VOL. XVIII. No. 1 JANUARY 1933.

MECCANO MAGAZINE



FIGHTING SNOW ON THE SOUTHERN PACIFIC

(see page 2)

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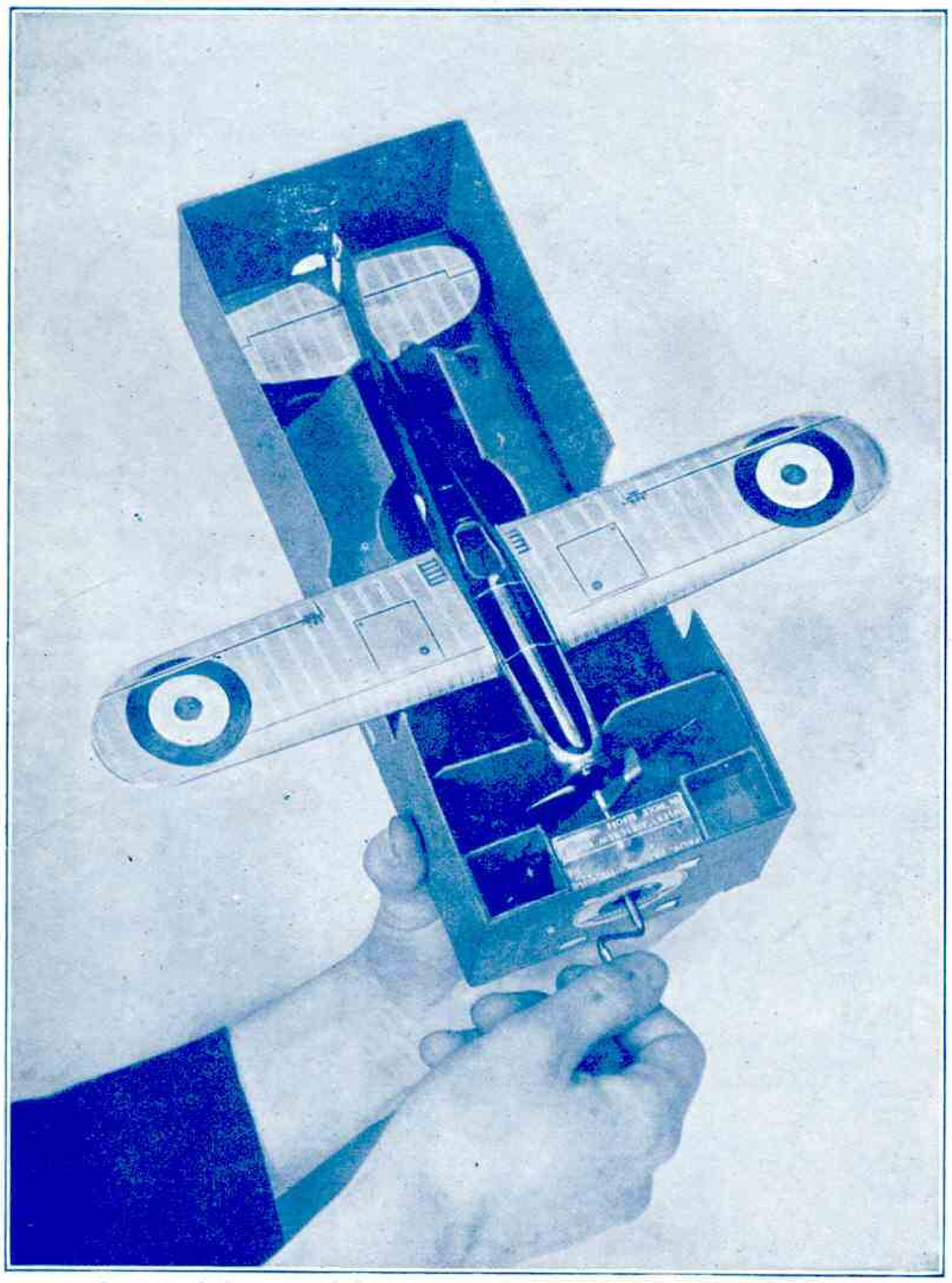
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MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool
England

Vol. XVIII. No. 1
January, 1933

With the Editor

A Record Christmas Issue

I wish to thank my readers for the hearty Christmas and New Year Greetings they have sent me, and also for their enthusiastic comments on the December issue of the Magazine. This issue was specially enlarged to 112 pages, and it is very gratifying to know that the hard work and care that went to its production have been rewarded by the pleasure it has given to the great army of "*M.M.*" readers in all parts of the world.

More than 90,000 copies of the Christmas issue were printed, and when these were waiting to be sent out to their eager readers the piles seemed really formidable. The Magazines in them actually weighed nearly 30 tons, and contained sufficient paper to cover an area of 148 acres; but this enormous quantity disappeared as if by magic, and within a few days the issue was sold out.

Records in 1932

Looking back over the events of 1932 it is gratifying to find that Great Britain still holds the speed records on land and in the air, for the 253.968 m.p.h. achieved by Sir Malcolm Campbell in the "*Bluebird,*" and the 407.5 m.p.h. of Flt. Lt. Stainforth in the Supermarine-Vickers Rolls-Royce seaplane, have not yet been surpassed. For a short time Great Britain held also the water speed record, for in July Mr. Kaye Don in "*Miss England III*" covered a measured mile on Loch Lomond in both directions at an average speed of 119.75 m.p.h., which was 8 m.p.h. above the previous record of the American, Mr. Gar Wood. Shortly afterwards Mr. Wood regained the record by putting up a speed of 124.91 m.p.h. in his new boat "*Miss America IV.*"

In aviation the outstanding event of the year was Flt. Lt. Uwins' capture for Great Britain of the record for the greatest height attained in an aeroplane. The full story of the flight was told in last month's "*M.M.*" Flt. Lt. Uwins reached a height of 43,976 ft., or a little over eight miles, and was then three miles higher than the summit of Mount Everest, and more than 12 times as high as Snowdon.

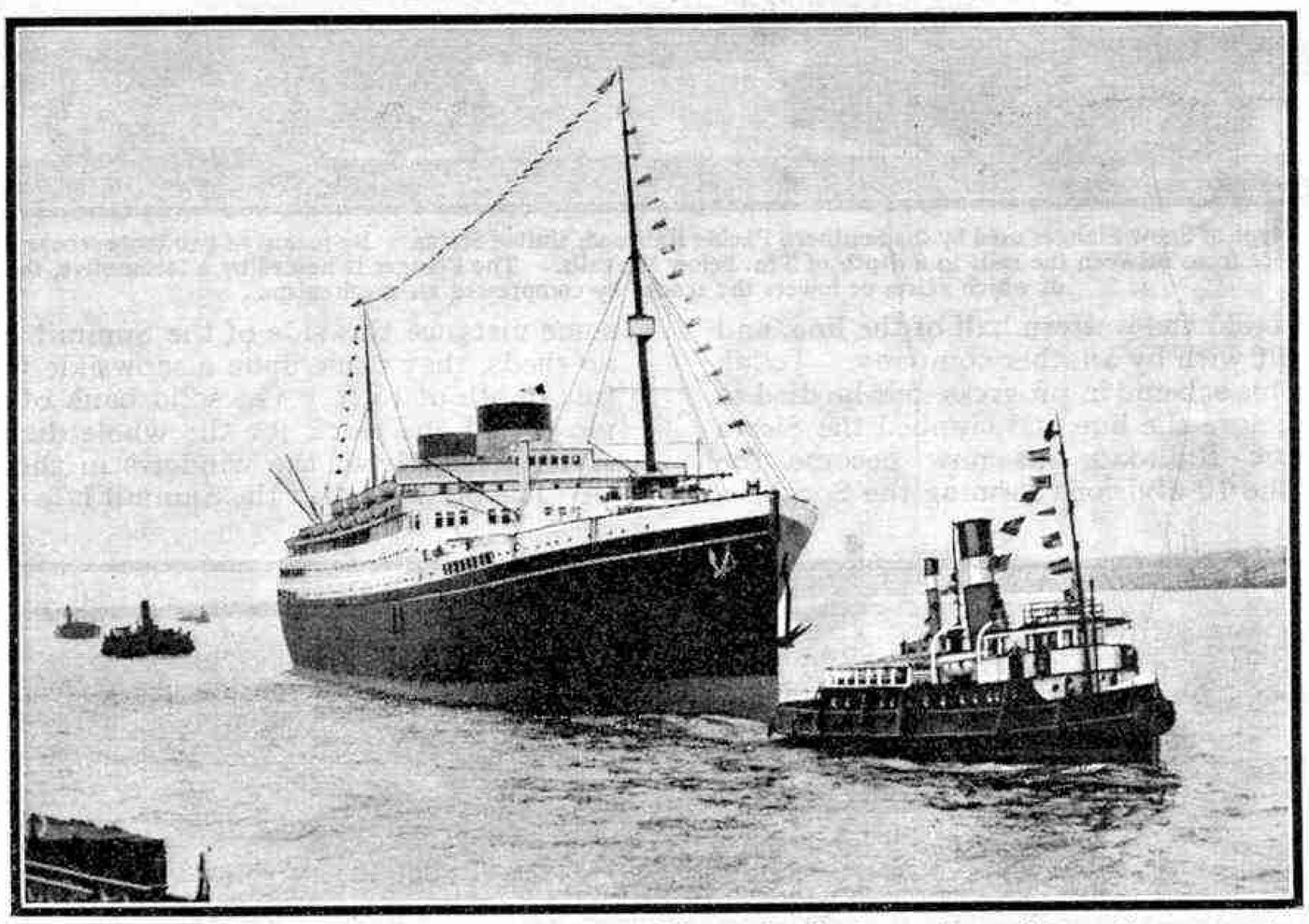
Many excellent aeroplane flights were made during the year. Among these must be mentioned Mr. J. Mollison's flight from Ireland to New Brunswick, Canada, the first flight made from Europe to the mainland of America; Miss Amelia Earhart's flight from Newfoundland to Ireland in 13¼ hours, the first solo trans-Atlantic flight by a woman; and Mrs. Mollison's record flight from this country to Capetown in 4 days 6 hours 53 minutes.

Great Empire Engineering Works

Turning now to engineering, the outstanding feature of 1932 was the completion of great projects in Canada, Australia and India. Canada's contribution was the Welland Ship Canal, which was formally opened during the Ottawa Conference in September. The Canal was described in articles that appeared in the "*M.M.*" for October and November of last year. Its construction is one of the greatest triumphs of the civil engineer, and it is to be followed by even more striking developments. The lower stretches of the St. Lawrence are to be made deeper and wider, and canals are to be cut to avoid rapids, in order that steamers 600 ft. in length and drawing up to 30 ft. of water may pass between the Great Lakes and the Atlantic Ocean. When the scheme is finished, Toronto, Chicago and other cities on the shores of the Lakes will practically become seaports!

In Australia the great arch bridge across Sydney Harbour was opened for traffic on 19th March. Although a similar structure 2 ft. longer has been built near New York, Sydney Harbour Bridge remains the greatest of its kind in the world, for it is 150 ft. in width and accommodates two lines of railway, in addition to a roadway and two footpaths, whereas the American structure has a roadway only 40 ft. in width and one footpath.

The third of the great Empire engineering projects is the Sukkur Barrage irrigation scheme. The wonderful dam erected across the course of the Indus at Sukkur will store up water for distribution over an area of 5,000,000 acres.



The White Star motor passenger liner "Georgic" at Liverpool, prior to starting on her maiden voyage to New York on 25th June, 1932. The "Georgic" and her sister ship the "Britannic" are the largest vessels regularly using the Port of Liverpool, the subject of the first article in the series on "Great Ports of the World," that appears on page 6.

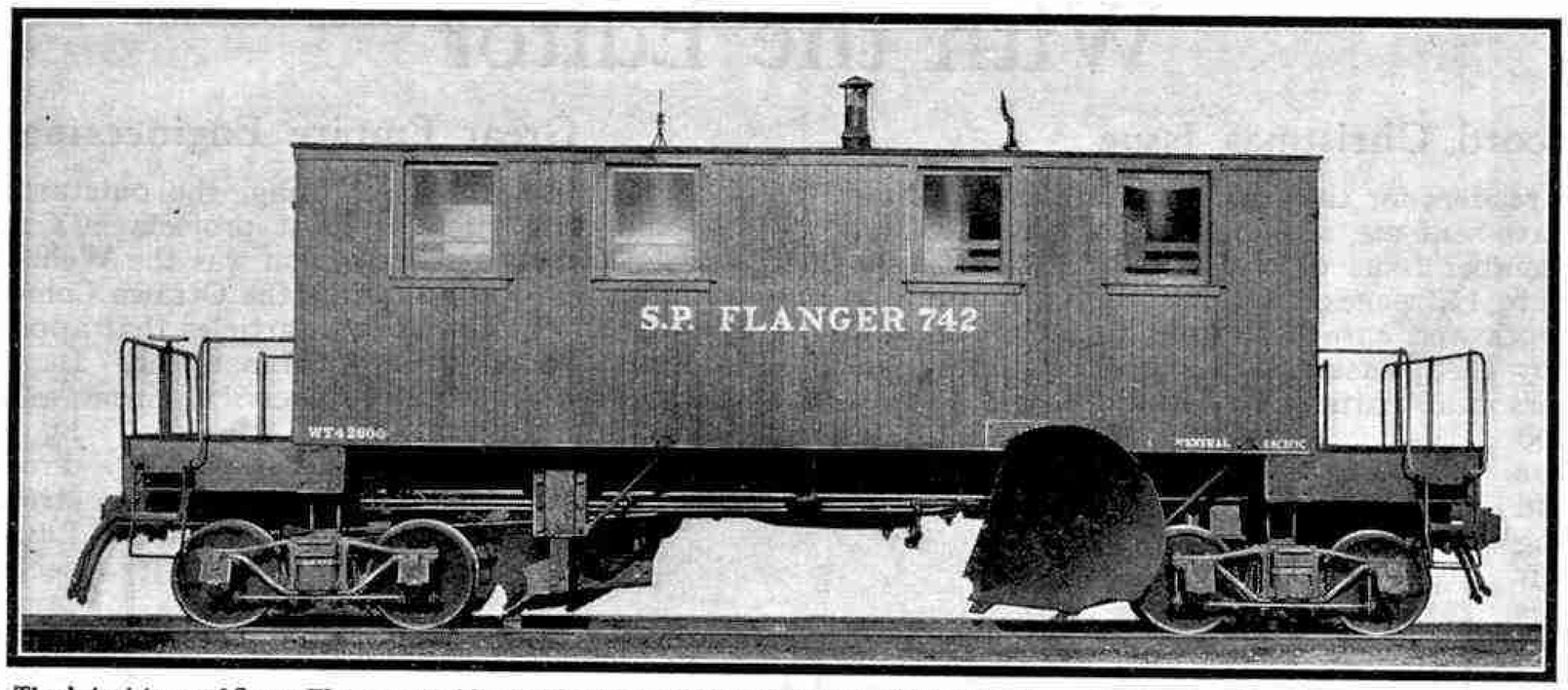
The World's Largest Ship

Great Britain did not figure prominently in the shipbuilding world during 1932, for the giant Cunarder on which so many hopes were founded still remains unfinished on the stocks in the Clydebank yard in which her building was commenced. Two remarkable Italian passenger liners made their appearance, but the greatest event was the launch of the largest ship in the world, a 70,000-ton French liner built at St. Nazaire. It is expected that this vessel will be completed next year, and as her designed speed is 30 knots the Blue Riband of the Atlantic probably will pass into French keeping. It is interesting to note that the "*Normandie,*" as the new liner has been named, is to be driven electrically, and her turbo-electric engines will develop 160,000 h.p.

Fighting Snow on the Southern Pacific

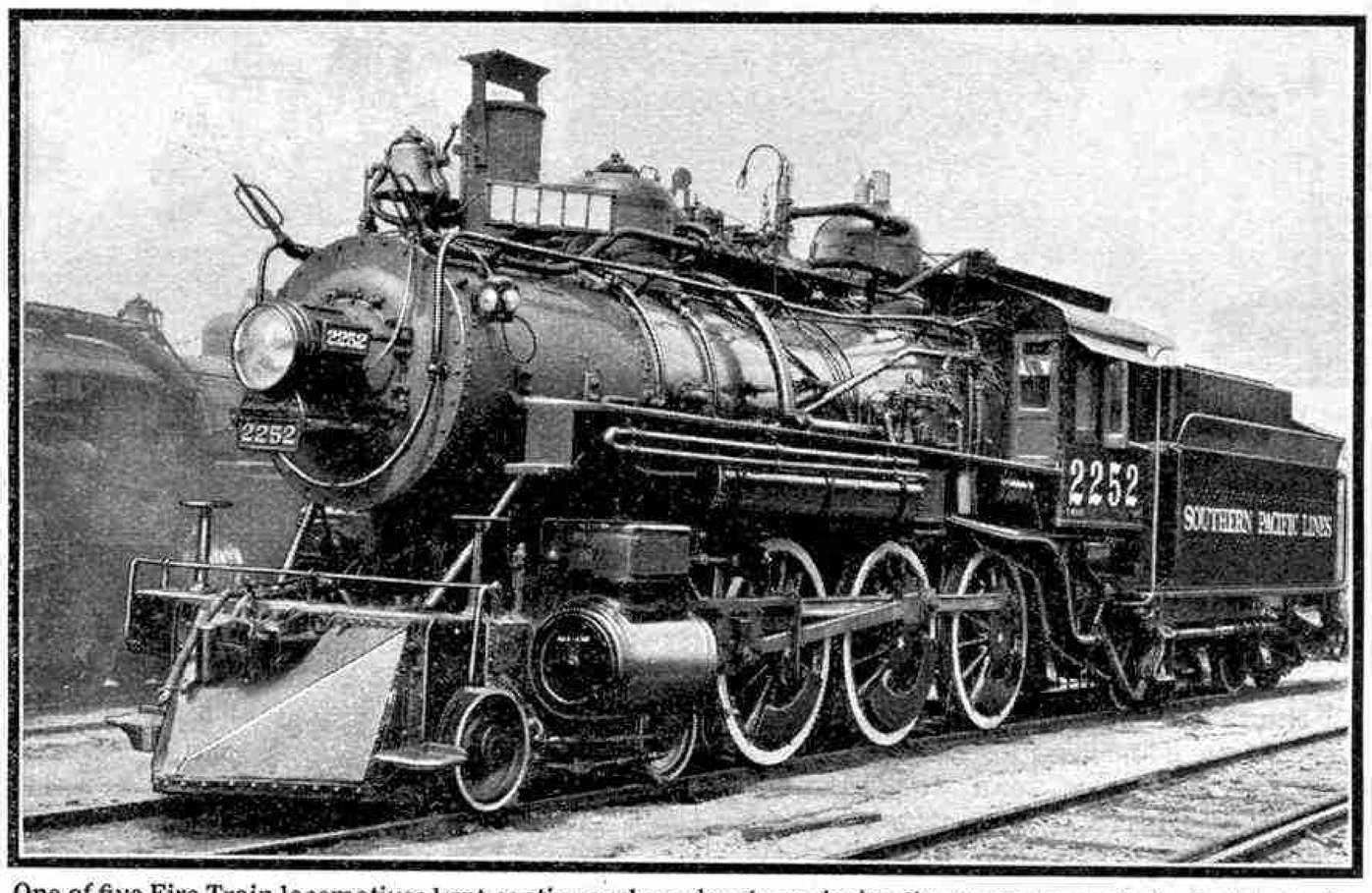
Railway Conquest of the Sierra Nevada

THE Southern Pacific Railroad originated in a single line of railway running from Sacramento, the capital of California, to Falsom, a distance of about 22 miles. This was the first railway in California, and its construction was due to the energy and ability of a young engineer named Theodore D. Judah. It represented the first step towards the realisation of his vision of a railway crossing the entire continent. In conjunction with Dr. D. W. Strong he prepared a scheme for a "Pacific Railroad," but failed to obtain Government support for it. Subsequently a company was formed in California under the title of the "Central Pacific Railroad," and ultimately an Act was passed authorising the construction of the first trans-continental railway. According to this Act the Californian company were to build the western half of the line, and the eastern half was to be dealt with by another company. Judah had the satisfaction of seeing his scheme in progress, but he died in 1863 at the early age of 37, before the line had climbed the Sierra Nevada. The Central Pacific Railroad has now become the Sacramento division, one of the 10 divisions forming the Southern Pacific Railroad.



The latest type of Snow Flanger used by the Southern Pacific Railroad, United States. By means of two large scoops it clears snow and ice from between the rails to a depth of 3 in. below the rails. The Flanger is hauled by a locomotive, the driver of which raises or lowers the scoops by compressed air mechanism.

The snowfall on the Sierra Nevada is extremely heavy, and indeed it is said that the snow reaches as great a depth here as at any place in the northern hemisphere. The early engineers of the Central Pacific seem to have underestimated the difficulties that might arise from snow, and although they erected snow sheds, these were inadequate for the purpose of protecting the road bed. The snow ploughs used in those days were also inefficient. They were of the type known as the "bucker" plough, a V-shaped wooden structure mounted on a pair of ordinary car axles and wheels, and driven by a battery of six or more locomotives.



One of five Fire Train locomotives kept continuously under steam during the summer months to deal instantly with snow shed fires.

In 1890 the necessity of tackling the snow problem seriously was driven home by the greatest snow blockade in the High Sierras since the completion of the railway. Some idea of the conditions then existing may be gathered from the following extracts from the files of the "*Sacramento Union*."

4th Jan. 1890—"Six hundred men fighting snow . . . On Thursday afternoon (2nd Jan.) with the wind blowing a hurricane and the air filled with blinding snow, one of the old model snow plows, with six large locomotives behind it, together with three car loads of shovellers, started to clear the track to Blue Canyon. It succeeded in scattering the snow from the track up to within two miles of the latter place, where on account of the increasing violence of the wind and falling snow it had to give up the attempt to get to Blue Canyon. Snow had fallen over the track behind the train, and the entire outfit became blockaded. Meanwhile the new rotary plow was looking over the road near Cascade (now Spruce), where the sheds were recently burned down, and it was headed eastward endeavouring to keep the road clear as far as Summit. Receiving the news that the other plow was storm-bound near Blue Canyon, and being ordered thither, the trainmen started for the Summit turntable in order to head the plow westward. When some distance this side of the Summit in a place where there were no sheds, they came upon a snowslide for a distance of over 200 ft. to a depth of 15 ft. The solid bank of snow was bored into by the plow, and the track for the whole distance was cleared in grand style, although all the windows in the cab were smashed.

"The plow reached the Summit late at night, and it was resolved to wait until daybreak yesterday morning before starting back. With the fast mail train behind them the start was made, but again 8 ft. of snow was found on the track in the open space which had but a short time before been cleared of the obstruction—a fissure in the bank had caused it to slide back again upon the track. Forging through this they proceeded as far as Cisco, where the '*Overland*' stopped, and the passengers were accommodated at the hotel. The plow then proceeded to the assistance of the one blockaded. The depth of snow at Summit was 16 ft. Later.—The westbound trains were still behind the blockade."

5th Jan. 1890.—"It required the services of 200 shovellers to release the bucker plow at Blue Canyon, working constantly in two shifts of 100 men each."

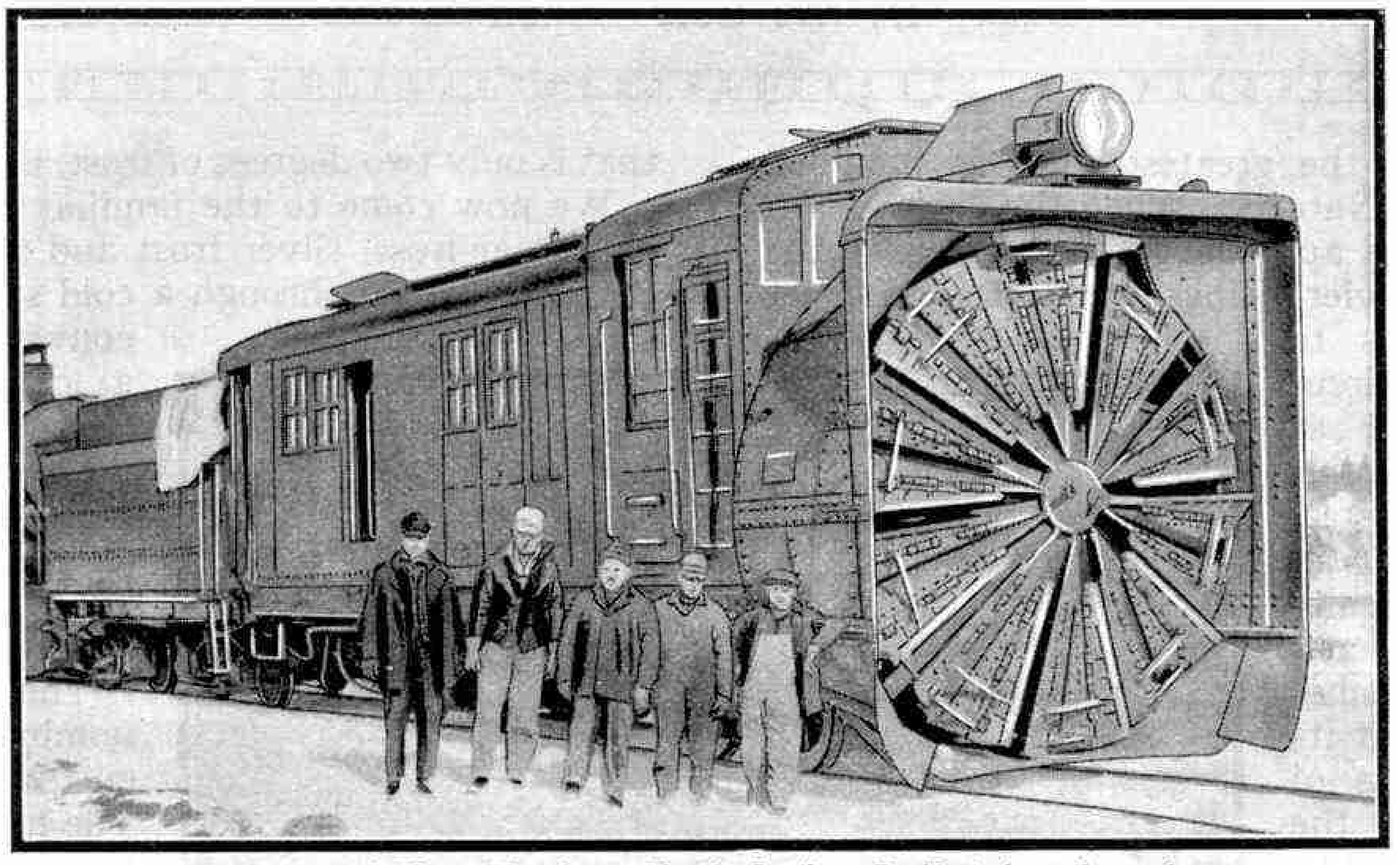
The storm continued for some days, and the report chronicles repeated trouble with the ploughs and derailment of the engines.

20th Jan. 1890.—"Storm increases in intensity. A bucker plow with five engines started to go east from Truckee the other day and got corraled on short notice. Five more engines were sent to help them out, and they met with the same fate. . . . It took a bucker plow and five engines 36 hours to get to Tunnel 13,

five miles west of Truckee. A car load of provisions was afterwards despatched, and after going as far as possible on the track, men on snow-shoes carried the supplies the rest of the way."

22nd Jan. 1890.—"Still blockaded. The passengers in the two trains imprisoned at Blue Canyon are well provided for. Much of the provision had to be packed many miles by snow-shoers."

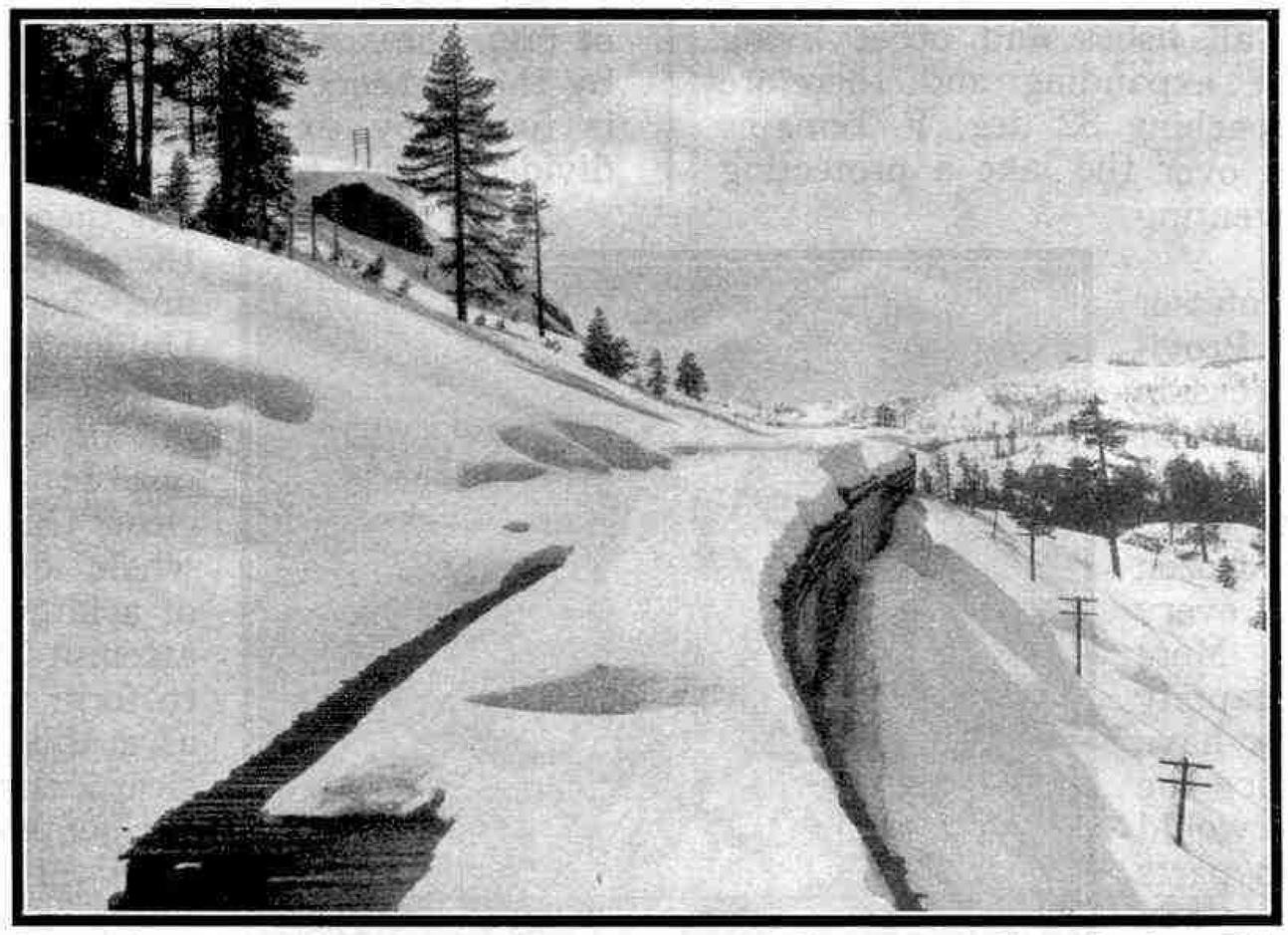
The blockade was raised on 31st January after 16 days, and eight trains proceeded on their way from Truckee to Sacramento with 59 cars of passengers. The blockade demonstrated more closely than ever the urgent necessity for a complete and efficient system of snow sheds, and in view of the trying experiences of travellers during this period it is extraordinary to read the strong objections made against sheds on account of their shutting out the view. These objections resulted in various attempts to overcome the difficulty by inserting windows in the sheds at the most interesting points along the line, but their frequent breakage resulted in their abandonment.



One of the powerful Snow Ploughs used by the Southern Pacific to keep the road open.

The first sheds had a peaked roof, but they were soon abandoned in favour of those of flat construction. The flat type has proved capable of bearing tremendous loads in times of abnormal snowfall, and it is readily restored to its original alignment after the structure has been pushed sideways by the thrust of snow against it. Reinforced concrete sheds are used on some lines with the object of securing greater permanency and eliminating the risk of fire, but they would not form a satisfactory substitute for wooden sheds on this difficult stretch of track. They would be difficult to anchor securely, and if, as is probable, they gave way from time to time under the enormous pressure of melting ice, they would be much more costly than wooden sheds in regard to both removal of debris and renewal of the structure. The early peaked roof sheds had a clearance of 17 ft. The standard clearance of the existing flat sheds is 22 ft., this increase having been necessitated by the steadily-growing dimensions of both locomotives and cars.

The wooden snow sheds are liable to constant danger from snow slides, but an even greater agent of destruction is fire. Some of these fires are due to brush or forest fires in the vicinity, some can be traced to incendiarism, and still others bear no definite signs of their origin. In the days of the old wood-burning locomotives the fire risk was much greater than it is to-day, with the exclusive use of oil as fuel. Various schemes for protecting the sheds against fire were tried, including covering them with galvanised iron, but these schemes were soon abandoned. The extent of any fires that may occur is limited by providing gaps at intervals in the line of sheds. As these gaps are only required in the summer, they are provided by means of telescopic sections. These sections average about 100 ft. in length and are mounted on wheels and rolled back inside the adjacent main shed in summer to form the necessary gap. On the approach of winter they are rolled out again, thus restoring the continuous line of sheds. The fire risk is reduced to the minimum by an elaborate system of shed watching from suitable points in telephonic communication with the stations, and by a system of district telegraph boxes along the line, from which patrolling watchmen can give the alarm. Fire trains were first installed in 1870, and now form a very important feature of the line.



Winter view of a stretch of the snow sheds that protect the line across the Sierra Nevada. This photograph gives a good idea of the severe conditions that prevail.

The Southern Pacific now have nine powerful rotary ploughs fully occupied in keeping the road open. Every train is preceded by one of these ploughs, attached to one of the company's huge articulated locomotives carrying a pilot plough and drawing a "flanger." The task of the flanger is to keep snow and ice from between the rails to a depth of 3 in. below the rails. It carries scoops that are lowered between the rails, and digs out the snow and ice and hurls it away from the track. The scoops are lowered and raised as required by the driver in the cab of the engine. When he observes a crossover he moves a lever and up comes the scoop; when the crossover is passed, down goes the scoop again. If he should be too late in raising the scoop, two $\frac{5}{8}$ in. bolts shear off and the cutter blade swings up out of harm's way. The crew in the cab of the flanger then signal the driver, who stops his engine; the two bolts are renewed, and away goes the engine again. Two metal flags on the roof of the flanger indicate whether the scoops are up or down. The scoops are made right and left, so that it is not necessary to turn the flanger, and the vehicle is weighted down with old rails to keep it on the track.

A difficulty arises where the eastbound and westbound tracks are side by side, for there a wall of snow is left, 4 ft. or 5 ft. high and about 3 ft. wide, and every now and then this wall falls over. This difficulty is being overcome by equipping one of the ploughs with extended wings to enable it to reach out and scoop up the snow between the tracks.

The company have five fire train engines equipped with powerful pumps on top of the boiler, reels of hose in the water car, nozzles, axes, and in fact everything to fight a fire. During the summer months, when there is danger of fire in the sheds or along the track, these engines are kept under steam and manned with a full crew to go anywhere at a moment's notice. A fire train may consist of a locomotive with a tender having a capacity of 6,000 gallons of water, and two water cars with a combined capacity of 12,000 gallons.

The Sierra Nevada is the loftiest mountain range in the United States, one of its peaks, Mount Whitney, reaching 14,500 ft. The name Sierra Nevada means "snow ridge," and the range lives up to its name. At Truckee, which has already been mentioned, many of the most effective "Far North" cinematograph scenes have been taken. A winter sports carnival is held here, a popular feature of which is the "Sierra Dog Derby." The famous Southern Pacific Overland Route crosses the Sierra Nevada, following the historic trail made by the covered wagons during the great gold rush to California of 1849. Four magnificent trains, the "*Overland Limited*," the "*Pacific Limited*," the "*San Francisco Limited*" and the "*Gold Coast Limited*" travel over this route on their wonderful 2,260-mile journey from Chicago to San Francisco.

Frost and its Handiwork

The Varied Marvels of Ice Formation

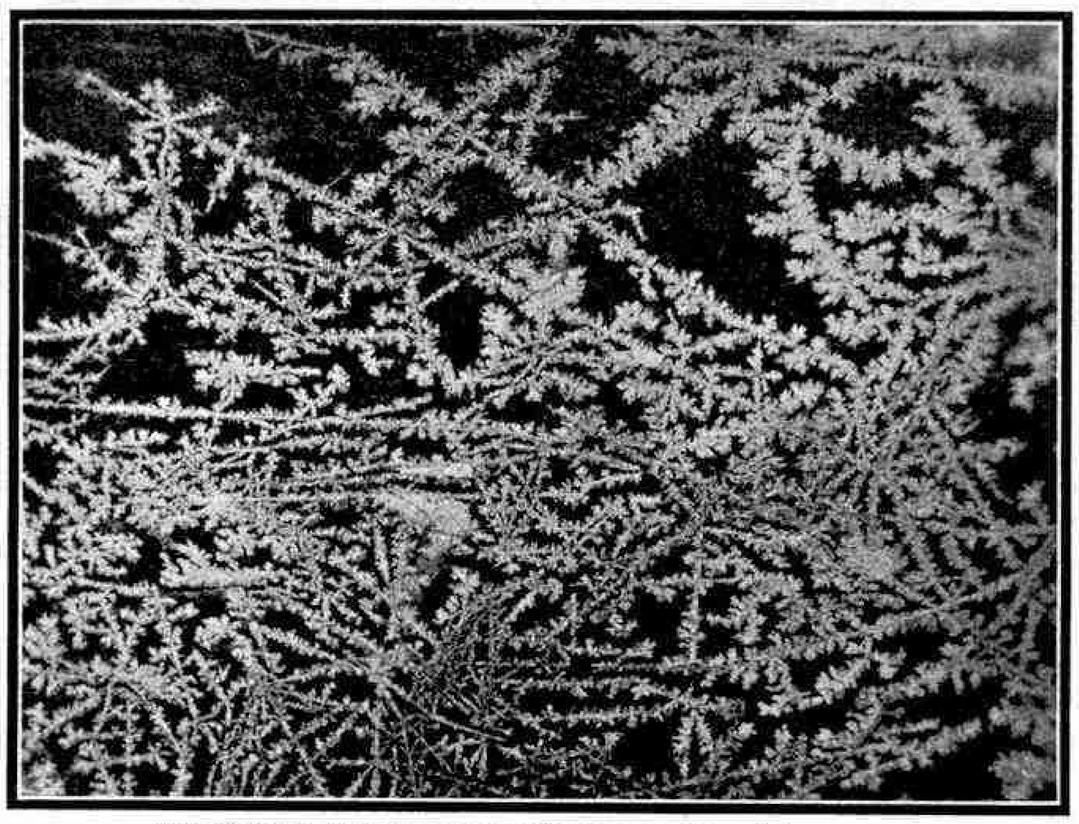
By W. Coles Finch

IN ice we see one of the greatest marvels moulded in the laboratory of Nature. When the surface of a lake cools as winter approaches, the water at the surface, becoming heavier, sinks, and the warmer water from below rises to take its place. This circulation continues until, at 32 deg. F., the water begins to turn into solid crystals of ice.

Water cooled gradually contracts slightly but continuously until it reaches 39.2 deg. F., when it is at its densest. If the process of cooling be continued, the water expands slightly until freezing point is reached, and then its expansion, with solidification, is both sudden and intense. If it were not for the fact that water increases in volume after passing 39 deg. F., all lakes would in time reach 32 deg. F. throughout, and the water would be formed into a solid mass of ice, killing all fishes and other living inhabitants. As it is, the expanding and therefore lighter water that is approaching 32 deg. F. remains at the surface, and throws over the lake a protecting mantle of ice, thus preventing solidification below.

In this connection Professor Tyndall wrote: "Had not Providence interfered on this occasion in a manner which may well be considered as miraculous, all the fresh water within the polar circle must eventually have been frozen to a very great depth, and every plant and tree destroyed." More than this, many lands now happily populated would before now have become uninhabitable, for the never-ending grip of the ice would have extended gradually to parts where even the hot summer sun would fail to break for long its relentless hold.

If water be prevented from expanding it cannot freeze, but the force it will expend in its effort to do so is tremendous, as we have proof in the way in which it bursts pipes, cylinders, etc., that are exposed to its severity. The pressure required to prevent water from freezing at 30 deg. F., that is only two degrees of frost, is 138 tons to the sq. in.!



The delicate tracery of frost figures on the window pane.

We now come to the familiar forms of ice as seen in hail, hoar-frost, silver frost and the icicle. Hail is rain that has passed through a cold stratum of air and been converted into ice. It is a curious fact that hailstorms are most common in tropical regions and during the heat of summer, and they usually occur during the hottest part of the day.

The writer recalls a phenominal hailstorm that occurred on 4th June, 1908. The heat, which is one of the necessary factors in the generation of a storm of this description, had been oppressive. At 3.45 p.m. the temperature quickly dropped to 74 deg. F., and as the sun became obscured by dark threatening clouds it fell to 64 deg. F. The prelude to the storm took the form of a few very large drops of rain, the size of which could only be accounted for by the presence in the atmosphere of electricity, which is found by experiment to cause particles of finely divided spray to coalesce. Hailstones of considerable size then fell with the rain, some of them measuring $1\frac{1}{4}$ in. in diameter, and being of irregular shape. Unlike the ordinary small white pellets, or frozen raindrops that fall in winter, these had a small opaque core cased in perfectly clear, transparent ice, making the whole an irregular mass the size of a large marble. There was an attempt in all the larger hailstones to form what I can only describe as a thin, irregular wide band of clear ice around this centre, making it resemble somewhat the familiar form of Saturn and its rings. Sharp angular points protruded irregularly from the edge of the band. It was to this curious ring of ice that I attributed the manner in which the hailstones fell, or rather seemed to alight, for the delicate points of the ring were uninjured in spite of the fact that they had fallen on a paved yard. Even large ones that struck me while I was gathering specimens fell quite lightly.

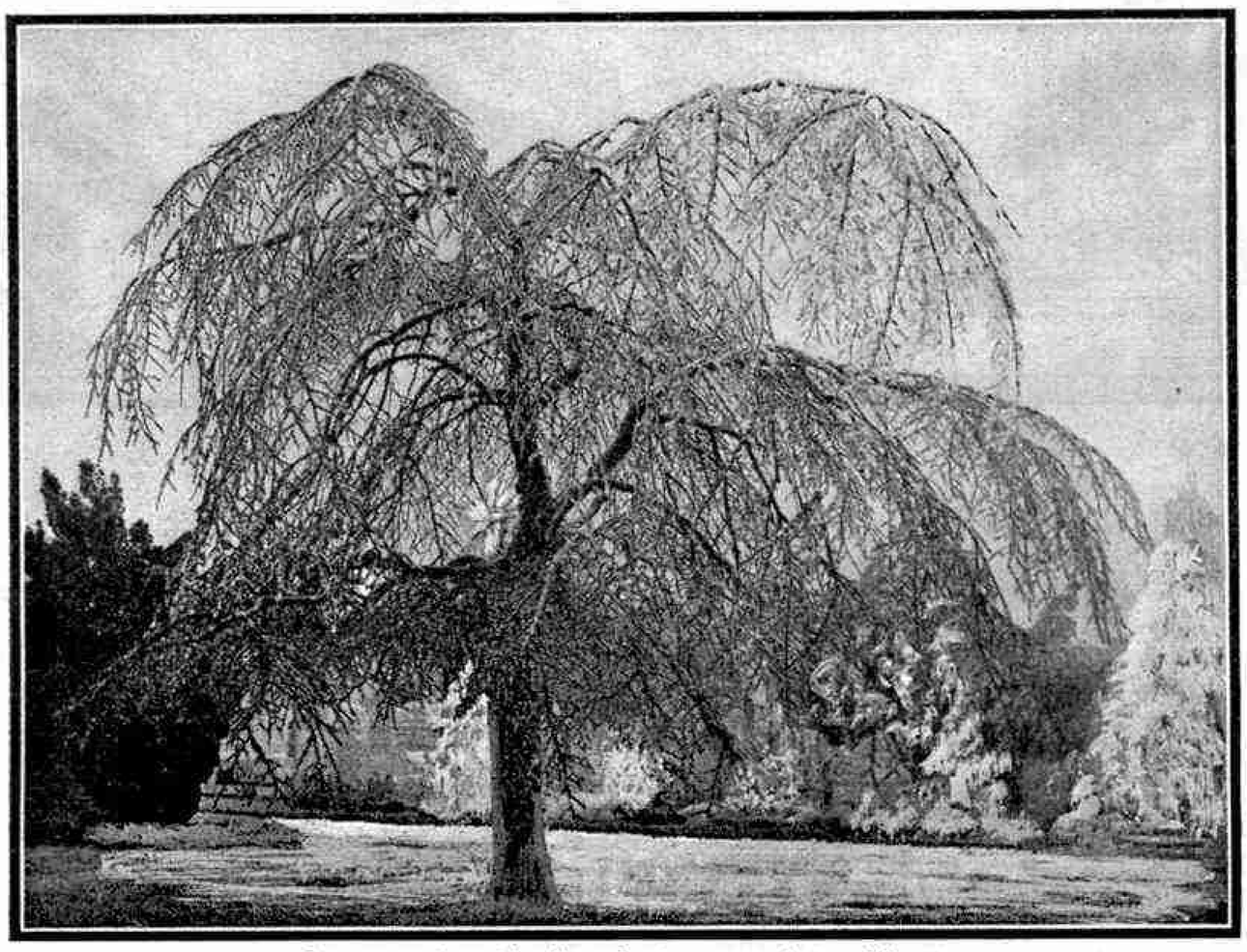


A heavy coating of hoar-frost on a cypress.

