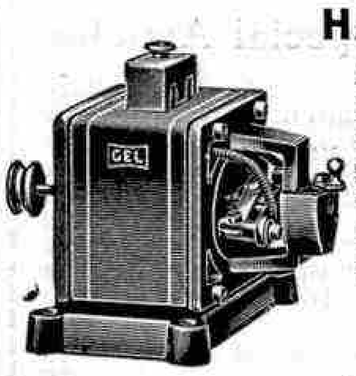
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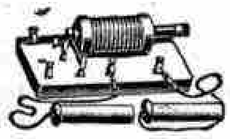
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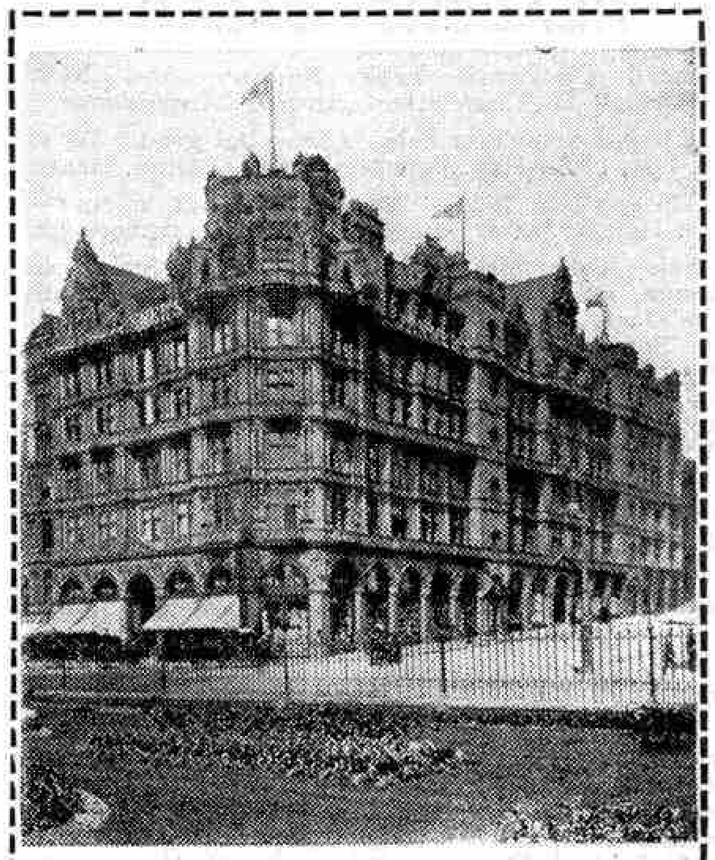
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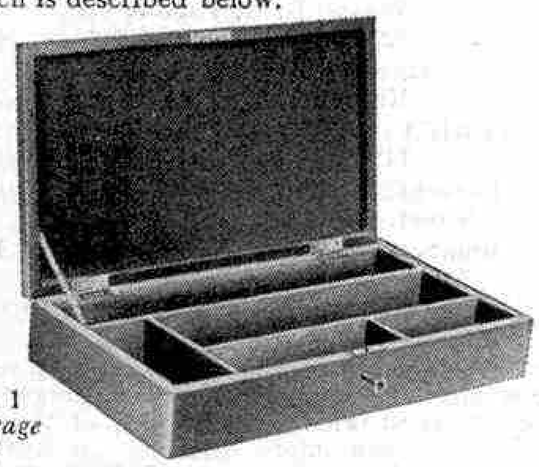
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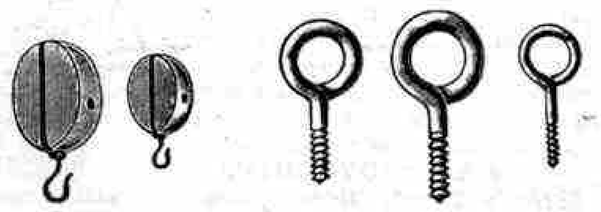
No. 1 Storage Box

No. 1 STORAGE BOX. Stained and varnished rich oak effect, and fitted with partitions as shown in the illustration. The lid is hinged and is secured by means of lock and key. Dimensions: Length 15½ ins. Width 8¾ ins. Depth 2¾ ins. Price 10/6.