During the fall the lightning played its usual pranks, causing the telephone to emit sharp cracking sounds, ringing bells, and burning the protecting fuses in long-distance lines leading to delicate electrical instruments. It travelled down a lightning conductor from chimney shaft to earth, transmitting a shock to men working on pumps 230 ft. below the surface.

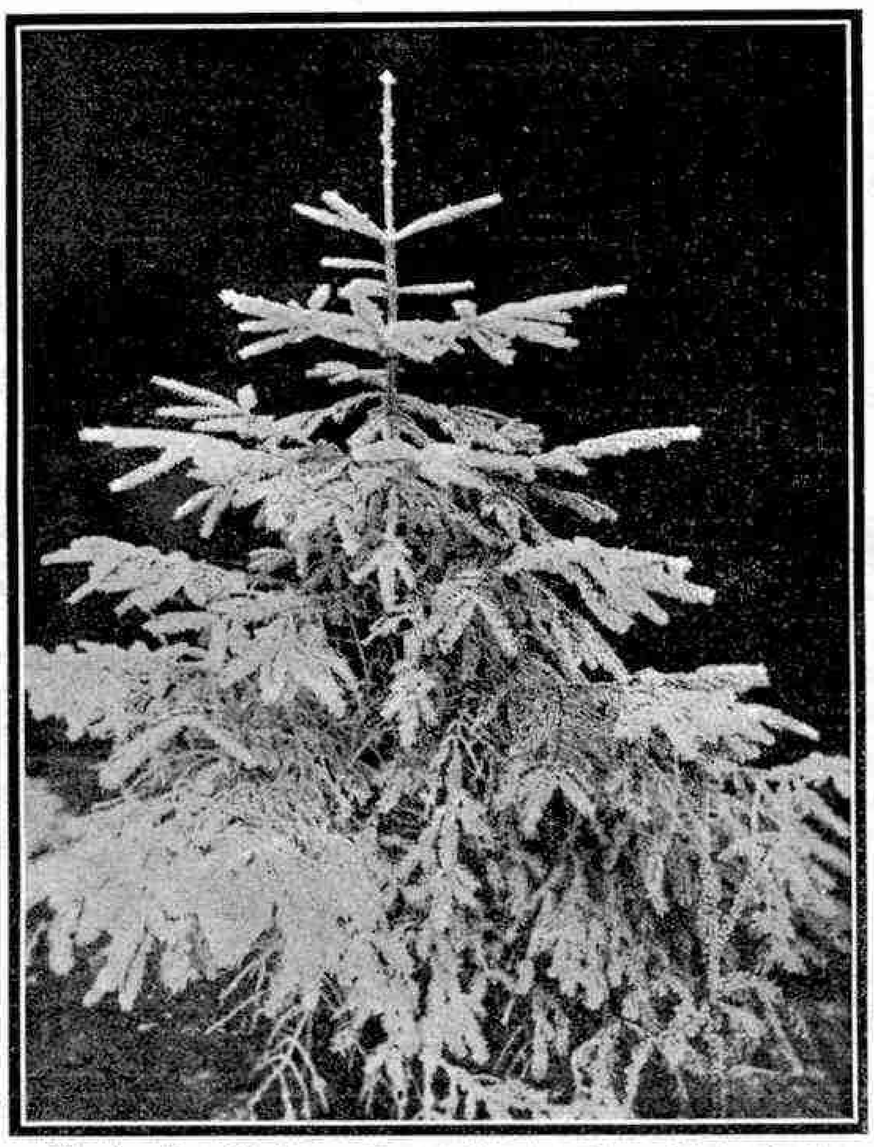
There are records of hailstones measuring up to 3 in. and 4 in. in diameter, or massed by whirlwinds into blocks weighing over 4 lb.

Of the familiar icicle there is not much to tell. Over the edges of the chasms and crevasses in our icefields and glaciers they often hang like huge transparent stalactites 10 ft., 20 ft., or even 30 ft. in length ; but the manner of their birth is precisely the same as that of the small pendants of ice that a spell of sunshine will produce when it falls upon the snow-covered roof of our home. The sun melts the snow or ice, and the water leaving its warmer presence and passing into the cold shadow either forms its own tiny icicle on the eaves, or trickles down the surface of an icicle already formed, and freezing there, adds to its size and length.



A tree enveloped in silver frost, a rare winter visitant.

When there has been a heavy fall of dew, or the earth is enveloped in mist, and the temperature sinks below freezing point, the tiny globules of water that have been deposited on every conceivable object freeze, and hoar-frost is formed. Afterwards the sun may break through the mist and quickly destroy all the icy creations of the night, or perhaps conditions favourable to the formation of the icy tracery may continue so that the display increases, crystal growing upon crystal. In this interesting form ice will decorate and beautify everything, even loading down the delicate strands of the spider's web until at last the frail geometrical net collapses under the weight. By copse and hedgerow one may notice how on every different tree Nature produces a tracery of glittering whiteness, and as we tramp along there issues from beneath our feet the familiar crisp and crackling noise of the crushing of the myriad ice-spears.

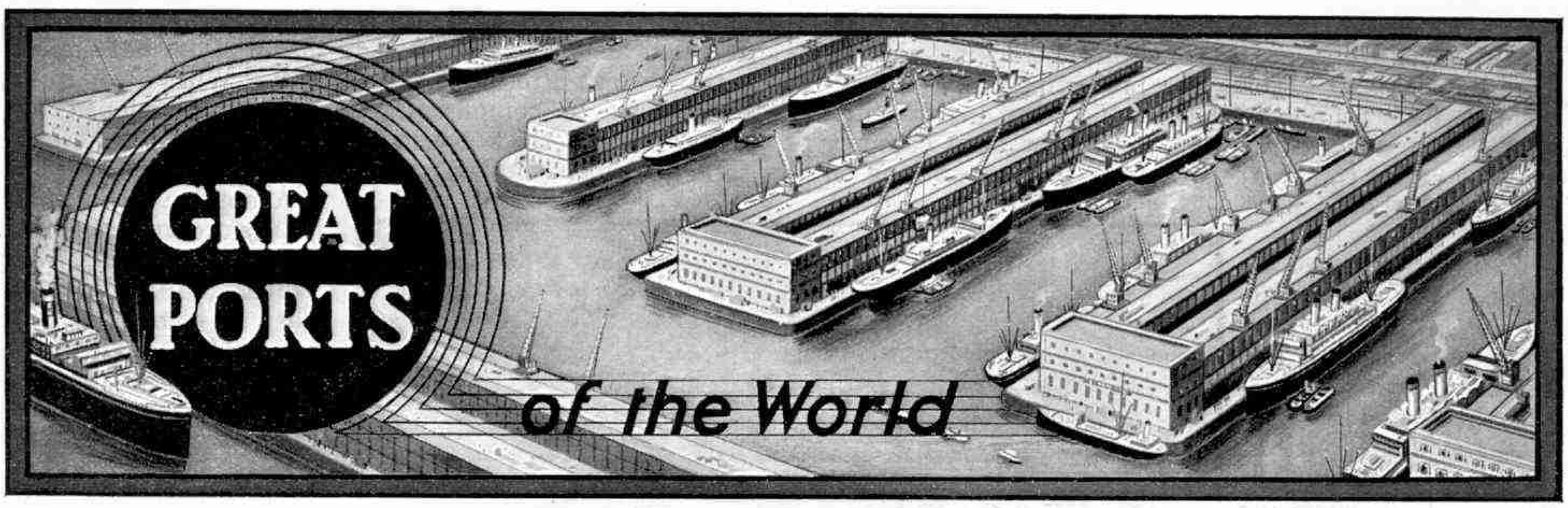


The familiar Christmas Tree with a coating of hoar-frost.

A somewhat rare frost visitant is silver frost, sometimes called glazed frost. It is distinct from rain frozen in the ordinary manner after it has fallen on the boughs of a tree and run to the underside, there to be congealed to form tiny icicles or an under-ridge of ice. It differs also from hoar-frost in that it is not built up in a tracery of glittering white crystals. With silver frost every twig is completely and equally enveloped all round with a thick covering of clear transparent ice, through which the twig can be clearly seen.

A notable fall of this nature occurred in Kent on the night of 17th January, 1912, and it was a scene not to be readily forgotten. The weight of the ice enveloping every branch and twig caused the graceful silver birch actually to bend to the ground, and the ice-covered male catkins suspended from the twigs hung like fairy crystal lamps. The trees of the woodland track-ways bent towards each other and locked their heads together in an icy embrace, embowering the way ; boughs from the more stubborn trees were split and torn asunder by the weight of the ice. Telegraph poles were snapped off and wires torn down, and chaos prevailed in the world of wire communication. At 9 a.m. a fitful breeze began to play havoc with the display, and as the trees swayed under its influence their twigs and ice-bound limbs emitted continuous sharp cracking sounds, the result of the fracturing of the ice. This was followed by the ceaseless patter of the icy particles as they were broken off and shaken to the ground.

It is interesting to watch the formation and growth of frost crystals. We may do this at home on the window-pane, but a far more strange and interesting sight is the earliest stage of ice formation on a sheet of water. The sequence of events is well described by W. Beach Thomas in his "*Autumn and Winter*" : "The frost seizes the water in delicate rays, and afterwards fits the filigrees together and pieces out the pattern. As the cold falls below the freezing point, you see a sort of shiver move along an undefined line across the water, as a nerve vibrates under the skin ; and then the line, the thin course of the movement, becomes a rigid mark. A few minutes later you may pick up from the water a delicate stick of crystal, that fades at once in your hand. The tip falling perhaps on to a fellow-crystal in the water beneath, tinkles out a thin and bell-like note, which is one of the most distinct and memorable sounds of any season."



I.—LIVERPOOL

THE early history of Liverpool is rather obscure, for the part of the country in which it is situated was not prominent in the earlier period of British history. No Roman remains have been discovered in the vicinity, but it is known that under the Saxons the site formed part of the kingdom of Deira, and that the River Mersey, then called Moere-sea, formed the boundary between that kingdom and Mercia. In the eighth century colonies of Norsemen established settlements on both sides of the river. After the Norman conquest the site of Liverpool was part of a feudal estate awarded by William the Conqueror to Sir Roger de Poitou, and after several forfeitures and re-grants from the Crown it was eventually handed over by Henry II to Henry Warine, keeper of Lancaster castle and prison. A deed executed about 1190 by John, Earl of Montaigne, afterward King John, confirms the grant of "Liverpul" and other manors to Henry Fitzwarine, son of the former possessor. This deed is the most ancient document in existence in which the town is mentioned by name.

The romance of commerce is nowhere better expressed than in the Great Ports of the World. There the ships of many nations arrive daily with an endless variety of products, and depart with other goods consigned to merchants in far distant lands. At London, Liverpool, New York, Rotterdam and other great ports this flow of world trade goes on unceasingly.

In this series of articles we shall tell the fascinating story of how the Great Ports of the World have developed from tiny hamlets, centuries ago, to their present great size and importance. This month we deal with Liverpool and in next month's article we shall tell the interesting story of the Port of London.

It is most likely that in those days "Liverpul" was used as a place of shipment for the large quantities of salt that were brought down the river from Cheshire, and that it commanded some share of the trade with Ireland owing to its geographical position and the natural harbour formed by the "Pool," where a small creek joined the River Mersey. Chester was then the chief port of communication with the north of Ireland, but the gradual silting up of the River Dee eventually rendered the port unsuitable. When this unwelcome development began to make itself felt a quay protected by a castle was built at Shotwick, about eight miles below Chester, but during the reign of King John (1199-1216) it was abandoned in favour of "Liverpul." King John was really the founder of the city, and from his time the progress of the port can be traced more clearly.



A fine aerial view of the Port of Liverpool, showing the Pier Head buildings and the southern portion of Prince's Landing Stage. From left to right the three prominent buildings are respectively, the offices of the Royal Liver Friendly Society, the Cunard Steam Ship Company, and the Mersey Docks & Harbour Board. The illustrations to this article are reproduced by courtesy of the Mersey Docks & Harbour Board, Liverpool.

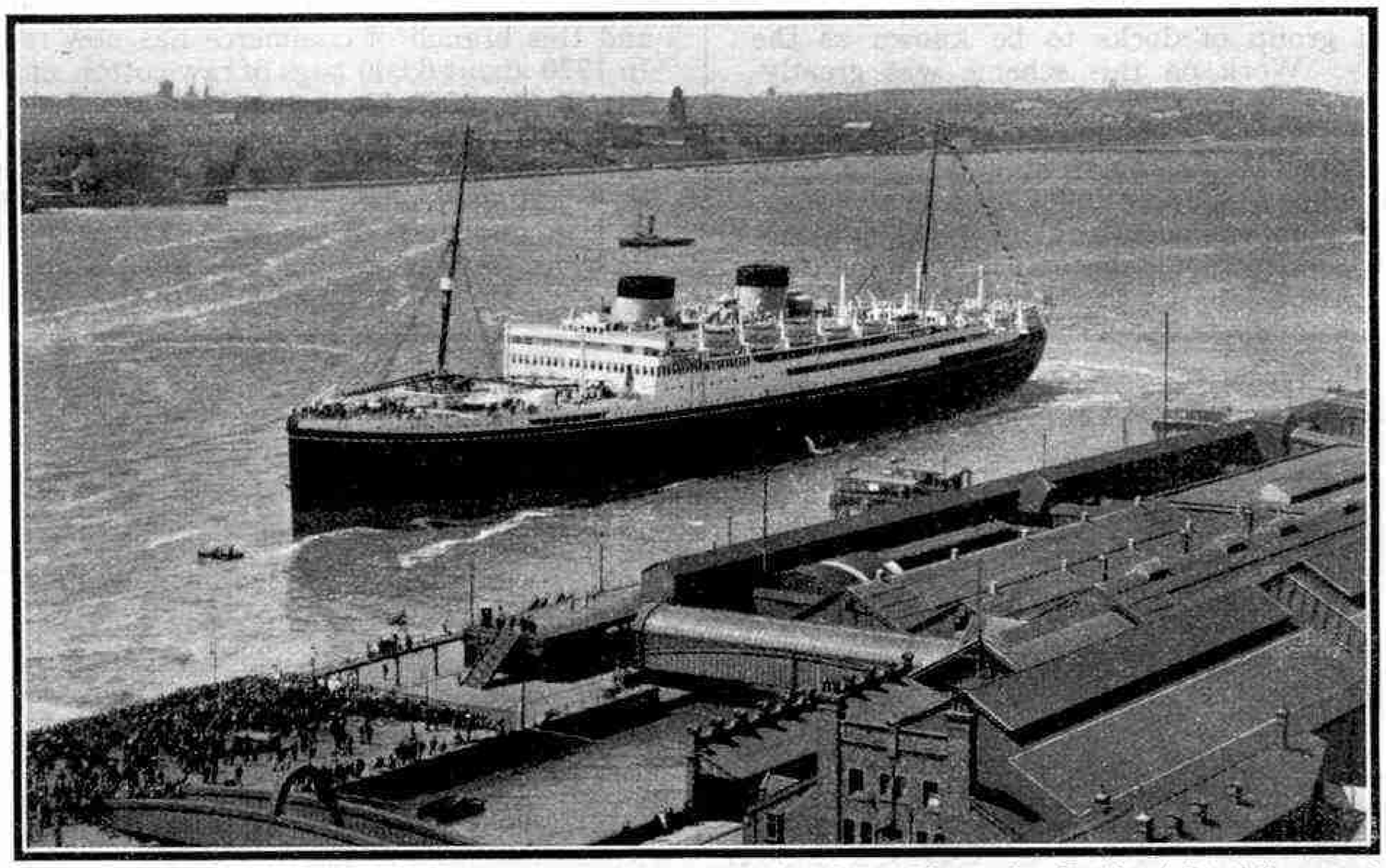
On his accession to the throne John desired to carry out to the best advantage his scheme for completely conquering Ireland, and he determined to take possession of Liverpool and form a port from which men and provisions could be sent to his armies in Ireland and Wales. At that time there was no port in Lancashire, and in addition to the silting up of the river, Chester was too much under the control of its Earl to be suitable for the King's purpose. He therefore got "Liverpul" back from Fitzwarine and gave him another manor in exchange. The King then built a castle on the land and established a town by erecting 168 tenements, and in a charter, or Letters Patent, dated 28th August, 1207, he invited settlers to take up allotments there. This charter also gave the town the same status as other boroughs on the coast, and thus the first established port in Lancashire came into existence.

From the time of King John shipping became the chief industry of Liverpool, and the frequent mention of the town in 13th and 14th century records indicate that it had become a well-known port, corn, tallow, iron and wine being mentioned as subjects of trade. John Leland, antiquary to Henry VIII, visited Liverpool in 1533 and reported that Irish merchants frequently came to the port "as to a good haven," and that there was good merchandise here and "much Irish yarn that Manchester do buy."

The trade of the port did not develop rapidly, however, and the revenue only increased from £10 a year at the beginning of the 14th century to £38 a year at the close. The Wars of the Roses were a serious setback to Liverpool trade, which declined so much that in 1514 Henry VIII sent a Commission to enquire into the cause of the decrease in revenue. Trade had hardly begun to recover when the outbreak of the Civil War in 1642 again seriously hampered it. During this war the town was fortified and garrisoned for the King, and withstood three sieges before it was taken by Prince Rupert in 1644.

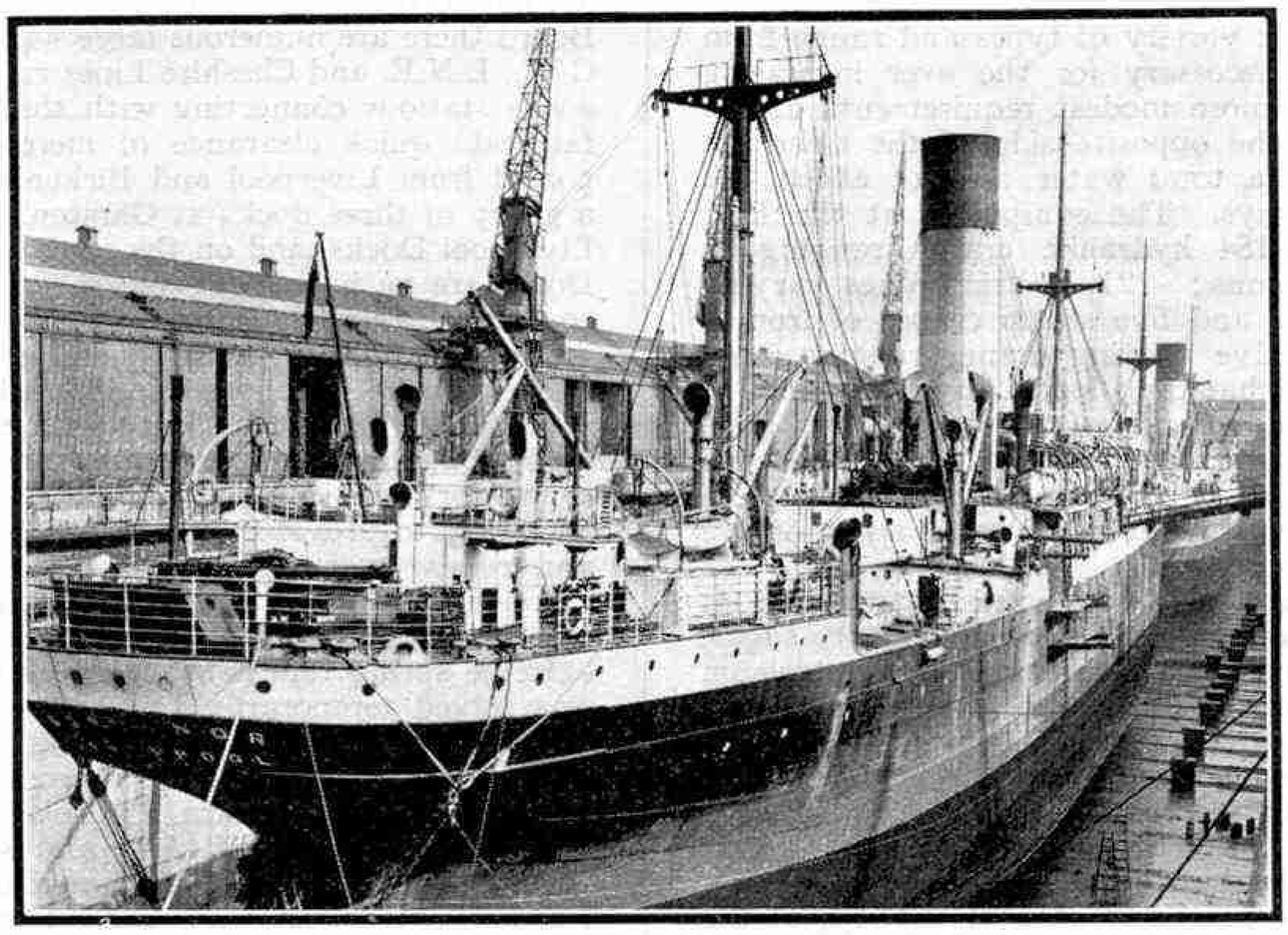
Mention must be made of two interesting developments within the period just covered. In 1551 the Corporation appointed a Water Bailiff to keep order and to prevent encroachments and obstructions in the port. Ten years later, according to the municipal records, a great storm did much damage to the town and destroyed the breakwater of the old haven. No mention can be found of the building of this jetty, but it is very probable that it was at the entrance to the Pool. The construction of a new haven was put in hand immediately. The Corporation and the inhabitants carried out the work, and as far as possible each house supplied one labourer free.

At the end of the Tudor period prosperity appears to have been returning, and in 1586 the Customs duties at the port produced £272, which was more than those of the rival ports of Chester, Conway, and Beaumaris combined. In the time of Charles I it was proposed to extend and deepen the Pool in order to render it navigable farther inland, with means of providing a supply of water for flushing to keep the channel clear, but this scheme was left in abeyance until the reign of Queen Anne. By the year 1708 the existing harbour had become insufficient to accommodate all the ships coming to the port, and several schemes for its enlargement were considered. Finally the Corporation invited Thomas Steers, an engineer, to visit the town and survey the site and plan of the Pool extension. Steers rejected the proposed scheme, and put forward an alternative plan for converting the Pool into a wet dock by impounding the water with floodgates, so as to keep vessels afloat during the ebb of the tide. The Corporation adopted his scheme and applied to Parliament for authority to raise money to carry out the work. After much opposition they won their case, and an Act was passed authorising the forming of a dock at Liverpool. The dock was built on a site now occupied by the Custom House, and was the first commercial wet dock of the kind in England. It was opened in 1715, but work on it was not completed until 1720, in which year Acts were passed for making the River Mersey and its tributary, the River Irwell navigable for the whole distance between Liverpool and Manchester.



The White Star liner "Britannic" approaching Prince's Landing Stage, Liverpool. To the right of the crowd of spectators are the upper stage and high level bridges adapted to the towering decks of ocean liners.

The dock proved a great asset to the port, but in a few years it became insufficient for the increasing shipping, and a second dock was built. This was at first called the South Dock, but later was renamed the Salthouse Dock, as it was situated close to a large salt warehouse. In 1737 the Corporation obtained the authority of Parliament to construct a pier on the north side of the entrance to the old dock, to shelter ships that had left the dock and were waiting in the river for a fair wind; and this work was completed by 1753. The old dock was closed in 1826, after being in use for a little over a century, and in 1829 the pier just mentioned was extended and the area it enclosed converted into a wet dock. The construction of a third dock was authorised in 1762, and when completed it was named the George's Dock in honour of the King, George III. At this period lighthouses were erected on the Lancashire and Cheshire banks of the Mersey, and light dues ranging from ½d. to 2d. per ton were collected from all ships according to length of voyage. The property in all the docks, piers, buoys, landmarks, etc., was vested in the Mayor, Aldermen, Bailiffs and Common Council of Liverpool, as Trustees of the docks and harbour of Liverpool. After the American War of Independence commerce and shipping increased so rapidly that during the period 1785-1821 three other docks were built at Liverpool. In 1825 an Act was passed giving power to extend the docks to the north and south, and five more docks were constructed between 1830 and 1846.



The Gladstone Graving Dock. The two ships give a good idea of the great length of the dock.

About this time the monopoly of the Dock Trustees was threatened, and a company called the Harrington Dock Company was formed to build docks and warehouses on land purchased near the Brunswick Dock. This company spent about £50,000 in preparing the ground and in constructing two small inlets for river vessels, but the threatened competition was averted in 1843 when the company was bought out at a cost of £253,000.

A more serious attempt was made at Birkenhead, where plans were secretly prepared for the construction of docks, and in ignorance of this scheme the Liverpool Corporation were persuaded into selling the land on the water's edge. The moment the sale was completed a Bill was submitted to Parliament for authority to convert the Wallasey Pool into docks, and to the dismay of Liverpool it became law in 1844. The Birkenhead Dock company was formed, and two docks were built, and were opened in 1847. The company did not prosper, however, and after a 12 years' struggle the undertaking was bought by Liverpool for £1,143,000.

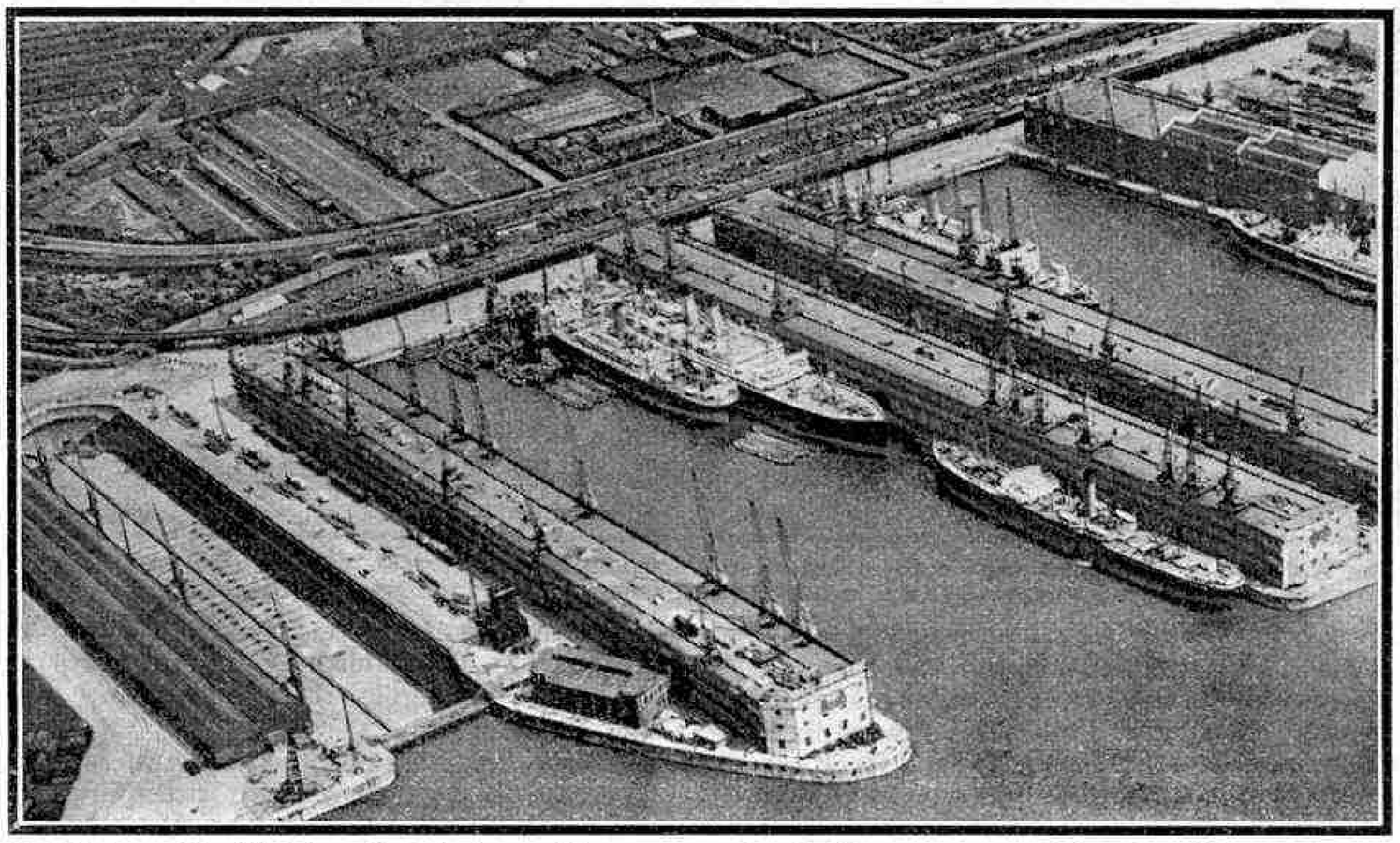
For a long time there was much discontent among Liverpool merchants regarding town dues levied by the Corporation on all goods shipped to and from the port. It was believed generally by the traders that the money obtained in this way was spent on town improvements instead of on harbour and dock works, and by 1853 public agitation had become so great that a Royal Commission was appointed to investigate the matter. The Commission recommended the formation of a new body to take charge of the docks and harbour, and in spite of opposition a Bill to this effect, promoted by the Manchester Chamber of Commerce and others, was passed by Parliament in 1857. By this Act a body of 28 trustees, under the name of the Mersey Docks and Harbour Board, was formed to take over the entire control of the port accommodation. The town dues that had been such a source of grievance to the traders became the property of the Board on payment of £1,500,000 and the Birkenhead Dock estate also was made over to them.

These sweeping changes were followed by a long period of great activity in dock construction and development, necessitated not only by the growth of commerce but by the increasing size of ships using the port. This activity culminated in the construction of the Gladstone Graving Dock, the largest dry dock in Europe. This dock cost nearly £500,000 to build and was opened by the King on the 11th July, 1913. It is 1,050 ft. long, 155½ ft. wide at the top and 141 ft. wide at the bottom. The depth of water on the sill is about 45 ft. at high water of spring

tides, and the largest ships at present afloat can easily be accommodated. On a 28-foot tide the dock can be emptied of water in 2½ hours by a powerful pumping plant consisting of five sets of centrifugal pumps that draw off the water through discharging pipes 4 ft. 6 in. in diameter. Each set of pumps is driven by a vertical four-cylinder two-cycle Diesel engine capable of developing 1,000 h.p. at 180 r.p.m. The pumping machinery is housed in a chamber on the south side of the dock.

This huge graving dock was built beyond the north end of the existing line of docks, in a position where ultimately it would form part of a proposed group of docks to be known as the Gladstone Dock System. Work on this scheme was greatly slowed down during the War, and was not completed until 1927, when the entire system was opened by the King on 19th July. It cost approximately £7,500,000 to construct and has a total water area of about 58¼ acres with three miles of quays. Ships pass in and out by way of an entrance lock 1,070 ft. long and 130 ft. wide. This lock has a depth of water on the sill amounting to about 50 ft. at high water and 22 ft. at low water of ordinary spring tides, and it is possible therefore for the largest ships to enter and leave the docks on every single tide of the year. The lock has three pairs of steel gates, the leaves of which are each 500 tons in weight and are operated hydraulically. Three-storey transit sheds built of reinforced concrete extend along the quays of the Gladstone Docks, and have a gross floor area of about 60 acres.

To-day the Mersey is fronted on the Liverpool side for a length of 6½ miles by a system of docks and basins that have a water area of about 475 acres and 29 miles of quays. These docks and basins are of a great variety of types and range from the gigantic accommodation necessary for the ever increasing size of Atlantic liners to the more modest requirements of the small coasting steamer. On the opposite side of the river the Birkenhead Docks now have a total water area of about 172 acres and over 9 miles of quays. The equipment at the Port of Liverpool docks includes 184 hydraulic cranes ranging in capacity from 10 cwt. to 40 tons; 121 electric cranes varying from 13 cwt. to 30 cwt. each, and five steam cranes of from 5 to 87 tons. There are also five floating cranes ranging from the small *"Titan,"* capable of handling loads up to 25 tons, to the *"Mammoth"* that can handle loads of 200 tons. This huge crane is electrically operated and the jib is of the luffing type and can be swung, with suspended loads, through a complete circle. It is self-propelling, and in still water has a speed of five or six knots.



Aerial view of the Gladstone Dock System. The numerous level luffing cranes mounted on top of the warehouses are clearly shown, and at the extreme left of the picture is the graving dock, here shown unoccupied.

The vast commerce of Liverpool is very varied, and includes tobacco, grain, wool and cotton, timber, frozen meat, sugar, dried fruits and general goods. The importing of petroleum also has become an important feature, and extensive storage accommodation has been provided by the Board and the large oil companies. The warehousing facilities of the port are on a huge scale. The most outstanding feature is the great tobacco warehouse at Stanley Dock, which is probably the largest warehouse in the world. It was built in 1900 and is 725 ft. long, 165 ft. wide and is 125 ft. high. Some idea of the size of the building may be gathered from the fact that 27,000,000 bricks and about 6,000 tons of iron were used in its construction. It is equipped with hydraulic lifts and hoists, and can accommodate 75,000 casks of tobacco. Smaller tobacco warehouses in other parts of the dock system provide accommodation for a further 112,500 casks.

During recent years Liverpool has developed enormously as a milling centre and is now the second largest in the world. There are extensive grain warehouses on both sides of the river, and the storage accommodation for the port has been assessed at 200,000 tons.

The imports of East India wool into this country are conducted entirely through Liverpool, and the warehouse specially set apart for the storage of this commodity has an actual storage capacity of 16,000 bales of wool. It is the practice for the wool to be placed "on show" at the warehouse for public auction, however, and the actual working capacity of the building is thus reduced to about 75,000 bales. The top floor is provided with a weaving shed roof specially constructed to give a good north light for the convenience of the wool buyers, and about 37,000 bales can be exhibited here at one time.

Cotton has been imported into Liverpool for nearly 300 years and this branch of commerce has now reached huge proportions. In 1770 about 6,000 bags of raw cotton entered the port in a year; but in the 1930-31 season 1,500,000 bales passed through.

An important branch of the commerce of the port that does not come much before the public is the seed, oil and cake trade. It is not generally realised that the cattle population of Great Britain and Ireland is about 12,000,000, and that in addition there are several million pigs and sheep. The majority of these flocks and herds are directly dependent on Liverpool for their daily food. The oil and compound cake business is therefore the heaviest of food trades. The necessary raw materials are drawn from nearly every quarter of the globe, and about 800,000 tons of these products are imported annually into Liverpool. They include linseed, cotton seed, palm kernels, ground nuts, etc., from which the oil is extracted to be used in soap and other manufactures, while the residue is converted into cakes and meals for cattle food.

In addition to the extensive storage accommodation provided by the Mersey Docks and Harbour Board there are numerous large warehouses owned by the L.M.S., G.W., L.N.E. and Cheshire Lines railways. Conveniently situated goods stations connecting with the Board's dock railway system facilitate quick clearance of merchandise imported into or exported from Liverpool and Birkenhead. The L.M.S.R. also own a group of three docks at Garston, about four miles south of the Liverpool Docks, and on the same side of the river. The Garston Docks are an important coal shipping and timber centre and the equipment there includes six movable hydraulic coal tips, each of 30 tons capacity, many portable hydraulic and electric cranes, and extensive warehouse accommodation.

So far we have dealt only with the freight side of Liverpool's trade, but for almost a century the port has been an important centre for ocean passenger traffic. As long ago as 1847 it became necessary to provide some means by which ships could discharge and receive passengers and their luggage at varying levels of the tide. This was a serious matter, for the range between high and low water in the Mersey is very considerable, and on an extreme spring tide it has been as much as 34 ft. The problem was solved temporarily by constructing off St. George's Pier a floating landing stage 500 ft. long and 80 ft. wide, supported on iron pontoons. This soon proved inadequate, and in 1857 a new stage was built opposite Prince's Pier at a cost of £130,000. This stage was 1,002 ft. long and 81 ft. wide, and was connected with the land by three bridges rising and falling with the tide. Further extensions were carried out in 1871 when these two stages were united by a new structure, resulting in a floating platform 2,063 ft. long.

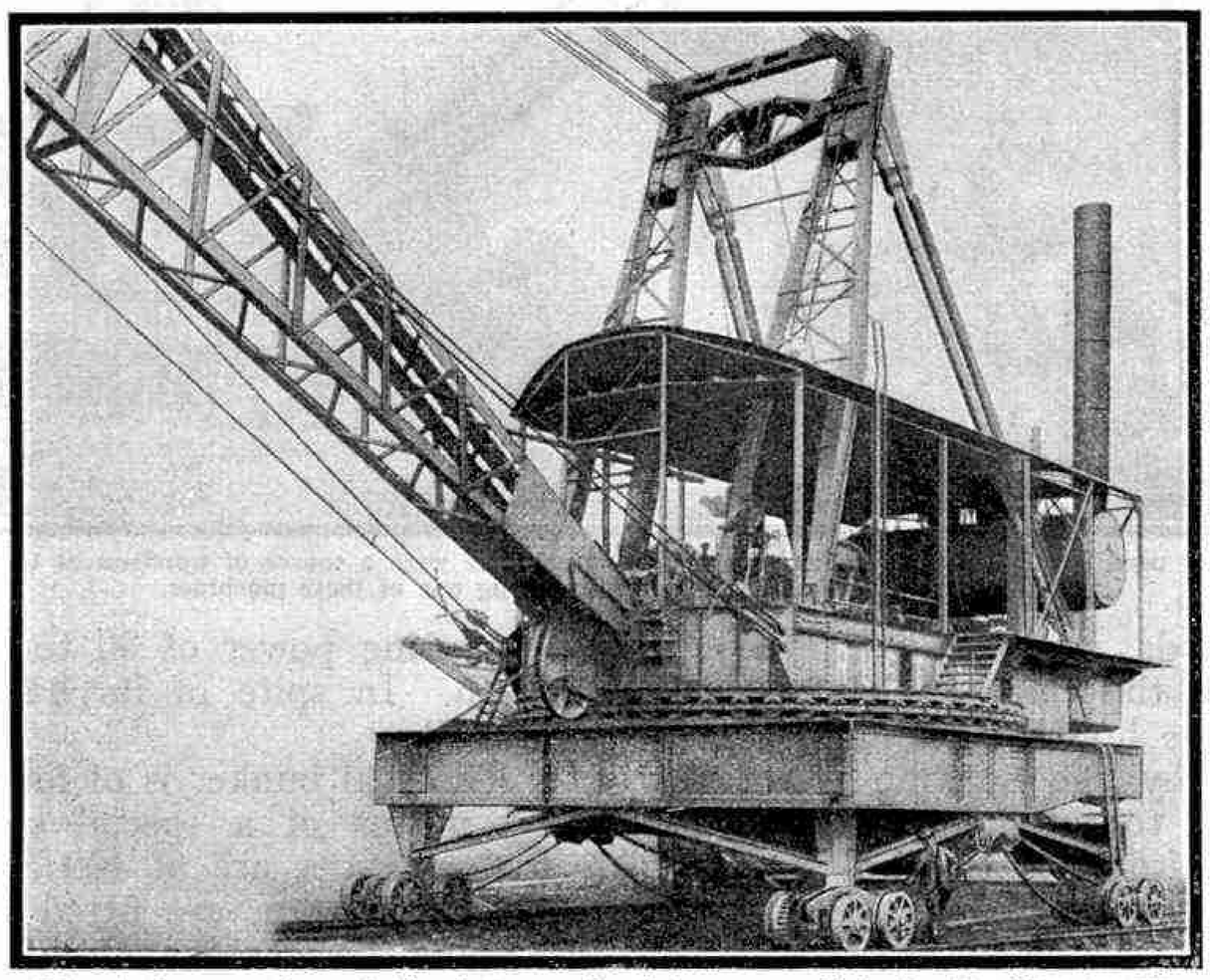
The improved landing stage was completed and awaiting inauguration by the Duke of Edinburgh when it accidently caught fire on the 28th July, 1874, and was destroyed in a few hours. It was rebuilt with improvements, and was opened for traffic in 1876. Extensions have been made at various times, and the landing stage now has a total length of 2,534 ft. or nearly half-a-mile.

The present Prince's Landing Stage is a floating structure carried on about 200 iron pontoons that rise and fall with the tide. It is held in position by a number of bridges and booms connected with the shore and stage by swivel joints *(Continued on page 64)*

Digging by Machinery

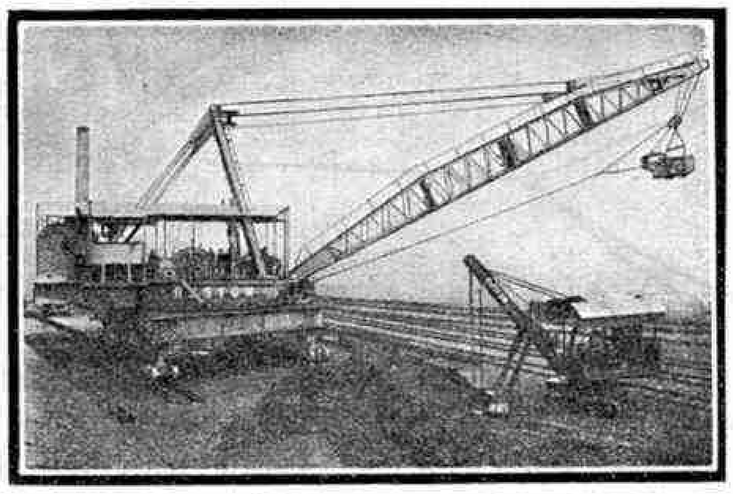
Giant Excavators at Work in India

A LARGE proportion of the work of engineers might be described as consisting of digging holes in the ground. This is the case in such undertakings as cutting canals, boring tunnels, quarrying, excavating reservoirs, and sinking the deep foundations of very large buildings. In ancient times big excavation works involved the employment of vast numbers of men because little or no machinery was available and everything had to be done by manual labour, and this state of affairs continued to a considerable extent up to comparatively recent times. To-day, although large numbers of men have to be employed on any big undertaking, the bulk of the work is carried out entirely by mechanical power. The spade wielded by hand is still necessary, but most of the excavation is done by gigantic shovels operated by steam or electric power, and each capable of doing the work of many hundreds of men.



(Above) A near view of the immense Carriage upon which the Dragline travels.
(Below) A Dragline and Steam Shovel on railway work.

One of the most familiar of digging machines is the steam shovel, often referred to as the steam navvy. This consists of a huge shovel mounted on the end of a powerful steel arm or jib and operated by a steam engine accommodated in a cab resembling that of a breakdown crane. Steam shovels are employed in the excavation of railway cuttings, open mines and quarries, and canals and docks. They are capable of accomplishing an enormous amount of work, and they are to be found wherever large scale excavation is in progress. At the same time their scope is limited, for they cannot excavate material below their own level, and they are unfit for use on wet or marshy ground. Where the existing conditions make the steam shovel unsuitable, its place is very frequently taken by another mechanical digger known as the dragline excavator, and it is with this machine that we are now concerned.



The dragline gets its name from the fact that its bucket or shovel is dragged towards the machine on a flexible rope instead of being mounted on an arm that pivots on a jib as is the case with the steam shovel. The main difference between the steam shovel and the dragline lies in the method of working. The steam shovel excavates above the level on which it stands, it works away from itself and it advances into the excavation as the work proceeds. The dragline does exactly the opposite for it excavates below the level on which it stands, works toward itself, and travels backward when it has excavated all material within reach. As regards general construction the two machines are very similar and, as a matter of fact, the steam shovel may be designed in such a manner that it may be converted into a dragline if required by fitting a different jib and a special bucket and adding another winding drum to the machinery.

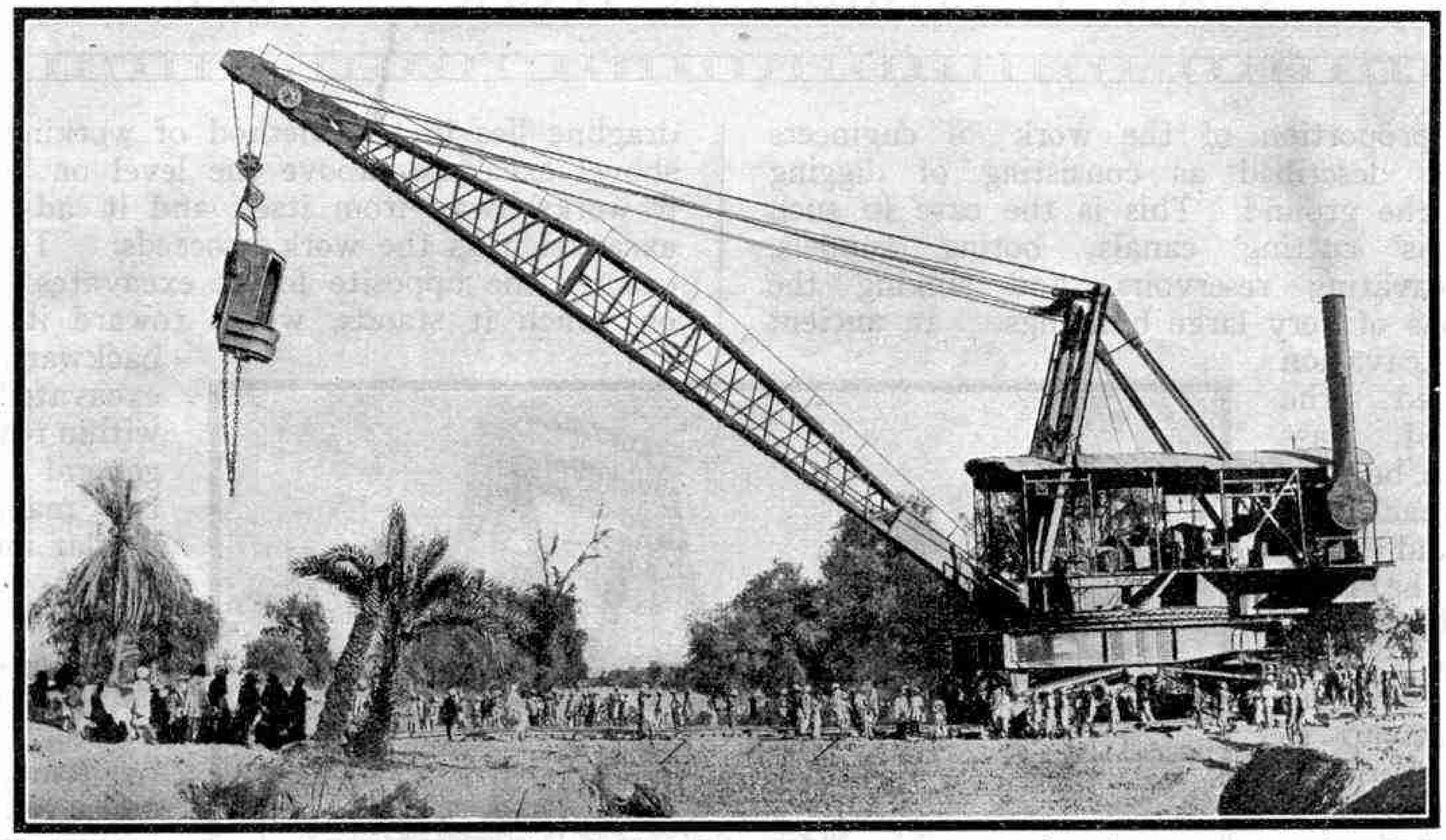
The dragline has two drums, one for the digging rope and the other for lifting the bucket out of the excavation, regulating the depth of cut and allowing the bucket to swing back after discharging, for another cut. The digging rope passes out of the front of the machine close to the foot of the jib, and is connected to the bucket. The hoisting rope which takes the weight of the bucket and its load runs over the head of the jib and is attached to the bucket.