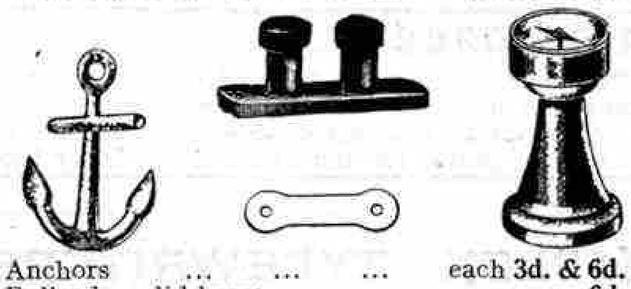
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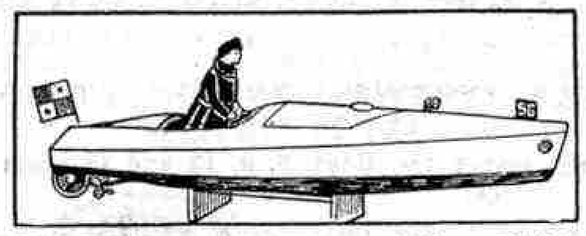
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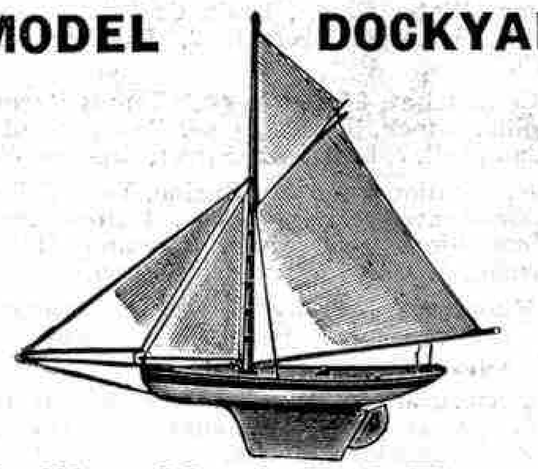


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HORNBY TRAINS
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BOWMAN & WORMAR ENGINES
AIR GUNS, FOOTBALL, HOCKEY
INGERSOLL WATCHES & CLOCKS
INDOOR GAMES
ELECTRIC LAMPS & TORCHES
MOTORS & ACCUMULATORS
HOBBIES STEAM LAUNCHES
MOTOR BOATS
LIST "M" TWOPENCE

C. H. LORBERG
185, Kensington High St., London, W.8

READERS' SALES

Small Clockwork Table Railway, 5/–. New.—Waddell, 20, Clark Street, Airdrie, Lanarkshire.

Wireless Spares for Sale. Cheap but good. Write for List, 1½d.—Hay, Foresters Terrace, Alton, Hants.

Thirty-eight 1928 "Magnets." What offers?—Ivor Holt, 4, Lower Cambridge Street, Loughborough.

Sale. Collection 1,000 different Foreign Stamps in Album, £2. Projector Outfit, 12 films, 15/–. Full-size Magic Lantern in case with 4 dozen slides, 30/–. Set Boy's Boxing Gloves, 5/–. 450 Cigarette Cards (9 sets) in Albums, 3/–. Good Box Conjuring Tricks, 5/–. 19 "Meccano Magazines," various dates between April 1925 and August 1928. Offers.—Greaves, Woodville, Gordon Road, Camberley.

Album containing over 1,000 Stamps, catalogued over £10. £5 or nearest.—Tempest, Roderidge, Wingate, Co. Durham.

Always wanting Clean Cigarette Pictures. Please send Lists.—Jeffery, Gunthorpe, Peterborough. Stamp.

For Sale. "Keech" Banjolele and Case. Cost £3/10/–, accept £2.—Tallis, Llwyn Celyn, Caerleon, Mon.

B.S.A. Airgun 45/–; General Radio 3-valve set with speaker and valves, 90/–; Brown's Crystovox, 40/–; Watchmaker's Lathe with Compound Slide-rest, etc., 90/–; 5×4 Folding Cameo Camera, slides and leather case, 15/–; Heavy Hot-air Engine, 25/–; .410 Folding Shotgun, 40/–; 4-volt Motor, 5/6; Electric Pocket Lamp and Magic Lantern combined, 5/–; New Webley Airgun.—22, Grappenhall Road, Stockton Heath, Warrington.

Sale. 650 British Colonial Stamps. Catalogued about £7. Accept 50/–.—G. Swann, 23, Selbourne Grove, Keighley.

Sale. 1,300 Cigarette Photos., all different. What Offers?—J. Herbert, Camp Cottage, Bishopton, Scotland.

Sale. Chemistry Cabinet. Nothing used. Cost 12/6. Offers—A. Beaton, 135, Melbourne Street, Dennistoun, Glasgow.

Sale. Chemical Apparatus, Stamps, Dynamo, etc. Stamp for list.—Rutter, 21, Warton Terrace, Heaton, Newcastle.

For Sale. Miniature Electric Table Railway. Perfect Condition. Apply—Scrimgeour, Culter, Aberdeenshire.

For Sale. Lincoln Stamp Album containing 1,500 Foreign and Colonial Stamps. Catalogued £7. What offers. Also 17 1/3 Broadcast Records for sale, the lot 12/–. All issued since July 1928. Unscratched.—BM/ZLFW, London, W.C.1.