The jib of a dragline is a lattice-girder and is of lighter design than the jib of the steam shovel. This is made possible by the fact that in a dragline the jib takes only the load due to the lifting rope and this, with the slewing motion, is its only stress. In the steam shovel, however, the jib not only takes the stress from the digging rope, but also bears the whole of the excavating stresses from the bucket arm, with their attendant slewing and digging stresses. In the dragline the stresses at the head of the jib are considerably less than in the case of the steam shovel and so the jib may be made longer. This is an advantage, for it enables the bucket to be thrown out further, and to take a deeper and wider cut.

The bucket of a dragline is of simple construction, and, being open at the front and the top, to a certain extent resembles a coal-scuttle. The digging rope is connected to a cross-bar above the front of the

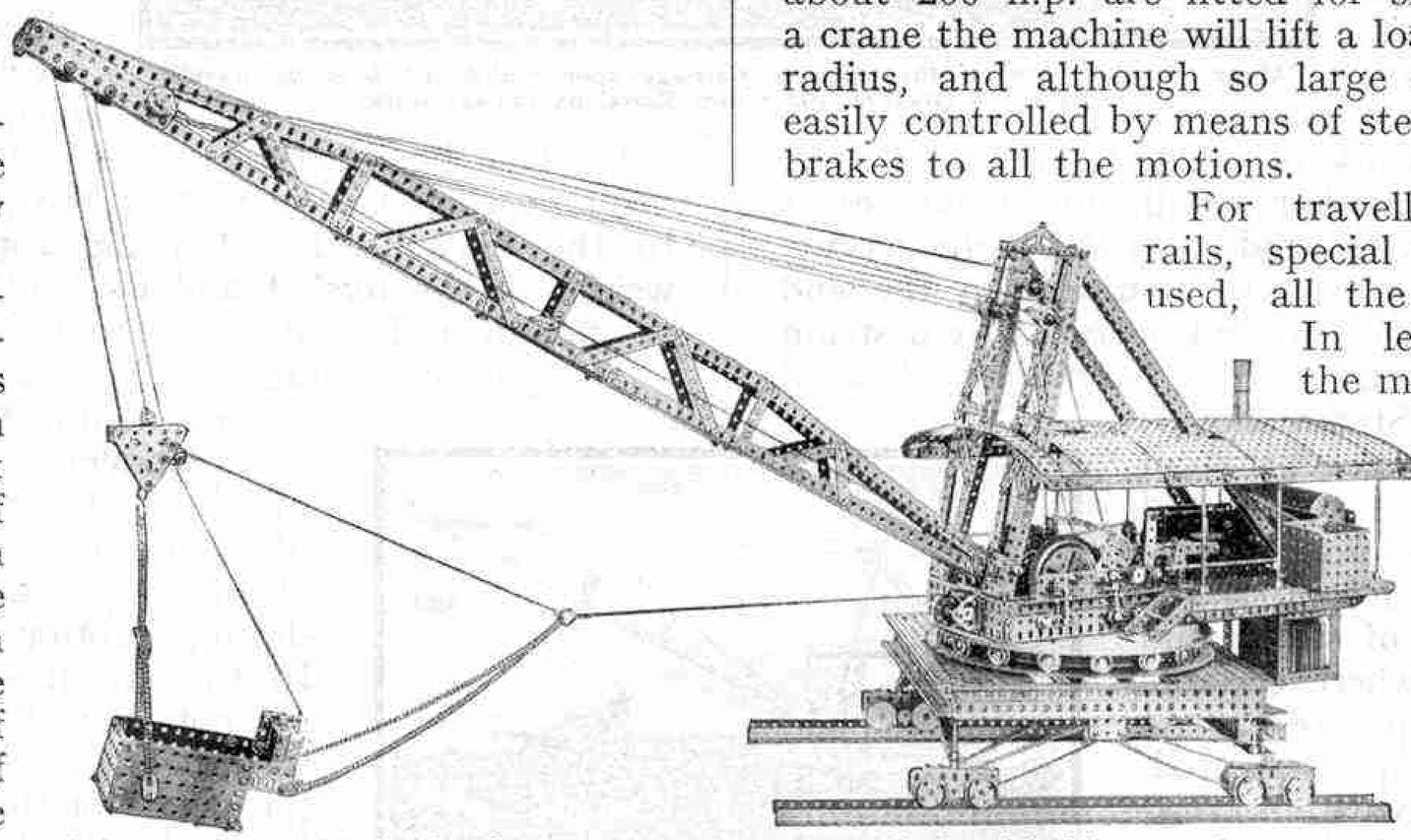
bucket, the hoisting rope being fixed to the body of the bucket farthest away from the machine. The bucket is emptied by hauling upon the hoisting rope, and releasing the digging rope. This allows the bucket to tilt forward, and so discharges the contents from the open mouth.

In the cycle of operations of a dragline the bucket is first lowered, at its extreme radius, to the foot of the excavation. By placing the winding-drum in gear, the digging rope is then wound in, hauling the bucket toward the machine, and dragging it into the material to be excavated.



The huge Draglines used in India in connection with irrigation schemes were a source of wonderment to the natives. This photograph shows a crowd of them viewing one of these machines.

When the bucket is full, the clutch of the digging drum is thrown out, and the hoisting gear is engaged. The bucket is then lifted by the hoisting rope, and the digging rope is allowed to run freely, the bucket thus swinging toward the front of the jib. On the machine being slewed over the dumping point, the bucket is discharged in the manner already described.



A fine Meccano model of a Dragline, in which every movement in the original is accurately reproduced.

The largest draglines ever constructed in this country have been built by Ruston & Hornsby Ltd., of Lincoln, for work in connection with the Indian irrigation schemes for the reclamation of millions of acres of barren desert. The work involves the excavation of hundreds of miles of canals and the project as a whole is the largest undertaking of its kind in the world. Some of the channels under construction are over 200 ft. in width and 12 ft. in depth, the excavated material being deposited on the sides to form banks.

In the first place only one dragline was ordered, but this machine gave such satisfaction that the Indian Government shortly afterward placed an order for a further three excavators of the same type. At a later date six additional draglines were ordered, and it is interesting to note in passing that the last two machines ordered were completed in seven weeks from receipt of the order, a remarkable achievement in view of their size and complexity.

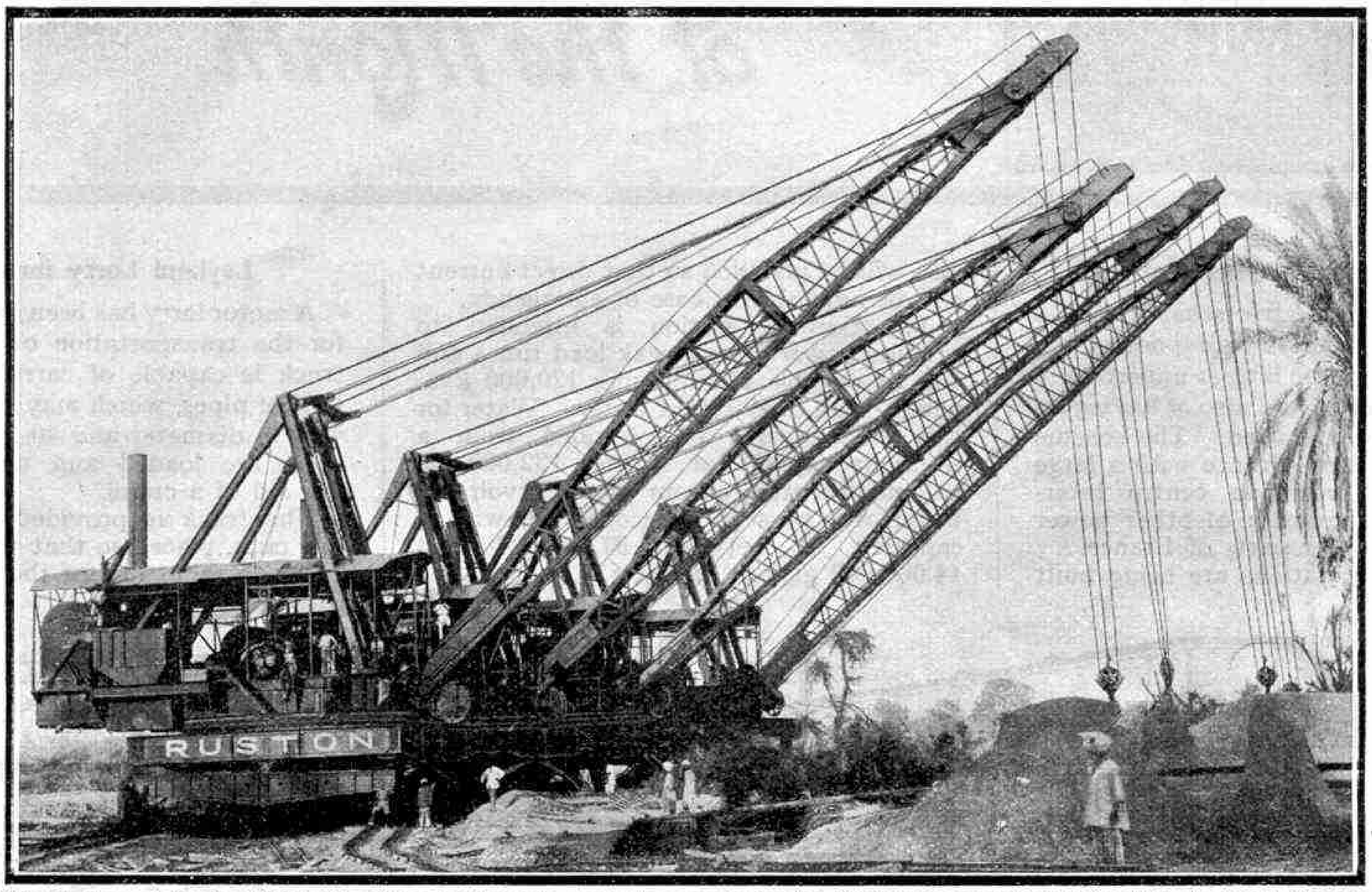
These wonderful excavators each weigh 250 tons nett and upwards of 300 tons when fully equipped and in working order. The bucket has a capacity of 8 cu. yd. and can excavate 10 tons at one cut, a rate of working that enables the machine to load a train of 60 wagons in an hour. The jib is 120 ft. in length and the drag rope from the bucket $1\frac{3}{4}$ in. in diameter. A cutting power of 30 tons is exerted on the bucket teeth. In spite of its bulk the crane operates very speedily.

The coal bunker is of four tons capacity and is filled by means of a special steam-operated hoist. The main engines are of 400 h.p. and separate engines of about 200 h.p. are fitted for slewing operations. As a crane the machine will lift a load of 22 tons at 125 ft. radius, and although so large and heavy it is very easily controlled by means of steam clutches and steam brakes to all the motions.

For travelling the machine on rails, special swivelling bogies are used, all the wheels being driven. In less than one minute the machine digs from seven to eight cubic yards of material and deposits it 200 ft. away from the point where the material was taken out. In other words, the excavator is capable of digging 300 to 400 cu. yd. of material in an hour, and will deposit the material over 120 ft. from the centre of the machine. In order to perform the same amount of work in the same length of time at least 300 men would be required.

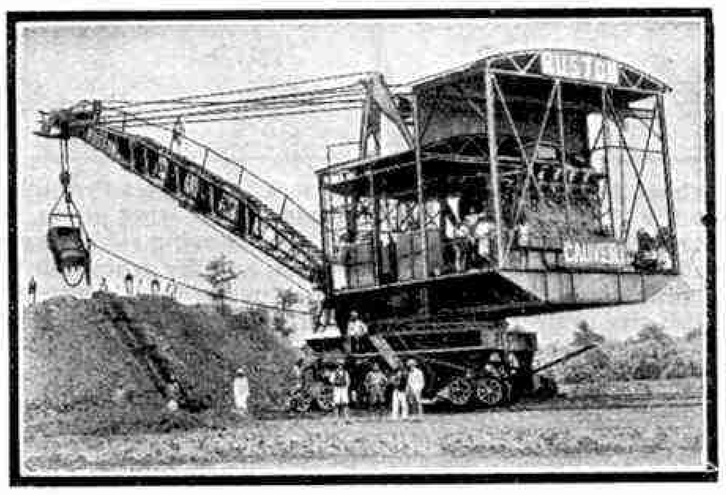
In each of these huge draglines there are over 1,000 parts, the heaviest of which weighs over 19 tons. The work of assembling the draglines in India had to be done with inadequate lifting appliances and by native labour under the supervision of the firm's engineers. In these circumstances it is not surprising that considerable difficulties presented themselves. Then

there were difficulties of another kind. For instance, one of the engineers in charge dislocated his shoulder, but carried on for a considerable time until help arrived, while another engineer nearly lost his life through being bitten by a snake while oiling the machinery. The engineers had also to contend with stifling desert heat, bad water supply and fever. Notwithstanding all these difficulties, four of the excavators were erected in three months, a very creditable performance in the circumstances. Even when the machines were finally erected the difficulties were not over, for the natives had to be educated to drive and operate them. It is interesting to note that the draglines are fitted with searchlights to enable work to proceed at night.



(Above) Four of the ten 350-ton Draglines employed in excavating canals for the distribution of water retained by the Lloyd Barrage at Sukkur, in India. (Below) A rear view of a Dragline, showing the Steam Power Plant.

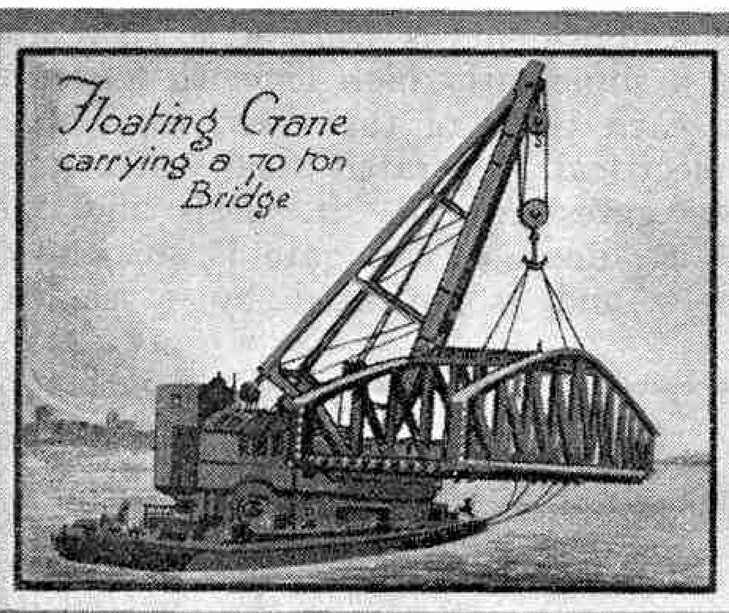
It was on the Sutlej Valley irrigation scheme that the original dragline was first employed in India. The machine began work in April 1924 and on the average excavated 670,000 cu. ft. per day. Some idea of the economy effected in labour may be realised from the fact that this amount of excavation represents the work of 8,000 coolies, who would not only have had to be paid, but fed and housed as well. The scheme included the construction of four weirs across the Sutlej and Panjnad rivers, from which 12 canals lead away water that benefits 9,200,000 acres, an area larger than Belgium and almost as large as Denmark.



Draglines were employed extensively in the irrigation scheme recently completed at Sukkur, in the province of Sind. This scheme gives control of cultivation of over 7,500,000 acres, of which nearly 6,000,000 acres is reclaimed sandy desert area, brought into cultivation for the first time. Included in the project was the building of the Lloyd Barrage, a massive masonry structure across the River Indus at a point about three miles downstream from Sukkur, to control the fluctuations of the river. The Barrage consists of 66 spans each 60 ft. in length, giving a total width of waterway of 3,960 ft., and the overall length of the Barrage between abutments is 4,725 ft. To retain the river water at a sufficiently high level to feed the take-off canals on each bank of the river, each span is fitted with an electrically operated steel water-gate. Fifty-four of these gates are 18½ ft. deep and the remainder are 22½ ft. deep. Each gate is suspended by steel wire ropes and is operated by a central mechanism incorporating spur gearing and connected to two end crabs, which are connected through further spur gearing to the winding drums. The lifting and lowering gear can easily be operated by two men, and each gate can be raised to a height of 8 ft. above maximum flood level of the river. The Barrage is designed to pass a maximum river flood of 1,500,000 cu. ft. per second, which is 50 per cent. more than the highest flood ever recorded in that province.

Canals lead off from the right and left banks of the river just above the Barrage, and the total length of the main canals and distributing branches is 6,222 miles. From the branch canals smaller channels serve as feeders to the fields, and at least 50,000 miles of feeders are being constructed, mainly by the farmers on their own land. The excavation of the main and branch canals entirely by manual labour would have necessitated the employment of 135,000 men, and on account of the difficulty of recruiting such a large number, 46 draglines were used for the greater part of the work. The machines were built by Ruston-Bucyrus Limited, Lincoln, and were of various sizes and types. They included steam-driven excavators with an average output ranging from 46,000 cu. yd. to 86,000 cu. yd. per month, and Diesel electric excavators which averaged from 17,500 cu. yd. to 65,000 cu. yd. per month.

The excavators worked in pairs, each cutting half of the canal, and the construction involved the excavation of 5,670 million cu. ft. of earth. Work on the project was begun in July 1923, and was completed at the beginning of last year, and the Barrage was opened by the Viceroy of India on 13th January, 1932.



Engineering News of the Month

An Underground Power Station

A French hydro-electric scheme that is now nearing completion will possess the distinction of being the largest undertaking of its kind in France, and also of having an underground power station. The scheme will provide Southern France with a large electric power production centre interconnected with a number of other power undertakings in other parts of France.

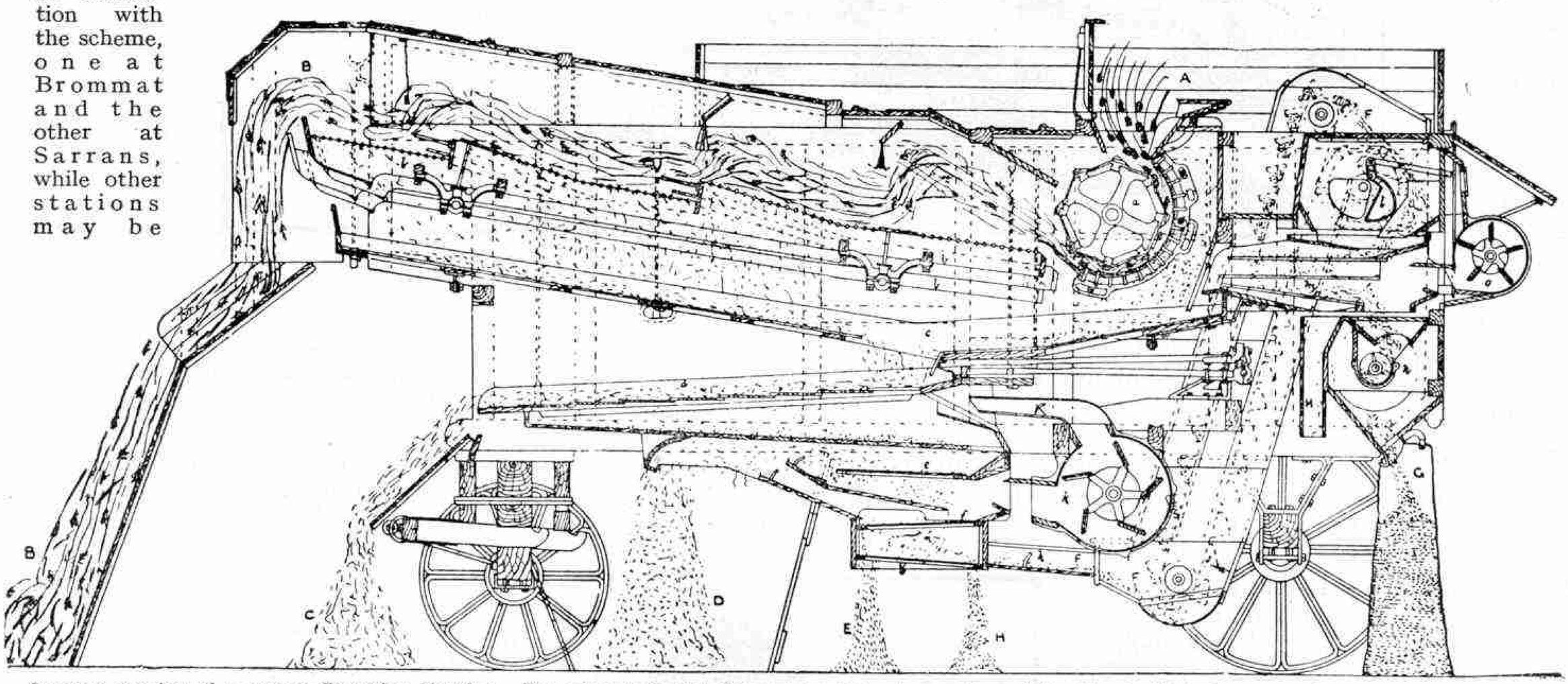
Two generating stations are being built in connection with the scheme, one at Brommat and the other at Sarrans, while other stations may be added later as the necessity arises. The station at Brommat will be the larger of the two, and will be entirely underground. It is designed to use water at the rate of 18,490 gallons per second, and will be capable of developing 190,000 kva. during eight hours each day. The machine room for this unusually situated station has been excavated in solid granite, the space excavated being 246 ft. in length, 72 ft. in width and 95 ft. in height.

The station is to be equipped with six vertical shaft turbines and alternators, each developing 29,250 kw. These will operate at 500 r.p.m. and 15,000 v. with a head of water varying between 787 and 840 ft. Auxiliary supplies of power for the station will be provided by a 1,500 h.p. horizontal-shaft 5,500 v. set operating at 750 r.p.m. A battery of accumulators also will be installed so that direct current will be available in case of emergency.

The Sarrans station is intended to provide power during peak load times and will be capable of supplying 120,000 kva. with a head of 420 ft. of water. Water for this station will be obtained from a reservoir capable of storing 132,000,000 gallons of water. From this reservoir the water will pass to a second one with a capacity of between 37,400,000 and 44,000,000 gallons of water. These reservoirs are about 4.8 miles apart, and are connected by a tunnel with a diameter of 19 ft. 9 in., cut through solid granite and lined with concrete. From the second reservoir the water is led to two vertical pressure pipes through a tunnel 23 ft. 9 in. in diameter and more than a mile in length, and the pressure pipes carry it to the subterranean power station.

The power generated in the Brommat station is conducted at 15,000 v. to transforming stations in the neighbourhood. There it is stepped up to 220,000 v. for transmission to Paris, Lyons and a number of other large towns, or to 150,000 v. for Marseilles and certain other places.

It is interesting to note that work on the project was commenced before the War. It was suspended, however, and not recommenced until 1928.

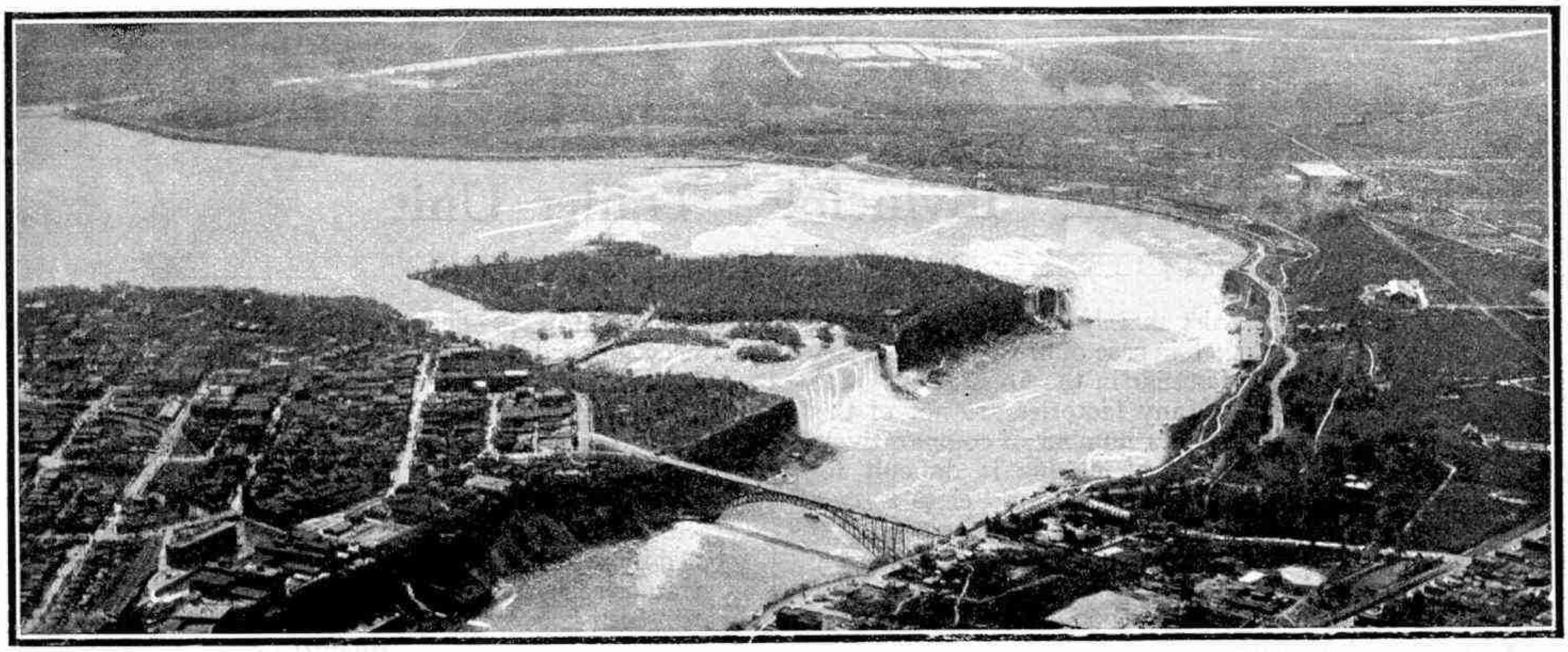


Sectional drawing of a modern Threshing Machine. The wheat is fed into the machine at A and passes through the "beater" (a) where the grain is separated from the chaff and straw. On emerging from the beaters the straw is fed on to the "shaker," a series of rapidly oscillating plates, where the grain is shaken out of the straw and falls to riddles placed beneath, the straw being carried along and discharged through an opening at B. The slow moving riddles keep back the short pieces of straw, allowing the grain, chaff and dust to pass through, but a strong current of air from the fan (k) blows out the light chaff and dust, and the grain falls to a lower riddle of very fine mesh through which the remaining particles of dust fall. The grain is now at the bottom of the machine, and it is delivered into the cups of the elevator F that take it again to the top where it passes over a screen of such fine mesh that only immature seed falls through. The full size grain is retained and after further riddling and winnowing is delivered through a chute into the sack G.

Leyland Lorry for Oil Pipes

A motor lorry has been designed specially for the transportation of oil pipes. The truck is capable of carrying a load of 7 tons of pipes, which may be any size up to 4 ft. in diameter and 40 ft. in length, and these are loaded and unloaded without the aid of a crane.

The truck is provided with a cab for one man, placed so that there is plenty of room on each side for the pipes to extend the full length of the truck. The pipes rest against four bolsters provided with clamps so that it is unnecessary for them to be lashed into position. Loading and unloading of the truck is carried out mechanically by the use of hawsers attached to winches operated by the driver of the truck. The truck is not only suitable for the transport of pipes, but may be used to carry the heavy machinery required when pipes are being laid. For work of this nature the bolsters are removed from the floor and the machinery is hauled on or off the lorry by a special winch situated under the driver's seat, and capable of exerting a pull of 7 tons in either direction. Ramps are placed at the end of the truck when machinery is being loaded or unloaded. The lorry has been constructed by Leyland Motors Ltd., for the Burma Oil Company Ltd.



A Large Cylinder Boring Machine

A cylinder boring and facing machine, claimed to be the largest in America, has been constructed for simultaneously boring and facing cylinders up to 22 ft. long and 8 ft. in diameter. It is mounted on a bedplate 48½ ft. long, and complete weighs approximately 80 tons.

The driving head is fixed but the tail-stock can be moved longitudinally, and a hollow boring bar 44 ft. long by 1 ft. diameter moves through long sleeves in the heads and is attached to them. This bar is driven by a 40 h.p. electric motor, through a speed-change box giving speeds ranging from 1½ r.p.m. to 30 r.p.m. The tail-stock is moved along the bed by a 5 h.p. motor operating through a gear train and driving a pinion engaging with a rack on the centre line of the bed.

World's Largest Hollow Forging

What is claimed to be the world's largest hollow forging recently has been made by Thomas Firth & John Brown Ltd., of Sheffield, for a London firm.

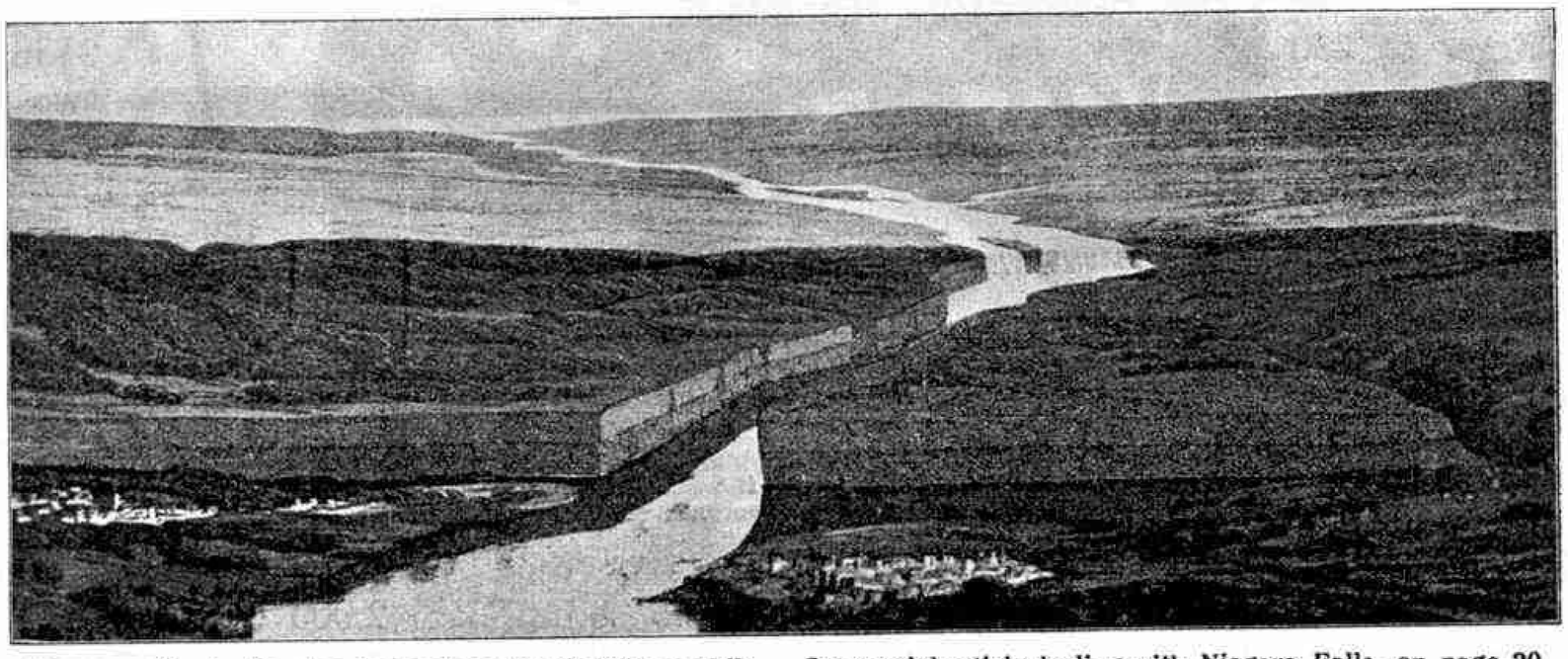
The ingot from which the forging was prepared was about 170 tons in weight and was cast from three open-hearth acid furnaces. The ingot was then worked under a huge 6,000-ton forging press and afterwards a hole, 25½ in. in diameter, was trepanned, or bored with a cylindrical saw, through it. After this the ingot was again taken to the 6,000-ton press where its diameter was expanded and the drawing process begun. The resulting open-ended forging was put into an 82 in. lathe with a 70 ft. bed, and bored through its entire length. Some idea of the extreme accuracy of the work and the skill shown by the workmen may be gained from the fact that it was only necessary to remove ⅞ in. of material from the inside of the forging.

New American Liners

Four new ships are shortly to be added to the fleet of the Grace Lines, an American shipping company. The vessels have been constructed in the yards of the Federal Shipbuilding Drydock Company, at Kearney, New Jersey.

All four ships are alike in all respects, with the exception of their interior furnishings. They are to be used to open a new and rapid passenger, mail and freight service between the East and West coasts of the United States, from New York to Los Angeles and San Francisco via the Panama Canal. Each of the ships is 508 ft. in length and has a beam of 72 ft. The displacement is approximately 16,000 tons, and the vessels are capable of maintaining a cruising speed of about 18 knots. The first to be completed, the "*Santa Rosa*," attained a speed of 20.05 knots during her official speed trials. This speed was made at 14,350 h.p. with turbines throttled.

The ships have a large cargo capacity arranged to facilitate rapid and easy handling of freight by means of new and specially designed winches, and each has a carefully planned refrigerated space for perishable cargo. As the ships will operate in the tropics, the public rooms are arranged with large windows for natural ventilation and light, and have in addition a system of mechanical ventilation.



The upper illustration is a fine aerial view of Niagara Falls. See special article dealing with Niagara Falls, on page 20. The lower illustration (from the Editor's book "Water in Nature," by permission of the publishers, Thos. Nelson & Sons Ltd.), shows a model of the Falls, and clearly indicates how the Falls have receded and formed a gorge through the flat plateau of rocks, which at one time extended unbroken to as far as Queenstown, half way to Lake Ontario.

Wolverhampton Water Supply

A waterworks that has recently been opened at Dimmingsdale, 4½ miles from Wolverhampton, to provide water for that town, obtains its supply from two bore holes that are 1,025 ft. in depth. The holes are lined with steel to a depth of 250 ft., and are capable of providing 3,000,000 gallons of water every 24 hours. The pumping plant at the waterworks consists of slow-speed triple-expansion pumping engines, and the pumps are capable of raising water to a total height of 610 ft. Actually they raise the water from 250 ft. below the ground level to 360 ft. above ground level. The total cost of construction of the waterworks and of the scheme generally was £82,400.

Graving Dock for the Tyne

Swan, Hunter & Wigham Richardson Ltd., the well-known shipbuilders of Wallsend, are to replace their existing floating dock by a new graving dock that is to be situated near the firm's other graving docks at Wallsend. The new dock will be capable of accommodating the biggest vessels visiting the Tyne, and the work of construction will occupy about 18 months. Further details are not yet available.

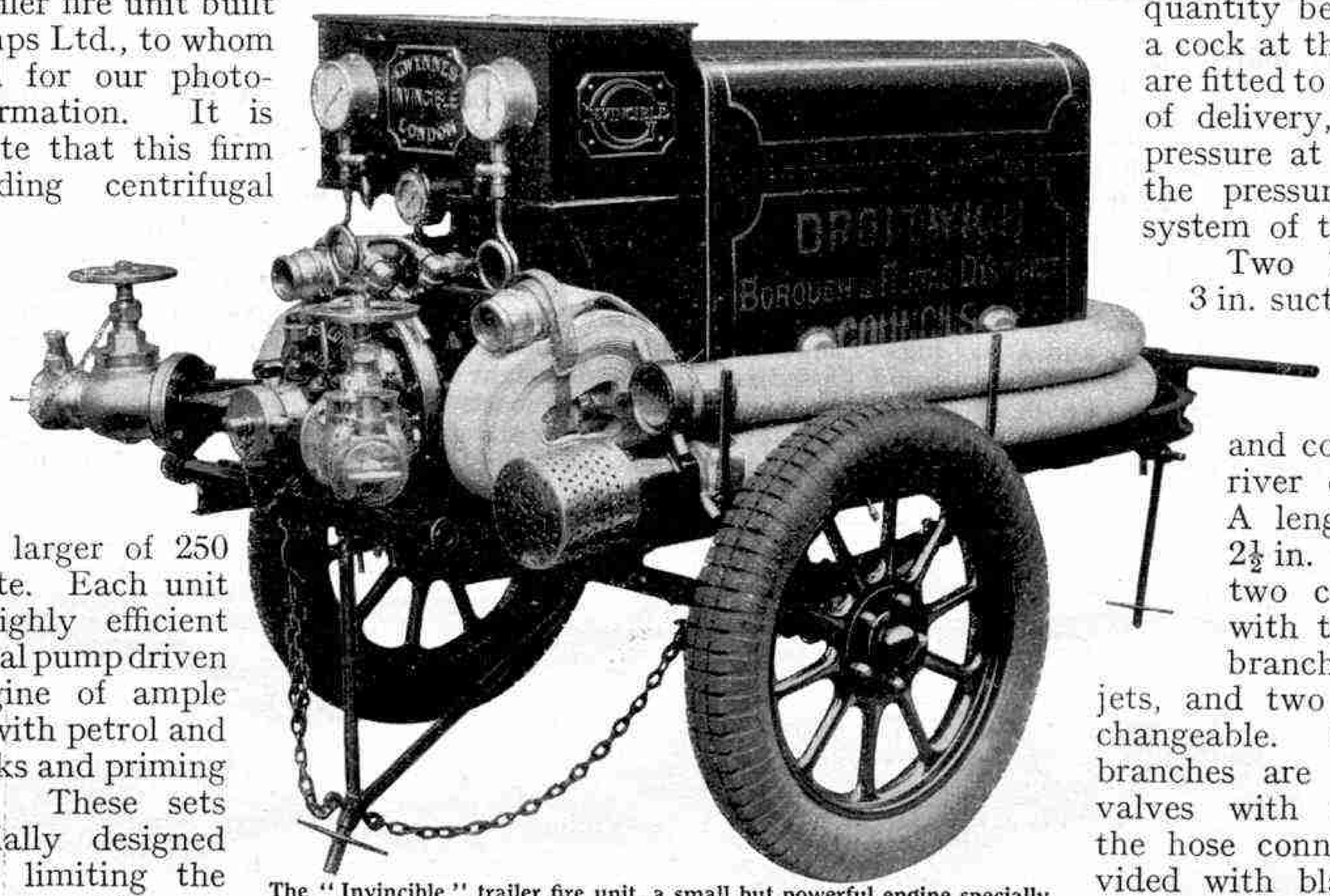
New Atlantic Steamship Service

A new steamship service between Vancouver and various European ports has been inaugurated by Balfour, Guthrie & Company, a Canadian firm of shipowners. The service is at first to be operated by M.V. "*Geisha*" and "*Vinland*," the vessels journeying from Vancouver to Havre, Rotterdam and Hull. These vessels were previously employed on a service between Canada and South America, and are each provided with 25,000 ft. of refrigerator space.

An Interesting Small Fire Engine

The "Invincible" Trailer Unit

FACTORIES that consist mainly of a single building can usually be reached in case of fire by the ordinary type of fire engine familiar in the fire stations of all large towns and cities. Many factories are not of this type, however, but comprise a number of comparatively small buildings near together, making it difficult for a large fire engine to approach sufficiently close to deal effectively with a serious fire. In such cases a smaller engine is more efficient, its lower pumping capacity being outweighed by its ability to come to close quarters. An interesting example of this type of fire engine is the "*Invincible*" trailer fire unit built by Gwynnes Pumps Ltd., to whom we are indebted for our photograph and information. It is interesting to note that this firm has been building centrifugal pumps since 1849.



The "Invincible" trailer fire unit, a small but powerful engine specially designed for use in situations where it would be difficult or impossible for a large fire engine to approach sufficiently close.

This pump is available in two sizes, the smaller having a nominal capacity of 100 gallons per minute, and the larger of 250 gallons per minute. Each unit consists of a highly efficient two-stage gunmetal pump driven by a petrol engine of ample power, complete with petrol and cooling-water tanks and priming exhauster-pump. These sets have been specially designed with a view to limiting the weight as much as possible, so that they may either be drawn by hand or trailed behind a suitable vehicle. In addition to their use for fire fighting these units are very useful in agricultural districts, where they can be effectively employed at low running costs for spraying, irrigation, or drainage purposes. When a unit is used in this manner the pump will be operating against a much lower head, and a considerably larger amount of water will be delivered than when operating on fire service.

The 100-gallon outfit has a pump capable of discharging 100 gallons of water per minute through one or two jets at a pressure of 110 lb. per sq. in. when running at a speed of 3,000 r.p.m. It is of the two-stage type with impellers arranged back to back to minimise end thrust. Any small thrust that might arise is provided for by a double ball thrust washer that serves also to locate the impellers. The pump is entirely of gunmetal, with a stainless steel spindle, so that any possibility of rust is eliminated. The tail end of the spindle runs in a grease-lubricated bearing of ample length formed in the suction passage.

Priming is accomplished by a rotary exhauster driven from the pump spindle through a friction drive, brought into action when required by a hand lever. An interceptor tank is interposed between the pump and the exhauster to prevent water from entering the exhauster when the pump is primed. This interceptor comprises a ball float and mitre valve, and acts automatically. The tail end bearing and the main roller and ball bearings are lubricated by grease cups. The bearing housing is cooled by water tapped off from the pump casing through a strainer easily removable for cleaning, and the cooling water then passes to the engine cylinder jacket, the quantity being regulated by a cock at the pump. Gauges are fitted to show the pressure of delivery, the vacuum or pressure at the suction, and the pressure of the oiling system of the engine.

Two 10-ft. lengths of 3 in. suction hose are provided, together with a gunmetal footvalve and copper strainer for river or pond supply. A length of 100 ft. of $2\frac{1}{2}$ in. delivery hose in two coils is included, with two 18 in. copper branch pipes, two $\frac{5}{8}$ in. jets, and two $\frac{3}{4}$ in. jets interchangeable. On the delivery branches are $2\frac{1}{2}$ in. gunmetal valves with outlets to suit the hose connectors, and provided with blank caps.

The pump is driven by a four-cylinder monobloc engine of 66 mm. bore by 100 mm. stroke, developing 17.5 b.h.p. at 2,000 r.p.m. The crankcase is of aluminium with a sump capacity of six pints of oil. The cylinder block is water-cooled by thermo-syphon from the header tank at starting, with an adjustable supply from the pump when this is working.