Sale. Films, 5/– per 1,000 ft. Stamp Collection 30/–. Wireless Sets, Books, Annuals, etc., etc. Stamp for List.—Nikola, 87a, The Drive, Wembley.

For Sale. Locos, Rolling Stock, etc. Also Horizontal Steam Engine, practically new. Apply—Walton, 105a, High Street, Tunstall, Staffs.

Sale. Quantity Gauge 1 Tinplate Track and Accessories. Particulars—Erroll, 3, Milnthorpe Road, Eastbourne.

22/6 Vertical Slide-Valve Steam Engine, Vaporising Spirit Lamp, Water Gauge, Drain Cock, etc. Little used. Cost 39/6.—K. Sherriff, 2, Kinnear Road, Edinburgh.

Sale. Cricket Bat, 25/–, was £4. Tennis Racquet, 12/–. Rolling Stock, Tank Engine, Rails. Send for list.—T. Campbell, 7, Dinicombe Street, Glasgow West.

For Sale. Stationary Steam Engine, Twin Cylinder Injector, Gas-heated, Steam Gauge, ⅛ Horse Power. Excellent condition. Nearly new. Bargain £6/10/–.—D. C. German, 5, Darwin Avenue, Buxton.

Sale. Miniature Railway, Railway Literature, Wireless Parts. Cheap. Particulars—Russell, 68, Coniston Road, Croydon.

Sale. Horizontal Steam Engine with Governor. Cost 32/6. What offers.—Cowdry, "Downside," Moberly Road, Salisbury, Wilts.

Cigarette Cards. Sets, Odds, Lots. Lists.—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Sale. Complete set of trains (Gauge 0), Clockwork and Steam. Many accessories. Perfect condition.—Newell, "Dormurs," Shalford Road, Guildford.

FOR SALE

We have a few wooden outfit boxes, similar to those in which our 1927 Nos. 5 and 7 Outfits were packed. These boxes, which are slightly shop soiled but otherwise in excellent condition, will be found very useful for storing the parts equivalent to 1927 Nos. 5 and 7 Outfits respectively, or for storing Meccano Parts generally.

The prices, which include carriage, are as follows :—

Wooden Box for 1927 No. 5 Outfit Parts 25/–

Wooden Box for 1927 No. 7 Outfit Parts 85/–

Meccano Ltd., Old Swan, Liverpool.

This Month's Special Articles

	Page
Aeroplane Landing Grounds in the Atlantic	2
Air News	28
A Wild Night Ride	11
Books to Read	16
Competition Page	73
Engineering News	24
Famous Aero Engines—"Bristol" Jupiter	35
Famous Trains—The "International Limited"	8
Fire Floats and Chemical Engines	18
Fireside Fun	75
From our Readers	30
Guild Pages	68, 69, 71
Hornby Railway Company Pages	52–59
How to use Meccano Parts	38
In Reply: Hornby Section	61
In Reply: Meccano Section	67
Matthew Murray, Pioneer Engineer	26
Meccano Three-Engine Biplane	48
Model-building Contest	45
Model-building Contest Results	62
New Diesel Railway Engine	32
New Meccano Models	46
Of General Interest	14
Photography by Artificial Light	51
Producing the "M.M."	4
Railway News	12
Scientific Apparatus in Meccano	40
Stamp Collecting	77, 79
Story of our Daily Bread	21
Suggestions Section	65
Visit to the Home of Meccano	42

RAILWAY PHOTOGRAPHS

We list the finest photographs ever produced at 3d. each, or 2/6 per doz. Send 4d. for specimen card and our new booklet, "Collecting Railway Photographs," which includes our latest list of over 100 titles.

Railway Photographs, 23, Hanover St., Liverpool

HOME CINEMATOGRAPHS



Call or Write

FILMS AND ACCESSORIES. Projectors at all prices from 5/– to £90. Film Spools, Rewinders, Lighting Sets, Screens, Sprockets, etc. Films all lengths and subjects. Sample Film 1/– and 2/6 post free. *Illustrated Price Lists Free.*

FORD'S (Dept. M), 13, Red Lion Sq., London, W.C.1. (Entrance Dane St.)

BOYS MAKE YOUR OWN LEAD SOLDIERS

Cowboys, Indians, Animals, Zulus, Model Farmyard Sets, Rodeo, etc. Our CASTING MOULDS make thousands from any scrap lead WITHOUT PREVIOUS EXPERIENCE. Send stamp to-day for Illustrated Catalogue. Complete mould ready for work **2/6.—"TOYMOULDS," 67, Stafford Street, Birmingham.**

"Mention Meccano."



This Space is set to ½ inch s.c. and costs 8/– per month. The sum is the 50th of £20, the price of a whole page advertisement. Over 62,000 copies of the November issue were sold in various parts of the world. Your advertisement therefore reaches this exclusive public for approximately 1½d. per 1000.