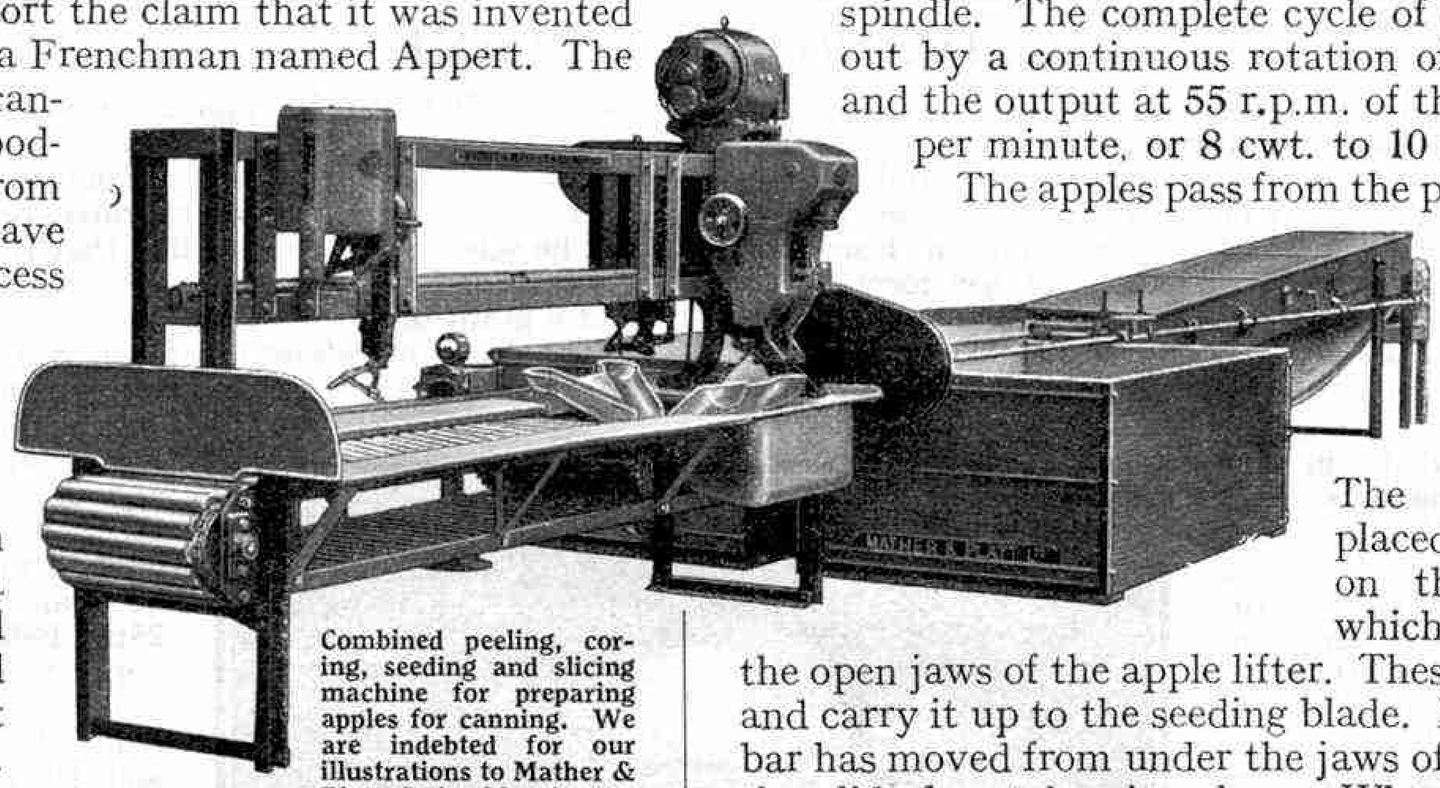
The drive from the engine is taken through a gear-box giving a pump speed of 1.5 times the engine speed. The gears are totally enclosed, and run in an oil bath. The frame is constructed of steel channel, and the units are independently mounted on cross members. A suitable draw-bar attachment is provided for trailing and hand haulage.

The specification of the 250-gallon unit is generally in accordance with that of the 100-gallon unit just described, but with various modifications necessitated by the increased size. The pump of this larger unit discharges 250 gallons of water per min. through one or two jets at a pressure of 140 lb. per sq. in. when running at a speed of 2,400 r.p.m.

British Machines for Canning Industry

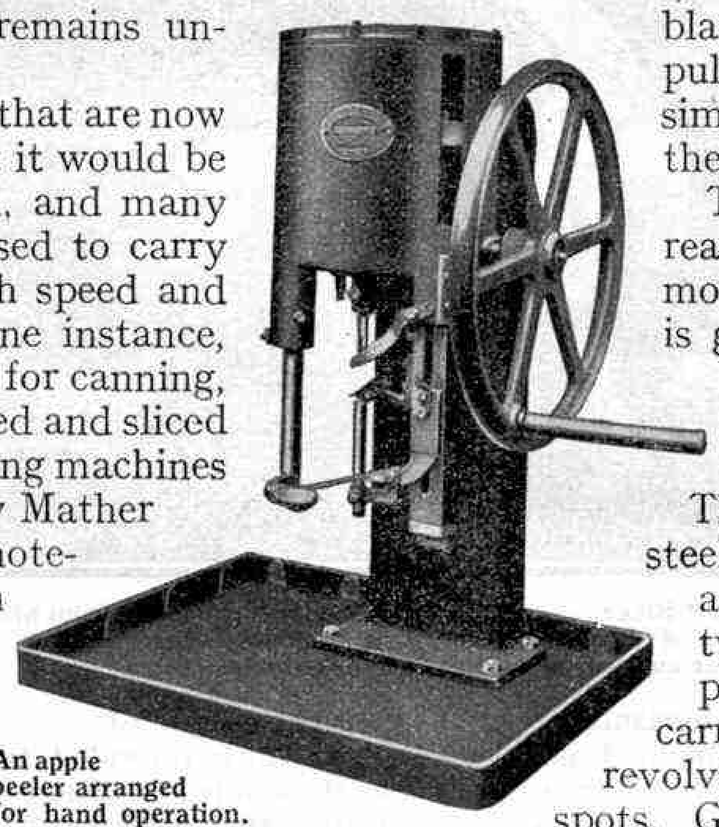
Peeling and Coring at 10 cwt. per hour

CANNING, or the process of preserving foodstuffs by sealing them up in cans or tins, has grown to enormous importance during the present century. It is difficult to say who originated canning, but there is a good deal of evidence to support the claim that it was invented about the year 1810 by a Frenchman named Appert. The essential principle of canning is to seal up the foodstuff in a container from which air and germs have been expelled. The process varies to some extent with different commodities, but generally speaking it consists of packing the food in tins, which are then placed in a steam oven or immersed in boiling water, and thus subjected to a heat that destroys all germs. In the canning of meats and fish the air and steam are drawn off at the time of sealing by a vacuum closing machine. In the canning of fruit this is not considered necessary, as the steam that is sealed in the cans from the exhausting operation creates sufficient vacuum by condensing. If the work is carried out properly the food should remain in good condition indefinitely, provided that the tin remains undamaged and airtight.



Combined peeling, coring, seeding and slicing machine for preparing apples for canning. We are indebted for our illustrations to Mather & Platt Ltd., Manchester.

The quantities of various foodstuffs that are now required for canning are so great that it would be impossible to prepare them by hand, and many interesting machines have been devised to carry out the preliminary processes at high speed and with perfect cleanliness. To take one instance, large quantities of apples are required for canning, and these apples must be peeled, cored and sliced at a high rate of speed. Some interesting machines for this purpose are manufactured by Mather & Platt Ltd., of Manchester. The noteworthy features of these machines, in addition to the essential one of peeling and coring apples perfectly simply and continuously, are as follows. All driving gears are enclosed in the cast iron body, so that a generous supply of grease can be applied to the gears while the actual working spindles remain clean and sanitary. There are no external wheels to be guarded or to collect dirt, and the driving pulley is the only rotating part exposed.



An apple peeler arranged for hand operation.

The first machine is the peeler and corer. The apples are placed by hand on the apple holder which, in the feeding position, is well clear of the moving spindles. Afterwards the holder moves inward and upward, impaling them on a stationary spindle that commences to revolve at a high speed. The peeling knife moves up the surface of the apple, the rotation of which against the knife removes the peel; while the coring blade takes a $\frac{5}{8}$ in. diameter hole out of the core. Lastly the apple is taken down by the coring blade and released by a stripping fork. Any core adhering to the driving spindle is stripped off by an internal rod in the spindle. The complete cycle of operations is carried out by a continuous rotation of the driving pulley, and the output at 55 r.p.m. of the pulley is 15 apples per minute, or 8 cwt. to 10 cwt. per hour.

The apples pass from the peeler and corer to the seeding and slicing machine, the function of which is to remove the seed cells, and slice the apple into quarters. The peeled apples are placed by hand on a peg on the apple feed bar, which is later drawn into the open jaws of the apple lifter. These jaws grip the apple and carry it up to the seeding blade. By this time the feed bar has moved from under the jaws of the apple lifter, and the slide bar takes its place. When the apple is at its highest point, and the seeding blade, which revolves continuously, is well into the hole in the apple, the blade is made to move in an outward path while still revolving, thus taking a neat spherical cut in the centre of the apple. The jaws then carry the apple down until it is well on the slide bar, where it is released to slide down on to the slicing blades, through which it is pushed by a lever. The pulley speed and output of this machine are similar to those of the peeler and corer. After these operations the apple is ready for canning.

The design of both machines makes them readily adaptable to the "battery" form of mounting, as illustrated above. This method is generally adopted, as it is necessary for the apples to be examined after peeling for bad spots, bruises, etc., which cannot be removed by the peeling blade.

The machines are mounted on each side of a steel frame, the peelers at one end and the slicers at the other, with a roller conveyor between the two sets of machines. The peelers drop the peeled apples on to the conveyor which, as it carries the apples towards the slicers, slowly revolves them on the rollers, thus exposing the bad spots. Girls placed on each side of the conveyor trim the apples as necessary, and then replace them on the conveyor. Finally the peeled apples collect in a trough under the slicers.

After seeding and slicing, the apples are dropped into the collecting chutes that can be seen in the illustration, and deposited on an endless rubber conveying belt that carries them on to the next process.

The frame illustrated is designed for a maximum of four peelers and four slicers. The supporting bars are already fitted to the frame, but only one peeler and two slicers are actually mounted. This illustrates the ease with which machines can be added to the existing plant.



IV.—ROBERT BLAKE

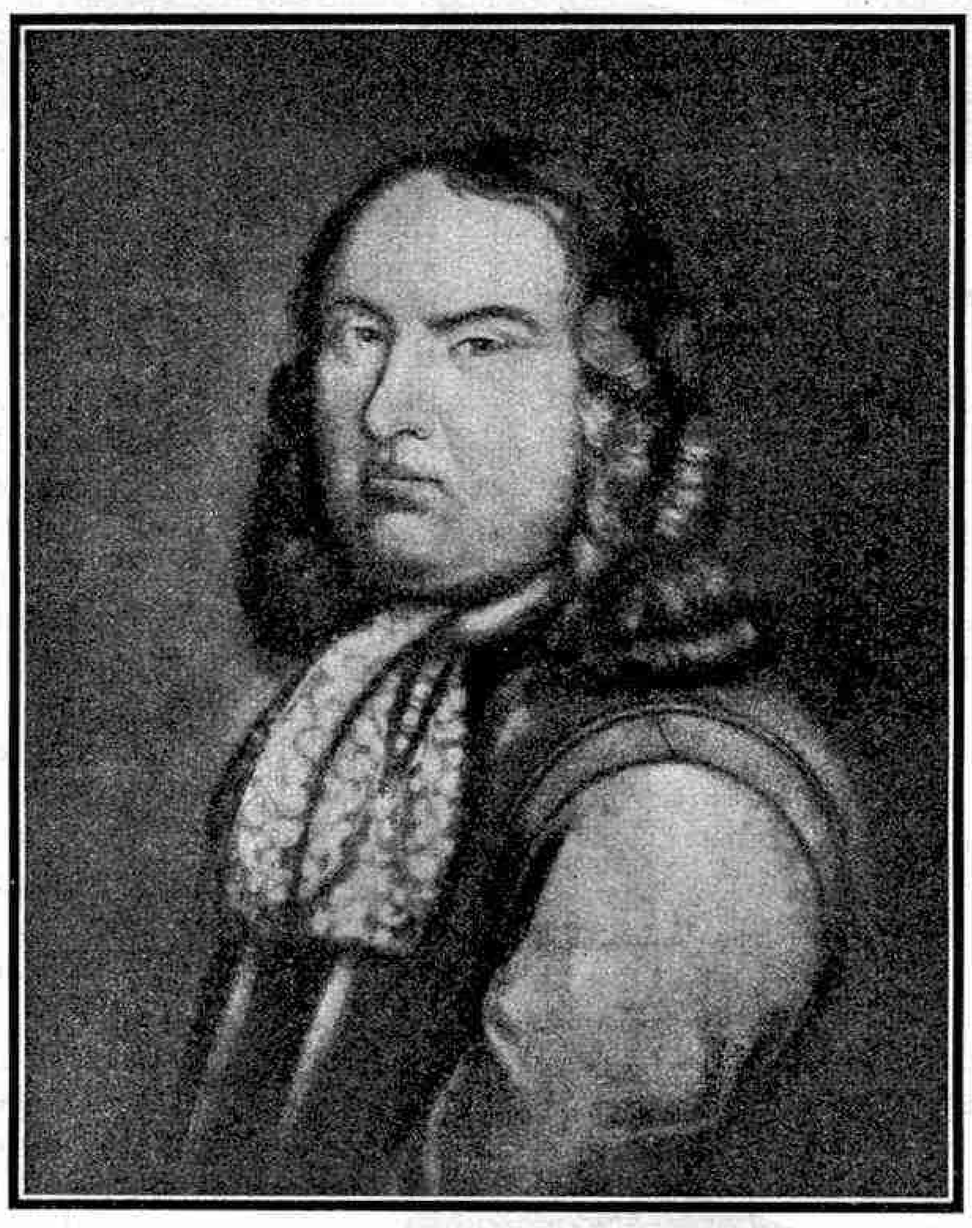
THE defeat of the Spanish Armada marked the beginning of the decline of Spanish sea power. During this period Holland began to develop her sea commerce, and was so successful that by the early years of the 17th century she owned nearly four-fifths of the merchant ships trading in European waters. England viewed this rise in power of her former ally with increasing misgivings and jealousy. Incidents such as the refusal of the Dutch to pay a yearly tax of £30,000 for herrings caught by them in English waters, and the refusal of Dutch ships to lower their topsails as a salute to English vessels when in the narrow seas around England, widened the rift. Ultimately it became clear that only war could settle which country was to be acclaimed the sovereign of the seas. In the conflicts that ensued one of the outstanding figures on the English side was Admiral Robert Blake.

Blake was born in 1599, three years after the death of Drake, at Bridgwater, where his father was a wealthy merchant. His education included a period at Oxford, and after the death of his father in 1625 he carried on the merchant business. He was elected to Parliament in 1640, but King Charles dissolved Parliament three weeks later.

When the Civil War broke out in 1642 Blake volunteered for the Parliamentary army, and during the next six years he fought against the King's forces. He distinguished himself by capturing Taunton from the Royalists in 1644 and by holding it until relieved by John Fairfax, a year later, and attained to the rank of Colonel. Blake had been made Governor of Taunton in 1644, and two years later he was elected Parliamentary member for the town. He therefore resigned his military command, but when the Civil War recurred in 1648 he was quickly recalled to active service, this time with the Navy. A Royalist fleet under Prince Rupert had become a source of danger, and Parliament decided upon counter measures. A commission was issued appointing "Colonel Popham, Colonel Blake and Colonel Deane, or any two of them, to be Admirals and Generals of the Fleet now at sea." Thus at one step Blake became second in command of the National fleet, in spite of having had no previous naval experience. An Admiral or Captain in those days did not need to be a seaman, however, as his responsibilities consisted merely of commanding the soldiers placed on board for fighting purposes. A sailing master and crew were responsible for the management of the ship.

As soon as the necessary ships were equipped Blake and Deane sailed to Kinsale, Ireland, where Rupert's squadron was anchored in the harbour. Blake blockaded the harbour for six months, and Rupert's position had become desperate when, fortunately for him, the autumn storms compelled Blake to move farther away from the rocky coast. Seizing this opportunity, Rupert escaped to Lisbon, and when the news of his flight reached the Council of State they at once equipped a fleet of 16 ships to pursue him and placed Blake in command. This fleet arrived off Lisbon early in March 1650, and for eight months waited in vain for Rupert to come out and fight. Finally the King of Portugal ordered the Royalist fleet to depart. Blake encountered it in Cartagena Bay and either captured or drove ashore every vessel, but he was disappointed to find that Rupert was not with the fleet. He returned to England and received the thanks of Parliament and a grant of £1,000 for his success.

The death of Admiral Popham in 1651 resulted in Blake being appointed to succeed him as commander of a fleet that was to watch the Downs to prevent help from abroad reaching the Royalists, and he maintained this watch until the collapse of the Royalist cause later in the year. For a few months he again sat in Parliament, but on 25th February, 1652, he was reappointed for nine months to the command of the fleet. War with Holland had at last become imminent, and Blake lost no time in making preparations. On the 19th May a Dutch fleet of 42 ships commanded by Admiral Tromp encountered in the English Channel a squadron of 12 ships commanded by Blake, and attacked them. Blake's flagship, the "*James*," was well ahead of his other shi s, and several of the Dutch men-of-war concentrated their fire upon her. The "*James*" suffered severely, her Captain and about 40 men being killed or wounded, and the ship dismasted. Late in the afternoon, however, nine other English ships reached the scene, and with his au mented fleet Blake forced the Dutch to retire, with the loss of two of their ships.



Portrait of Robert Blake. The illustrations to this article are from prints in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, by whose courtesy we are enabled to reproduce them.

This critical incident led to an effort on the part of England and Holland to come to terms, but the negotiations failed and war was declared. With a fleet of 39 men-of-war, two fire ships, two shallops and 18 merchant ships, Blake sailed on 27th June, 1652, to destroy the Dutch herring fisheries in the North Sea. He captured all the ships that were rotecting the fishing vessels, but he permitted the latter to continue their work provided they agreed to forfeit every tenth herring, as demanded by King Charles. The ships that refused to do this were either sunk or driven away. Tromp did not encounter the English fleet until after it had played havoc among the fishing vessels, and a gale then scattered his ships—five or six of which were captured by Blake—and prevented him from engaging in battle. He returned to Holland without having punished the English, and as a result found himself so unpopular that he resigned his command. He was succeeded by Admiral de Witte, with Admiral de Ruyter as second in command.

There were one or two minor engagements between the English and Dutch fleets before the first big battle was fought on 28th September, 1652, near the mouth of the Thames. The English fleet was in three divisions and totalled from 50 to 60 sailing ships, and the Dutch fleet, in four divisions, totalled 64 ships. Blake attacked the Dutch fleet inshore so as to retain advantage of the wind, but three hours later darkness put an end to the fighting. The battle was resumed next day and Blake pursued the Dutch, who

had lost two ships, until close to the Dutch coast. He waited in vain for De Witte to come out again into the open sea to renew the battle, and eventually returned to England and divided his fleet into squadrons to protect the coast.

Soon afterwards Tromp was restored to the command of the Dutch Navy, and with a great fleet totalling 95 ships he visited the English Channel to protect a large convoy of 300 Dutch merchant ships. When the enemy was sighted Blake immediately put out to sea in the "*Triumph*" of 60 guns, although he had only 37 men-of-war and a few smaller vessels available, and the two fleets met off Dungeness on 30th November, 1652. Blake was at a serious disadvantage in fighting such a superior force, and he suffered a heavy defeat. Three of his ships were sunk, and two were overpowered and captured while they were attacking Tromp's 90-gun flagship, the "*Brederode.*" The Dutch three times obtained a footing on board the "*Triumph,*" but were driven off, and at last under cover of darkness the much-battered English fleet returned home.

According to an unreliable legend Tromp subsequently hoisted a broom on the top of the mainmast of his flagship as a symbol, and swept all English merchant ships from the Channel.

Blake was greatly depressed over his crushing defeat, and submitted his resignation to the Council of State. They refused to accept it, however, for they realised that he had lost the battle owing to being hopelessly outnumbered. Instead they thanked him for his services, and at once began to prepare a fleet that would be strong enough to do battle with Tromp.



The Battle off the Coast of Essex, 3rd June, 1653, in which the Dutch fleet, commanded by Admiral Tromp, was severely defeated, after two days' fierce fighting.

The new fleet was ready by 1st February, 1653, and comprised about 80 ships. It was divided into three divisions known respectively as the Red, White and Blue divisions. The first, or Red division, was commanded by Blake and Deane, aboard the "*Triumph.*" The fleet cruised about the English Channel on the lookout for the Dutch, and while off Portland on 18th February they sighted Tromp with a fleet of 80 ships convoying about 200 merchant vessels. The English ships were scattered over a wide area, and Tromp was quick to take advantage of this. Aided by a favourable wind he concentrated his attack on an isolated group of about 12 ships that included the "*Triumph,*" and during the four hours that elapsed before assistance arrived the English ships were subjected to intense fire by the enemy. The Captain and many of the men aboard the "*Triumph*" were killed, and Blake was wounded in the thigh by a splinter of iron that also tore Deane's coat and breeches. By nightfall the English had lost five ships, one being sunk and four captured; while the Dutch had three ships sunk, one blown up, and one captured. The ships taken by the Dutch were later recaptured, but they proved to be so badly damaged that they were useless.

Tromp arranged his men-of-war in the form of a half-moon to the rear of the merchant vessels, and in this formation the Dutch fleet moved up the Channel. When the English ships caught up with them again the next day further fighting took place, and resulted in the capture of two Dutch men-of-war and about 12 merchant ships. The third day of the battle brought further success to the English when Admiral Penn broke through the enemy's defence and captured about 40 more merchant ships. Tromp then retreated close to the French coast, where shallow water prevented his pursuers from getting within firing range, and during the night he escaped with the greater part of his ships.

Then followed a quiet period for Blake, who had caught cold in his wound and lay seriously ill at Portsmouth for many weeks. The fleet at sea was commanded by Admirals Deane and Monk, and when Blake returned to duty at the end of May, 1653, he took command of ships refitting at the Thames Dockyards. He had hardly done so when news was received that Tromp had reappeared in the Channel with a great fleet and bombarded Dover Castle. Monk and Deane with a fleet of 95 ships immediately sailed from Yarmouth and encountered the enemy off the mouth of the Thames.

The two fleets were fairly evenly matched, and the engagement quickly developed into a fierce battle that lasted two days. The battle started badly for the English, as the first enemy broadside killed Deane. The fortunate presence of Monk made it unnecessary to take in the Admiral's flag, an action that would have made the tragedy known to all the fleet; and quickly covering over the body with his cloak, Monk directed the attack as though nothing unusual had occurred. On the second day the fighting was even more intense. The English obtained a footing on the "*Brederode,*" but were repulsed, and were in the act of boarding the flagship a second time when her almost exhausted magazine exploded, killing some of the English seamen as well as the Dutch. Tromp escaped unhurt. The Dutch suffered a crushing defeat, having eight or nine ships sunk or burned and 11 captured. During the closing stage of the battle Blake arrived with 18 more ships and joined in the pursuit of the fleeing enemy. His premature return to active service brought about a relapse, however, and he was landed at Solebay very ill and conveyed to his home.

The Dutch endeavoured to come to terms, but Cromwell would make no concessions, and therefore they prepared for another and final clash, and this occurred while Blake was still convalescent. The English and Dutch fleets were commanded by Monk and Tromp respectively, and the great battle was fought off Scheveningen, Holland, on Sunday, 31st July, 1653. Early in the fight Tromp was killed while giving orders to his men. With the fall of their great leader the courage of the Dutch ebbed away, and they were so severely defeated that the war ended soon afterwards. The final overthrow of the Dutch was acclaimed in England with joy, and Cromwell's Parliament appointed the 25th August, 1653, to be a Day of Thanksgiving, and ordered gold chains each valued at £300 to be sent to Blake and Monk.

Blake returned to active service during 1654, and in September of that year he sailed with 20 men-of-war to look after English interests in the Mediterranean. While cruising in these waters he visited the Barbary Coast, the abode of pirates who had long been a menace to Christian seamen, and demanded compensation for piracies that had been committed against his countrymen. The Bey of Tunis declined impolitely, and Blake decided to teach him to be more respectful. After visiting Sicily to obtain water and provisions he returned to the Barbary Coast and anchored outside the heavily fortified harbour of Porto Farina, Tunis, in which was the Tunisian Navy.

The next morning the English fleet entered the harbour under a heavy fire from the fort, and in the words of Blake: "anchored before their castles, the Lord being pleased to favour us with a gentle gale off the sea, which cast all the smoke upon them and made our work the more easy. After some hours' dispute we set on fire all their ships, which were in number nine; and, the same favourable gale continuing, we retreated out again into the road. We had 25 men slain and about 40 besides hurt, with very little other loss. It was also remarkable for us that, shortly after our getting forth, the wind changed, and continued very stormy for many days, so we could not have effected the business, had not the Lord afforded that nick of time in which it was done."

Blake next received instructions to cruise off Cadiz to prevent Spain sending reinforcements to the West Indies, and also to intercept the incoming treasure fleet. The long period of constant duty made it impossible for Blake to obtain fresh supplies of water and provisions, and in a letter to Cromwell he speaks of his "men falling sick through badness of drink and through eating their victuals boiled in salt water for two months' space," and confesses that he also is far from well. The fleet returned to England in October, 1655, and Blake spent the winter at home. (*Cont. on page 30*)



XXXVIII.—A MUSICIAN

THE musical profession differs in many important respects from most of the professions with which we have already dealt in this series. There are almost as many ways of entering upon the career of a musician as there are branches of the profession, and it is usually impossible to say that any one way is the best. So much depends on the individual and his circumstances that an article on how to become a musician cannot be much more than a series of general suggestions.

First of all it must be emphasised that success in any branch of music involves downright hard and prolonged work. There is something very fascinating about the idea of playing or singing to large audiences, but only those who have succeeded in this direction know how much of their success is due, not to their musical ability, but to incessant practice. Natural ability is necessary—in no profession is it more so—but no musician has ever reached top rank without undergoing long and severe training to develop his ability to its utmost.

Before a boy decides upon a career as a musician he should consider carefully three things—first, whether he has the necessary musical ability; second, whether he is prepared to undergo the necessary severe training; and third, whether his parents can afford to maintain him during his period of training. This last consideration is important, because only in exceptional cases can a music student hope to earn more than trifling sums during his early training. As regards musical ability, the advice of an expert and experienced musician should be obtained, and if there is any doubt as to his verdict a second opinion should be sought. The ability to play a few pieces on some instrument, or to sing a few songs, is not sufficient. Without quite exceptional talent a boy will never achieve real success, and mediocrity in music is worse than in most other professions, from a financial point of view and in every other way.

We have already mentioned that there are many ways of entering the profession. Perhaps the two most practical, as well as the most useful, are to become a professional pupil of some prominent musician, or to enrol as a student at a school or college of music of good standing. The vast majority of musicians can never hope to earn a living entirely as soloists, and therefore must prepare themselves for teaching. Pianoforte students, unless they have such exceptional ability as to justify them in specialising in solo work, will probably take up the organ in addition, with the object of obtaining a good post as organist and choirmaster to form a sound financial and social basis for the working up of a teaching connection. Such students should aim at securing a good diploma, such as those granted by the Royal Academy of Music (L.R.A.M.) and the Royal College of Music (A.R.C.M.); and if they are at all ambitious in regard to the organ they should certainly obtain the diploma of Associate of the Royal College of Organists (A.R.C.O.) and subsequently the Fellowship (F.R.C.O.). These qualifications, if not absolutely essential, are of the utmost value, and the time taken in preparing for the respective examinations is well spent. A student who aspires to become organist of one of our larger parish churches, or of a cathedral, or to secure an appointment as music master at a first-class school, should certainly go further than this and obtain a University degree of Bachelor of Music, and later if possible of Doctor of Music. Either of these degrees confers a definite standing upon its possessor, which makes all the difference when application is being made for a really important post.

Vocal students, generally speaking, pay less attention to professional qualifications than pianoforte and organ students, but while they may not have need of a degree,

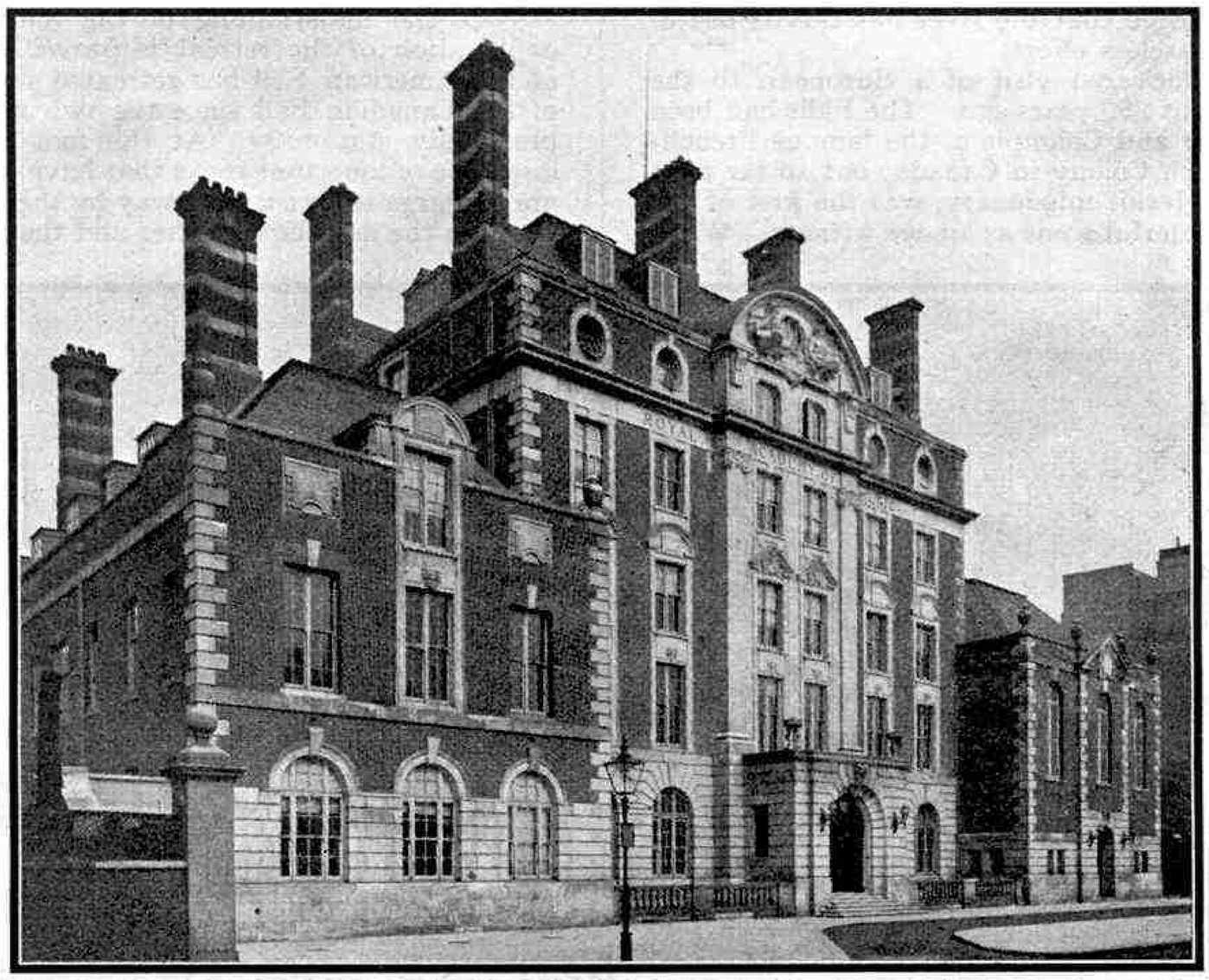


Sir Landon Ronald, F.R.A.M., F.R.C.M., the famous conductor and composer, is Principal of the Guildhall School of Music, a position that he has held since 1910. He has achieved an international reputation as a conductor, and his readings of both classical and modern music are highly individual. His compositions include orchestral works and pianoforte pieces, and many very popular songs.

they should most certainly aim at the diploma of L.R.A.M. or A.R.C.M. The training of all vocalists is more or less the same up to a certain point, but afterwards it varies according to the special branch of vocalism to be followed. Before this branch is finally decided upon expert advice should be obtained, especially if the singer has hankerings after the stage. Success in opera, grand or light, demands many qualities in addition to pure singing ability, and the stage is merciless to its failures. The alternatives are purely concert work, which necessitates a voice of outstanding quality; and a combination of concert work and teaching, in which those who are less favoured vocally are most likely to succeed.

Violinists and cellists are all the better for a good diploma, but probably it is not so essential for them as for pianists and organists. The standard required for success as a concert player is extremely high, and most violinists and cellists have to depend mainly on orchestral work, usually combined with a certain amount of teaching.

Students who specialise in most of the other instruments aim directly at orchestral work, and really first-class players of the less common instruments have a wide range of opportunities.



Our photograph shows the Royal Academy of Music at York Gate, Regent's Park, London. For permission to reproduce it we are indebted to the courtesy of A. Alger Bell, Esq., Secretary of the Royal Academy of Music.

Private tuition and training at a school of music each has its special advantages and disadvantages. For a boy whose tastes lie in the direction of church music there is little doubt that the best course is to become a professional pupil of the organist of an important church, or if possible of a cathedral organist. He thus not only obtains expert tuition, but has opportunities of deputising that give him practical experience under the best possible conditions. He thus grows into what has been called the "cathedral tradition," without which he can scarcely hope to reach the highest posts. For other students there is much to be said in favour of training at a first-rate music school. The teachers have a wide range of experience with pupils of all types, and a student has the advantage of special teachers for the different branches of his work, theoretical and practical. His work is mapped out for him on wise and comprehensive lines, so that while he devotes most of his time to his chosen instrument, he is not allowed to neglect his general musical education. Another point of importance is that contact with fellow students provides an incentive to hard work that is often lacking in private tuition.

In London the leading music schools are the Royal Academy of Music, the Royal College of Music, the Guildhall School of Music, and the Trinity College of Music. At each of these institutions a student is provided with a complete course of musical training under teachers of the highest qualifications.

Let us take the Royal Academy as typical. There are three terms in the academic year, Michælmas, Lent and Midsummer. Students are not admitted for less than three terms, and to obtain the highest awards of the Academy a course of at least four years' study is necessary. There is an entrance examination to enable the general fitness of a candidate for acceptance as a student to be judged, and to determine his degree of proficiency. The appointment of students to the various professors is left to the discretion of the Principal.

In the ordinary curriculum, students take one principal and one secondary subject of study, one of which must be the pianoforte. In addition they must take classes in elements of music, or harmony and counterpoint, or composition; and in aural training or sight reading, score reading and transposition. There are also special courses for the training of conductors and for opera, and a special teachers' training course. Finally there is the graduate course held jointly by the Royal Academy and the Royal College, successful candidates in which are created Graduates of the Royal Schools of Music (London). Students who take this course must have passed a matriculation examination or its equivalent.

The entrance fee to the Academy is two guineas. The fee for the ordinary curriculum and for the conductors' and opera courses is in each case 14 guineas per term; and for the teachers' training course seven guineas per term. There are 72 scholarships and exhibitions open for competition, in most cases to both students and non-students. As a rule these are tenable for three years. Full details of the courses and scholarships may be obtained from the Secretary, Royal Academy of Music, York Gate, Marylebone Road, London, N.W.1.

Particulars of the courses and scholarships at the Royal College of Music are obtainable from the Registrar, South Kensington, London, S.W.7; of those at the Guildhall School of Music from the Secretary, John Carpenter Street, Victoria Embankment, London, E.C.4; and of the Trinity College of Music from the Secretary, Mandeville Place, Manchester Square, London, W.1.

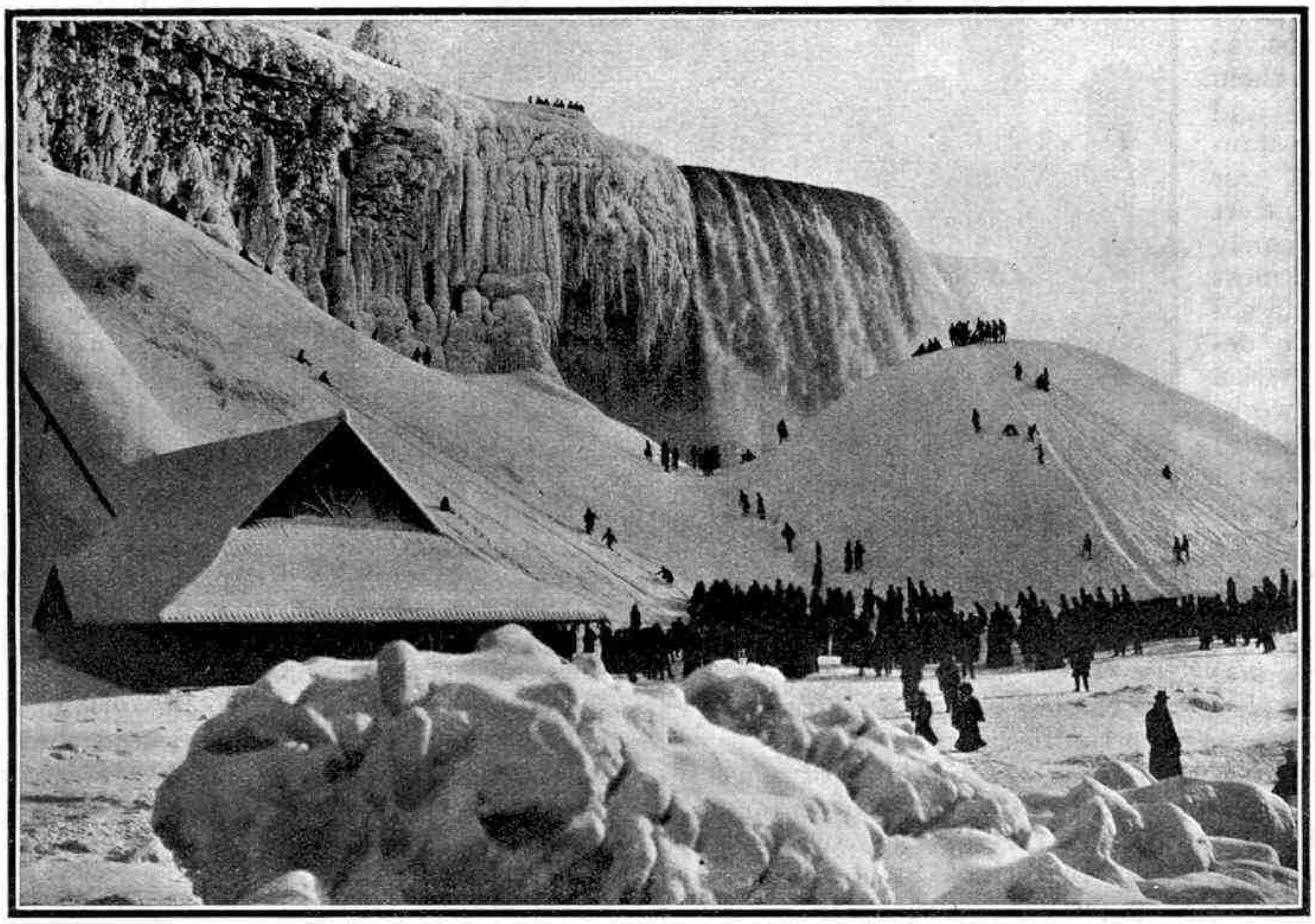
There are many excellent music schools in the provinces. Notable institutions are the Royal Manchester College of Music and the Birmingham and Midland Institute School of Music.

The Fascination of Niagara

Some Facts about the "Thunder of Waters"

THE great avalanche of water that pours over the limestone brink of Niagara Falls possesses a unique fascination. Every year the Falls are visited by more than a million people, who are awed by the stupendous rush of water and by the fury of the whirlpool in the great gorge that the river has carved out of the rock by centuries of ceaseless effort.

The first definitely authenticated visit of a European to the Niagara Falls was made about 250 years ago. The Falls had been mentioned earlier by Cartier and Champlain, the famous Frenchmen who founded the French Colony in Canada, but so far as is known Father Hennepin, a Jesuit missionary, was the first of the colonists to describe the wonderful scene as an eye witness. When travelling in the vicinity he heard the "Thunder of Waters," as the Indians called it, while still many miles distant, and on reaching the Falls he was so astounded at their magnificence that he described the waterfalls of Europe as sorry patterns in comparison.



A photograph of the remarkable sight presented by Niagara Falls when the water is frozen. The hillocks down which tobogganing is seen taking place, are created by frozen spray.

Hennepin speaks of two great falls divided by an island. These were, of course, what are now known as the American and the Canadian or Horseshoe Falls, the former, 1,060 ft. in width and 162 ft. in height, being separated by Goat Island from the Canadian Fall, which are almost three times as wide and only 7 ft. less in height. Goat Island itself presents a frontage of 1,300 ft. A sketch made by the discoverer shows three falls, however, the additional one being beyond the Canadian Fall and separated from it by a large rock. This third fall and the rock were mentioned by another early traveller, who was informed that they had disappeared a few years before his visit. Since then other large masses of rock have fallen at various times, culminating in 1850 in the breakaway of a shelf on the Canadian side known as Table Rock.

The Falls owe their existence to the presence of a ledge of hard limestone resting on a bed of soft shale that extends beyond it. The overflow from Lake Erie forming the River Niagara has cut deep chasms and gorges in the shale, but has been unable to make any impression on the limestone, with the result that its waters now leap down from a ledge of limestone into the gorges beyond.

As the water falls it undermines the soft shale supporting the ledge over which it leaps, and as this support is removed large masses of ledge are broken off by their own weight. Thus the brink of the Falls moves slowly backward, and this backward movement has been in progress for thousands of years. It has been suggested, in fact, that the retreat has brought the Falls to their present position from the end of the gorge at Lewiston, seven miles nearer the shore of Lake Ontario, and their age has been estimated at 32,000 years by comparing the present rate of retreat with the distance thus traversed.

That the undermining of the hard limestone is the correct explanation of the retreat is proved by the fact that the crest of the American Fall has retreated much more slowly than that of the Canadian Fall since the two were discovered, and is now practically stationary. At the foot of the American Fall is a large pile of limestone rocks that have fallen from the shelf. These are too large to be carried away by the flood, and as they intervene between the descending water and the face of the underlying shale they serve to protect the shale from erosion. No such protecting mass of debris exists on the Canadian side, and the shale there is fully exposed to the eroding action of the falling water. It is evident, therefore, that the brink is only receding where the underlying shale is being eroded and the great ledge is being deprived of its support.

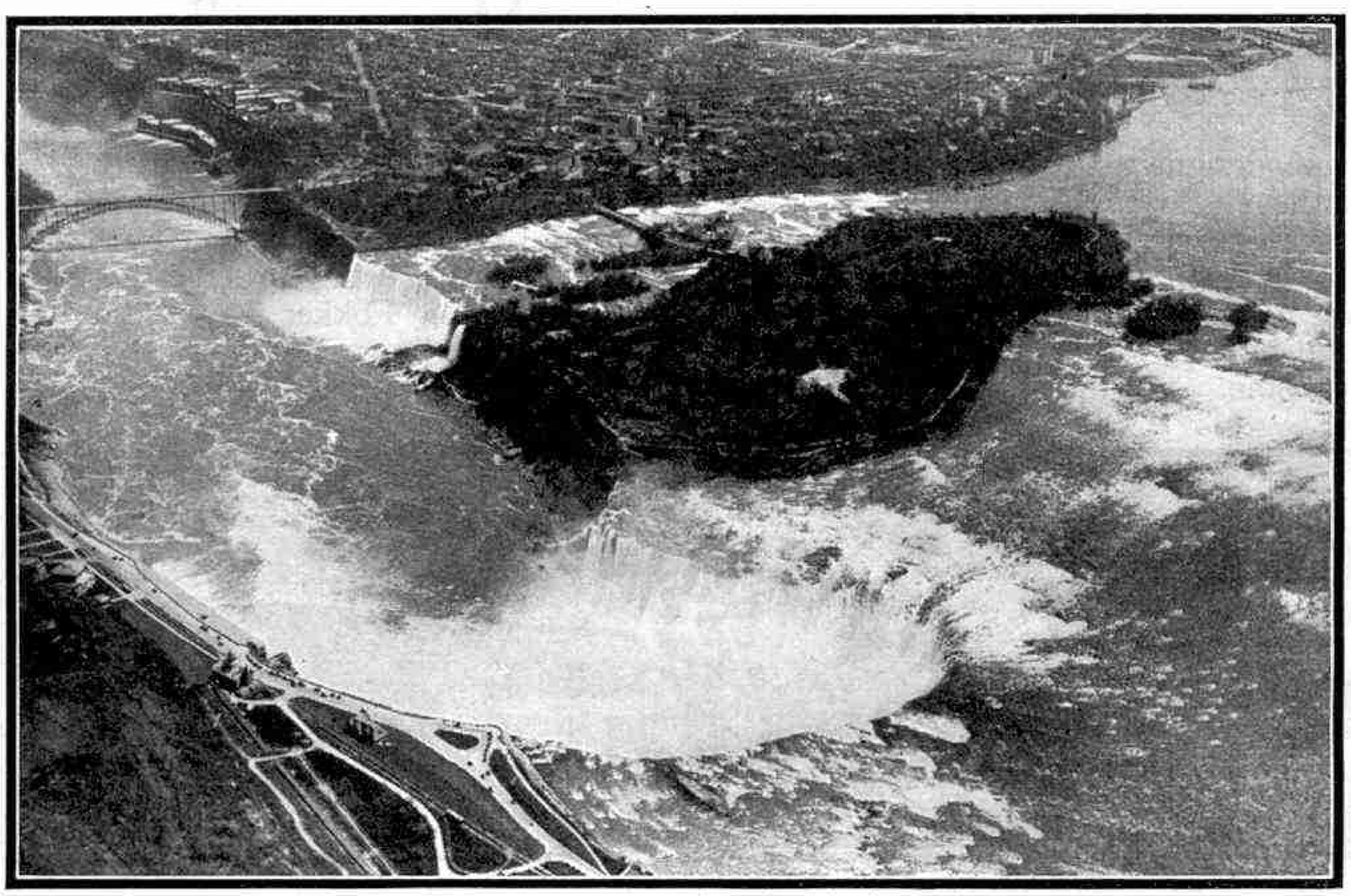
Some 200 years ago the wall of water extended from Goat Island to the Canadian shore in a beautifully regular curve that was the origin of the name Horseshoe Fall. Since then erosion has been most rapid in the centre of the curve where two deep channels in the river converge, with the result that a deep jagged notch has been cut in the curved outline. The Canadian Fall discovered by Father Hennepin has been replaced by a fall nearly 1,000 ft. nearer Lake Erie.