SIMPLEX TYPEWRITERS

so popular with Boys, are unique, practical, and render a useful service. Everybody can type with a Simplex. Faster than writing and far more interesting. Just as fascinating for grown-ups as for boys.

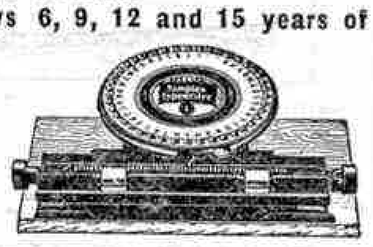
SPECIAL MODELS: **E 5/–, F 10/–, G 15/–, & H 20/–**

Standard characters, rubber type, visible typing, any length of paper, guaranteed to last years.

GREAT TYPEWRITING COMPETITION. £50 in Prizes.

Separate Prizes for Boys 6, 9, 12 and 15 years of age.

Type a simple letter on your Simplex—that's all. Entry forms supplied with each Simplex typewriter by any good Toy Shop. In case of difficulty write :—



Simplex Typewriter, 1, Newman St., Oxford St., W.1

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES :—

BINNS ROAD, LIVERPOOL.

Telegrams : "Meccano, Liverpool."

Publication Date. The *"M.M."* is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Advertisements

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the case of Australia, where the price is 1/– per copy (postage extra), and the subscription rates 7/– for six months and 14/– for 12 months (post free).

Overseas readers are reminded that the prices shown throughout the *"M.M."* are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA : Meccano Ltd., 45, Colborne Street, Toronto.

AUSTRALIA : Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.

NEW ZEALAND : Models Ltd., Kingston & Federal Streets, Auckland.

SOUTH AFRICA : Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.

INDIA : Karachi : Bombay Sports Depot, Elphinstone Street.

Bombay : Bombay Sports Depot, Dhobi Talao.

Calcutta : Bombay Sports Depot, 13/C, Old Court House Street.

Cases have been reported recently, in which readers in various parts of the world have been charged more than the published price for their copy of the magazine—that is to say, more than 1/– in Australia, and more than 6d. in other parts of the world.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the correct figure. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor. The name of the nearest Meccano dealer who is willing to supply at the correct figure will then be given.

"MECCANO MAGAZINE" BINDERS

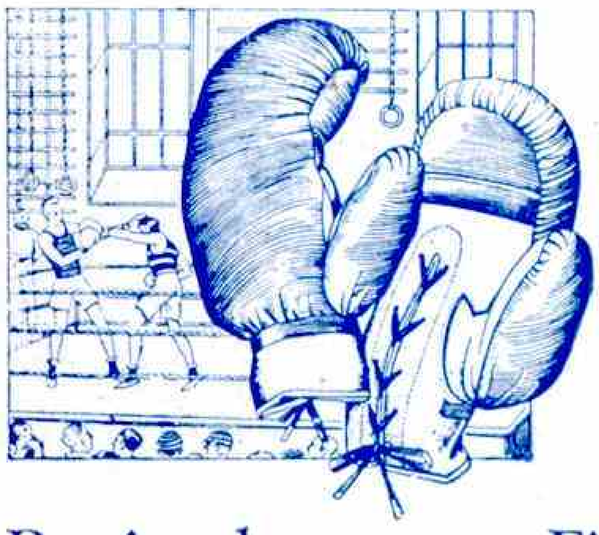
Your Magazines may be kept clean and tidy by enclosing them in one of the special binders we supply. Two sizes, price 3/– and 4/6 post free, from Meccano Ltd., Old Swan, Liverpool.

GAMAGES

The Great Boys' Store

HOBBIES SPORTS PASTIMES

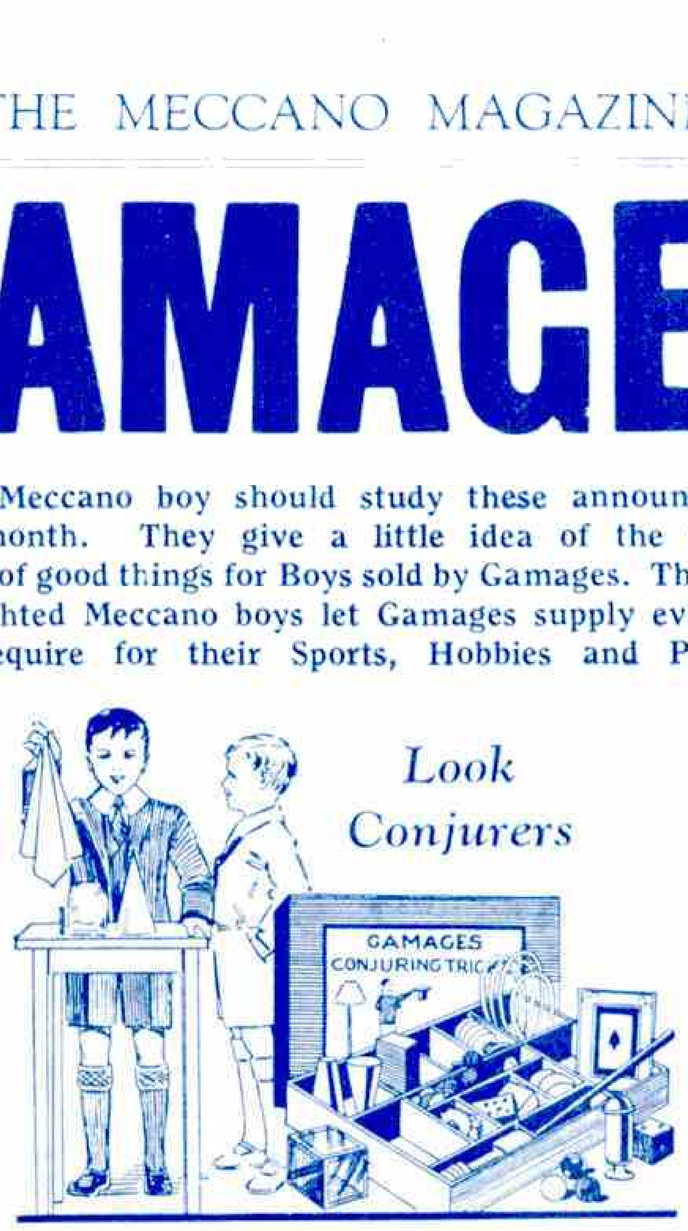
Every Meccano boy should study these announcements each month. They give a little idea of the splendid variety of good things for Boys sold by Gamages. Thousands of delighted Meccano boys let Gamages supply everything they require for their Sports, Hobbies and Pastimes.



Boxing keeps you Fit

A "few rounds" with the gloves every day will keep you fit and strong. These Boxing Gloves are most suitable for the hard wear you will give them. They have laced palms, correctly placed bar grip, and are stuffed evenly with pure horse-hair.

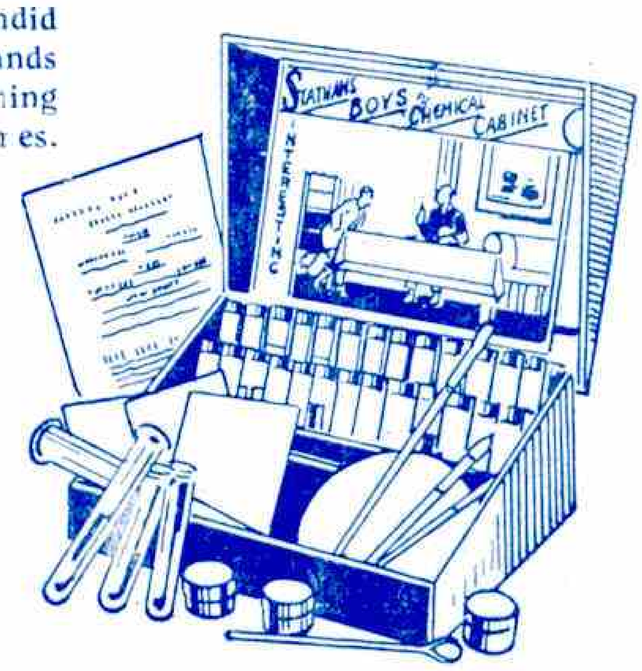
Youths', **14/6** the set. Boys', **13/6** the set.



Look Conjurers

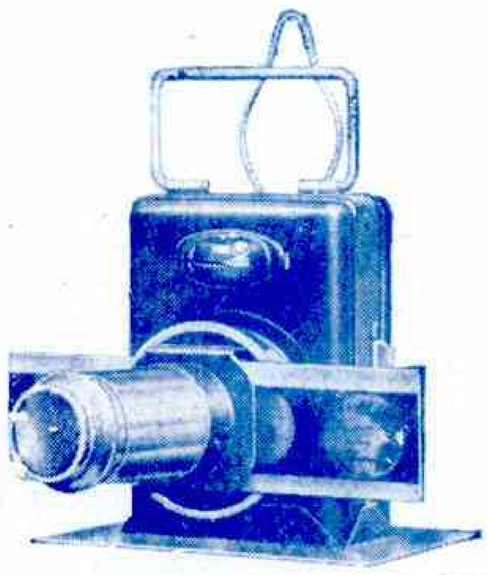
For the AMATEUR CONJURER

Jolly fun for the Long Winter Nights, Parties, etc., and dull days. The fellow that conjures is always welcomed wherever he goes—but only by using Gamages apparatus. Supplied in the following prices: **3/-, 7/9, 10/9, 15/9, 22/6, 35/-, 42/-, 63/-.** Post 4d. **4/6**