The Niagara River extends from Lake Erie to Lake Ontario, and is 33 miles long. It is three miles across at the widest point, and just above the Falls is slightly less than a mile in width. Above the Falls there are rapids that descend about 50 ft., and below the Falls is a deep basin that extends for 1½ miles. The water in this basin is comparatively smooth, and a small pleasure steamer, much used by visitors, is able to approach quite close to the Falls. Below this long basin the river enters a narrow gorge seven miles long and about a quarter of a mile wide. The almost perpendicular sides of the gorge range from 200 ft. to 500 ft. in height, and between them the river rushes at a speed of about 30 m.p.h., its turbulent waters urged forward by the great pressure behind. A short turn to the left half-way down the gorge has resulted in the swirling waters wearing away the rock until at this point there is now a huge pothole, known as the Whirlpool, and estimated to be 400 ft. deep. The Whirlpool is as great an attraction to visitors as the Falls themselves.

The impressiveness of Niagara Falls is not due to their height.

On the American side they are only 164 ft. in height, and this seems small in comparison with the 400 ft. of the Victoria Fall on the Zambesi River, or the 1,500 ft. of the Yosemite Fall in California, but in neither of these cases is the effect on the onlooker so great as that of Niagara. This is due to the enormous volume of water that pours over the brink of the famous cataract, for behind the river an enormous reservoir of water is stored up in Lakes Superior, Michigan, Huron and Erie, four of the largest fresh-water lakes in the world. Almost a quarter of a million cubic feet of water flow over the Falls every second, but as the total surface of the water in the lakes is 90,000 square miles this amount is comparatively a mere drop.

In winter the river below the Falls is often frozen into hills 30 ft. to 40 ft. high. The ice in the neighbourhood of the Falls assumes all sorts of fantastic and beautiful shapes, and one of the accompanying illustrations gives some idea of the wonderful scene at such times.



Niagara Falls from the Canadian side. This photograph shows how the rush of water is largely concentrated in the jagged notch of the Horseshoe Fall. The notch occurs where two deep channels in the river converge.

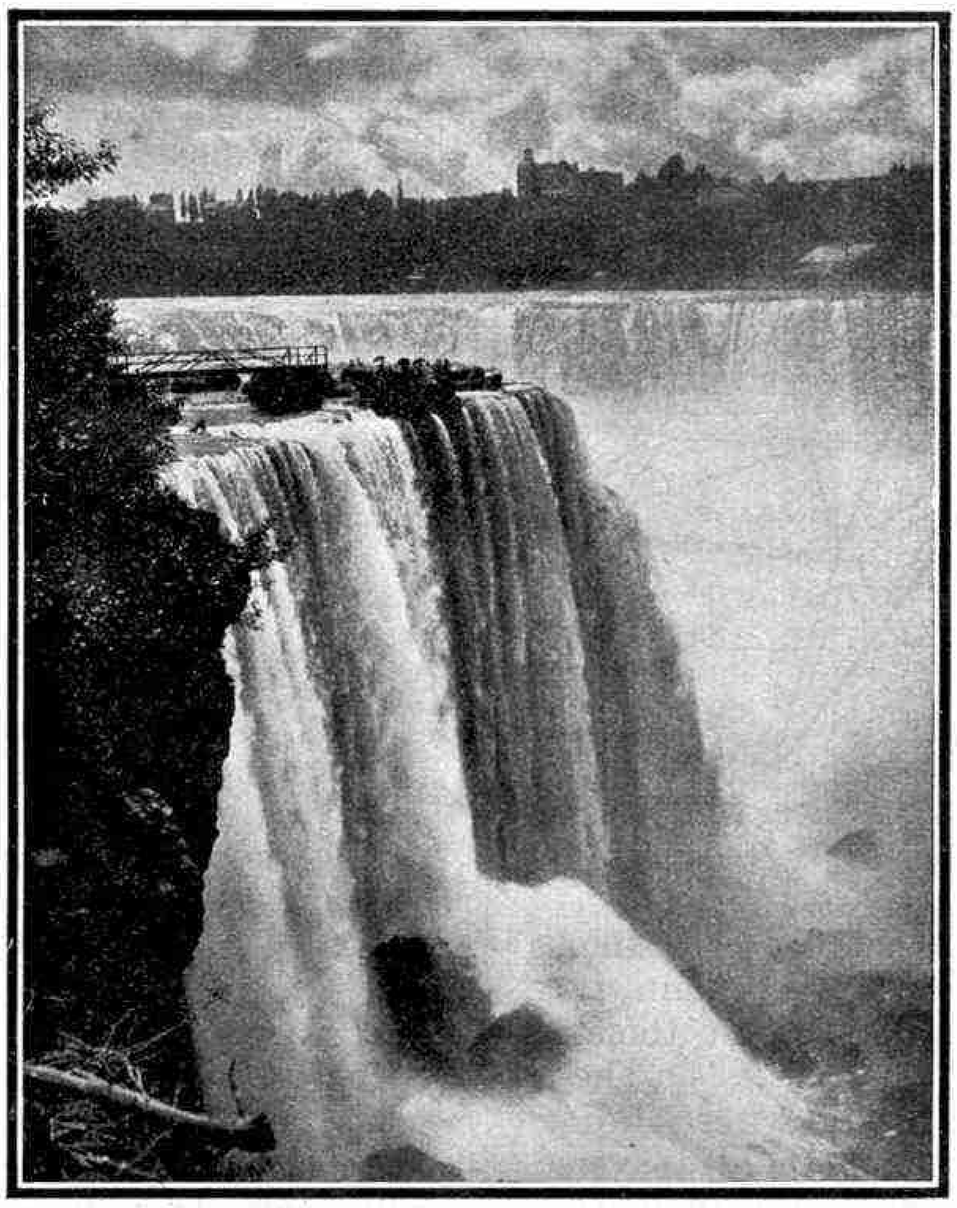
For more than 100 years after their discovery Niagara Falls were regarded as nothing more than a wonderful spectacle. During the last century, however, it was seen that they also were a source of enormous power, and the invention of the dynamo and the development of electrical machinery led to the establishment on both sides of the Niagara River of power stations in which the generators were operated by means of water-driven turbines.

It is scarcely surprising that engineers should turn their attention to Niagara Falls when looking for a natural source of power. The two chief needs of a hydro-electric power station are a good head of water and a constant flow, and both these requirements are provided at Niagara. There is little need to fear any great diminution of the ample supply of water that is available, for behind the Falls are the four Great Lakes. These lakes collect the water from a catchment area of 260,000 square miles and act as vast reservoirs, in which is stored the water that maintains the flow at Niagara.

The height of the Falls is little more than half of the total head of water available, however, for in its short course from Lake Erie to Lake Ontario the Niagara River falls 326 ft. Such an enormous quantity of water falling through this height could develop no less than 8,000,000 h.p., and in order to extract some of this energy for useful purposes engineers have established power stations along the banks of the river near the Falls. Unfortunately these schemes have robbed the Falls of some of their impressiveness. Of the 210,000 cu. ft. of water that flow from Lake Erie every second, no less than 56,000 cu. ft. are taken to the penstocks of the power houses and never reach the Falls. This has not only assisted in spoiling the Canadian Fall, but also has thinned out the American Fall considerably.

The decrease of water is partly due also to operations at Chicago, at the southern end of Lake Michigan, nearly 1,000 miles farther up the Great Lake system. Very large quantities of water have been diverted from Lake Michigan into the River Chicago to wash away sewage, and as that river discharges into the Mississippi Basin, water that should flow over Niagara Falls is finding its way into the Gulf of Mexico 1,000 miles to the south. In addition water is being taken from the Great Lakes for several canals, and in recent years the general level of the water in the lakes has been very low.

So serious did the effect of these various schemes threaten to become that there seemed to be a danger that the Falls would eventually dry up altogether! At this stage the Governments of Canada and the United States stepped in, and by a Treaty signed in 1909-1910 the amount of water that could be diverted for power purposes was restricted to 56,000 cu. ft. per second, a quantity little more than one-quarter of the average supply that flows down the Niagara River.



An impressive photograph of the Canadian Fall at Niagara.

Of the water that may be taken from the river, 36,000 cu. ft. may be diverted on the Canadian side and 20,000 cu. ft. on the American side of the river. For engineering reasons it is preferable to take the larger quantity from the Canadian side, but the power derived from the river is shared equally between the two countries.

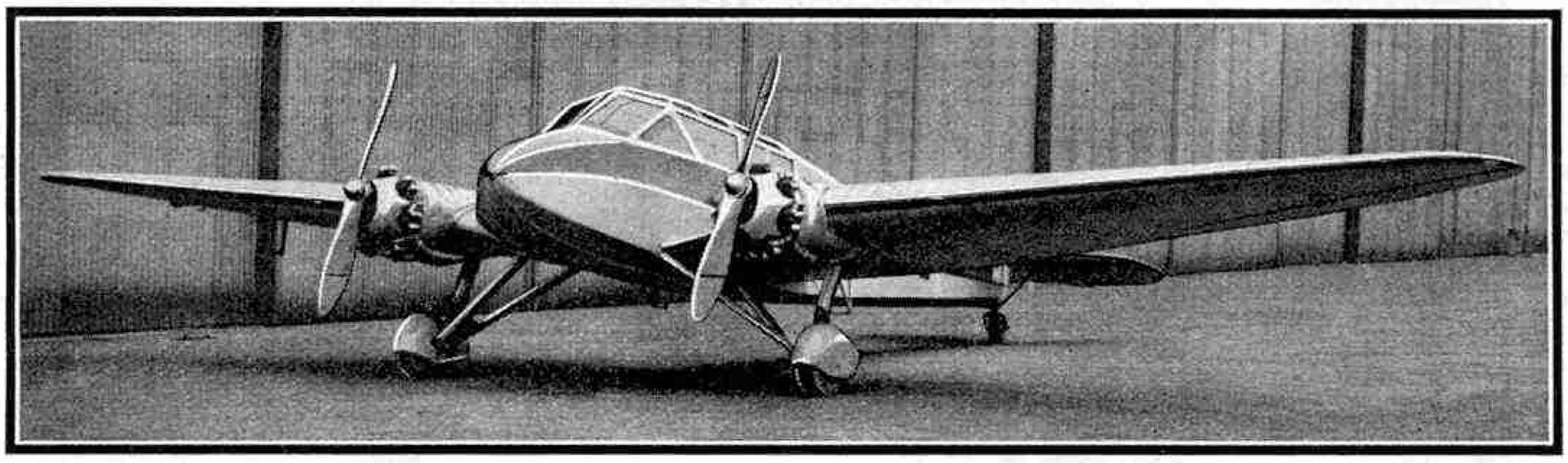
Quite apart from the heavy demands of adjacent power stations there is actually a possibility of the Falls becoming dry permanently as the result of a slow rise in the rock foundation. Water from Lake Erie enters the Niagara River at Buffalo, the well-known American city on the eastern shore of Lake Erie, 16 miles from the Falls, and here the rate at which the rock is rising is 6 in. per century. This seems an insignificant amount, but it may have far-reaching consequences. It is not absolutely certain, of course, that the rise will continue, but if it does the surface level of the water in Lake Erie will also rise until, in 1,600 years' time, it will have risen to the level of Lake Huron. The flow of water to the Falls from the west will then cease and Niagara will be dry!

Any rise of this kind in the surface level at one end of the Great Lake system would result in the waters seeking a fresh outlet, and probably this would be found at the southern end of Lake Michigan where the waters would link up with streams that form part of the great Mississippi system. The St. Lawrence then will shrink, and the Mississippi will be swollen by the overflow of the four largest of the Great Lakes.

British Aircraft Developments

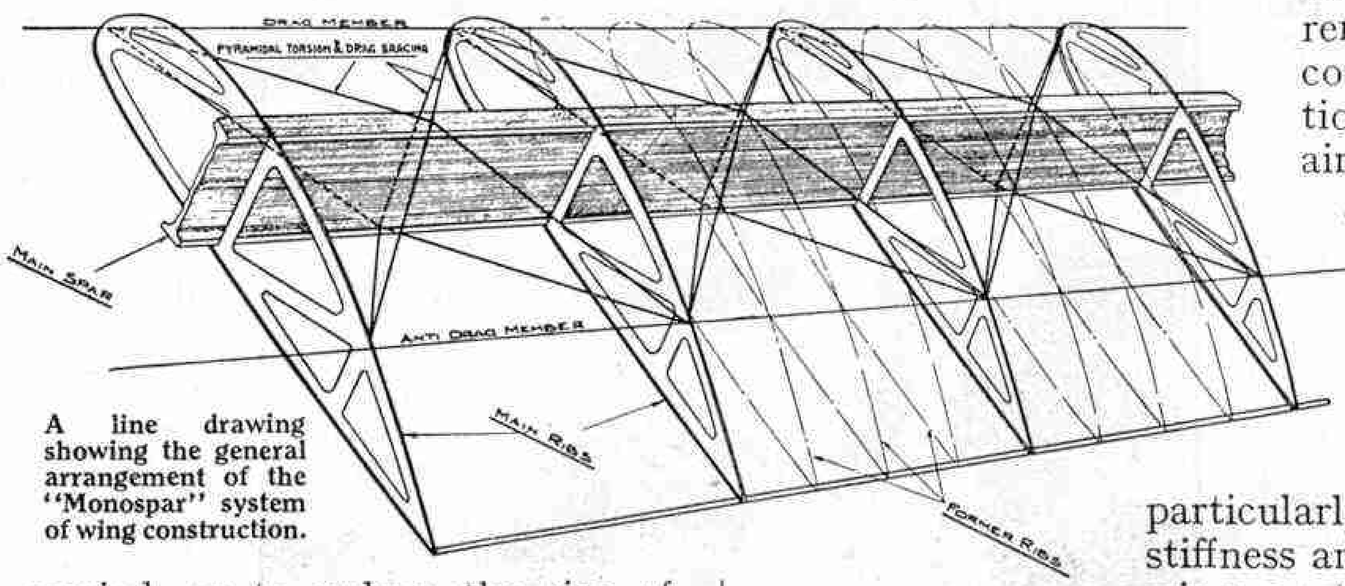
IV.—The General "Monospar"

THE majority of designers of monoplane aircraft employ cantilever wing structures in their machines. This type of structure is selected for various reasons, the main ones being that it possesses great strength, can be made fairly light, and does not require any external bracing struts that would increase the drag of the machine. An interesting development of this structure has been made by a British aircraft designer, Mr. H. J. Stieger, D.I.C., A.F.R.Ae.S., who is managing director of, and chief designer to, the Monospar Company and the General Aircraft Co. Ltd. Mr. Stieger made a scientific analysis of cantilever wing structures, and as a result produced the "Monospar" system, which makes it possible for one spar only to be employed in a full cantilever wing. The application of the system results in a substantial reduction of weight in the wing structure, and this in turn enables a greater pay load, or additional military equipment, to be carried. If the system is extended to the construction of the fuselage, a still further saving in weight is obtained.



The General "Monospar GAL ST4." For permission to reproduce the illustrations on this page and the upper one on the opposite page, we are indebted to the courtesy of the General Aircraft Co. Ltd. Other photographs of the "Monospar" appear on pages 24 and 25.

Actually the "Monospar" wing makes possible an increase in pay load of 30 per cent. in the case of commercial aircraft, while for military aircraft, such as bombers, the increased capacity is invaluable, whether it be used to increase the weight of the armament or bombs carried, or to reduce the size of the fleet, or of the machines, previously required to meet certain demands.



A line drawing showing the general arrangement of the "Monospar" system of wing construction.

A "Monospar" wing consists essentially of a single transverse spar that carries a number of main ribs spaced apart. The spar is braced to resist torsion, or twisting effect, by a series of "pyramids." These may consist either of rigid struts or of wires leading from the main spar to the apices of the transverse members. "Former" ribs in between the main ribs are provided to strengthen the fabric when the wing is covered. The principle of "Monospar" construction can best be understood by a study of the drawing on this page.

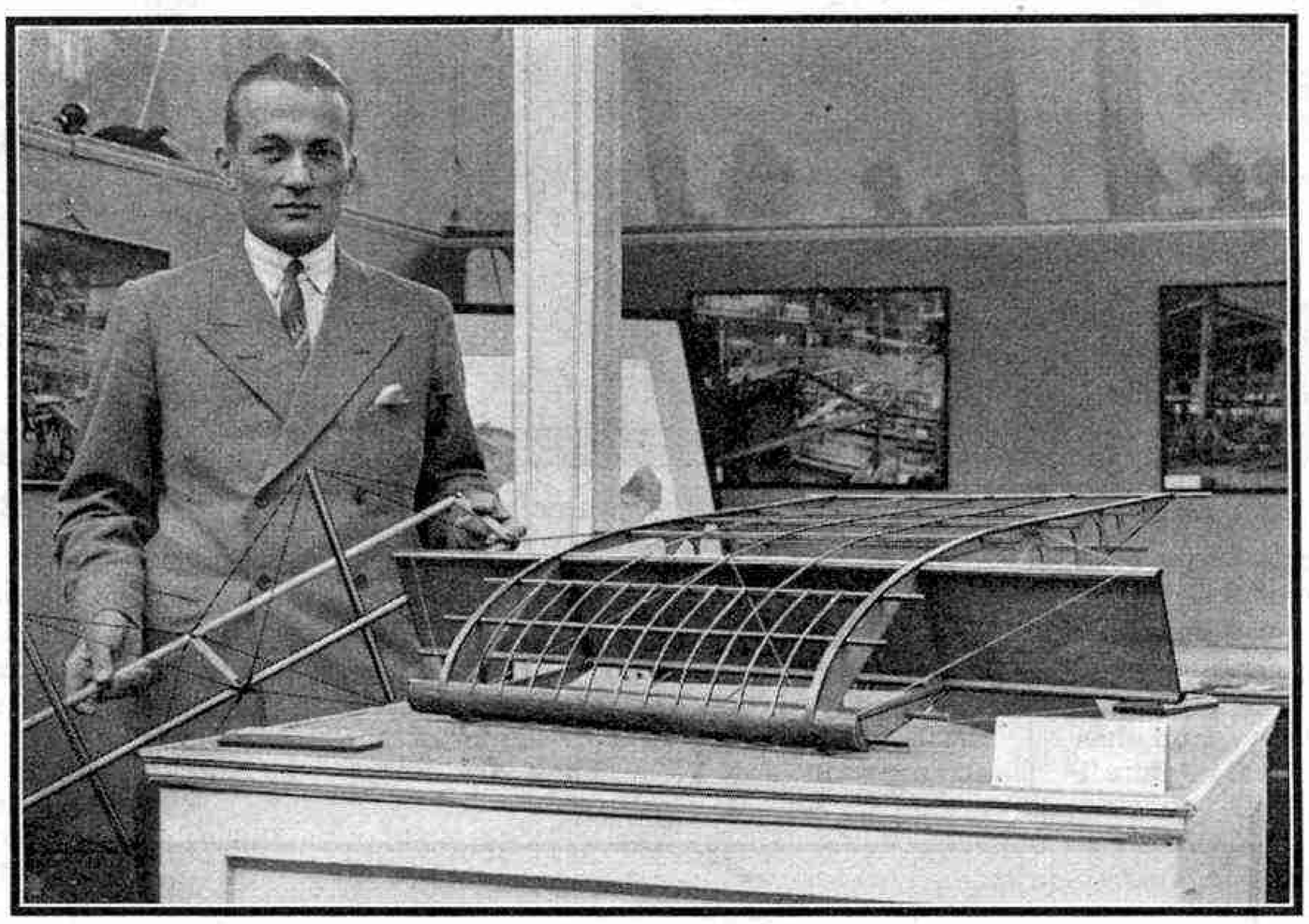
The practical application of the "Monospar" system of construction has been demonstrated in the experimental "Monospar" machine, and with a large "Monospar" wing ordered by the Air Ministry for service on a Fokker F.VII 3.m. The experimental "Monospar" was built solely for research purposes and in connection with the design of the new "Monospar" machine. It was a 3-seater low wing machine of the enclosed cabin type, and was powered by two 40/45 h.p. Salmson engines mounted outboard in nacelles on the wing. The machine was submitted to more than 1,000 hours of flying under the most rigorous conditions. During this time officially observed terminal dives were made at speeds of more than 178 m.p.h., while aerobatics of all kinds were carried out in the machine. An important feature is that it was taken off, flown, and made to perform all normal manœuvres without difficulty with one engine shut off. In order to test the structure the aeroplane has been flown with various component parts of the wing spar torsional bracing removed, and also with wing coverings slackened intentionally beyond the "unairworthy" standard.

As regards the "Monospar" wing supplied for the Fokker F.VII 3.m., carefully observed tests have borne out the calculations of the designers in every way, particularly in relation to strength, stiffness and weight. The use of the wing on the machine resulted in a saving in wing weight of 39.2 per cent., equivalent to an increase in pay load of 37.7 per cent., or an increase in range of 43 per cent. The speed of the machine was also increased by 10 miles an hour.

It is interesting to note that practically all the test flying of these aircraft incorporating the "Monospar" wing has been expertly handled by Flt. Lt. H. M. Schofield, who is well known as a member of the Schneider Trophy Team that was so successful at Venice in 1927. Flt. Lt. Schofield is now Chief Test Pilot and Sales Manager of General Aircraft Ltd.

The latest machine built with Mr. Stieger's wing, the "Monospar GAL ST4," is of metal construction.

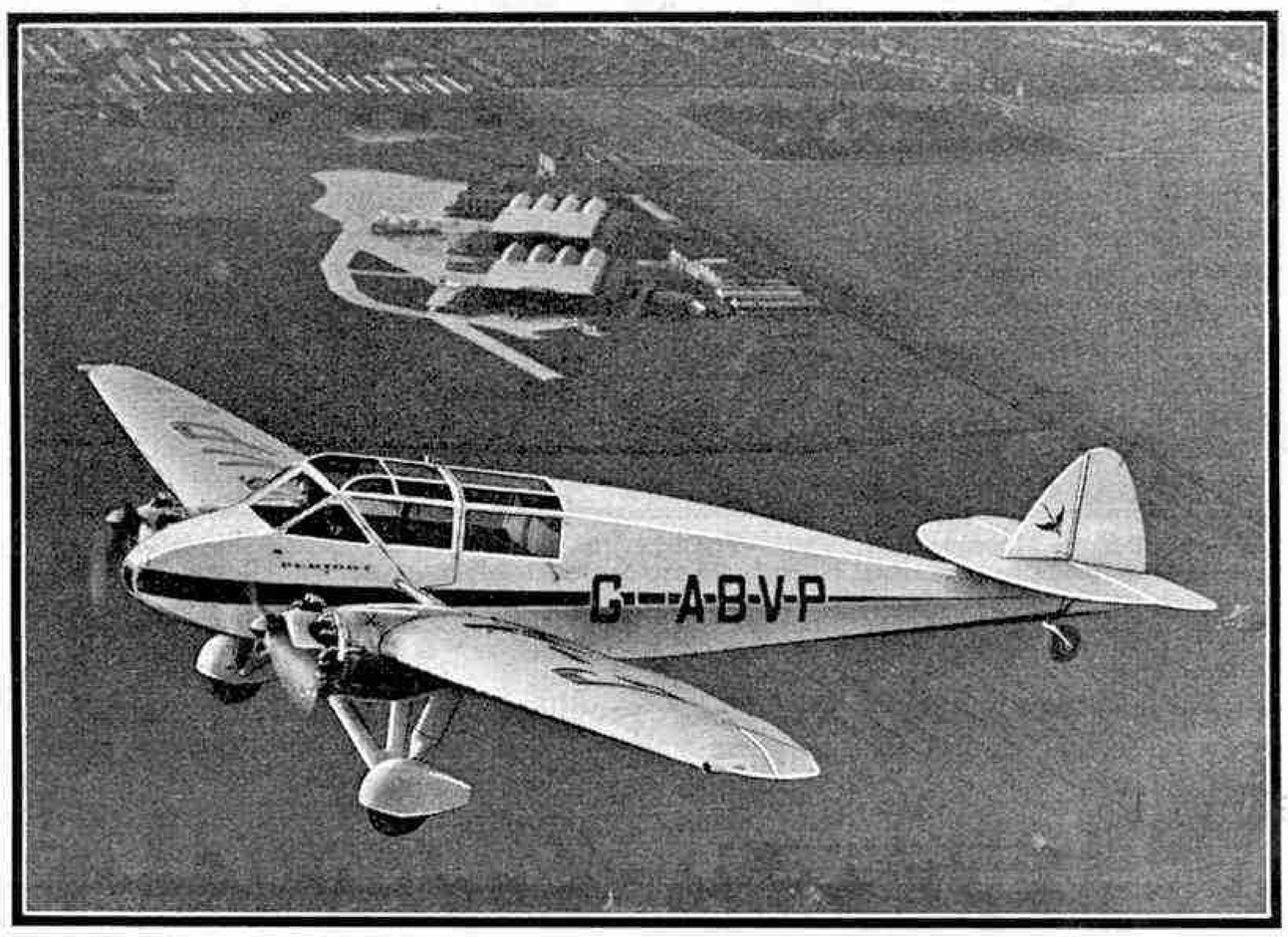
The design incorporates, in addition to the "Monospar" system of construction, features that are claimed to have been unattained hitherto in any similar type of light aircraft. The machine is an economical twin-engined light four-seater, with good performance, capable of maintaining flight and normal manœuvres and handling easily when fully loaded, with one engine out of action. The field of view from the pilot's seat is practically unobstructed in any direction, and saloon car comfort is available for pilot and passengers. It is a general purpose machine, equaly suitable for use as a luxurious private saloon or for mail, freight, photographic, survey and air line feeder work, or as an air taxi. The machine can rapidly be converted for service for any of these purposes.



Mr. H. J. Stieger, D.I.C., A.F.R.Ae.S., the inventor of the "Monospar" system of construction, with a model section of "Monospar" wing.

The machine, like the experimental type, is a twin-engined low-wing monoplane, the wings being constructed of metal on the "Monospar" system and fabric covered. They are made in two sections, and the rear of the inner or centre section hinges up to allow the extension, which contains fuel tanks, to fold round to the tail for garaging. As the wings are of full cantilever construction any external bracing is unnecessary, and consequently they present the cleanest possible aerodynamic form.

The fuselage is constructed on the "Monospar" principle. It is built up of an all-metal chassis that consists essentially of a shallow main girder braced so that it has a high degree of torsional rigidity, and a tubular framework that forms the "cabin tray." The secondary structure is of light but rigid metal stringers. This makes it possible for the machine to be adapted to a number of purposes without entailing any modifications of the main structure, which at the same time is sufficiently robust to minimise danger to the occupants if the machine should overturn. Fabric covering is employed throughout.



A "Monospar" in flight over Croydon Aerodrome. This photograph is reproduced by courtesy of the Editor of "The Aeroplane."

The tail unit is of normal monoplane type. It consists of a metal framework covered with fabric and is provided with a normal fin and rudder. The adjustable tail plane is braced to the fuselage by one steel tube on each side. The undercarriage is fitted with spring Oleo shock absorbers, and the wheels are provided with medium pressure tyres and differential friction brakes. The undercarriage is of the wide track type and wheel "spats" are standardised.

The power plant consists of two Pobjoy R 7-cylinder air-cooled engines developing between 75 and 85 h.p. They are of the geared type and are provided with suitable cowlings. The petrol is carried in standard tanks in the wings, with a capacity of 40 gallons, but additional tankage, giving the machine up to 10 hours' range, can be installed to special requirements. An interesting feature is that hand starting mechanism that may be operated from the cabin is provided.

Entry to the cabin is gained by doors on each side of the machine. These are shaped to the contour of the fuselage side and top, and thus it is unnecessary to stoop when entering or leaving. When the doors are opened they lock automatically on to the external portion of the wing spar, and form a guard frame from the propellers while the engines are being run up. The cabin is roomy and draught-proof, but adequate ventilation may be obtained by opening the side windows as required. Special attention has been given to subduing noise inside the cabin.

The pilot and the front passenger are accommodated on separate side-by-side seats, the other two passengers being seated in the rear in a double seat immediately in front of a roomy freight locker. The cabin is upholstered throughout. As all the fabric used is fire-proof, and the petrol tanks are carried outboard on the wings, passengers may smoke while flying.

The dashboard of the machine has been made as simple as possible, but there is room for complete equipment to cover instrument flying, night-flying, etc. The engine instruments are mounted outboard and are easily discernible for reading, and the control columns and rudder bars are of the

(Continued on page 64)



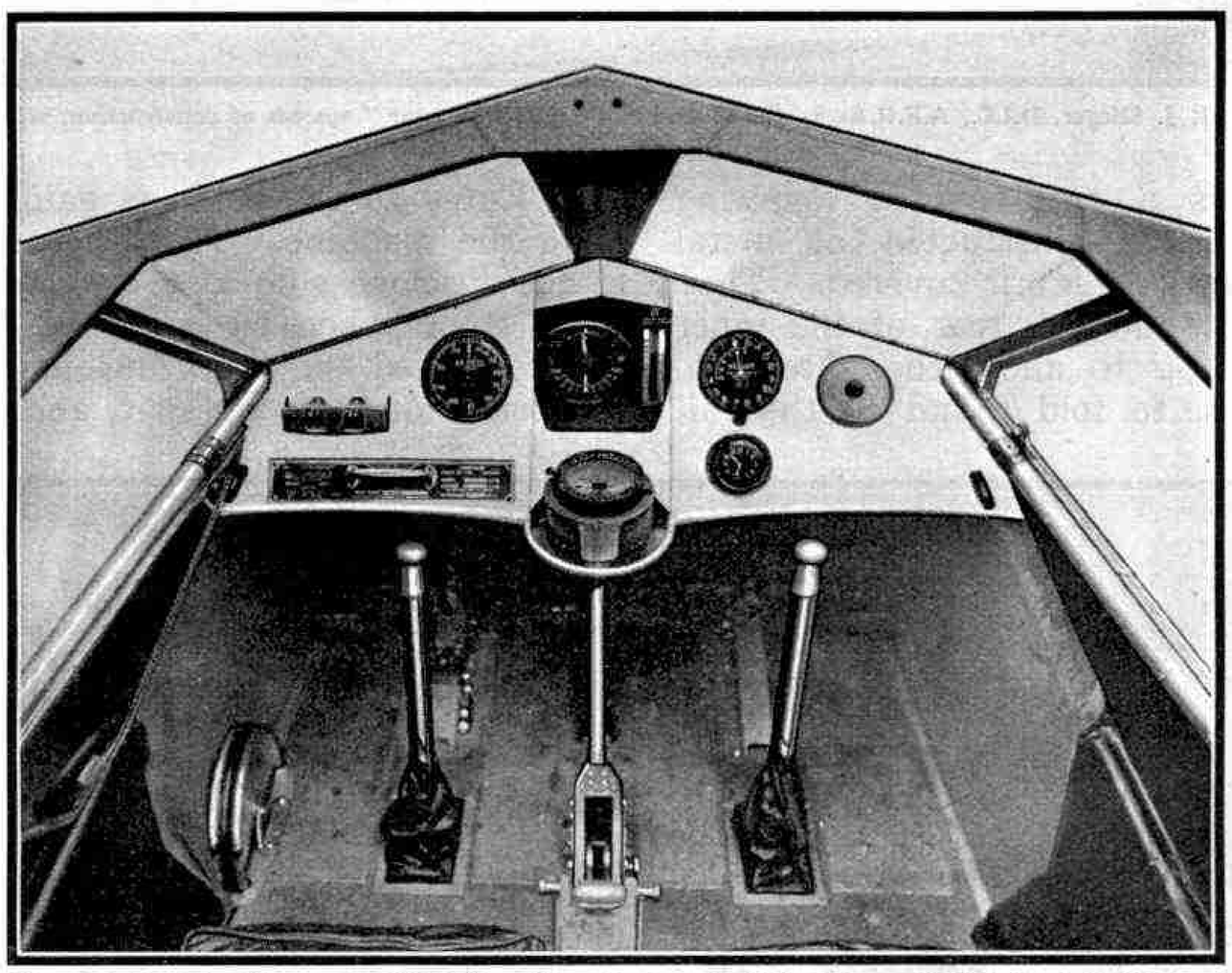
First British Heavy Oil Aero Engine

For some time experiments have been proceeding with a Rolls-Royce "Condor" engine that has been converted from an ordinary petrol engine to one of the compression ignition type. The work was initiated by the Air Ministry, and has been developed at the Royal Aircraft Establishment, Farnborough, with the co-operation of Rolls-Royce Ltd. The engine has successfully passed the Air Ministry's civil engine type test of 50 hours, and flight tests are now being undertaken at Farnborough in a Hawker "Horsley" aeroplane. The engine gives a maximum power of 500 h.p. and has a weight, including starter and accessories, of 1,504 lb.

Compression ignition engines have usually been designed with substantial increase in strength and weight in anticipation of increased stresses. In the case of the "Condor" engine, however, it was first ascertained how much increased strength was required to be added to an existing petrol engine to secure completion of the normal type test requirements for civil use when employing heavy oil as fuel. Some idea of the success of this method of approaching the problem may be gained from the fact that the engine is the only British compression ignition engine that has completed the Air Ministry test, with the exception of the Beardmore "Tornado" that was installed in the airship "*R.101*." The "Tornado" was of a considerably higher weight-power ratio, being designed to suit airship conditions.

The tests now being carried out on the "Condor" are being made with a view to exploring the problems of the operation of compression ignition engines in flight, including the effects of altitude and low temperatures, and ease of handling and control. It is hoped to establish by practical test the theoretical advantages of low fuel consumption and cost under cruising conditions, and to find out the extent to which the size of the radiator and weight of cooling water carried can be reduced as compared with standard petrol engines.

The adapted "Condor" engine normally develops 480 b.h.p. at 1,900 r.p.m. and a maximum power of 500 b.h.p. at 2,000 r.p.m. The engine is of the 12-cylinder type, the cylinders being in two banks of six, arranged in a "V." They are water-cooled, each being provided with two inlet and exhaust valves, and they have a bore and stroke of $5\frac{1}{2}$ in. and $7\frac{1}{2}$ in. respectively. The compression ratio is $12\frac{1}{2}$ to 1, and the maximum pressure 800 lb. per sq. in. The engine is $74\frac{1}{4}$ in. in length, $30\frac{1}{2}$ in. in width and $45\frac{1}{2}$ in. in height.



The cockpit of the Monospar GAL ST4. The wheel on the left of the cockpit is the tail adjusting wheel. The rudder bars and dual control columns can be clearly observed, while under the compass the wheel brake lever and, immediately in front, the throttle control box may be seen. For permission to publish this photograph, and the upper one on the opposite page, we are indebted to the courtesy of General Aircraft Co. Ltd. The "Monospar" is described on page 22.

Two-Ply Steel

Two-ply stainless steel, known as Ing-O-Clad steel, has been produced in America for use in aircraft. It consists of a surface of stainless steel applied to a carbon steel backing, and it can be drawn, stamped, welded, forged and polished. It is claimed that the new metal is considerably cheaper to manufacture than ordinary stainless steel.

Imperial Airways News

Owing to the termination of an agreement with Persia, machines flying on the London-Karachi service of Imperial Airways will in future fly on the Arabian side of the Persian Gulf and not on the Persian side. By the previous line along the Northern shore of the Gulf, the air liners, after leaving Basra, flew to Bushire, Lingeh and Jask, and thence to Karachi by way of Gwadar. Now, however, after ascending from the Shaibah aerodrome at Basra they fly towards Kowait on the Arabian side of the Gulf, passing this seaport, which is governed by a sheik who is on friendly terms with Britain, and continuing on down the coast, towards Behrein. This island is the largest of a group under the protection of the Government of India, and here a halt is made for lunch. The stay is usually long enough to allow passengers to do a little sight-seeing and to watch the pearl fishers for a short time.

From Behrein the flight continues over the low-lying peninsula of Qatar, and on via Yas Island to Sharjah, where there is a completely equipped rest-house in which passengers spend the night. From Sharjah the machines fly towards the range of mountains running up the peninsula, towards the Strait of Ormuz. These mountains are crossed through a pass between Sharjah and Dibah, and from here the aeroplanes fly via the Gulf of Oman to Gwadar, in British Baluchistan. From this point the flight follows the previous route to Karachi.

It is now a common occurrence for light refreshments to be served to passengers in air liners, and stewards and well-equipped buffets are carried on all the cross-channel aeroplanes of Imperial Airways Ltd. This winter it will be possible for hot meals, as well as cold, to be obtained on the principal air services. This provision is a great boon to business men flying from London to Paris, for it enables them to have their lunch en route and proceed straight to business immediately on arriving in Paris.

French Records

A new world's speed record over 500 km., approximately 310 miles, carrying a useful load of 1,000 kgs., or about 2,200 lb., was made some time ago by M. Lemoine, who is the test pilot of the Potez Company. M. Lemoine flew a Potez 50 A.2 machine fitted with a Gnôme-Rhône K.14 engine over the Villacoublay-Angers course at an average speed of about 182.8 m.p.h.

Two new height records have been set up in a Breguet XIX machine also fitted with a Gnôme-Rhône K.14 engine developing 700 h.p. The records were set up by M. Segnerin and were for 10,450 metres (34,276 ft.), and 9,440 metres (30,996 ft.), for machines carrying useful loads of 500 kgs. (1,100 lb.) and 1,000 kgs. (2,200 lb.) respectively. The machine on which the records were set up is the property of the Yugoslav Air Force, and had been sent to France to have the Hispano-Suiza engine with which it had previously been equipped, replaced by one of the Gnôme-Rhône type.

The machine when fitted with the Gnôme-Rhône engine was capable of attaining a speed of about 170 m.p.h. at 16,400 ft. and of climbing to 31,980 ft. in 1 hr. 7½ min. These performance figures were obtained when the aeroplane was carrying full military equipment, including machine guns. Its all-up weight was 5,720 lb.

An attempt on the world's absolute altitude record set up by Flt. Lt. Uwins, and dealt with in full on page 938 of our last month's issue, is also shortly to be made by a French airman. A Potez 50 biplane, equipped with a Gnôme-Rhône K.14 engine, is to be used. Another Potez 50 biplane has been equipped with additional fuel tanks in order to enable it to undertake an attack on the speed records over a 1,000 km. course.

Mrs. Mollison's Record

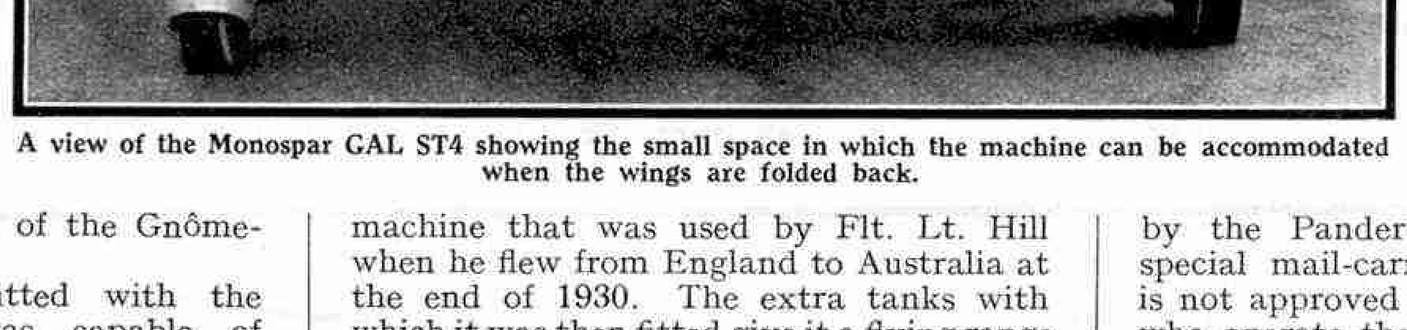
Mrs. J. A. Mollison (formerly Miss Amy Johnson), has succeeded in setting up a new record for the flight between London and Capetown by covering the journey in 4 dys. 6 hrs. 53 min. The previous record for the flight was held by her husband, Mr. J. A. Mollison, and this was decreased by 10 hrs. 29 min.

Mrs. Mollison's flight was made in a D.H. "Puss Moth" cabin machine named the "*Desert Cloud.*" During the 4½ days occupied by the flight, Mrs. Mollison only secured five hours' sleep. She experienced two delays; one just after she had crossed the Sahara Desert. Two hours out of Gao, where she had refuelled, she realised that the petrol in her tanks was lower than it should have been and returned for more supplies. It was then found that the tanks had previously only been half filled. The second delay was caused by trouble with the oil filter.

Round Australia by Air

Mrs. H. B. Bonney, a woman pilot of Queensland, who recently flew completely round Australia, is the first woman to accomplish this feat. The flight of 8,000 miles was made in Mrs. Bonney's own D.H. "Moth" machine fitted with a "Gipsy 1" engine. This is the same machine that was used by Flt. Lt. Hill when he flew from England to Australia at the end of 1930. The extra tanks with which it was then fitted give it a flying range of more than eight hrs., and this made it eminently suitable for Mrs. Bonney's purpose.

The most remarkable feature of Mrs. Bonney's flight was the manner in which she discovered a "station homestead" in the Kimberley district, where she was to spend the night. This region is an exceedingly dangerous one for pilots, as it is often impossible for a forced landing to be made for hundreds of miles. Mrs. Bonney was at first unable to find the station, and so she fixed on a high peak in the mountains and decided to explore every point of the compass leading from the mountain, returning to it each time until the landing place was sighted. After a few attempts she was successful in finding the homestead, in spite of the fact that it was invisible from the air except from directly overhead.



A view of the Monospar GAL ST4 showing the small space in which the machine can be accommodated when the wings are folded back.



Mr. C. H. Lowe-Wylde flying a primary glider constructed by members of the Kent Gliding Club. Mr. Lowe-Wylde holds the first gliding license granted in England.

Italian World Formation Flight

An Italian formation flight round the world is to be attempted this year. The flight will probably start in March or April, and 24 Savoia S.55 seaplanes will take part in it. These will be slightly modified, and will be equipped with new 800 h.p. Isotta-Fraschini engines. The flight will start at Ortobello, from where the machines will make for New York and Tokio.

High Speed Mailplane

An extremely interesting high speed mailplane has been designed by the Dutch firm of H. Pander and Zonen. The machine is not yet constructed, but the designs are completely worked out and a model has been prepared for wind tunnel experiments. The machine is a monoplane and is very efficiently streamlined. It is intended to be equipped with three Wright "Cyclone" engines, housed in streamlined nacelles, and will be provided with a retractable undercarriage, and accommodation for two pilots and a wireless operator, together with 1,100 lb. of mails. With a full load, the estimated top speed is 212 m.p.h., and the cruising speed 186 m.p.h. The designed range is 1,860 miles.

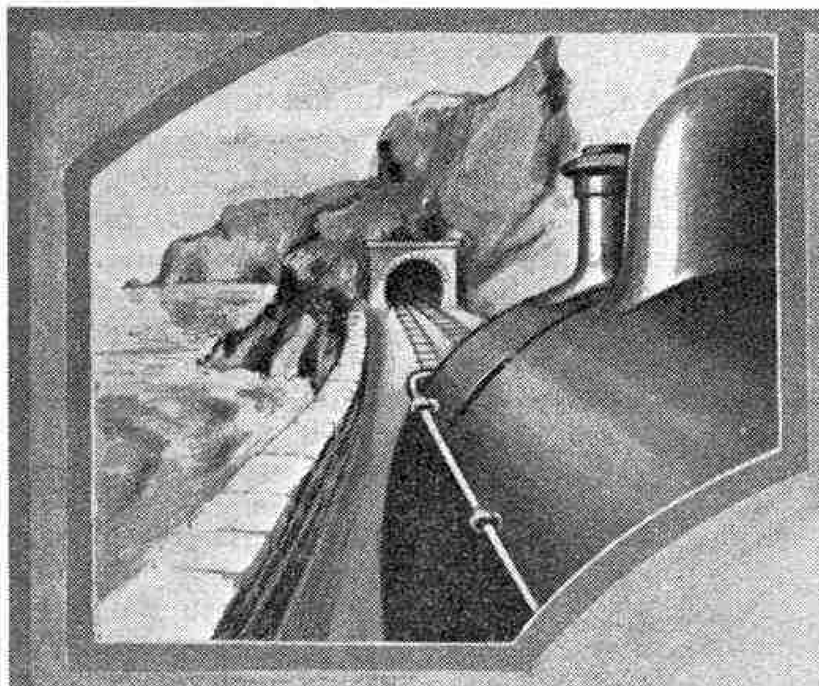
The designs for the machine have been prepared with a view to its use on a fast mail service between the Netherlands and the East Indies, enabling a return service between these places to be operated in a week by the Pander mailplane. The use of special mail-carrying machines, however, is not approved by the K.L.M. Company, who operate the service and thus it may be some time before the machine is built.

A New Airship

A new type of airship produced in California is a semi-rigid vessel and is 33 ft. in length and 9 ft. in diameter. Full details are not available, but it is equipped with two engines developing 1.36 h.p. and is provided with a narrow "tunnel" that extends right through the centre of the envelope from nose to tail. It is claimed that this reduces the wind resistance of the vessel. Reports state that in spite of the low power of the engines employed, the airship has carried out a number of difficult manœuvres and has been brought to the ground under its own power and without the aid of any ground crew.

Piston Without Gudgeon Pin

An American engineer, Mr. Herman Dock, has invented a piston without a gudgeon pin and it is claimed that this enables a considerable saving of weight and space to be made in the design of an engine. The Dock piston is normal in appearance, but inside is placed a hemispherical brass cap. The small end of the connecting rod is hollowed out to fit over this cap and is held securely in position by means of two locking rings that are screwed up into the piston. The piston has concentric surfaces on both the interior wall and its outside face and is only about three-quarters of the depth of an ordinary piston, which enables a saving in metal to be made both in the piston wall and the cylinder head. The life of the piston and its bearing is also stated to be longer than that of normal types. In addition the bearing is automatically self-adjusting.



Railway News of the Month

"Metro" Extension to Stanmore

The new extension of the Metropolitan Railway to Stanmore was opened on Saturday, 10th December. The new branch, which leaves the main Metropolitan line midway between Wembley Park and Preston Road stations, is a double track line, 4½ miles in length, and includes four new stations named Kingsbury, Queensbury, Canons Park—(Edgware) and Stanmore.

The construction of the line has involved the building of six important bridges in addition to footbridges. In the necessary excavations, more than 500,000 cu. yds. of earth have had to be moved. One of the most difficult tasks has been that of dealing with the Wealdstone brook. The line crosses the brook five times, and it was necessary to construct strong concrete channels for a considerable distance, build big culverts to carry the river from the west side to the east and back again, and provide large-capacity drains 25 ft. below the level of the permanent way.

The line is electrically operated, of course, and it is protected throughout by the most modern system of train control. The timetables provide for 134 trains daily over the new route, and the through journey time from Baker Street to Stanmore is less than half-an-hour.

G.W.R. Relaying Programme

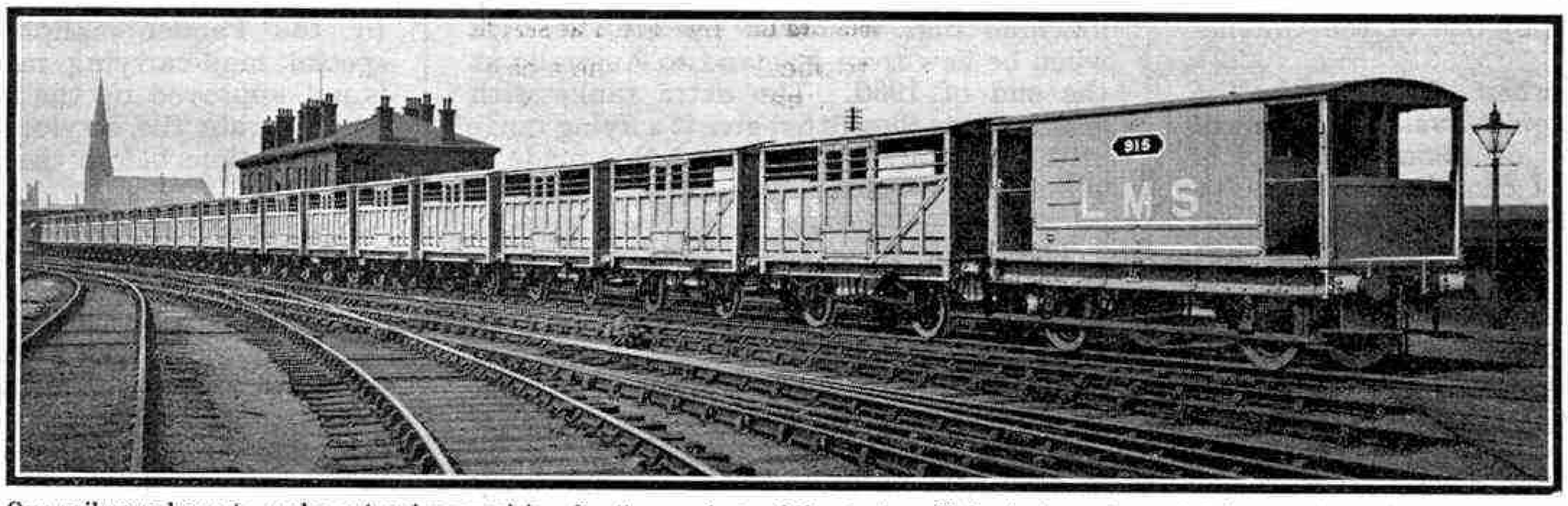
In the G.W.R. programme of relaying and re-sleepering to be carried out during 1933, the track mileage to be relaid totals 356 miles, re-railing 20 miles, and re-sleepering 25 miles. It is estimated that this work will require 29,000 tons of rails, 200,000 cubic yards of ballast, and 565,000 sleepers.

Safer by Train

Calculations by the Canadian National Railways show that the odds against being killed while travelling on a Canadian railway are 8,850,185 to 1. These statistics are based on the figures for 1931, when more than three times the population of the Dominion was carried by train.

London-Brighton Electrification

January 1st, 1933, will be a memorable day on the Southern Railway, witnessing as it will the inauguration of the through electric services between London and Brighton and Worthing. Test electric trains were worked through to Brighton as far back as 1st November last year, and since that time experimental running has been continued so that everything might be in readiness for starting the public services with the advent of the New Year.



Our railways have to make extensive provision for the carriage of livestock. This photograph, which is reproduced by courtesy of the L.M.S.R., shows a train of 20 cattle wagons of modern type.

The new time-tables provide four trains an hour to Brighton—one non-stop, two semi-fast, and one stopping at intermediate stations—and one train to West Worthing. The fastest booking allows precisely one hour for the 51 miles between Victoria and Brighton. This is the same timing as was given to the best of the former steam expresses, and that it is well within the power of the new "electrics" is shown by the fact that during the preliminary test runs, the journey was accomplished in as short a time as 46 minutes. This involved an average speed of 66.3 m.p.h.

L.N.E.R. Scottish "Wireless" Express

The two train sets that are employed on the L.N.E.R. mid-day Scottish expresses leaving King's Cross at 1.20 p.m. and Edinburgh at 2.5 p.m., have been out of service for six weeks for thorough renovation. When they returned to traffic on Monday, 28th November, they looked like new trains. The northbound train was drawn by "Pacific" No. 2597, "*Gainsborough.*"

These train sets are equipped with wireless receiving apparatus and during the time they were away undergoing renovation, passengers between London and Edinburgh were unable to enjoy the wireless programmes en route.

New Channel Train Ferry

The Southern Railway have decided to introduce a train ferry service between England and France, using the port of Dover on the English side, and the port of Dunkirk on the French coast. The ferry is intended primarily for merchandise traffic but the vessels have been designed to carry a limited number of passengers as well and it will be possible to run through sleeping cars between London, Paris and elsewhere, including Constantinople. Three up-to-date train ferry vessels are to be built. It is expected that the service will be put into operation in the summer of 1934, and arrangements are in hand with the French railway companies with this objective in view.

The work of preparation at Dover is to be begun immediately. It will involve the building of a new dock and the widening of an existing quay, and will cost over £500,000. There is a slight difference in the gauge of British and French railways, the British being 4 ft. 8½ in., and the French one-eighth of an inch wider, but it is felt that this need not be taken into account. The difference in the loading gauges is greater, however, the British standard being much more limited than that of the French railways. British coaches must therefore e used on the through services or if French coaches are used they must be specially constructed to comply with the restrictions of the smaller British loading gauge. It is confidently believed that these and all other difficulties will be surmounted with success.

A Remarkable Belgian Train

An interesting exhibition train has recently been touring Belgium, evidently for the purpose of arousing interest in native products of all kinds. It is made up of 20 saloon coaches painted vermilion and lettered in gold. A buffet car is included and loud speakers enable music to be provided in each car. Two transformer wagons receive current from local supplies for lighting and for operating various exhibits.

Names for remaining " Royal Scots "

Crewe works are turning out a new series of standard 4–4–0 passenger tender engines of class 2, and eight, numbered 686 to 693, are in traffic. Four more " Claughtons " have been reconstructed as " Baby Scots," their numbers being 5958, 5982, 5983 and 5992. These complete the present batch of fifteen.

All the express locomotives of the " Royal Scot " class now bear names. Seven that previously were nameless have been named recently after famous territorial regiments of London and the Home Counties as follows:—No. 6160, " *Queen Victoria's Rifleman* " ; No. 6162, " *Queen's Westminster Rifleman*" ; No. 6163, " *Civil Service Rifleman*" ; No. 6164, " *The Artists' Rifleman*"; No. 6165, " *The Ranger (12th London Regiment)* " ; No. 6166, " *London Rifle Brigade* " ; and No. 6167, " *The Hertfordshire Regiment.*" In addition, engine No. 6144, formerly " *Ostrich,*" has been renamed " *Honourable Artillery Company.*" No fewer than 43 " Royal Scots " now carry the names of famous fighting units. Altogether there are about 500 named locomotives on the L.M.S.R.

One former North Staffordshire Railway 4–4–0 locomotive still continues in service. It is numbered 5413 and stationed at Crewe South shed.

Remarkable " Beyer-Garratt " Locomotives

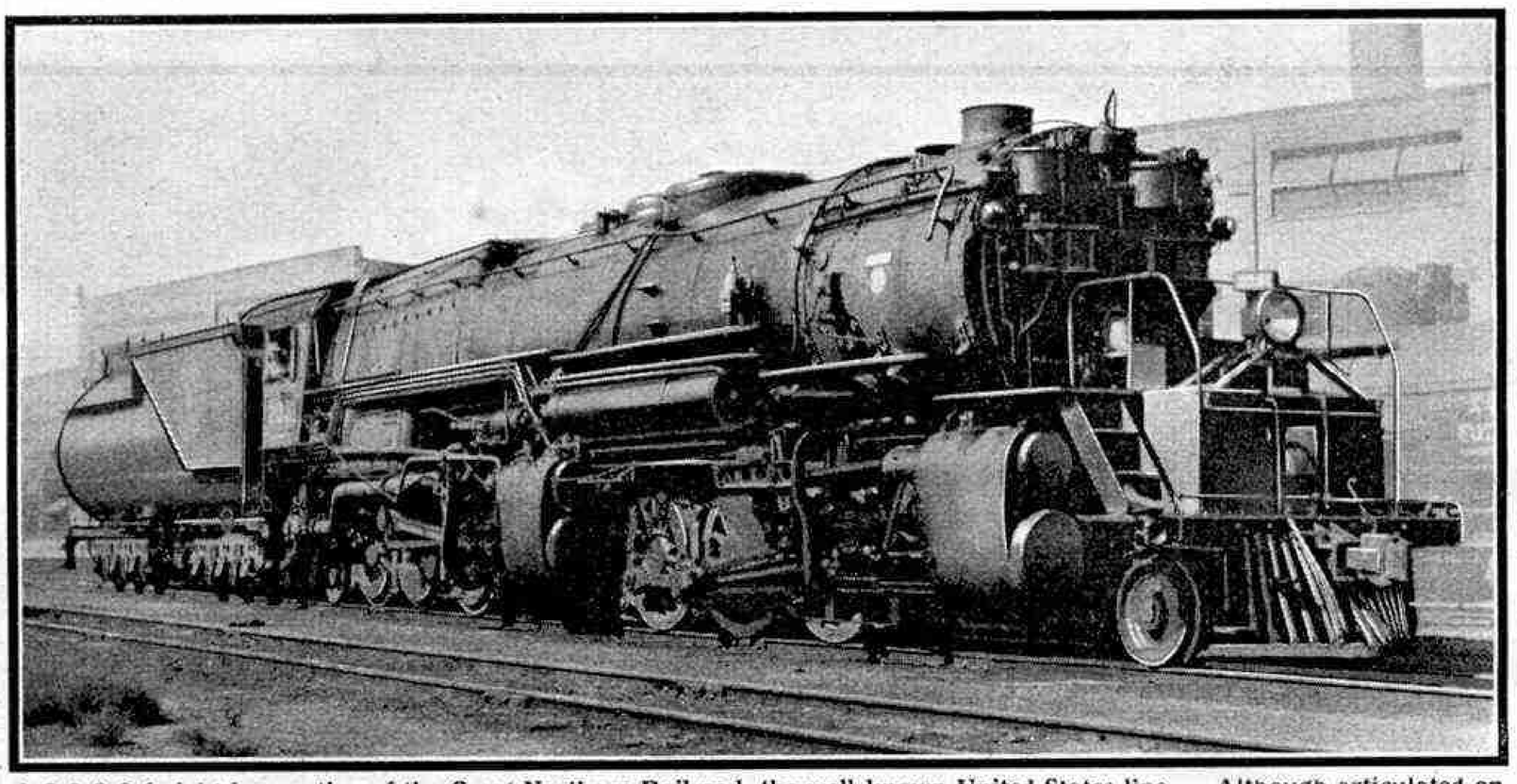
The *"M.M."* for November last contained an article on articulated locomotives of the " Garratt " type, and particulars were given of some of the powerful engines of this design that have been built in recent years. It is now possible to record further advances that have been made in yet later " Beyer-Garratt " locomotives.

Beyer, Peacock and Co. Ltd. have just built at their works at Gorton, Manchester, an extraordinarily powerful locomotive for service on the railways of Russia. It is designed for the 5 ft. gauge and has the 4–8–2 + 2–8–4 wheel arrangement. Its total length is just over 100 ft., its maximum height being 17 ft. 2 in., and its width 10 ft. 6 in. It weighs almost 260 tons in working order and has a tractive effort of upwards of 72,000 lbs. The coupled wheels have a diameter of 4 ft. 11¼ in. and the cylinders, four in number, measure 22 7/16 in. diameter by 28 in. stroke.

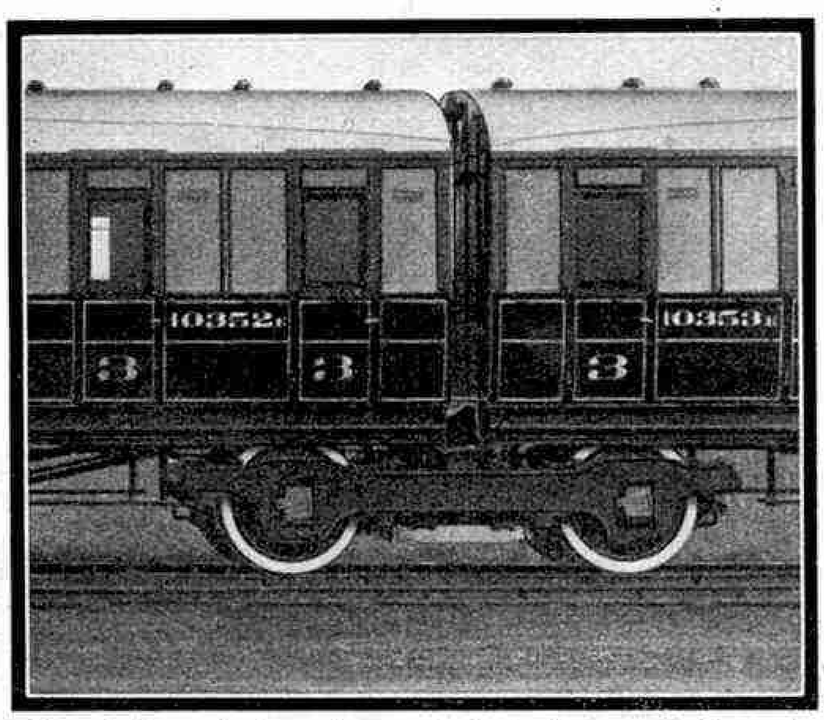
The boiler has a diameter of 7 ft. 5 in. and the grate an area of 86 sq. ft. There are 3,500 sq. ft. of evaporative heating surface, with an additional 1,277 sq. ft. of superheating surface. Fully loaded, the engine carries 16 tons of coal and 8,130 gallons of water. A mechanical stoker is fitted, together with numerous other modern devices that make for convenient and efficient operation. The engine will be put to work and thoroughly tested in various parts of Russia, including Siberia, where the winter temperatures are considerably below zero. It is in view of these extremely cold conditions that an exceptional proportion of superheating surface has been given.

Another " Beyer-Garratt " locomotive has recently been subjected to a series of tests in France on the Paris, Lyons and Mediterranean main line and has shown conclusively that engines of this design are not only able to deal capably with the heaviest freight traffic but that they can acquit themselves equally well on express passenger services. The engine used in the tests had the 4–6–2 + 2–6–4 wheel arrangement, with coupled wheels of 5 ft. 11 in. diameter. It has been built for service on the P.L.M. line in Algeria but the test runs were made over the difficult section of the French main line between Laroche and Dijon—a distance of 99 miles. Starting from Laroche, the line rises steadily for 82 miles, culminating in a stretch at 1 in 125 ; while in the other direction there is a stiff rise for 17 miles, much of it at 1 in 125.

Altogether 26 test non-stop runs were made on express trains, and at all speeds the running of the locomotive was exceptionally steady and smooth, although the driving wheels are comparatively small for such fast express work. One run from Laroche to Dijon, with a load of 625 tons, was made at an average speed of 51.3 m.p.h., being 4 m.p.h. better than was required by schedule. To climb the long 82-mile gradient with such a load at so high a speed meant that the regulator was fully open for 1½ hours—a very exacting test of the steam-raising capacity of the boiler. In the opposite direction, with a load of 549 tons, an average speed throughout of 52.6 m.p.h. was achieved, and nearly 65 miles were run at an average of 64 m.p.h. A maximum speed of no less than 75 m.p.h. was reached—the highest ever attained by an articulated locomotive.



A 2-8-8-2 freight locomotive of the Great Northern Railroad, the well-known United States line. Although articulated on the " Mallet " principle, the engine is not a compound, its four cylinders receiving boiler steam direct. Our reader, Mr. W. Hendry of Vancouver, obtained this photograph at Seattle.



Our photograph shows how a single bogie supports the ends of adjoining coaches of the articulated train sets of the L.N.E.R.

All-Electric Signals at King's Cross

A complete transformation has been brought about in the signalling operations at the L.N.E.R. King's Cross Station, where all-electric colour-light signals have been installed to enable the whole of the traffic movements to be controlled from a central tower instead of from the two mechanically-worked signal boxes that for the past 45 years have guided trains to and from their platforms. The new apparatus has been superimposed upon the existing system without interference with traffic, and is working smoothly and efficiently.

The signalling installation now in use includes a battery of 232 miniature levers to work 63 colour lights, 81 shunting signals to control engines and empty trains, nine route indicators, 69 motors to move points, and 86 track circuits, the power used being electricity throughout. The whole of the lines and signals at King's Cross are reproduced on a chart in front of the signalmen in the new signal tower, and every engine and train movement is indicated by means of tiny spotlights.

Smart Runs on the L.M.S.R.

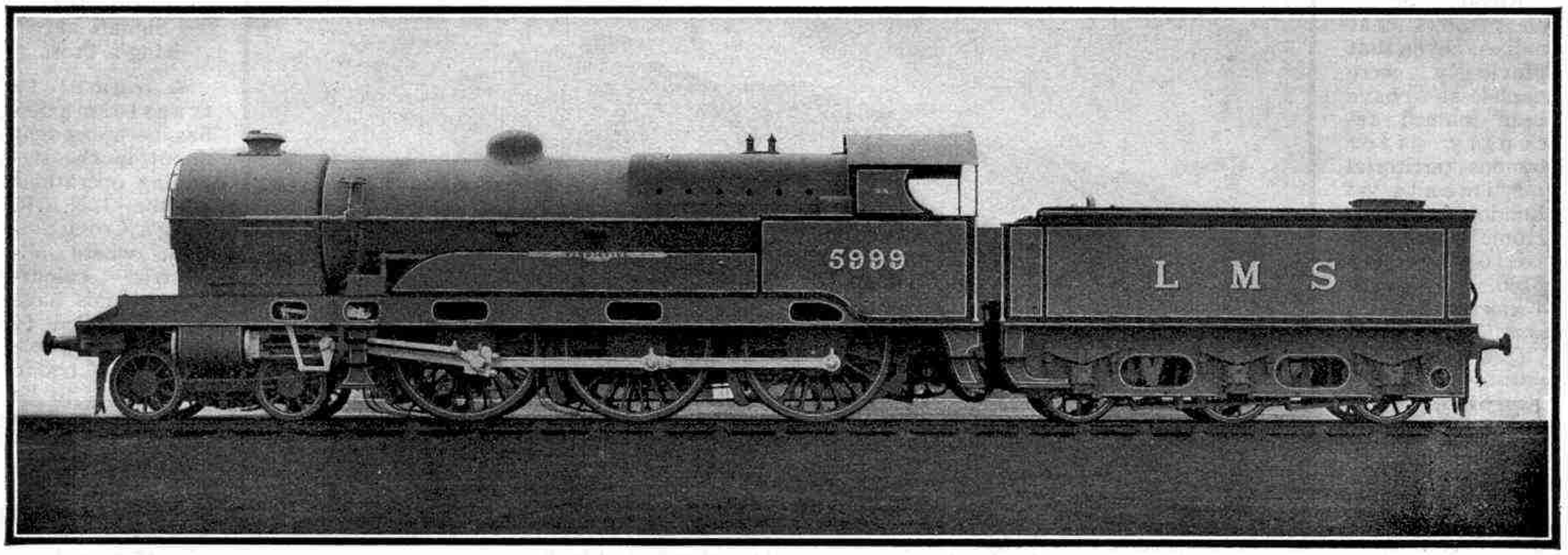
" *The Mancunian,*" the L.M.S. Railway's 3¼ hours express from Manchester to London, established a remarkable new speed performance recently by running the 177 miles from Wilmslow to Euston in 164 minutes, inclusive of two minutes delay. The 82½ miles from passing Rugby to stopping at Euston were covered in 71 minutes at an average speed of 69.7 m.p.h.

The train of eleven coaches, weighing 323 tons, was hauled by " Royal Scot " class engine No. 6167. On the same service one of the " Baby Scots," No. 5959, with a load of 355 tons stopped at Polesworth with injector trouble. Restarting, Euston, 106½ miles, was reached in 91 minutes.

The 158 miles from Crewe to Euston were covered recently in 158 minutes (exactly 60 m.p.h.) by No. 5996, a locomotive of the former L.N.W.R. "Claughton" class, when hauling a special train from Liverpool to London. This achievement was the more remarkable because the weather conditions were bad, an easterly wind with considerable rain prevailing during the journey. The train weighed 264 tons. From Rugby to Euston the average speed was 63 m.p.h., while between Tring and Watford an average of 71.2 m.p.h. was maintained.

"The Merseyside Express"

I.—From Liverpool to Trent Valley Junction



THE name "*Merseyside Express*" is given to the L.M.S.R. train from Liverpool at 10 a.m. and from Euston at 6.05 p.m.

The times of departure and arrival are in each case very convenient, so that the maximum time may be spent in London by anyone living in the Liverpool district who travels up to town by "*The Merseyside Express*" in the morning and returns by the corresponding down train in the evening. Restaurant accommodation is provided in both directions.

Liverpool was always well served by the former L.N.W.R., though at one time five hours were required by each of six trains daily to cover the distance of 193.7 miles. This timing was characteristic of the leisurely progress of North Western trains at the period, and is in striking contrast with the 3½-odd hours schedule of to-day. As far back as 1902 as good a time as 3 hours 45 minutes was inaugurated, and in July, 1905, the 3 hours 35 minutes allowance came into force for the down train from Euston at 6.05 p.m., arriving in Liverpool at 9.40. The Liverpool services, in common with most others, suffered as a result of the speed reductions due to the War, 4 hours 45 minutes being the quickest time in both directions, an increase of 32 per cent. over the best time of 1914. After the Armistice matters were gradually improved, and a satisfactory service was again afforded. Then, under the L.M.S.R. regime, came the application of the present name "*The Merseyside Express*" to the up and down service that we have referred to, and there followed the acceleration of the up morning express from Liverpool to the 3 hours 30 minutes timing. Owing to the large number of residents on the outskirts of Liverpool who use these trains, the "conditional" but invariably-made stops at Mossley Hill have now become regular, for this station is convenient of access by roads from many districts. The down train now has five minutes extra to allow for this, for the restarting of the 15 or 16-coach load on the up gradient is no easy task for any engine, as a slope of 1 in 113 has to be faced.

The main line journey between Euston and Crewe has already been described in the "*M.M.*," and as it seems more natural to set off in the morning, we will imagine ourselves to be in Liverpool and intending to travel up to London by the 10 a.m., arriving in the Metropolis at 1.30 p.m. As "*The Merseyside Express*" is a popular train, we will make our way to Lime Street Station in good time. Pausing to look at the historic locomotive "*Lion*"—a relic of the Liverpool and Manchester Railway that was built in 1838 and even now in working order with the original frames, wheels and motion—we pass on to Platform 2 and find our train ready drawn up. Nine coaches, including a 12-wheeled dining car, make up the train at present, but two more coaches will be added before we finally leave.

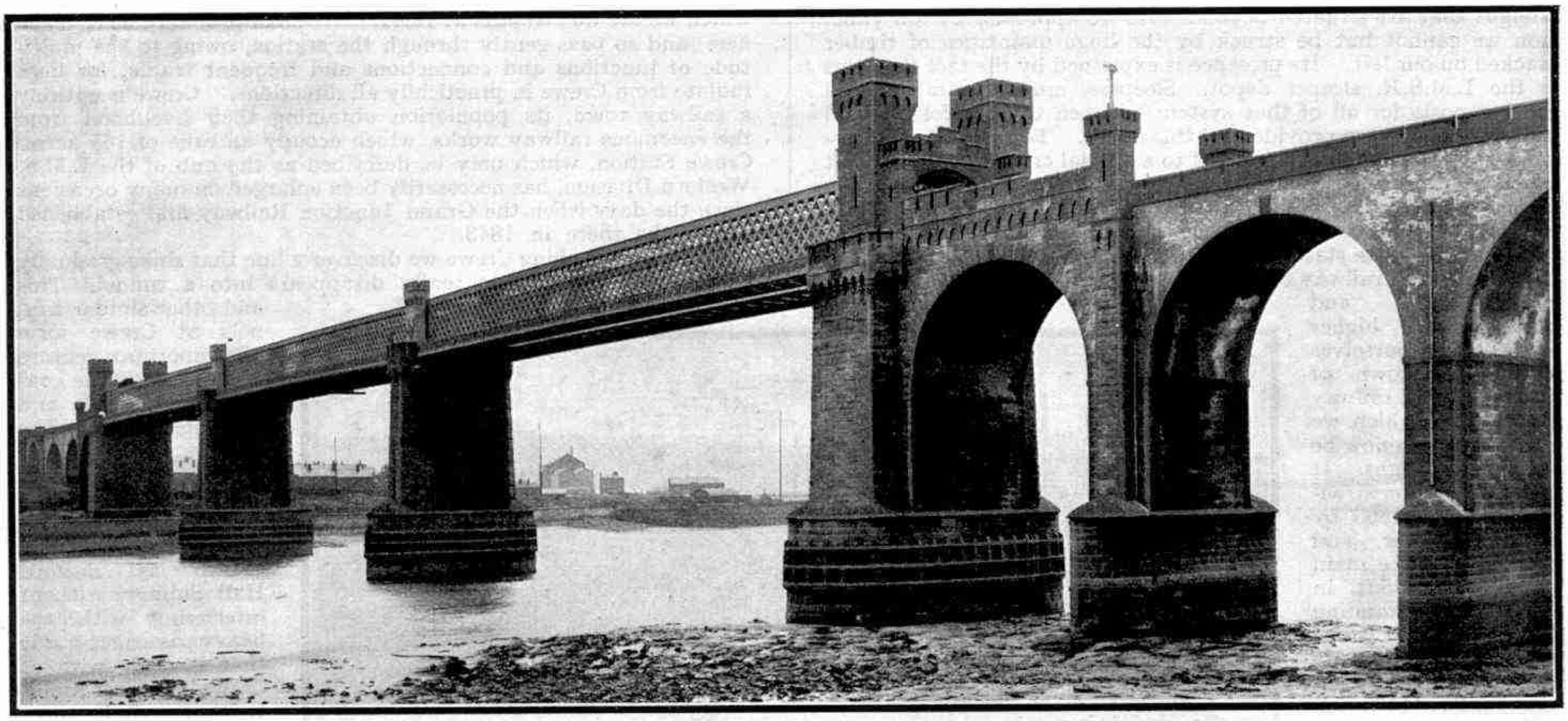


The upper illustration shows L.M.S.R. No. 5999, "Vindictive," a well-known locomotive of the reboilered "Claughton" class. The lower photograph shows one of the entrances to Lime Street Station, Liverpool. In the foreground will be noticed the Punch and Judy show that has been a well-known feature on this site for nearly 50 years. For the illustrations to this article we are indebted to the L.M.S.R.

We cannot but be struck by the trim appearance of the train as a whole, for it consists of modern elliptical-roofed stock, including several of the latest low-waisted vehicles. They are very clean in their red livery, and each of them bears the legend "*The Merseyside Express*" on a neat white board attached to the roof, giving an air of due importance to the train.

At 9.40 leaves the Liverpool portion of "*The Pines Express*," on which we have travelled previously to Bournemouth, and 10 minutes later a train for Wigan, Preston and the North departs.

Meanwhile an unfamiliar whistle sounds, and into No. 1 Platform there runs in from Southport a locomotive of the former Lancashire and Yorkshire Railway hauling two local coaches and two corridor



vehicles similar to those already on our train. This engine is one of the 4–4–0 class with 6 ft. driving wheels, constructed by Beyer-Peacock & Co. Ltd., some 40 years ago. It is stationed at Southport specially for this service, and is relieved by one of the well-known Horwich 2–4–2 tanks. This is a grouping development, as previously an L.N.W.R. engine and stock were used.

Our train engine now appears and backs on to the tail of the Southport portion, which is drawn forward and then attached to make our total up to 11 vehicles. The engine and one coach are clear of the somewhat short platform—Lime Street is not too well off in this respect—but we notice that we have one of the reboilered "Claughtons," and not a "Royal Scot."

The station at this time is busy, and we shall be interested in the evolutions performed by various locomotives and coaches in the marshalling of different trains. An interesting feature of the practice at Lime Street is that gravity is largely made use of for empty coach movements into the station, for the line slopes up to Edge Hill, and the shunting neck used for the storage of coaches is inclined still more at the outer end. Trains are therefore frequently pushed out by the engines that brought them in, and after these have been disposed of, are allowed to gravitate into the station under the control of a brakesman.

Punctually at 10 o'clock we get the "right away" and move gently out of the platform, the train being assisted in the rear by the engine that brought the coaches in, one of the familiar 0–6–2 "Coal Tanks" of the late L.N.W.R., designed originally by Mr. Webb for local goods and mineral work, but found exceedingly useful also for passenger duties. We commence the climb to Edge Hill at 1 in 88, easing to 1 in 93. The measured beat of our engine awakens the echoes of the vast rock cutting, with its many bridges and short tunnels, through which the line passes. Originally about a mile of this section was wholly in tunnel, but it was opened out to the present arrangement when additional tracks were laid about 40 years ago. Passing an elevated signal-box over the slow line on our left, we top the rise in good style and pass through Edge Hill itself. Here we notice the extensive yards and sidings for which the place is famous.

We swing to the right at Edge Hill Junction, and leaving Stephenson's line to Manchester to keep straight on, we climb up again at 1 in 93, curving past Edge Hill locomotive sheds and yards. A short time ago we might have seen one of the few remaining "Jumbos," for one was employed as an inspection engine and filled in time in odd duties. This engine was formerly No. 742, "*Spitfire*," of the "Samson" class, with 6 ft. 3 in. wheels. In any case, as the coaling plant is situated close to the line, we shall be able to see quite a variety of locomotives. We climb to Wavertree Station, where the pair of tracks open out into four and are joined by lines from the carriage sidings, where rolling stock of all four groups may be seen on occasions. Here also come in connections beneath which we have just passed, leading from the goods yards noticed previously.



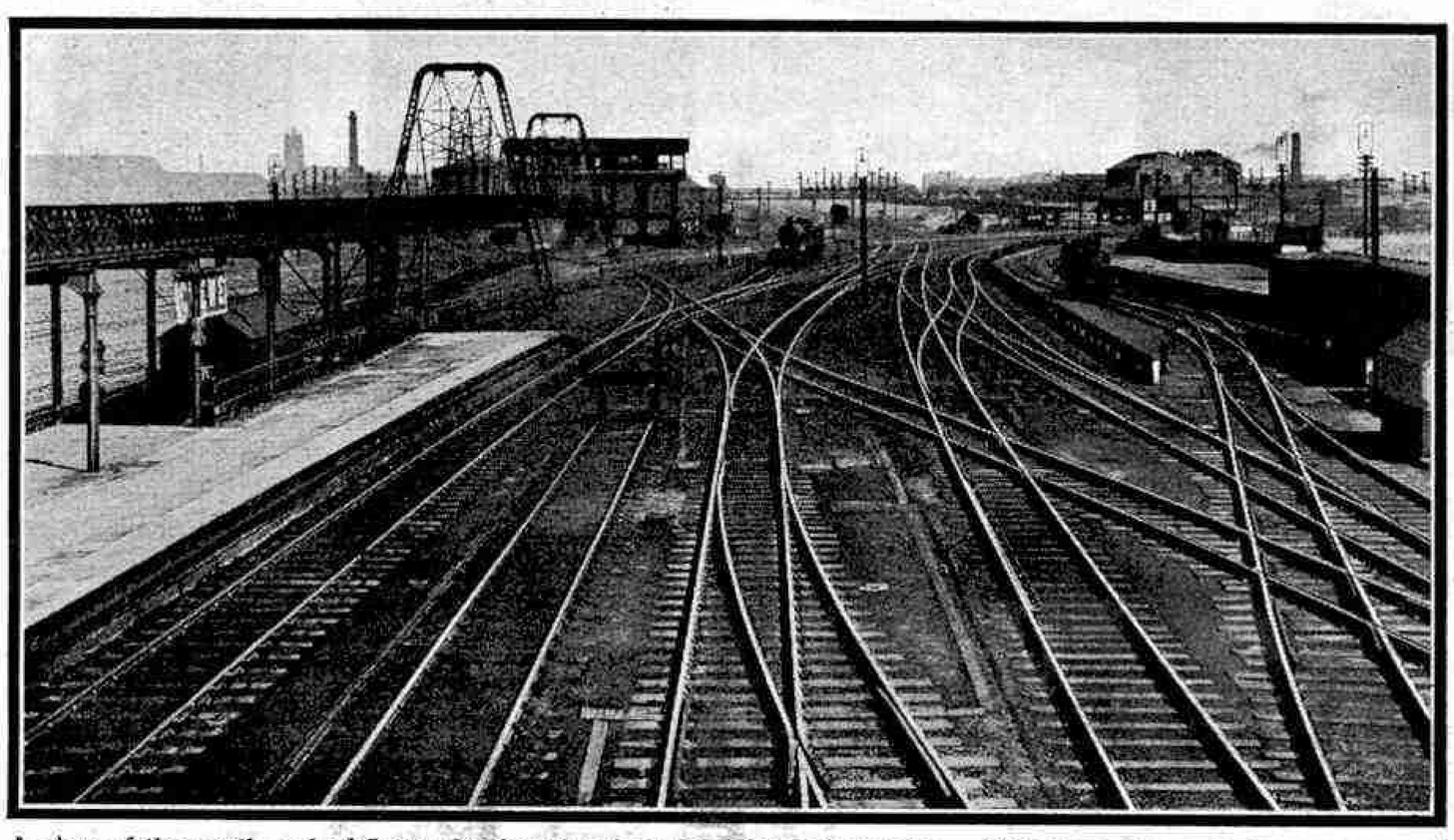
The upper photograph shows Runcorn Bridge, where "The Merseyside Express" crosses the River Mersey and the Manchester Ship Canal. The bridge connects Widnes in Lancashire with Runcorn on the Cheshire side. Below is a view of one of the busy platforms at Crewe Station.

We now speed down the 1 in 200 and 1 in 445 and pass on our left the spacious Wavertree Playground, or "Mystery" as it is called locally, where the Centenary Celebrations were held in 1930. Spinning past Sefton Park Station, we are soon reducing speed for our stop at Mossley Hill, where we are due at 10.9. A number of people hurriedly join the train—only a minute is allowed here—and at 10.10 we are away again, a slope of 1 in 320 or so in our favour enabling us to pick up speed rapidly. There is nothing more of note after Mossley Hill until we come to Allerton, and immediately afterwards we cross over the C.L.C. main line from Liverpool to Manchester and the East Coast. Soon our route takes a big sweep to the left to Speke, the super-elevation or banking on the curve being particularly noticeable. As we negotiate this we pass the Garston locomotive depot and timber yard on our right. At Speke we emerge properly into open country, and Speke Hall is interesting as one of the finest half-timbered "black-and-white" houses standing at the present time.

Halebank is the next station, and we pick up water from the

troughs that are situated beyond. As we approach Ditton Junction we cannot but be struck by the huge quantities of timber stacked on our left. Its presence is explained by the fact that this is the L.M.S.R. sleeper depot. Sleepers, crossing timbers and fencing posts for all of that system between the Bristol Channel and the Solway are provided by this depot. To make it weatherproof, all this timber is subjected to a special creosoting treatment under a pressure of 160 lb. to the sq. in. The sleepers have the chairs screwed and spiked to them before they leave the depot, so that these permanent way components are ready for use.

After Ditton we start on a steady rise, leading up to the bridge that carries the railway over the River Mersey and the Manchester Ship Canal; and climbing still higher we soon find ourselves above the town of Widnes. The railway bridge over which we are to pass can now be seen on our right. It is a lattice girder structure built in 1868 by William Baker, and consists of three main spans each 305 ft. in length, and standing 75 ft. above water level. The viaducts leading to it on each side consist of 115 brick arches. As we rumble across we see on our left the Widnes and Runcorn transporter bridge, which conveys foot passengers and motor traffic over the river and the Ship Canal at this point. The four cast iron towers that carry the suspension cables and stiffening girders stand 190 ft. above high water level. The bridge has a span of 1,000 ft., and the car that travels across the river and canal is capable of making on an average 10 trips in the hour.



A view of the north end of Crewe Station showing the suspension bridge. This reminds us of the presence of the L.M.S.R. railway works founded in 1843, for it spans the tracks between the works and the station.

Shortly after passing Runcorn a beautiful view opens out on the right-hand side, and if the weather is fine the Welsh Mountains will be visible in the distance. We are now climbing again, and we leave the North Wales and Holyhead main line on our right at Halton Junction. Our speed will have dropped considerably, and as we are on a slope of 1 in 115 we shall probably be able to hear the engine working hard.

After a gentle dip the next station we come to is Sutton Weaver, at the commencement of a downward gradient of 1 in 101; after which we join the main line from Scotland at Weaver Junction and then cross the river that gives its name to this place. Our train is now 16¼ miles out of Liverpool and 177½ miles from Euston. Moderate grades follow, so that rapidly passing Acton Bridge, Hartford, Winsford, and Minshull Vernon, we come to Crewe, which we are due to pass at 10.47. We shall probably be checked here, and so pass gently through the station, owing to the multitude of junctions and connections and frequent traffic, for lines radiate from Crewe in practically all directions. Crewe is entirely a railway town, its population obtaining their livelihood from the enormous railway works, which occupy an area of 165 acres. Crewe Station, which may be described as the hub of the L.M.S. Western Division, has necessarily been enlarged on many occasions since the days when the Grand Junction Railway first established the works there in 1843.

While approaching Crewe we discover a line that sinks gradually away from us and eventually disappears into a tunnel. This and other similar tunnels at Crewe form an important feature that prevents the conflicting of goods and passenger traffic. The tunnels conduct the freight traffic under the main line and the station itself to the vast sidings beyond, known as Basford Hall Sidings, without interfering with the heavy passenger traffic that is dealt with at Crewe day and night. In these sidings there are said to be no less than 100 miles of track. Although we do not stop at Crewe we cannot fail to notice the size of the station and the extent of its yards.

We now begin to climb at 1 in 269, and the next station we reach is Betley Road, 41½ miles from Liverpool. The Madeley bank of 1 in 177, which commences shortly before Betley Road, will take us over an outlying spur of the Pennine Hills that divides the Cheshire Plain from the Central Plain of England. Once over the top of the gradient we gather speed over Whitmore Troughs, passing two pumping stations on our left close to the line. Up to now we have not touched any extreme speed, but the slopes down to Stafford enable us to bowl along in good style. We are booked to pass Stafford at 11.15 a.m., and immediately south of it, at Trent Valley Junction, our line turns sharply to the left, where there is a speed restriction owing to the sharpness of the curve. We cannot resist putting our heads out of the window to observe the length of our train from tip to tail as it carefully winds its way round.

The original Manchester and Birmingham main line will now be seen on our right, proceeding straight on to Bushbury Junction. This is the route followed by *"The Pines Express."*

Famous British Admirals—(*Cont. from page 17*)

In February, 1656, Spain declared war on England, and although Blake was unwell he sailed with a fleet of 40 ships for Cadiz to resume the blockade. About the end of August he retired with most of his fleet to the Portuguese coast for supplies of fresh water, leaving a detachment of seven ships on guard. While he was away the treasure fleet from Brazil arrived at Cadiz. The English ships lay so low in the water that the Spaniards took them for fishing vessels, and discovered their mistake too late. In the fight that ensued four of the treasure ships were burned or sunk, two were captured, and two escaped. The captured ships contained about £3,000,000 sterling, and one-fifth of this was in the form of silver bullion from the mines of Peru. The treasure was taken to Portsmouth and there loaded into 38 wagons that conveyed it by road to London, where it was carried through the streets to the Tower.

Though Blake had missed the main treasure fleet he returned to Cadiz and continued his blockade. In the spring of 1657 he received news that another fleet of treasure ships had put into Santa Cruz, and with 25 ships he immediately sailed for that harbour, arriving there on 20th April. He saw that it would be impossible to capture the treasure fleet, and determined to destroy it. Aided by a stiff landward breeze and a good tide he braved the heavy fire of the Spanish guns ashore and entered the harbour, where he set on fire 16 Spanish ships. A sudden veering of the wind enabled him to escape from the harbour without the loss of a single ship. The attack was undoubtedly the most daring feat of its kind that had ever been undertaken, and when the news reached Cromwell he wrote to Blake expressing his highest praise, and sent with the letter a portrait of himself, framed in gold and inset with diamonds. Parliament voted a Day of Thanksgiving in celebration of the great victory, and ordered a ring value £500 to be presented to Blake. A gift of £100 was presented to the captain who brought the news of the victory.

Blake continued the blockade of Cadiz for a further four months, but his health again failed and at times he was too ill to command the fleet. In July, 1657, he received the welcome order to return to England, but by then the long period of confinement aboard the ship and the lack of wholesome food and exercise had so weakened his constitution that he felt that the end was near. On the homeward voyage he repeatedly expressed the desire that he would live long enough to reach the shores of England, but he died on 17th August, 1657, just two hours before his flagship, the *"St. George,"* anchored outside Plymouth. The joyous welcome that awaited him was turned to sorrow at his tragic death, for he was recognised as one of the greatest of British Admirals.

The body was laid in state at Greenwich and was afterwards placed on a Thames barge draped in black velvet and conveyed up the river to the city to be interred in the Henry VII Chapel at Westminster Abbey. During the troubled times of the Restoration the remains of Blake and other great men of the Commonwealth were disturbed, and Blake was reburied in St. Margaret's Church.

First Stages in Producing a Locomotive

How the Design is Worked Out

THE processes involved in the construction of a locomotive commence long before the stage is reached of laying down the frames. As a rule, little information is available in regard to these early processes, and as a result their importance is apt to be underestimated. In this article we trace the progress of affairs from the time when the Locomotive Department is first engaged in the designing of a new class of engine, until the frames of the first engine or batch of engines are laid by the erectors.

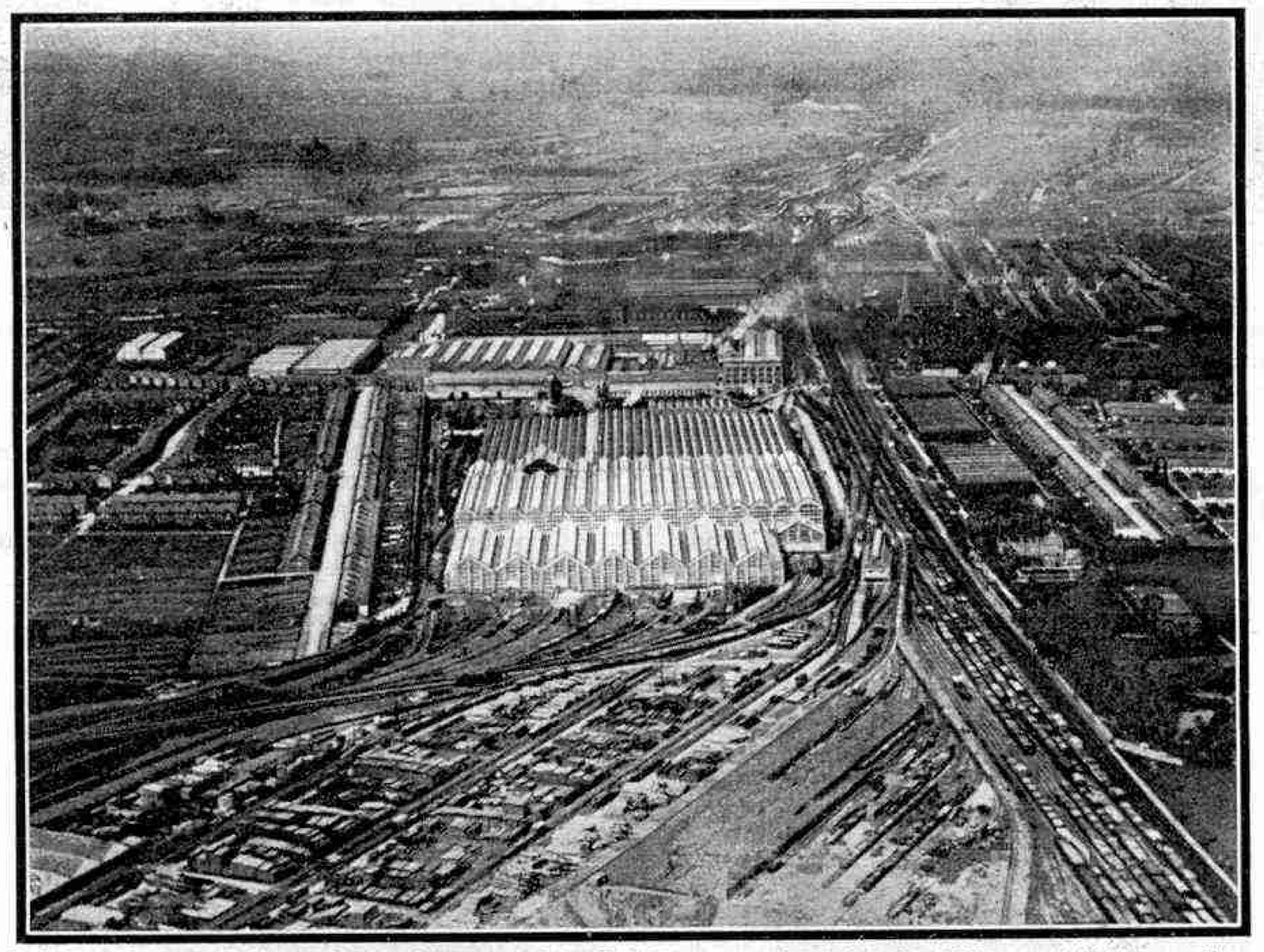
The official of a railway company responsible for the design of new locomotives is the Chief Mechanical Engineer, who is instructed by the Board of Directors speaking through the General Manager. Much correspondence and discussion takes place between the officers of the company before the Board are in a position to issue an order for the construction of a new engine.