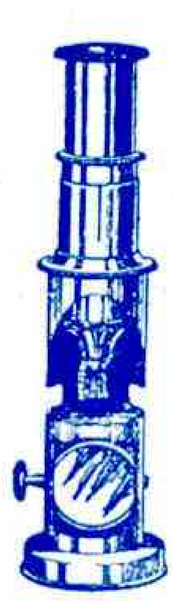
Chemical Cabinets

A fine Hobby for the Winter evenings and one of which you will not quickly tire. It is amusing, interesting, and very educational. You have a choice of a large range of outfits if you come to GAMAGES. Other Sets **3/3, 14/6, 25/-, 52/-.** **5/6**

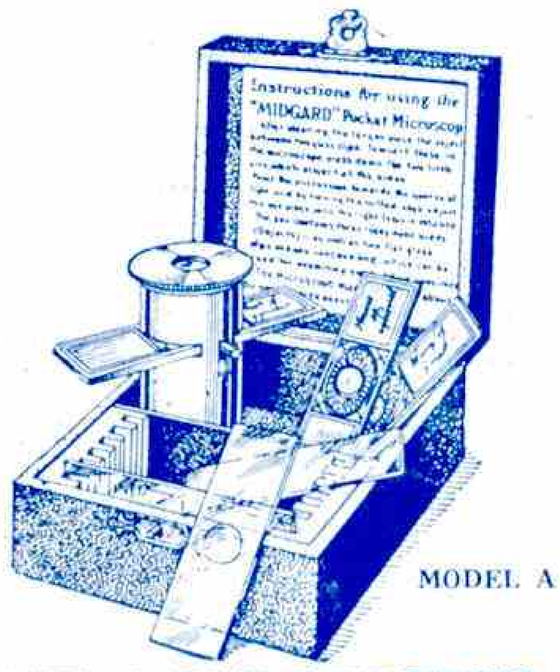


COMBINED ELECTRIC
MAGIC LANTERN
AND HAND LAMP

Complete with battery and slides (6) Extra battery, 6d. Extra slides, 1/- doz. Post free. **5/6**



MODEL B



MODEL A

JUVENILES' MICROSCOPES

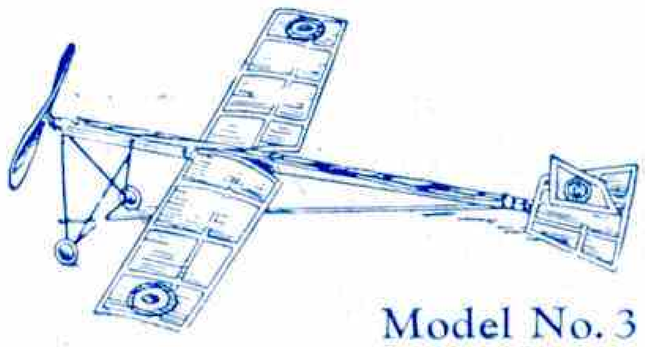
Model A. Lacquered brass with adjustable spring side, suitable for examination of pond life, cheese mites, etc. Magnifies 50 diameters. Complete in box with instructions and 2 prepared micro objects, 2 plain glass slides, 2 glass slides with cavity. Post 6d. Price **3/6**

Microscope, same as above, but with 3 only glass plates in box. Post 6d. Price **2/-**

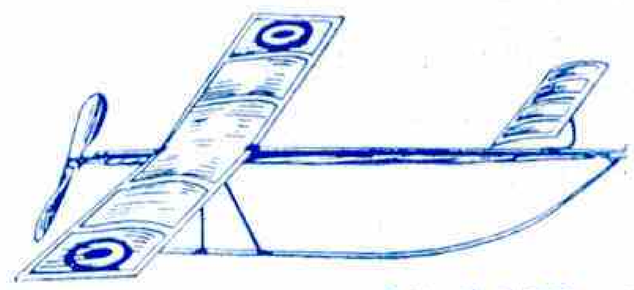
Model B. As illustrated, solid brass body of superior finish, finest lenses. Height when closed 6 inches, complete in polished wooden box. Divisible objective giving powers 30, 60, 90 x. Post 6d. Price **18/6**

Superior Microscope, **29/6, 37/6** and **63/-**

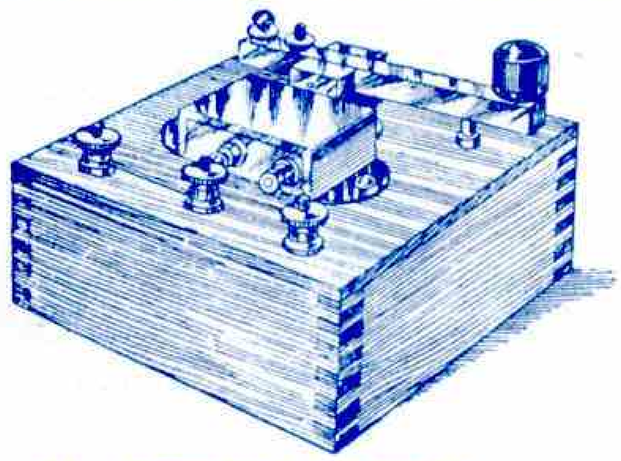
Mounted Slides, **4/6** doz. Post 4d. Plain slides **6d.** doz. Hollow slides **1/6** doz. Post 6d.