Possibly the Operating Superintendent finds that the long-distance express passenger traffic on one section of the system is increasing in such a manner that the existing engines cannot cope adequately with it. On the other hand, some of the bridges on that section are not strong enough to take heavier engines. The chief officers of the company then confer to decide upon the policy to be recommended to the Board, who review the whole of the circumstances before making a decision.

Generally speaking, if the traffic is sufficiently important and likely to yield a fair return on the expenditure, the necessary bridge-strengthening will be put in hand while the Mechanical Engineer is going ahead with his design for the new engine. This is a process that has been necessary on the Southern Railway, as the bridges on the lines between London and Dover were unable to carry the weight of the "King Arthur" locomotives, and the trains had developed beyond the capabilities of the superheated 4–4–0's employed. Rebuilding and strengthening have been carried out in such a manner as to make no less than three routes available for 4-6-0 locomotives.

We will suppose that, after thorough investigation, it is decided to adopt a locomotive of the 4–6–0 type with a tractive effort greater than that of any passenger engine so far owned by the company. The permissible axle load is fixed by the Chief Civil Engineer, account being taken of all sections on which the engine is likely to run. In getting out designs for new engines an attempt is made to keep them within such limits of weight and size that they can work over any part of the system. This is especially important in this country since the big amalgamations were effected. At the same time a balance has to be struck between the general availability of the engine and the restrictions imposed by various parts of the line. This necessity for general availability makes itself evident in boiler mountings of restricted size, and cabs with cut-down sides merging into the roof as on the L.M.S.R. and S.R. standard cabs. Similarly the cylinders on the standard 2–6–0's of the L.M.S.R. are placed extremely high and steeply inclined, with the object of rendering the engines suitable for service on all sections. This has resulted in their appearance at the front end being extremely unusual for British locomotives. Curves and gradients are very important in making decisions of the type of locomotive to be constructed, while another point to be considered is that larger turntables may be required to accommodate the new engine.

A 4–6–0 design having been decided upon, the Drawing Office receives its instructions from the Chief Mechanical Engineer and makes a start on the work. The Drawing Office is responsible for the issuing of all drawings and instructions required by the shops for the building of the engines. Certain leading features of the design probably will be standard practice with this particular line—for instance, two cylinders outside and either one or two inside; Walschaerts valve gear; possibly a tapered boiler; the Belpaire firebox or the wide Wootten type so much used on the L.N.E.R., and so on. These considerations to a large extent govern the design, for wherever possible standard parts are used for the sake of economy. The Stores Department thereby has a smaller variety of articles to keep in stock, which helps to reduce the value of the stores held. The importance of economy in this respect will be realised when it is stated that the value of the stores may run into many millions of pounds, the interest on which is a large drain on the company's resources every year.



Swindon Works, the locomotive headquarters of the G.W.R., as seen from the air. Many notable locomotives have been built there since their inception in 1843. Photograph by Aerofilms Ltd.

It will be necessary also to settle the coal and water capacity of the tender, which depends upon the location of these supplies on the line. Nowadays tenders are largely standardised, especially in regard to wheel arrangement.

A general outline and end-view drawing of the proposed locomotive is gradually evolved and then a great deal of tedious work has to be done in order to find where the centre of gravity of the engine will come, so that the loads on the axles when the engine is in working order may be settled. Several modifications and sets of calculations may be required before a suitable weight distribution is arrived at, giving no axle weight in excess of that permitted by the Civil Engineer. The labour is not so great when there are in existence many drawings of engines that in some respects resemble the new one, as the weights already have been taken out in detail.

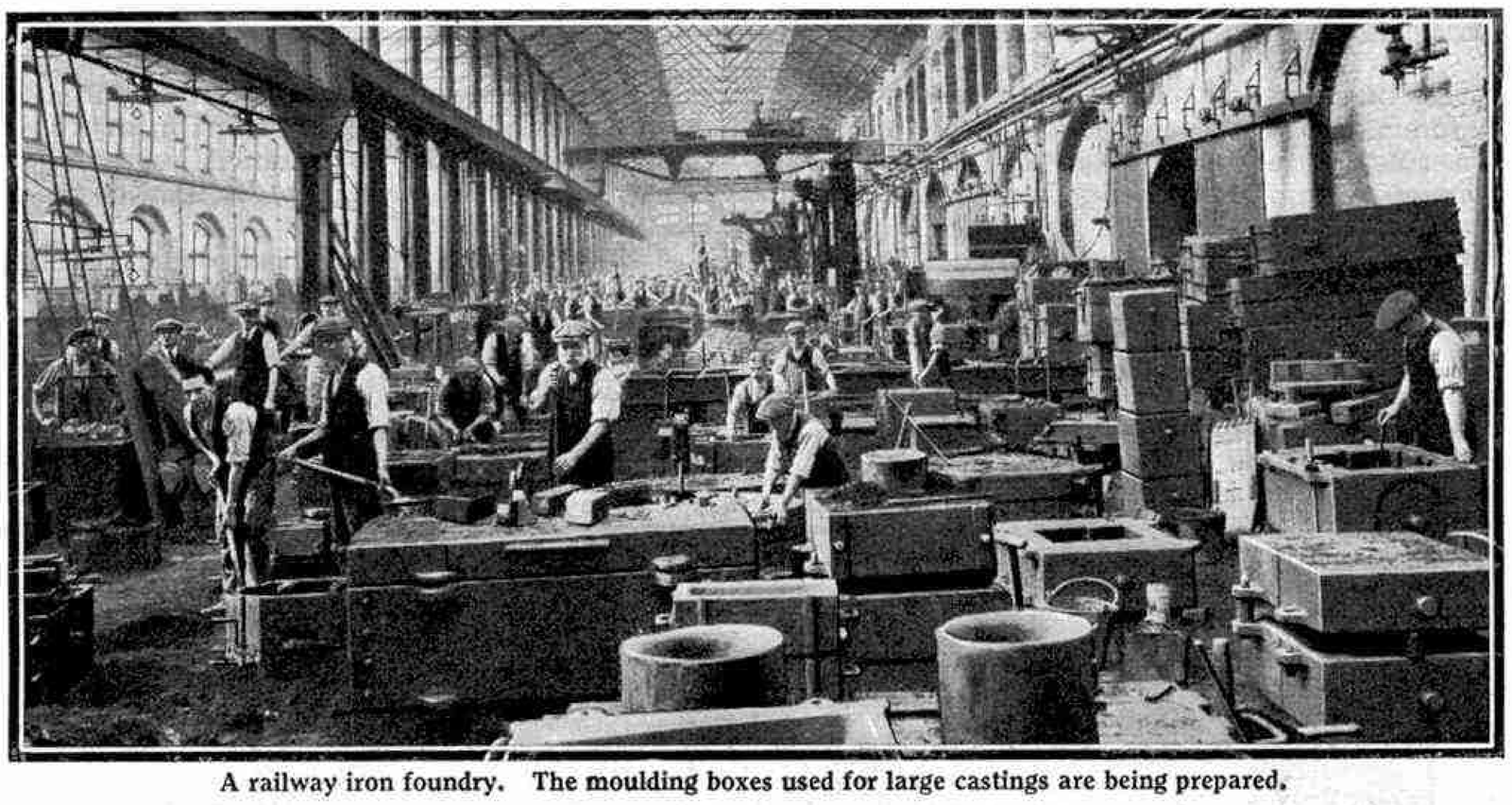
An essential feature of all well-conducted drawing offices is a well-thought-out filing system by means of which any particular drawing or data may be quickly turned up for reference. New drawings are usually roughed out in pencil on drawing paper, and from them tracings are made on transparent tracing cloth, from which in turn any number of photo-copies can be made. The tracings are kept in the Drawing Office, and only prints are sent out to the various officials concerned.

Several prints of the general drawing are sent to the Chief Civil Engineer, who distributes them to his district engineers for their comments in regard to any restrictions on the running of the engine. Where small alterations will give the necessary clearances, these are carried out. Larger works have to be specially sanctioned, and

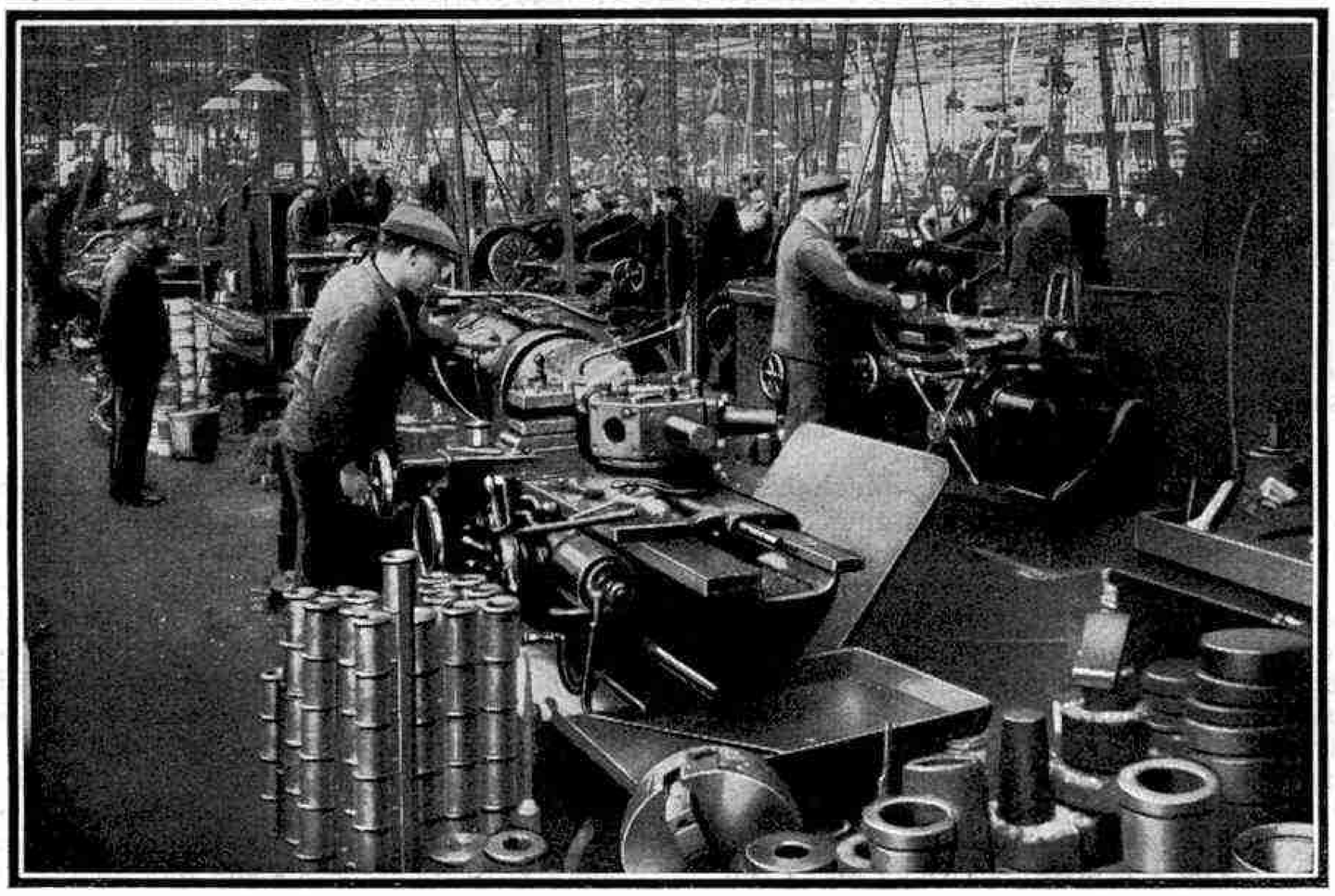
possibly modifications in the design of the engine may be called for. The expense of removing restrictions on certain sections of the line may not be justified, in which event all concerned are notified in due course, through the Appendix to the Working Timetable, that the new engines referred to as Class so-and-so may not run on these sections. The G.W.R. have a particularly interesting system of indicating the classification of their various engines, in accordance with the routes over which they may run. The indication takes the form of circular dots of different colours for different routes, painted on the side of the cab.

General approval of the outline design having been obtained, the detailed drawings are put in hand and may amount to several hundred sheets for an engine such as we are considering. Many of the fittings, such as injectors and lubricators, are specialities manufactured by outside firms, and for these nothing but an outline giving the overall size is required. For the boiler, motion, firebox and tender, however, every detail has to be drawn out. The drawings are arranged with a view to giving each part of the workshops just those particulars they require for their work, so that they have not to waste time in picking out their information from the general mass of material provided by the complete set of drawings.

One very important set of drawings is that which deals with the castings required. The steel castings for such parts as wheel centres, pistons and motion plates, are usually ordered from outside firms. At the L.M.S.R. Crewe Works, however, a very complete plant was in use until recently. The steel works was originated in 1864 by Mr. J. Ramsbottom, inventor of water troughs; and the manufacture of steel was subsequently further developed under his successor Mr. F. W. Webb, of "Compound" fame. From 1866 to 1871 Mr. Webb had been out of the company's service and had been managing partner of the Bolton Iron and Steel Company. He was therefore well qualified to carry on the work when he returned to Crewe in 1871 when Mr. Ramsbottom retired. Iron castings such as the cylinders are made in the company's foundry. For the latter wooden patterns will be made in the Pattern Shop. Pattern making is a highly specialised trade, quite distinct from ordinary carpentry and demanding a very high degree of skill from those who practise it. Where large numbers of castings are required from one pattern, that pattern can be made with advantage of metal to resist wear; but this metal pattern will be made from a wooden one.



A railway iron foundry. The moulding boxes used for large castings are being prepared.



View of a railway machine shop, showing lathes and other machines in operation.

When the pattern maker receives the drawing of the part that is to be cast, he has to decide first of all how the cast is to be made. Iron and brass are cast in what is called "moulding sand." Impressions in this are made by the pattern which, when removed, leaves cavities to be filled by the molten metal. The whole art of pattern making lies in scheming things out so that it is possible to withdraw the pattern without disturbing the sand. Another important point for the pattern maker is that the molten metal shrinks as it solidifies, and therefore if the pattern were made the exact size of the finished casting as given on the drawing, the casting produced would be too small. All patterns therefore are made larger than the required casting by an amount known as the "shrinkage." This varies for different materials, but is about $\frac{1}{8}$th in. in 15 in. for cast iron, and $\frac{1}{8}$th to $\frac{1}{4}$ in. in 12 in. for brass.

All but the very simplest patterns have to be jointed otherwise they could never be withdrawn from the moulding boxes without disturbing the sand. "Coring" is another very important consideration where hollow castings such as cylinders have to be made. Large patterns also have to be made with what is called "taper" or "draught," so that they can be lifted out without breaking down the sand. A machining allowance is also made where required as, for instance, for the bedding of the cylinder covers, but this will be indicated on the drawings.

From the pattern shop the next step is obviously to the foundry, which is one of the most spectacular parts of the works, at any rate when casting is going on. Casting does not take place at all hours of the day, but usually only in the afternoons, the morning being taken up in moulding.

The first objects that claim our attention are the cupolas, in which the molten iron is produced. The brass foundry, where brass, copper and phosphor bronze castings are made, is a separate building, containing tilting and crucible furnaces, but the work of casting, except for the difference in the furnaces, is much as will be described for the iron foundry.

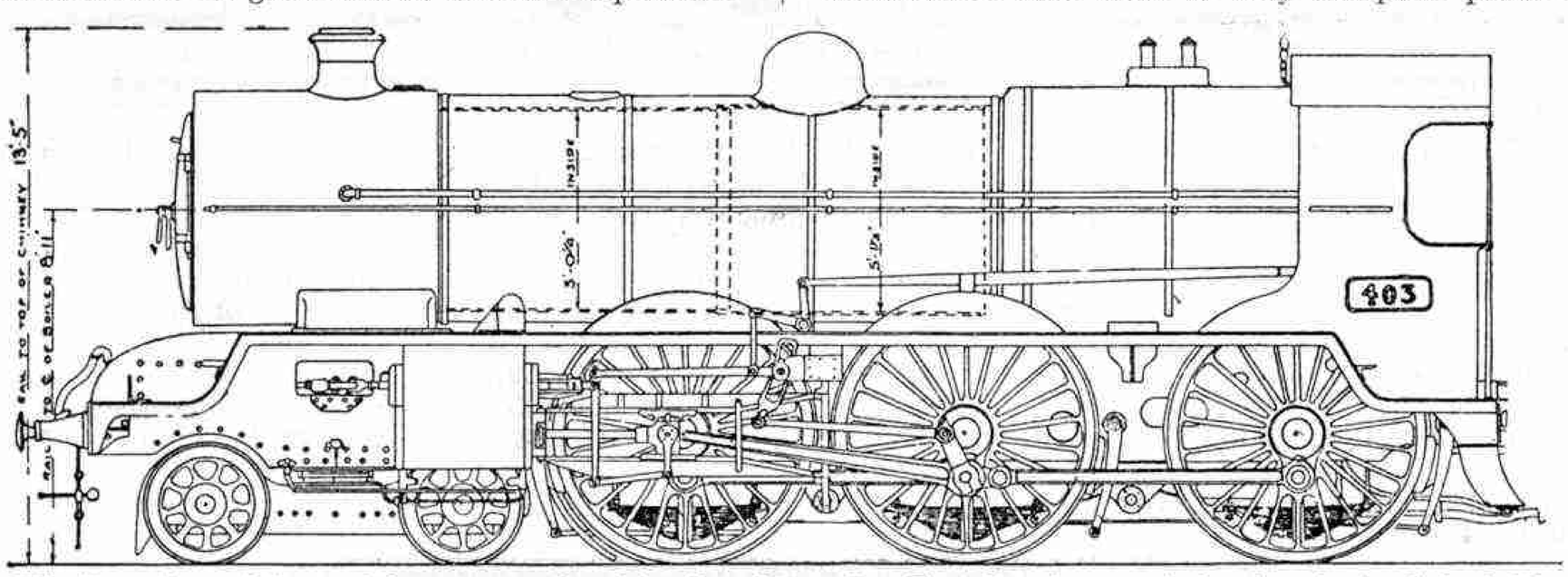
The cupolas consist of vertical cylinders built of steel plates. They are lined with firebrick and have a loading platform built near the top. Before charging up, the tapping hole in the front of the cupola near the bottom is plugged with fireclay and the delivery channel smoothed off with fireclay plaster. After a small fire has been lit in it the cupola is charged with alternate layers of coke, limestone and a mixture of pig and scrap iron. When it is nearly full, the air blast is turned on and enters the cupola by several pipes or tuyeres near the bottom. It forces its way up through the mass, which very soon attains a very high temperature, and the iron begins to melt. By looking through a peep-hole of dark glass one can see the drops of iron falling to the bottom. The limestone unites with the impurities to form a slag, which luckily floats on the molten iron. At all costs slag must be kept out of the castings, as any inclusions of this kind seriously impair their strength.

The furnaceman removes the fireclay plug when the men with the fireclay-lined ladles are ready, and the ladles are charged and taken

to the mould boxes. The flow of molten iron from the furnace is readily stopped at any time by a fireclay plug pushed home by an iron rod. As molten iron is tapped from the cupola, fresh charges of coke, limestone and pig iron are added from the charging platform. The whole process is thus continuous throughout the period during which casting is in progress, so that there is no risk of shortage of metal. The greatest care must be taken at the same time to see that the metal used is homogeneous.

Meanwhile, the various moulding boxes have been got ready by using the appropriate patterns. Moulding is a skilled art, which does not generally receive the recognition due to it. The moulding is done in special moulding sand, which must be damp enough to make it workable, but not so wet that the hot metal will produce dangerous amounts of steam. A great deal of skill and experience is required to enable the moulder to know where the pouring holes should be placed so as to ensure a good sound casting free from blow holes and porosity.

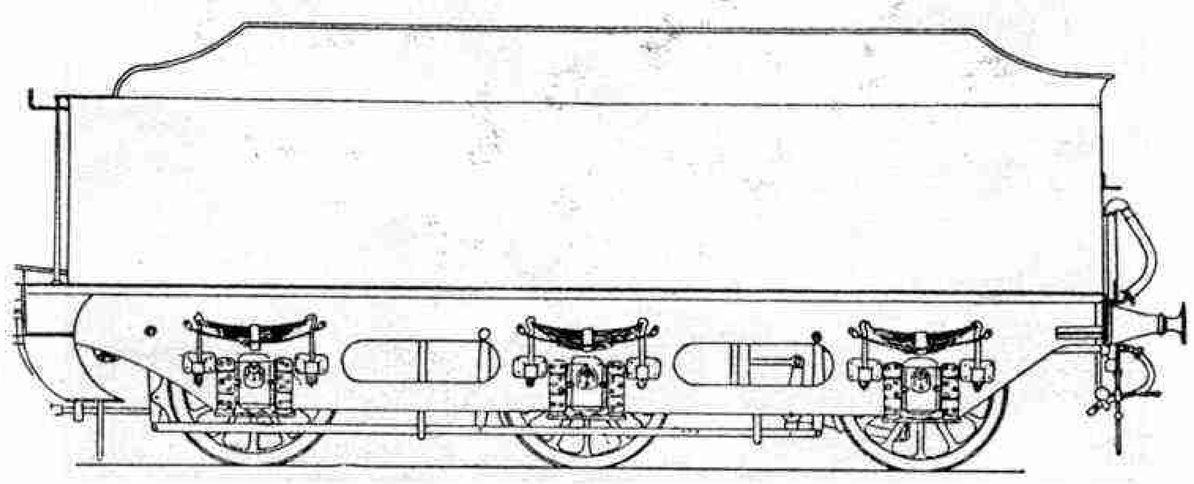
Most of the large and complicated moulding is done by hand, but a lot of the smaller work is done by machine moulders, which are capable of turning out a lot of work in a short time and are of great value in a modern iron foundry.



This illustration and the one below are examples of drawing office work. They show the general elevation of a 4-cylinder 4-6-0 express locomotive and tender of the Great Southern Railways of Ireland.

Some locomotive castings are of very large size. We are told that in order to cast the combined saddle and cylinder for one of the Great Western Railway "Castle" type locomotives, it is found necessary to use moulding boxes made in four separate parts. These moulding boxes are rectangular iron frames, with lifting handles, arranged so that they can be piled up on the top of one another and secured together by bolts. One is apt to forget that the boxes may sometimes contain many hundredweights of molten metal, and therefore must be very strong. In order to obtain the necessary holes in this casting, twenty cores have to be used in the moulding. These are of clay, usually baked to hardness in an oven. When the four moulds are fastened together they are taken to a casting pit, from 6 ft. to 8 ft. in depth, and finished off with the runner boxes to guide the molten iron into the mould.

Following up the cylinders from the foundry and the "fettling" shop, where the rough edges and spare bits of metal are knocked off, we can see in another shop how the cylinders are bored and faced —operations requiring a high degree of accuracy. The sides of the castings have to be planed so as to fit tightly against the main frames of the engine, and numerous bolt and stud holes require to be drilled. All important shops are now supplied with large multiple drills which are set by means of "jigs," and may then be used to drill many holes in a casting simultaneously. Some wonderful machinery is to be seen at Crewe, where, among a host of appliances, is a circular saw, 7 ft. in diameter, the edge of which travels at the rate of 13,000 ft. per minute, and can cut through a 9-inch steel axle in 25 seconds!



The frame plates are a feature of particular interest. There are two of these to each engine, and they run the full length of the engine. There are generally two lighter outer frames also, which support the footplating, splashers, etc., and in some designs they have to carry the wheel bearings. Although of practically uniform thickness, the frame plates have a very elaborate contour, to accommodate the outlines of the buffer plate, cylinders, bogie centre pin casting, axle box guides, boiler expansion brackets, footplate, and trailing buffer plate. As received from the steelworks, the plates are about 4 ft. in width, and 1¼ in. thick, and of suitable length to avoid a joint. After marking off they are roughly punched out to the required shape, afterwards being slotted and otherwise machined to the exact dimensions; then levelled by hammering or rolling, and finally drilled. To save time, 8 or 10 plates are piled on top of one another and all are slotted together, the top one having been carefully marked off and forming a template for the others. Good use is also made nowadays of flame-cutting machines in which a blowpipe is employed that moves in accordance with the profile of a prepared template and so cuts out plates to the outline required. So clean is the cut that little or no subsequent machining is necessary. Rapidity and accuracy of production are great advantages of this method. On the conclusion of drilling, the frames are sent to the erecting shop where they are set up on timber trestles and accurately spaced and levelled. The erection of the engine has now begun.

Piston valves are an essential feature of all modern superheated locomotives and there is very complete plant for dealing with them. For good working there should be no leakage of steam past the piston valves, so it will be appreciated that very accurate machining is called for. The piston valve consists of two pistons, or heads, on a stem, which reciprocate in a valve chamber. This has to be bored with great exactitude and the valve heads have to be turned to equally fine limits. The finished surface is obtained by hand scraping.

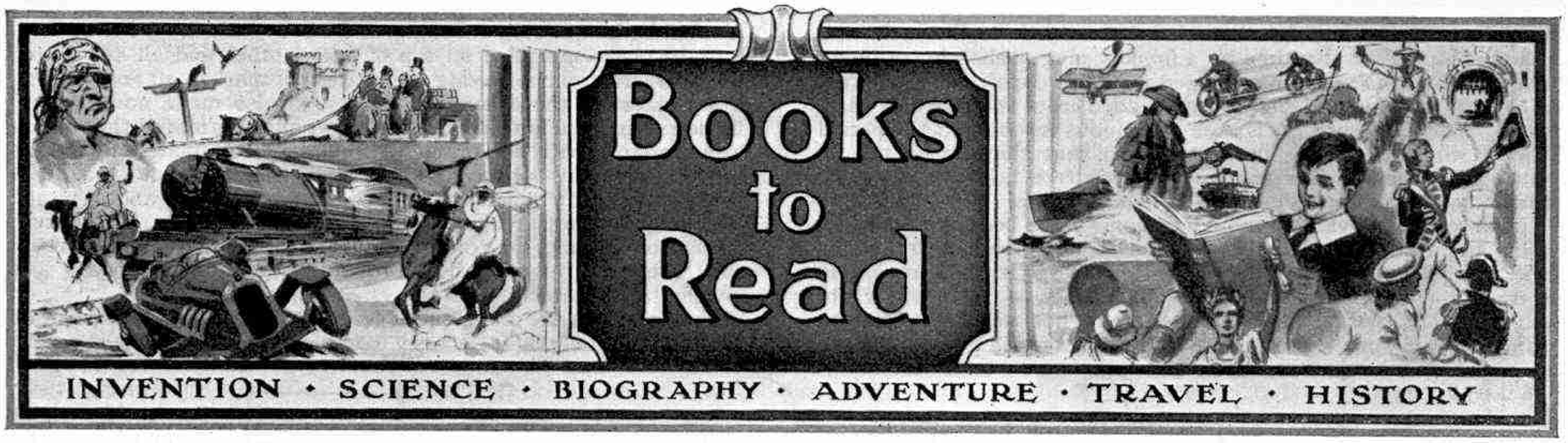
The valve gear and motion require a good deal of attention in the machine and fitting shops, especially if the much favoured Walschaerts gear is used, as they enter the shops as rough castings and forgings. The piston heads are turned, bored and screwed in the lathe, and then screwed on to the piston rods, which have been turned and screwed ready to receive them. The finishing touches are given by means of a grinding lathe, and we may notice that grinding now plays a very important part in machine shop operations, especially since very hard alloy steels have come into favour. The brake gear is similarly dealt with. Milling machines are an essential part of the equipment of up-to-date machine shops, and we shall probably find them engaged on the milling of valve rods, connecting and coupling rods. The latter are milled out to an "I" section, which gives the maximum of rigidity with a minimum of weight.

Wheel centres, crank axles, axle boxes, and a multitude of small brass fittings also have to be dealt with in this part of the locomotive works.

The wheels mounted on their axles are set up in special wheel lathes, and the tyres are then turned to the correct profile, being tapered or coned at the rim to suit the angle at which the rails are laid. This assists in keeping the locomotive central with the track. Nowadays wheel centres are usually steel castings, and are somewhat lighter than the wrought iron centres that formerly were employed.

The tyres are made by rolling from a single slab of steel, so that there is no welded joint. They are bored out slightly smaller than the diameter of the wheel centres, and are then heated and shrunk on. They are then so firmly fixed by special means that there is little chance of one of them flying off if it should become loose or even break. Crank-axles are either forged or built up, and are turned in a specially-designed lathe.

The axle-boxes may be iron, steel or gunmetal castings, or even may be forged from the best hammered iron. Bearing "brasses" are fitted into the boxes when these are not made of gunmetal, and they have pockets so as to allow white metal liners to be run into them. White metal does not damage the bearings if they become warm, and in addition it has very smooth-running properties. In connection with bearings it is interesting that an experimental locomotive incorporating roller bearings has been running on several of the railways in America. It is understood to have given very satisfactory results.



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool, adding 1/– for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"Watchings and Wanderings Among Birds"

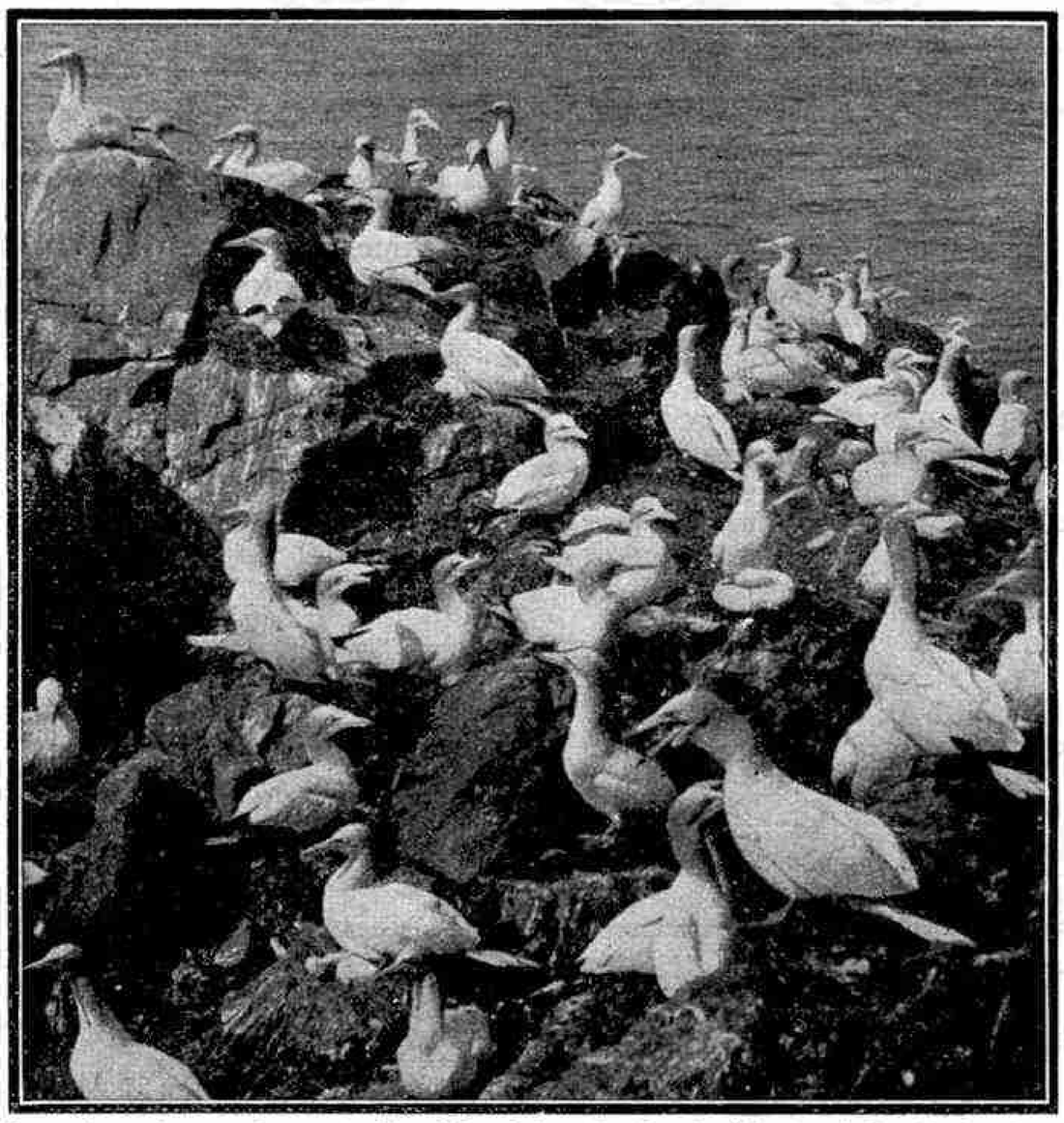
By GILBERT and BROOK. (Arrowsmith. 10/6)

The authors describe their observations and adventures among birds over a number of years, on the coast of Pembrokeshire, the Welsh border lands, in the Orkneys and in Scotland. There is also some description of Grasholm—well-known as being the haunt of the only colony of Gannets on English or Welsh soil—and an account of an expedition to the lakes of Switzerland in search of the Great White Heron and the Spoonbill.

The interesting fact is brought out that birds do not remain stationary in their numbers in any given district. "As the years pass by, the countryside alters in various ways. Woods are felled or planted; cornfields are replaced by grass; bad farmers succeed good ones, and vice versa; marshy ground may be drained . . . and so on," and naturally the bird life of the district is inevitably affected by these changes. "Yet so slowly does the countryside change that a man's life-time is all too short a period during which to study the effect on bird life." In mid-Wales changes were effected in bird life by the Act of Parliament of 1903 that made illegal the use of the pole trap—set on the top of a pole in open spaces to destroy hawks and similar birds that rested on such vantage points. This form of trap was made illegal on account of its cruelty, the trapped bird being tortured for hours because the traps, being set in very lonely places, were seldom visited. At one time these pole traps could be seen everywhere on the ridges of the Eppyut Hills and on the southern end of the Radnor Forest, and they destroyed an immense number of raptorial birds. The reduction in the numbers of the pole traps has naturally resulted in an increase in several varieties of these birds and this in turn has affected the distribution of the birds on which they prey.

The last chapter of the book deals with the Golden Eagle and we learn of its enormous strength—its talons are powerful enough to go through a man's fore-arm. We learn, too, with surprise that the fox has no fear of the eagle, although the dog, on the other hand, has an intense respect for the great bird. One of the authors expresses his astonishment at the difficulty with which an eagle was able to rise from the ground when lifting a hare from the hillside to carry it to its nest, although "once in the air it carried its burden with ease, but the actual lift from the ground was only accomplished after many ungainly attempts." An opinion is quoted that an eagle does not have much difficulty in carrying double its own weight and something to spare, if the hillside is steep and a fairly strong wind blowing so that he gets a good start. On the other hand it is about as much as he can do to raise his own weight off the ground. "A Golden Eagle weighs about 12 to 14 lbs. and it would appear that this is about the maximum weight the bird can carry under ordinary conditions." As we have read of eagles carrying off lambs, sheep, and even children, this is interesting information. It seems certain they cannot lift a child or a sheep, for indeed "shepherds agree that a lamb is quite safe after it is from 10 days to a fortnight old" from the depredations of the eagle.

The book is illustrated with many fine photographs, which obviously are the reward of hours of patient watching among a variety of interesting birds.



Gannets nesting on the west side of Grasholm, the lonely island off Pembrokeshire. From "Watchings and Wanderings Among Birds" reviewed on this page.

"The Modern Dowser"

By LE VICOMTE H. DE FRANCE
(G. Bell & Sons Ltd. 3/6 net)

The divining rod has been used for many centuries in the discovery of running water or of metallic ores, but has always been regarded with suspicion. In spite of this, dowsers, as those who use the rod are called, have persisted in claiming that it is reliable for finding water or minerals, for detecting underground passages, and even for investigating diseases.

This book deals practically with the art of dowsing, and its most valuable feature is a section describing how to make and use the divining rod, or the simple pendulum used as an alternative by many dowsers. The author gives detailed instructions for experiments to prove the truth of the claims advanced, but often it is difficult to believe that he is really serious. For instance, he states that the quality of underground water may be tested by using a black pendulum to which a piece of blue ribbon is tied by black thread, for this instrument will gyrate in a clockwise direction if the water below is contaminated! The success of other experiments is ensured by the simple expedient of pointing the first finger towards the Sun!

There is little doubt that in the hands of some people the divining rod behaves curiously in certain conditions, and some remarkable results have been obtained; but the subject is surrounded by a great deal of humbug. The author believes that the movements of the rod are due to the influence on the dowser of electric currents in the earth, but his explanation is not satisfactory because he confuses electric currents with the radiation of electro-magnetic waves. Those who are interested in this curious subject will find the book useful for its detailed descriptions and illustrations.

"The Golden City"

By J. SHERWEN ROBSON. (A. H. Stockwell Ltd. 6/– net)

Mr. Robson's story is of the type first made popular by Rider Haggard. It describes the adventures of three Englishmen and a Zulu who penetrate into a mysterious African city peopled by descendants of the ancient Egyptians. Their appearance leads to trouble with the priests of the city, and matters are complicated by the intervention of Jewish outcasts and barbarian slaves. Finally the city is destroyed in a great conflagration, and only one of the adventurers succeeds in escaping and returning home.

"The Search for Man's Ancestors"

By Prof. G. Elliott Smith, F.R.S.
(Watts & Co. 1/- net)

A little more than three years ago a fossilised skull was found during excavations in a cave near Peking. The skull was that of a very primitive human being who retained some of the characteristics of the apes to which he undoubtedly was related, and its position suggested that it was at least 1,000,000 years old. Thus it represented one of the forerunners of the human beings of to-day, and its discovery led to a great revival of interest in the search for those early ancestors of Man who first separated themselves from the rest of the animal creation and began the progress that has led to mastery over the earth.

There are three fossils that are claimed to be remains of the earliest human beings known to us, and Professor Elliott Smith tells the story of their discovery. The first to be found was a fragment of a skull unearthed from the banks of a stream in Java in 1891 by Dr. Dubois, a Dutch surgeon. For the next great discovery it was necessary to wait until the appearance about 20 years later of part of the skull of the earliest known inhabitant of Great Britain. For ages this wonderful relic remained hidden in a bed of gravel near Piltdown, Sussex, and it was not discovered until the gravel and flint in this bed were required for roadmaking.

Finally came the discovery of Peking Man. Again only the fossilised part of the skull was found, the other bones of the individual who lived in the cave near the Chinese capital having disappeared ages ago. Since then other remains have come from the same cave, and with them crude stone tools and charred remains of the fires round which these ancient men gathered.

The Peking skull is similar in many respects to that found at Piltdown, 11,000 miles away, and it links this with the remains of Java Man, who lived far to the south. Professor Elliott Smith makes clear the wonderful interest of these skulls, and shows how they enable us to visualise the characteristics of the common ancestor of the three known primitive types of humanity.

This book, in spite of its small size, gives a remarkably attractive account of a subject of great importance, and most of those who read it will wish to go deeper into the fascinating problems with which it deals. It is well illustrated by six full-page plates and several drawings.

"Warne's Pleasure Book for Boys"

(Warne & Co. Ltd. 2/6 net)

A good collection of stories forms a useful present for any boy, and "Warne's Pleasure Book" can be recommended for this purpose. The stories are well written and cover a wide range of thrills, on land, at sea and in the air. The book is illustrated with four coloured plates and a large number of black-and-white illustrations. This is a splendid present for a young boy.

"In Great Waters"
"Adventurers of the Air"

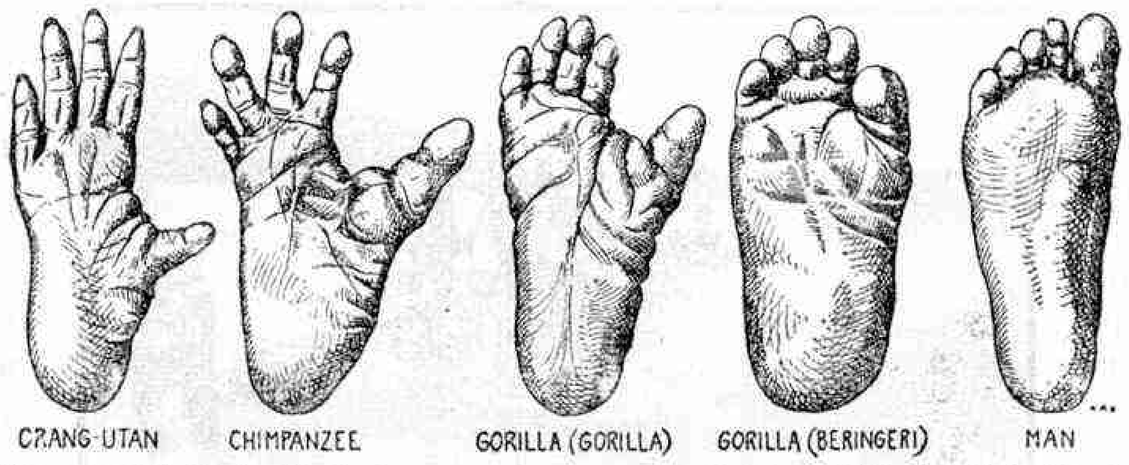
By E. Keble Chatterton
(Warne & Co. Ltd. 2/- each net)

Mr. Chatterton is not quite so successful in his stories as in his serious books of the sea, but nevertheless he has produced two readable yarns. Both concern the adventures of Bob Crane, an English boy, and his American friend Wilmer Lorning. "*In Great Waters*" deals with the voyage from England to China of an armed motor boat specially built to deal with pirates in Chinese waters. The boat is attacked repeatedly during the voyage by a large submarine owned by a sinister Chinaman who is determined to prevent it from reaching its destination. Aeroplanes also take a hand in the game, and exciting incidents follow one another in quick succession until the boat reaches China and deals a deadly blow at the pirates.

In "*Adventurers of the Air*" our heroes find themselves in a wonderful new airship capable of travelling at 150 miles per hour. They make a thrilling voyage from America to Calcutta by way of the Arctic, and desperate encounters with aeroplanes, a rival airship, and a mysterious and deadly "Z" ray prevent the story from ever becoming dull.



A Sparrow Hawk with its young. One of the many fine illustrations from "Watchings and Wanderings Among Birds" reviewed on the previous page.



The soles of the feet of the larger apes and man compared. From "The Search for Man's Ancestors," by Professor G. Elliott Smith, F.R.S., reviewed on this page.

"The Splendid Book of Railways"

By W. H. Boulton. (Sampson, Low. 2/6 net)

Every year more "popular" books on railways appear, and still the public demand seems unsatisfied. This is rather remarkable when one considers the rival attractions of the high-speed motor car and the aeroplane, and it shows that the steam locomotive possesses a fascination entirely its own.

Mr. Boulton deals with his subject on conventional lines, and covers the ground fairly completely. He writes in an easy and readable style, and the numerous illustrations are well chosen. It is a pity that the book contains a number of doubtful or incorrect statements which, though they may not be of great importance, are undesirable in a book of this nature. For instance, the late L.N.W.R. is credited with having originated the "flying junction" in 1869, whereas this arrangement was in use much earlier on the L.B. & S.C.R. The "*Southern Belle*" is wrongly named the "*Brighton Belle*," and one photograph showing a Great Western engine crew at work is ascribed to the L.N.E.R. Coloured "jackets" are not intended to be taken very seriously, but one must protest at the hopeless confusion of signals on the jacket of this book.

"Yells"

By A. Short
(Brown, Son & Ferguson Ltd. 1/- net)

In his foreword Mr. Short points out that "The word boys rhymes with noise, and where there are boys there also is noise"; and his book is certainly a valuable contribution to the development of organised noises! It is intended primarily for Scouts, but it is equally suitable for any gathering of boys whenever the necessity arises of "letting off steam."

The more elaborate group yells are intended to be accompanied by action, and full directions are given for the effective carrying-out of the necessary movements. Many of the yells are remarkably ingenious, especially those for producing a definite effect, such as a whistling rocket, a gigantic sneeze, rattles, or a moving locomotive. Then there are blood-curdling yells, such as one supposed to represent a dying man with a wooden leg having a fit on a tin roof! After a threefold repetition, with increasing emphasis, of the words "We're out for gore," followed by a ghastly silence of a couple of seconds, the performers produce an electrifying effect by leaping forward with a terrible yell of "Bel-lud"! We recommend this book to the attention of Meccano Clubs and H.R.C. Branches.