Model No. 3



Model No. 0



HANDY MORSE PRACTICE SET

(as illustration).

This practice set is fitted with reliable buzzer and well made morse key. Battery can be fitted into the base of the set. All brass parts lacquered and beautifully finished. Size: Height over all, 2¼ ins.; length, over all, 3⅞ ins.; width, over all, 3¼ ins. Battery **6d.** extra. Post 6d. Price **6/6**

We Stock all Hornby Train and Meccano Parts and send them Carriage Paid to any Station U.K.

THE WARNEFORD MODEL AEROPLANE

Is a guaranteed flying machine very easy to fly—no complicated adjustments. The Elevator or Controller can be bent down towards the main plane in order to make the machine rise quickly—or flattened out for long distance flying—and can be bent to the right or left in order to obtain a circular flight in either direction. The length of flight depends on weather conditions, and under suitable conditions, it is quite possible to get a flight of 300 to 500 yards.

Model No. 0 Pusher Type **5/6**
„ No. 1 „ „ **7/6**
„ No. 3 Tractor ... **21/-**



SCOUT CHALLENGE

An Ideal Game for Boys

Played on a Board with 72 pieces, representing the different members of the Scout movement, including Camps, Man Traps and Taboos, with screen to hide the arranging of Pieces. Post 4d. Price **2/6**

A. W. GAMAGE LTD.
HOLBORN
LONDON, E.C.1

City Branch: 107, Cheapside, E.C.2

The greatest thrill of model-building



is that which you experience when you set in motion your Crane, Ship Coaler, Motor Car, Windmill, or any other model you have built, by means of a motor. Could anything be more exciting? You push over the control lever of the motor and immediately the model commences to work in exactly the same manner as its "big brother" in real life.

The fullest possible enjoyment from the Meccano hobby can only be obtained by operating your models with a Meccano Motor. All Meccano Motors are strongly made, and the utmost care is taken in their manufacture to ensure that they give every satisfaction to their owners.

Particulars and prices of the Motors and Accessories are given below.

MECCANO CLOCKWORK MOTOR

This is a splendid piece of mechanism, simple, powerful, reliable and free from all danger. It is fitted with starting, stopping and reversing levers, and all its movements are fully explained in the instructions that accompany it. Price **7/6**

MECCANO ELECTRIC MOTOR No. 1

(4-volt)

The 4-volt Motor is specially designed to build into Meccano models. It may be run by a 4-volt accumulator or, by employing the Transformer described below, from the main. Fitted with reversing motion, provided with stopping and starting controls, and the gearing is interchangeable. Price **15/6**

NOTE.—The Electric Motor No. 1 will not run satisfactorily from dry cells.

MECCANO RESISTANCE CONTROLLER

By employing this variable resistance the speed of the Meccano Electric Motor No. 1 (4-volt) may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. It will not regulate the speed of a high-voltage motor connected to the main. Price **3/6**

TRANSFORMER

By means of this transformer the Meccano Electric Motor No. 1 (4-volt) may be driven from the house supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Price **30/-**

MECCANO ELECTRIC MOTOR No. 2

(100-250-volt A.C. or D.C.)

This Electric Motor may be employed for any purpose for which a small motor is suitable, but it is specially adapted for driving Meccano models, into which it may be built. It is designed for connection with the electric light main—100-120-volts or 200-250-volts, alternating or direct. A 6-ft. length of flex, fitted with a plug for connection with the motor terminals and an adapter for connection with an ordinary lamp socket, is included. A suitable resistance is required when the motor is run with a 200-250-volt current, and this is supplied by connecting a 60-watt lamp in series with the motor. A board, on which are mounted a suitable lamp holder (lamp not included) and a switch, is provided separately. Price **32/6**

Lamp board (with lamp holder and switch) Price **4/6**

MECCANO ACCUMULATORS

These new and excellent types of accumulators have been adapted to drive the Meccano Electric Motor No. 1 (4-volt). They have remarkable recuperative powers, and will continue to supply current when nominally exhausted.

4-volt 8 amps. ... ... Price **17/6**
4-volt 20 amps. ... ... Price **25/-**

MECCANO RHEOSTAT

(For high voltage motors)

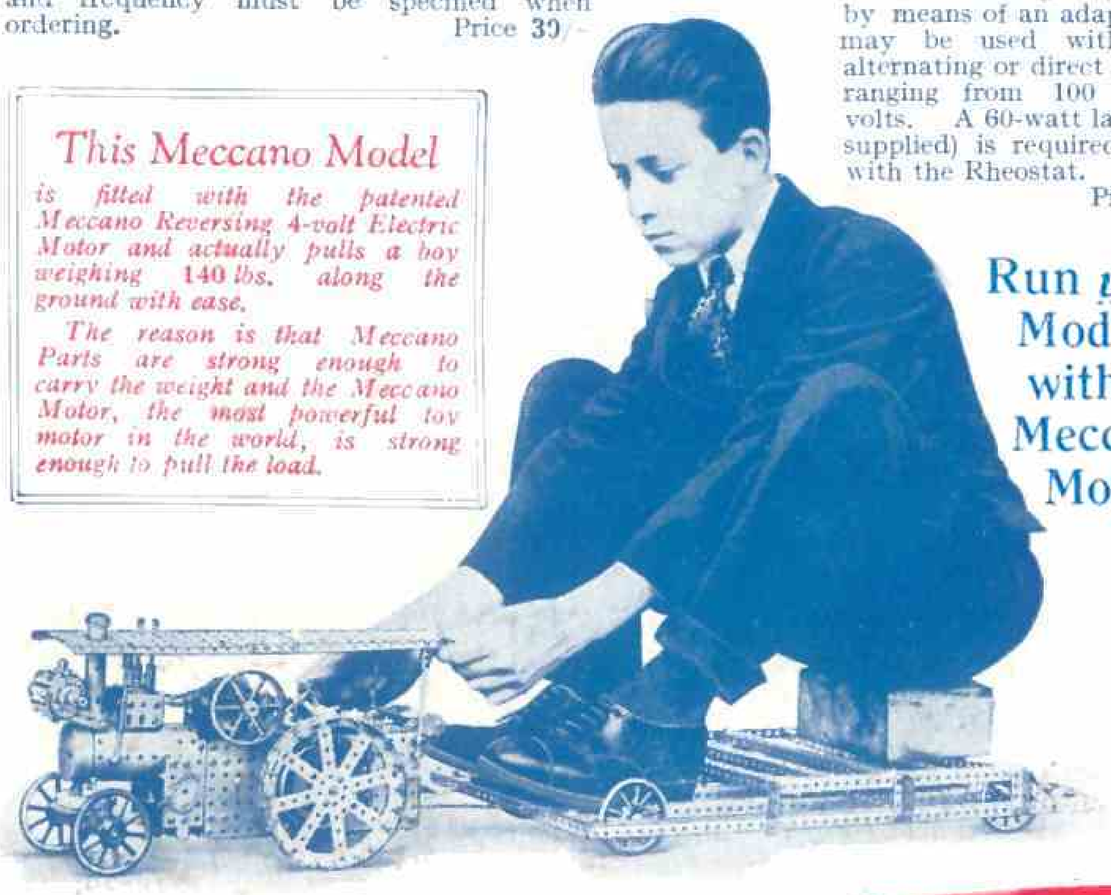
This Rheostat is for controlling the speed of the Meccano Electric Motor No. 2 or the H.V. Hornby Metropolitan Train. It may be connected to the house lighting system by means of an adapter and may be used with either alternating or direct currents ranging from 100 to 250 volts. A 60-watt lamp (not supplied) is required for use with the Rheostat.

Price **18/6**

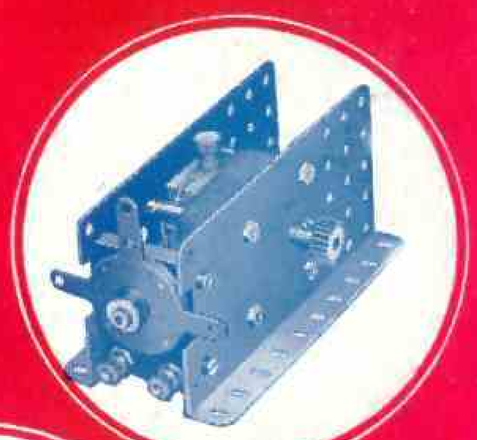
This Meccano Model

is fitted with the patented Meccano Reversing 4-volt Electric Motor and actually pulls a boy weighing 140 lbs. along the ground with ease.

The reason is that Meccano Parts are strong enough to carry the weight and the Meccano Motor, the most powerful toy motor in the world, is strong enough to pull the load.



Run *your* Models with a Meccano Motor



Meccano Electric Motor No. 1 (4-volt)



Meccano Resistance Controller



Transformer



Meccano Rheostat



Meccano Clockwork Motor



Meccano Accumulator



Meccano Electric Motor No. 2 (100-250-volt A.C. or D.C.)

Meccano Limited, Old Swan, Liverpool

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