"The Empire Annual for Girls"

(R.T.S. 7/6 net)

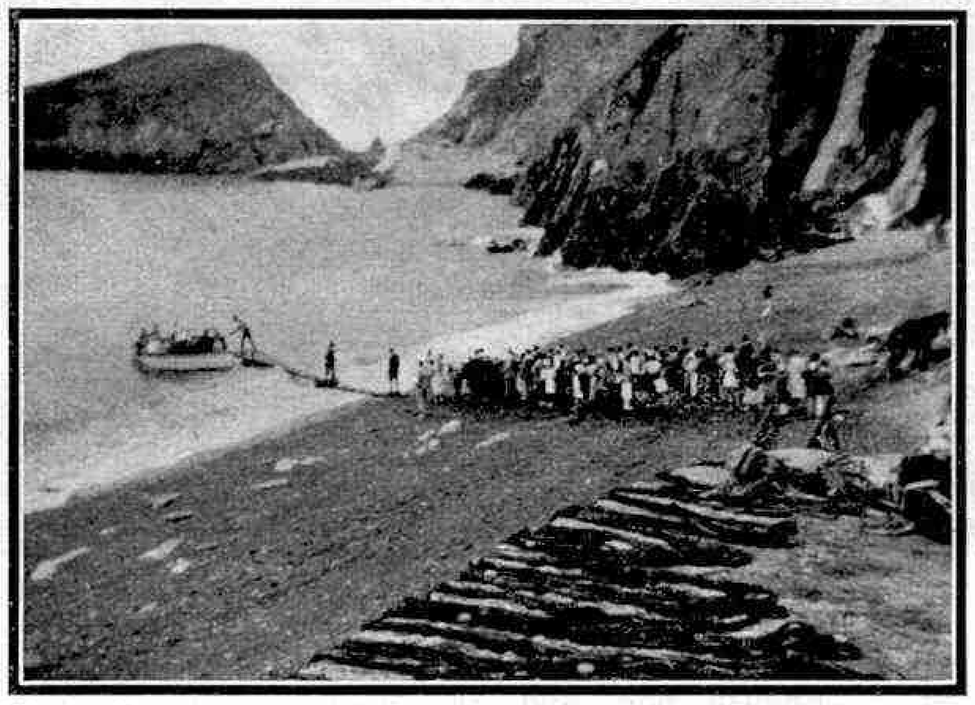
School stories form the best of the many attractive features of this popular annual. There are also many good stories of adventure, and articles on raffia work, and hiking and camping. The illustrations are on a generous scale, including four colour plates.

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subjec of general interest. These should be written neatly on one side of the paper, 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 aith, but the Editor takes no responsibility for their accuracy.

Lundy Island

While staying near Weston-super-Mare I visited Lundy Island, the lonely rock at the entrance to the Bristol Channel. The weather was splendid and the sea trip was very enjoyable. Eventually the great rock showed itself ahead, and we approached the tiny beach, in a cove at the southern end of the island, that serves as a landing place. As we did so I caught sight of several seals, pounding and rolling through the waves like porpoises. These creatures breed on the island, their home being Seals Rock, which lies off its north-east coast.



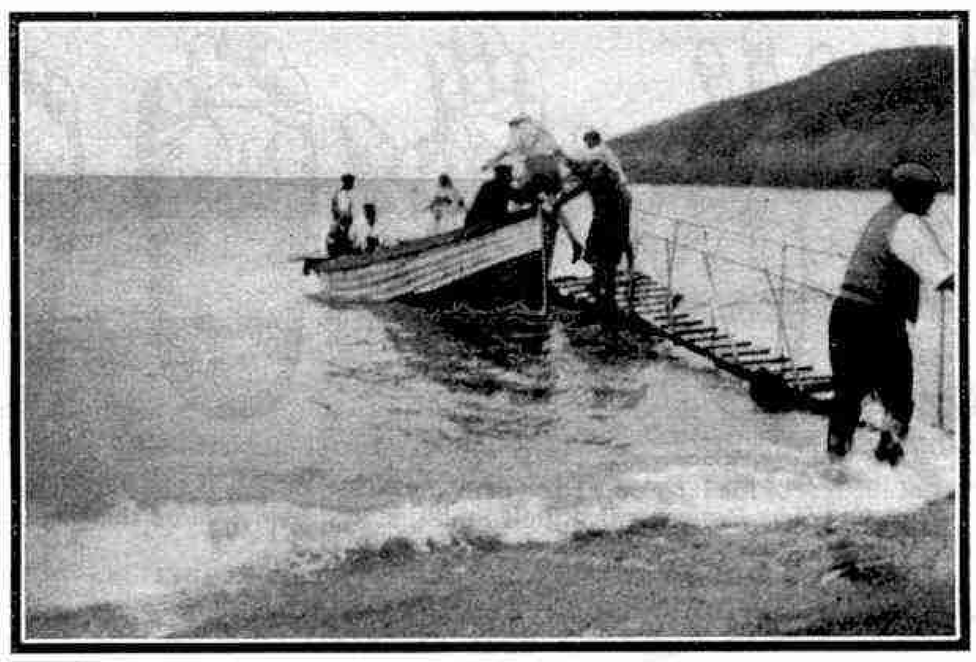
The landing place on Lundy Island. The photographs on this page are by K. B. Stump, Hove.

Lundy Island is a granite rock more than three miles in length but only half a mile in width. It is covered with heathery moorland, on which sheep and goats are reared. Most of its few inhabitants are dependent on fishing for a livelihood and Lundy lobsters are famous on the neighbouring mainland. In the past it was a haunt of pirates and smugglers, and was notorious for the number of wrecks that occurred on the west side, which is exposed to the full fury of Atlantic storms. At its southern end is the dreaded Shutter Rock, the scene of the wreck of Don Guzman's vessel, the thrilling final episode of Kingsley's "*Westward Ho.*"

Lundy Island is chiefly remarkable for the wonderful variety of its birds, the temperate climate making it an ideal home for them. The peregrine falcon, the cormorant and the oyster-catcher appear regularly in large numbers, and the puffin is so characteristic that representations of this bird are to be found on coins and stamps that have been issued on the Island. The gannet, one of the largest of wild birds, also breeds there, and woodcock abound, particularly when a severe winter is experienced on the mainland, 12 miles away. All these birds are protected and watchers are placed on duty in the breeding season in order to guard them.

I returned in the evening and not far away from the Shutter noticed the wreck of a Greek ship piled high on the rocks.

K. B. Stump (Hove).



The end of a visit to Lundy Island. Re-embarking in one of the small boats in which the steamer is reached.

Surveying a New Railway

On the Rhodesian Railways a new section of line, 72 miles in length, has been constructed between the Deka River and Victoria Falls, on the Zambesi River. The new line was built in order to give an easier road between Wankie Colliery and the copper mines in Northern Rhodesia, and was opened to traffic on 12th September last year. Its steepest gradient is only 1 in 120, and much heavier loads of coal can be hauled northward over it than were possible on the old line, on which stretches at 1 in 80, and even 1 in 50, were by no means unusual. The running times for mail trains between Wankie and Livingstone are now more than an hour less than they were before the new road was brought into operation.

I took part in the survey of the new railway. The country through which the line passes is very broken and covered with dense bush in which game is abundant. The surveyors seldom ran short of meat, for the district is the home of countless antelopes. I often heard lions roaring at night, but never saw one of these animals. Hyenas and jackals were frequently seen. These creatures were a nuisance, for they prowled round our camp at night and stole meat and other articles left unguarded.

The intense heat and the mosquitoes were our greatest trials while working in the bush, and we had to exercise great care in order to avoid sunstroke. In the evenings we were annoyed by moths, flying ants, winged beetles, and praying mantis, insects that hold up their forelegs as if they were praying. In addition, tarantulas and other spiders ran about the floor, and scorpions had an unpleasant habit of climbing along the ceilings of the tents and dropping on to the beds.

The line was opened for traffic last September and smaller deviations beyond Victoria Falls also have helped to ease traffic conditions on the way to Livingstone and the north.

W. E. Andrews (Bulawayo).

A Run on an Indian Electric Locomotive

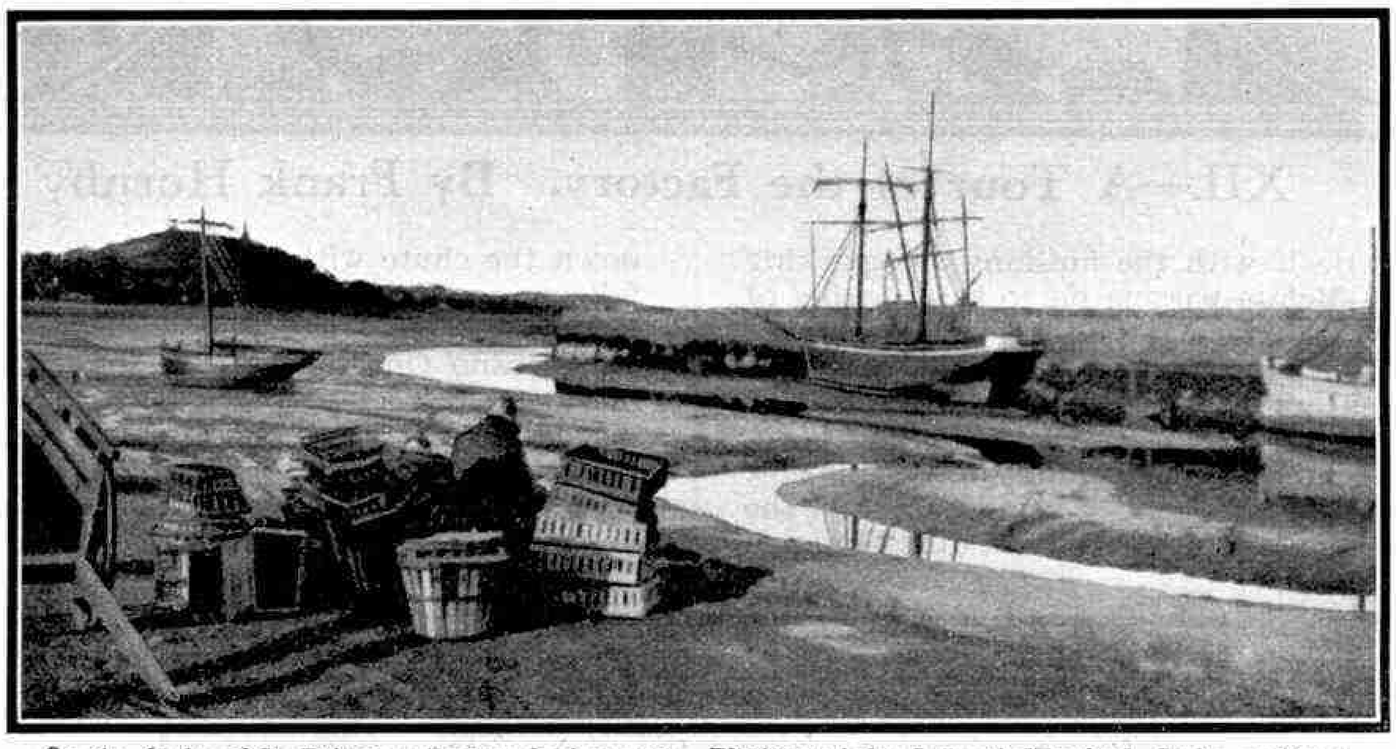
Recently I obtained permission to travel in an electric locomotive on the Great Indian Peninsula Railway. On arriving at Victoria Terminus, Bombay, I showed my permit to the driver of the engine in which I was to travel, and he immediately gave me a seat on the right side of the locomotive. This was one of a number built by Metropolitan Vickers Ltd., and the driver explained its chief features while waiting for the signal to depart for Poona, the destination of his train. Its weight is 112 tons and it has six motors with a total output of 2,430 h.p. The maximum speed of locomotives of this class is stated as 75 m.p.h., but I was told that they could reach a speed of 86 m.p.h. if necessary.

At 6 p.m. we started. The engine rapidly gathered speed, but soon had to slow down on account of heavy suburban traffic. When we were clear of this our speed rose until we were running smoothly along at 45 m.p.h., and in descending one bank we reached 55 m.p.h. The train rolled on through flat rice fields, crossed a creek by means of a short viaduct, and finally dashed through a long tunnel where water from a tapped spring fell on the roofs of the coaches. We emerged into daylight near Thana, having covered the 22 miles from Victoria Terminus in 33 minutes.

The start from Thana is a difficult one, but the locomotive tackled the inclines of 1 in 160 and 1 in 140 with confidence. Our speed never fell below 30 m.p.h., and actually was 38 m.p.h. when we reached the summit with our heavy load of about 400 tons. Then followed the long incline leading down to the junction at Kalyan. The driver accelerated as we ran down the slope, and the last 14 miles to the junction were reeled off in less than 16 minutes, giving an average speed of 52.5 m.p.h. The country through which we passed at this high speed was flat, and there was very little of interest to be seen except rice fields and an occasional sub-station.

At Kalyan the track to Calcutta and Delhi diverges from the line to Poona and Madras. I left the engine when we reached this point, after thanking the driver for his kindness during my short run, and returned to Victoria Terminus by another train. I thoroughly enjoyed the experience and remarked particularly the absence of the noise and heat experienced on a steam locomotive.

F. HEREDIA (Bombay).



On the docks of St. Brieuc, a Breton fishing port. Photograph by C. Lewis, Basford, Stoke-on-Trent.



The "Deccan Queen," near Khandala, on the Great Indian Peninsula Railway, hauled by an electric locomotive. Photograph by F. Heredia, Bombay.

Fishing with a Gun

Sardine fishing is one of the chief occupations of the inhabitants of the ports of Brittany. Many parts of the coast of this province are treacherous and the seas often stormy, and the light fishing smacks employed frequently have to fight hard against the waves and strong currents. The storms come on suddenly, and at times fishermen have to leave their nets and catch and make for the shore in order to avoid being caught.

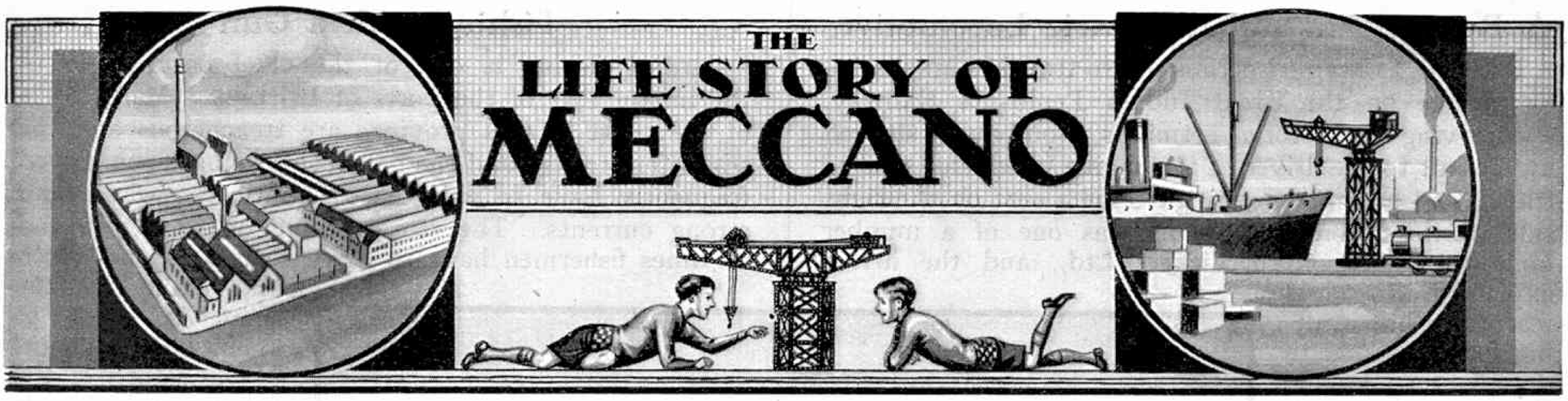
The return of the fishing smacks is always a fascinating sight. As the boats make their way into the harbour, fellow-fishermen on the quays shout questions regarding the size of the catch. Eventually each vessel is brought alongside and the net, with the silvery sardines flapping about inside it, is swung ashore. While the fishermen secure their craft, their wives scoop the fish into tin receptacles. Sardines are cheap in Brittany, but a good catch may fetch as much as £5.

St. Brieuc, on the north coast, is a typical Breton fishing port. At low tide the upper part of the dock is left dry and interesting creatures are left behind by the retreating water. On one occasion a friend drew my attention to a huge octopus floundering in the deep mud. A docker produced a gun from the hatch of his boat and shot it, standing on the edge of the dock to take aim. The successful marksman told me afterwards that an octopus is rarely found at St. Brieuc. Enormous conger eels are common, and he kept his gun handy in order to be able to deal with them, retrieving his slippery catch by walking out on planks resting on the mud.

The sardines appear on the western coast of France during May and the following months. They are caught chiefly off Brittany but also are found as far to the south as La Rochelle, while they provide occupation for the fishermen of the Mediterranean and the coast of Portugal.

The length of the fish varies from five to seven inches. They are salted as soon as they reach port and cooked in oil before being packed in the tins with which we are familiar. They are not the only small fish that are canned. Of these the best known is the brisling, a fish of about the same size that is caught in Norwegian waters. This is prepared for canning in a similar manner to the sardine.

C. LEWIS (Basford).



XII.—A Tour of the Factory. By Frank Hornby

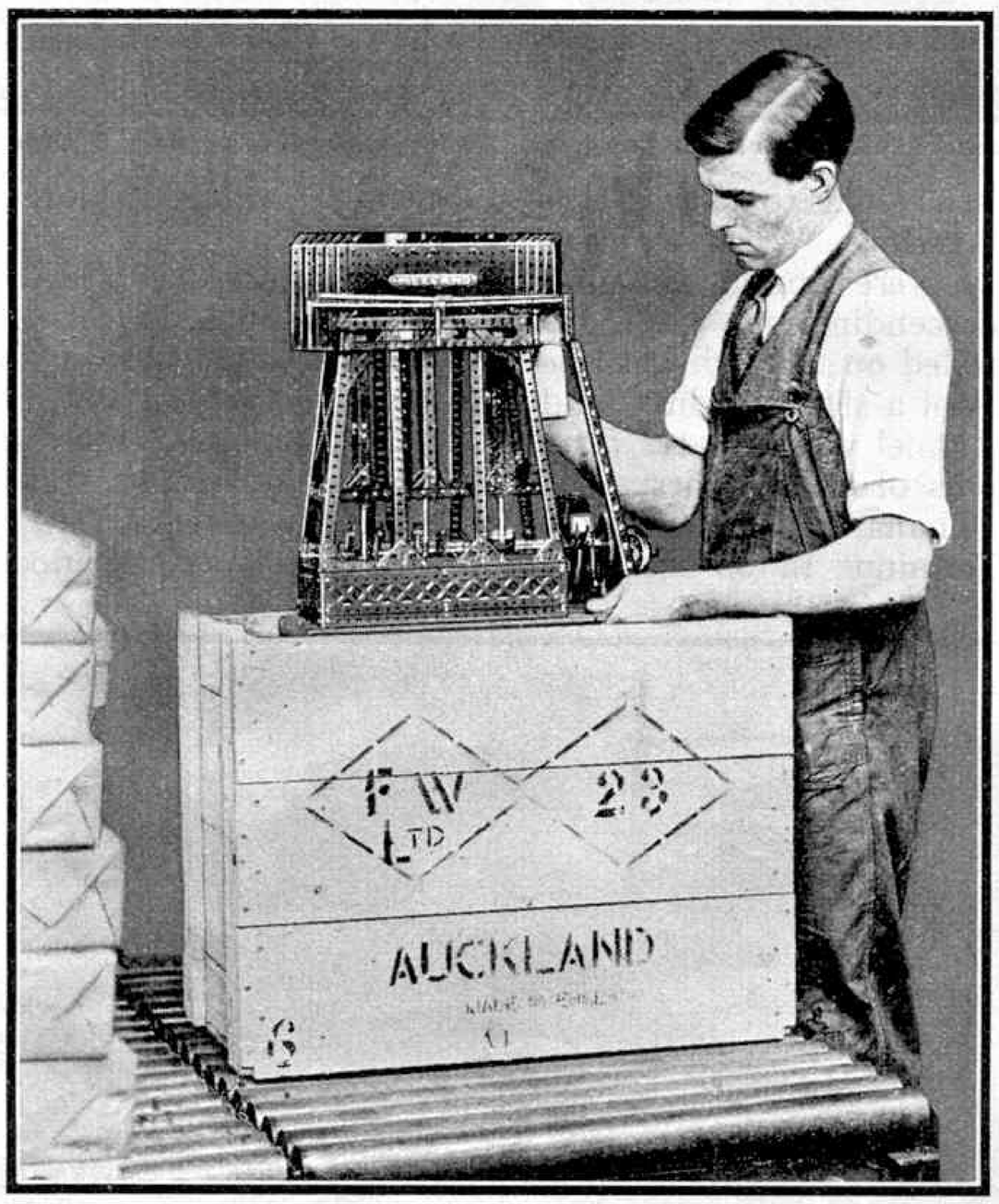
IN last month's "*M.M.*" I dealt with the finishing and packing of a Hornby Train Set. Before passing on to the packing of Meccano I would like to mention one interesting fact concerning the Train Room that will help my readers to understand the detailed study that has been applied to the organisation of this Department.

When any article is under production for immediate shipment, it is in continual motion from the moment of being placed on the Transfer and Handfinishing conveyor until it reaches the Shipping or Despatch Department. The journey from the Train Room is by way of an endless chain elevator and roller chute that carries the goods up to the Stock Room on the first floor, and deposits them on the upper band of a double conveyor running the full length—nearly 300 feet—of the Stock Room in each direction. The upper band travels towards the north end of the Store and the lower band towards the south. At the north end of this conveyor there is a spiral chute leading down to the Shipping Department, and goods reaching this chute automatically topple into it from the conveyor. It will thus be seen that goods brought up to the Stock Room by elevator and fed out on to the conveyor are automatically carried to the Shipping Department.

The conveyor is used primarily to distribute goods to the various bays in the Stock Room, however, and in normal practice an attendant is stationed at the head of the elevator to sort out goods going to stock bays south of the elevator from those going north. Material going north is allowed to transfer itself direct from the roller chute to the conveyor, while that going south is lifted from the chute and placed on the lower band of the conveyor to travel in the opposite direction. The storekeepers lift the goods from the conveyor as it passes the bays, and stack the parcels away in their correct places.

There is not space here to discuss the organisation of the Stock Room, but in order that the system under which the goods move through the factory may be made clear it is necessary to deal at this point with the actual despatch of finished goods. As the orders for despatch are received in the Stock Room they are split into sections, and issued to the storekeepers controlling the bays in which are stored the items included in those sections. The storekeepers collect the necessary goods and lay them on a rack immediately above the distribution conveyor just described. A system of coloured flags is employed—the same colour being allotted to all the sections of one order—to enable the storekeepers working at the different bays to identify the orders on which their colleagues are working. When the flags showing along the rack indicate that all the sections are collected and ready, the goods are laid on the conveyor and carried down to the Shipping Department. An advice note identifying the shipment passes down the chute with the first package, in order that the articles following may be checked during packing.

Simultaneously with the processes just described, the assembly of Meccano Outfits has been going on in the Meccano Packing Department. This work also is carried out on conveyors, empty cartons being placed on the belt together with the loose parts, to be carried to girl packers seated alongside the conveyor. The packing process follows the general lines of the conveyor work described in other assembly processes, each packer in turn fixing certain specified parts in position in the carton. There are two main assembly conveyors in operation in the Meccano Packing Department, each of them capable of handling 25,000 outfits a week with a normal complement of 26 operators per belt.



A Marine Engine Model being packed for shipment to New Zealand. The roller packing "table" that makes the handling of heavy cases an effortless matter is a specially interesting feature of this illustration.

The wrapped outfits are carried away to the Meccano Stock Room by conveyors working across the heads of the assembly conveyors. This stockroom occupies a comparatively small space in the department, for the great bulk of Meccano parts are stored loose in specially designed bins and trays, in order that the stock of parts may be kept in a fluid state and available for packing into outfits of any size as desired.

A specially interesting feature of the Department is the method of counting the parts when they are taken into stock from the Production Departments, or in the course of packing. Obviously hand counting is out of the question—each year we make thirty millions of nuts alone! What is known as a Computation Scale is therefore employed for small parts in mass. This is a lever scale with a large centre pan and two small pans suspended from levers, giving a ratio of 10 to 1 on the first lever and 100 to 1 on the second. One part in the small pan at the end of the first lever balances 10 parts in the large centre pan and one part in the pan of the second lever balances 100 parts in the large pan; so that it is a matter of seconds only to compute the number of parts in any consignment. For heavy parts such as Meccano Strips, where the consignment may weigh a quarter of a ton or more, a weight factor is used, and the total weight of the consignment in pounds is multiplied by this factor to give the number of parts in the consignment.

An interesting electrical counting machine is used to count bolts or nuts into boxes for packing with the outfits. The parts being packed are placed in a hopper and automatically fed out on to a small vibrating platform. As the platform oscillates it throws the parts one by one over its tilted lip into a small hopper mounted on one end of a scale lever arm. At the further end of this lever is a weight pan containing 12 bolts—assuming that bolts are being counted out in dozens—and the weight of this pan holds the small hopper in position until 12 bolts have been thrown into it. The equalisation of the weights then balances the lever arm and



This illustration gives a comprehensive view of the Train Room with the locomotive test tracks a prominent feature in the foreground. The long conveyors used in the assembly of clockwork motors and for hand finishing can be seen in the background.

automatically breaks the electric circuit that has energised the oscillating mechanism. Simultaneously the floor of the small hopper opens to drop the bolts into the box waiting below. With the dropping of the bolts the weight pan pulls the hopper back into position, the contact is restored, and the process repeated.

And now the only operation intervening between the Meccano Outfit or Hornby Train Set and the outside world is the packing for despatch in the Shipping Department. The scene in the Shipping Department is possibly more colourful than any that has been encountered previously in my story. The great many-hued stacks of cartons awaiting attention from the packers strike a cheerful note that leaves a very vivid impression in the mind of the observer.

The goods awaiting despatch are trucked to the packers from the Meccano Stores, or the foot of the Stockroom chute. After surveying a consignment, the packer handling it is able to estimate within very fine limits the number and sizes of the cases required, and without any apparent "juggling" he fills every inch of space with goods! A roller conveyor running alongside the packing "tables" is used to carry the filled cases from the packers to the loading platform, and in the course of its journey each case is checked for a moment while bands of steel strip are fastened around it as a further measure to ensure safe transit. At this point the case is also labelled or marked with a stencilled shipping mark. Finally the case is carried over a weighing machine—an integral part of the conveyor—where its weight is registered, and thence it passes down a gently inclined roller chute leading out on to the shipping platform, to await its turn to be loaded for despatch.

Although our busiest season is concentrated around Christmas, the most interesting time of the year in the Shipping Department is from the beginning of August until the end of September, when the main Overseas consignments are being handled. At this season consignments are going out to all parts of the world, and names such as Hong Kong, Tokyo, Melbourne, Beira, Bombay, Sydney, Karachi, Singapore, Auckland, Lisbon, Genoa, Hamburg, Berlin, Toronto, New York, Valparaiso, Buenos Aires and Rio de Janeiro are commonly observed. It has been said that the sun never sets on the British Empire. The words "Meccano Boy" might be substituted for "British Empire"; indeed, I might go further and say "The sun always shines on Meccano boys!"

Up to this point I have confined my description of the Meccano Factory to the departments engaged in the actual production of Meccano and Hornby Trains. There are, of course, several auxiliary departments of great importance, and without reference to these my story would be incomplete.

The most important of these departments are the Model Building, Printing and Service Departments. The function of the Model Building Department is apparent from its name. Here all the splendid models that are seen in Meccano dealers' displays during the winter season are constructed. Some idea of the extent of its work may be gauged from the fact that during the past year more than 730,000 bolts and over 750,000 nuts have been used in the department! Obviously the work calls for careful organisation, and although conveyor operation is not feasible, the mass production principle is in use here as elsewhere throughout the factory.

I call to mind an occasion some years ago when it was found necessary to construct quickly several hundreds of motor car chassis models for use in a special advertising scheme. For a week or two the department resembled a motor car factory. Every member of the model building staff was called into service, some to build gear boxes, some differentials, others chassis framings, and so on until every stage of the building and assembly had been portioned out. Never were motor cars constructed so quickly!

Our photographic work is carried out in the Model Department, a specially equipped studio and dark room being provided for the purpose. All the splendid reproductions of models and of realistic looking Hornby Railway scenes are from photographs produced here.

It is unnecessary to deal in detail with the work of the Printing Department, for only a year or two ago, in describing the production of the "*M.M.*," we devoted several articles to printing operations. There is much to interest the visitor in the Department, however, for although it is yet an "infant," it is growing rapidly, and during the past year it has produced many millions of small items in printed matter, principally leaflets, labels, and small folder catalogues.

Actually these represent but a small part of our yearly printing requirements, as will be obvious when I mention a few items in the list:—900,000 copies of the "*M.M.*"; 130,000 copies of the Hornby Book of Trains; 1,500,000 Manuals of Instruction; and 500,000 Dealers' Catalogues. Huge orders

(Continued on page 85)

At the Meccano Factory

Number of pieces sprayed per day	120,000
Number of operations in making Hornby Train Sets:	
M1 Goods	726
No. 1 Goods	1,583
No. 1 Passenger	1,887
No. 2 Special Passenger	2,732
Shipping tonnage handled per day	25 tons
Timber used per week, $\frac{5}{8}$ in. and $\frac{7}{8}$ in. thickness	200,000 sq. ft.
Weight of metal handled per day ...	70 to 110 tons

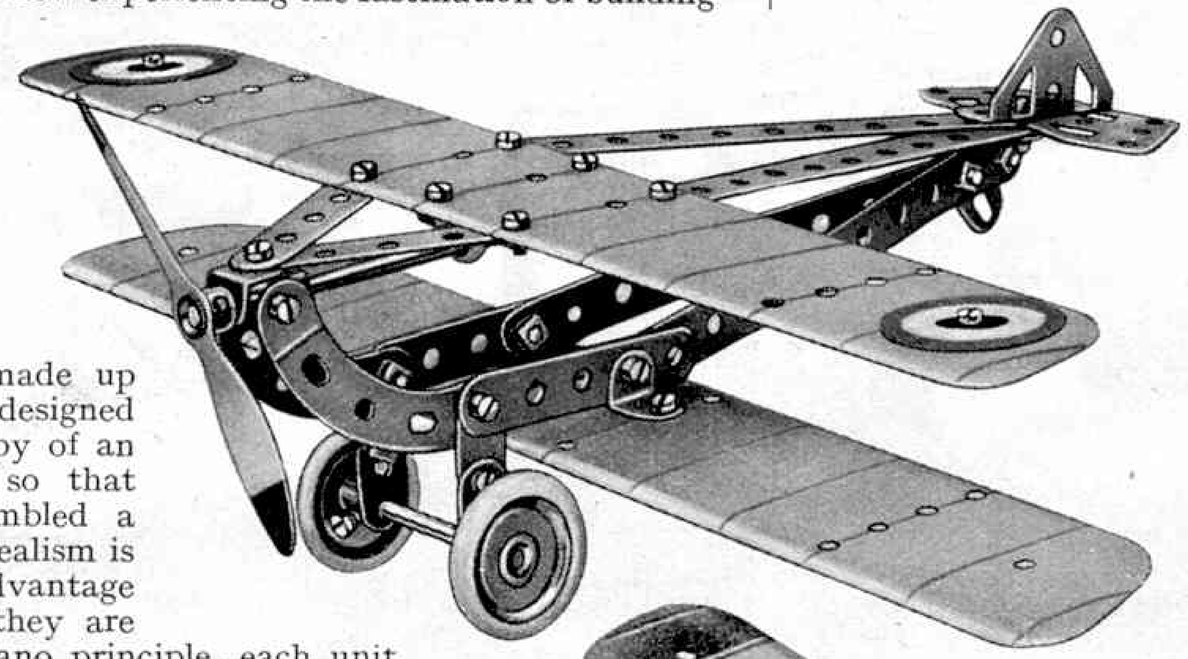
More Simple Aeroplane Models

Aero Parts Used with a Meccano Outfit

THE Meccano No. 1 and No. 2 Aeroplane Constructor Outfits have proved remarkably popular, and many thousands of Meccano boys are now experiencing the fascination of building realistic models of the latest types of aircraft, including three-engined air liners, single-seater monoplanes, seaplanes, flying boats, amphibians, and other machines.

The Aero Constructor Outfits are made up of a series of specially-designed parts, each a close copy of an actual aircraft unit, so that when these are assembled a remarkable degree of realism is obtained. A further advantage of the parts is that they are arranged on the Meccano principle, each unit being punched with holes of standard Meccano size spaced at $\frac{1}{2}''$ intervals. The Aero parts may thus be used in conjunction with standard Meccano parts, and owners of quite small Meccano Outfits may build splendid model aircraft by adding a few Aero parts.

In the "*M.M.*" for May, 1932, we illustrated and described a number of aeroplane models built in this manner, and the great interest that these models aroused has prompted us to describe this month a further selection of models. These range from simple machines built with a No. OO Meccano Outfit and a few Aero parts to more elaborate models, and all are easy to build.



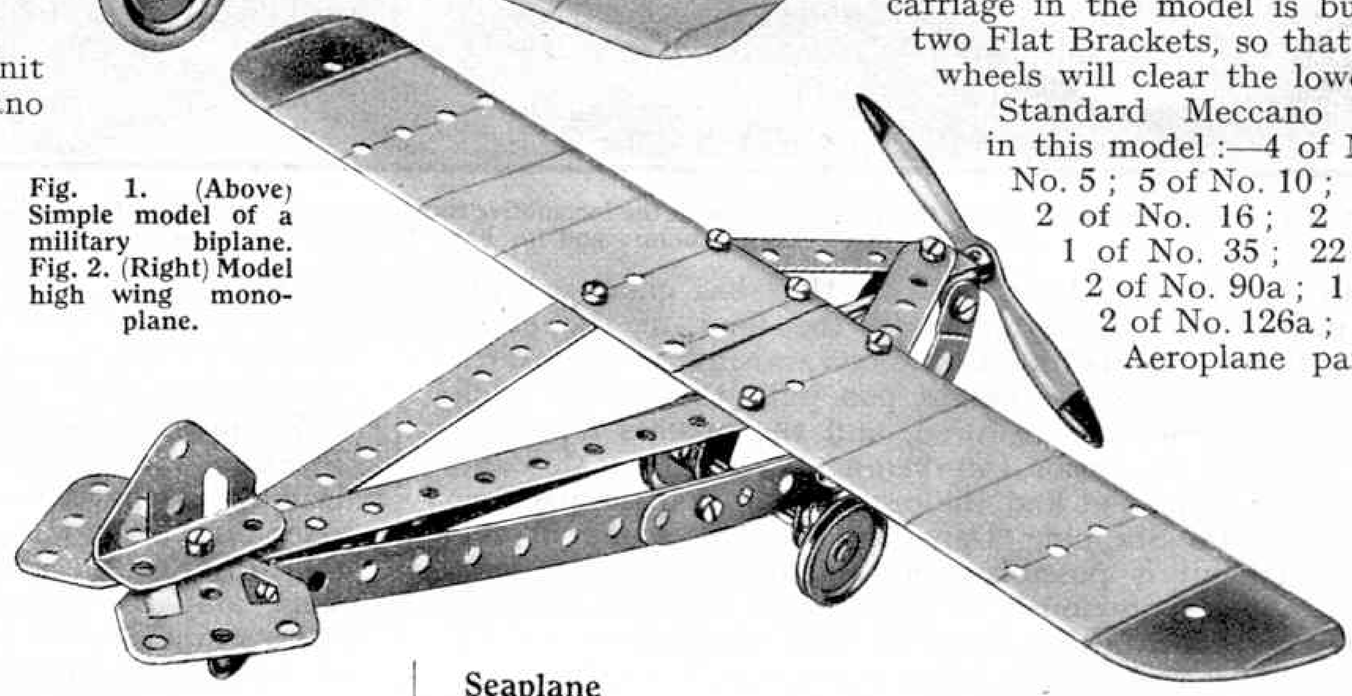


Fig. 1. (Above) Simple model of a military biplane. Fig. 2. (Right) Model high wing monoplane.

Simple Monoplane Model

In Fig. 2 is shown a simple model of a high wing single-engined monoplane that can be assembled from a No. OO Meccano Outfit with the addition of one Small Right-hand Main Plane (Aero part No. P3), one Small Left-hand Main Plane (Aero part No. P4), and a Small Propeller (Aero part No. P35). The fuselage of the model consists of $5\frac{1}{2}''$ Strips and $2\frac{1}{2}''$ straight and Curved Strips. The Small Main Planes are overlapped and bolted in position to the top Strips, and an Angle Bracket is secured to the centre of the undersurface of the wing thus formed. The Bracket forms one bearing for the Propeller shaft, which consists of a $3\frac{1}{2}''$ Axle Rod. This Rod is supported at the forward end in a second Angle Bracket attached to the nose of the machine, the small aero Propeller being fixed on the outer end of the Rod. The tail unit consists of Trunnions and two Flat Trunnions, and a Flat Bracket is secured to the rear of the fuselage of the model to form the tail skid. The landing wheel axle, a $3\frac{1}{2}''$ Rod, is mounted in Flat Brackets that in turn are bolted to the fuselage.

Standard Meccano parts used in this model :—4 of No. 2 ; 4 of No. 5 ; 3 of No. 10 ; 4 of No. 12 ; 2 of No. 16 ; 2 of No. 22 ; 1 of No. 35 ; 14 of No. 37 ; 2 of No. 90a ; 1 of No. 126 ; 2 of No. 126a ; Aeroplane parts used :—1 of No. P3 ; 1 of No. P4 ; 1 of No. P35. Note: Meccano $\frac{5}{8}''$ Rubber Rings (Part No. 155), may be fitted to the wheels if required.

Military Biplane

The model shown in Fig. 1 represents a military biplane. Actual machines of this type are fitted with two or more Vickers machine guns firing through the propeller, and a Lewis gun secured on a Scarff gimbal ring arranged over the rear cockpit. Model-builders who wish to do so will be able to devise some of these features from standard Meccano parts and fit them to the model.

The construction of the fuselage of this model is similar to that of the monoplane just described, with the exception that a second pair of Small Main Planes, one Right-hand and one Left-hand, are attached to the lower side of the fuselage by means of Angle Brackets. Each strut of the under-carriage in the model is built up from two Flat Brackets, so that the landing wheels will clear the lower plane.

Standard Meccano parts used in this model :—4 of No. 2 ; 4 of No. 5 ; 5 of No. 10 ; 7 of No. 12 ; 2 of No. 16 ; 2 of No. 22 ; 1 of No. 35 ; 22 of No. 37 ; 2 of No. 90a ; 1 of No. 126 ; 2 of No. 126a ; 2 of No. 155. Aeroplane parts used :—2 of No. P3 ; 2 of No. P4 ; 1 of No. P35 ; 2 of No. P102.

Seaplane

The model shown in Fig. 3 is built to a larger scale than the two previous examples, and it represents a single-engined cabin monoplane fitted with floats. Machines of this type are very useful in districts where rivers and lakes abound, and they are employed extensively in Canada. The model is constructed from the parts contained in a No. 1 Meccano Outfit, with the addition of one Large Right-hand Main Plane (P1), one Large Left-hand Main Plane (P2), one Large Propeller (P34), and two Aero Floats (P42).

The fuselage of the model is built up from $12\frac{1}{2}''$, $5\frac{1}{2}''$ and $2\frac{1}{2}''$ Strips. Two $2\frac{1}{2}''$ Curved Strips are bolted in position to form the front of the fuselage, and the Aero Main Planes are overlapped and bolted to the top portion of the fuselage by means of Angle Brackets. A $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is secured to the centre of the wing thus produced, and this Strip forms a bearing for the propeller shaft, a $3\frac{1}{2}''$ Rod that carries on its outer end a large Aero Propeller (P34). A Trunnion is secured to each side of the fuselage, and these Trunnions in turn support the Strips that carry the Floats. The Floats are held to the Strips by bolts that pass through the end holes of the Strips into the threaded portions in the Floats. The tail unit consists of a $5\frac{1}{2}''$ Braced Girder and two $2\frac{1}{2}''$ Strips.

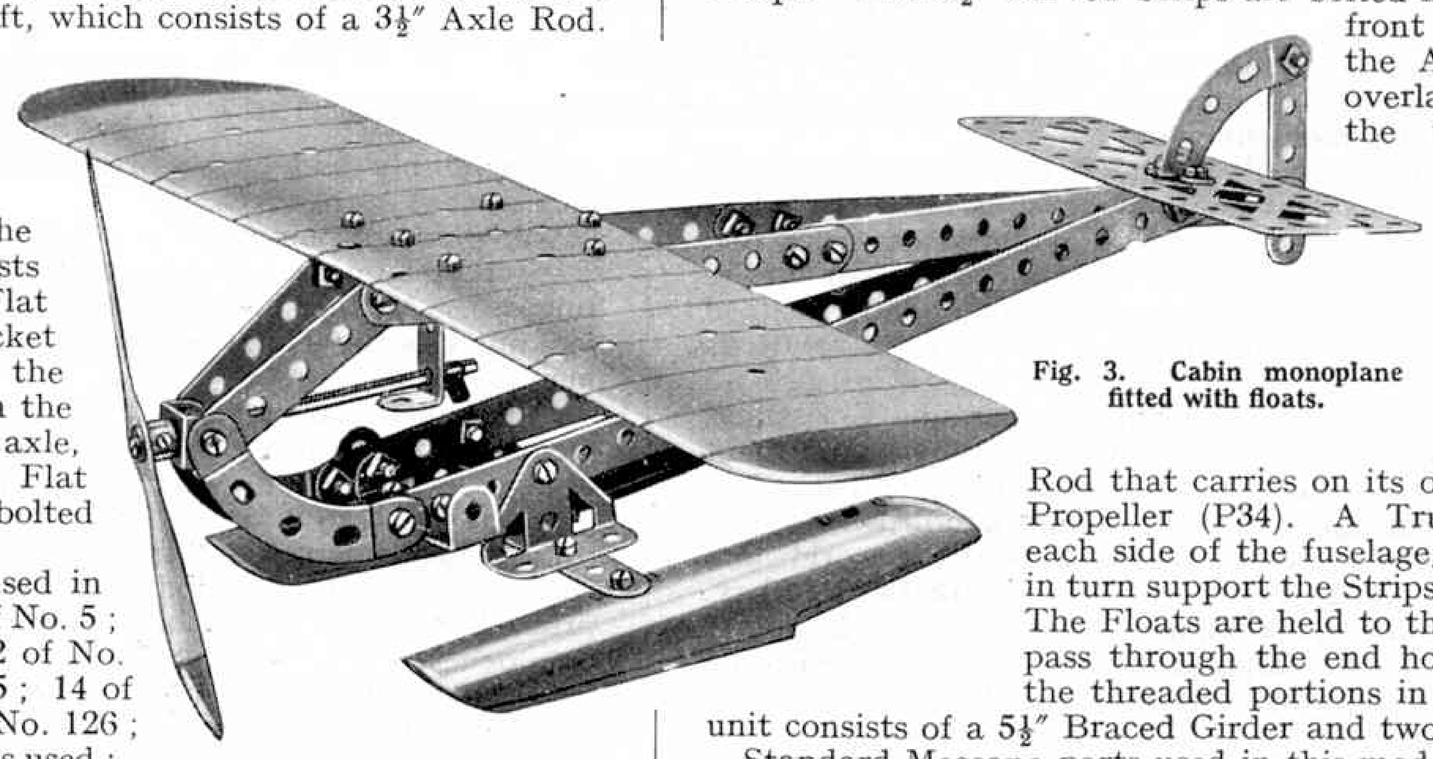


Fig. 3. Cabin monoplane fitted with floats.

Standard Meccano parts used in this model :—2 of No. 1 ; 4 of No. 2 ; 6 of No. 5 ; 1 of No. 11 ; 8 of No. 12 ; 1 of No. 16 ; 1 of No. 35 ; 3 of No. 37 ; 4 of No. 38 ; 1 of No. 48 ; 1 of No. 48a ;

1 of No. 90a; 1 of No. 100; 1 of No. 111c; 2 of No. 126. Aeroplane parts used :– 1 of No. P1; 1 of No. P2; 1 of No. P34; 2 of No. P42.

Low Wing Monoplane

The model low wing monoplane shown in Fig. 5 possesses several points of interest. Although simply constructed, it has a graceful appearance, and is a good example of how well Aero units blend with standard Meccano parts. The model is constructed with the parts contained in a No. 1 Meccano Outfit, with the addition of two Aero Main Planes, two Fuselage Side Fronts (Part No. P16), two Large Identification Discs (Part No. P101), and a Large Propeller. The fuselage of the model is built up from 5½" and 2½" Strips. A Double Bracket is secured at the nose and a 1½" × ½" Double Angle Strip is bolted in position between the Strips of the fuselage. The Double Bracket and Double Angle Strip provide bearings for the propeller shaft, which carries the Large Propeller (Part No. P34). The Main Planes and the Fuselage Side Front Sections forming the tail skid are attached to the fuselage by Angle Brackets. The undercarriage of the model is formed from a 2½" × ½" Double Angle Strip secured to the lower portion of the fuselage by means of Angle Brackets, and carries two 1" Fast Pulleys mounted on ⅜" Bolts. The Cord bracing should be attached as shown so as to keep the Planes rigid.

Standard Meccano parts used in this model :— 8 of No. 2; 6 of No. 5; 1 of No. 10; 1 of No. 11; 6 of No. 12; 1 of No. 16; 2 of No. 22; 1 of No. 35; 36 of No. 37; 1 of No. 40; 1 of No. 48; 1 of No. 48a; 1 of No. 90a; 5 of No. 112. Aeroplane parts used :—1 of No. P1; 1 of No. P2; 2 of No. P16; 1 of No. P34; 2 of No. P101.

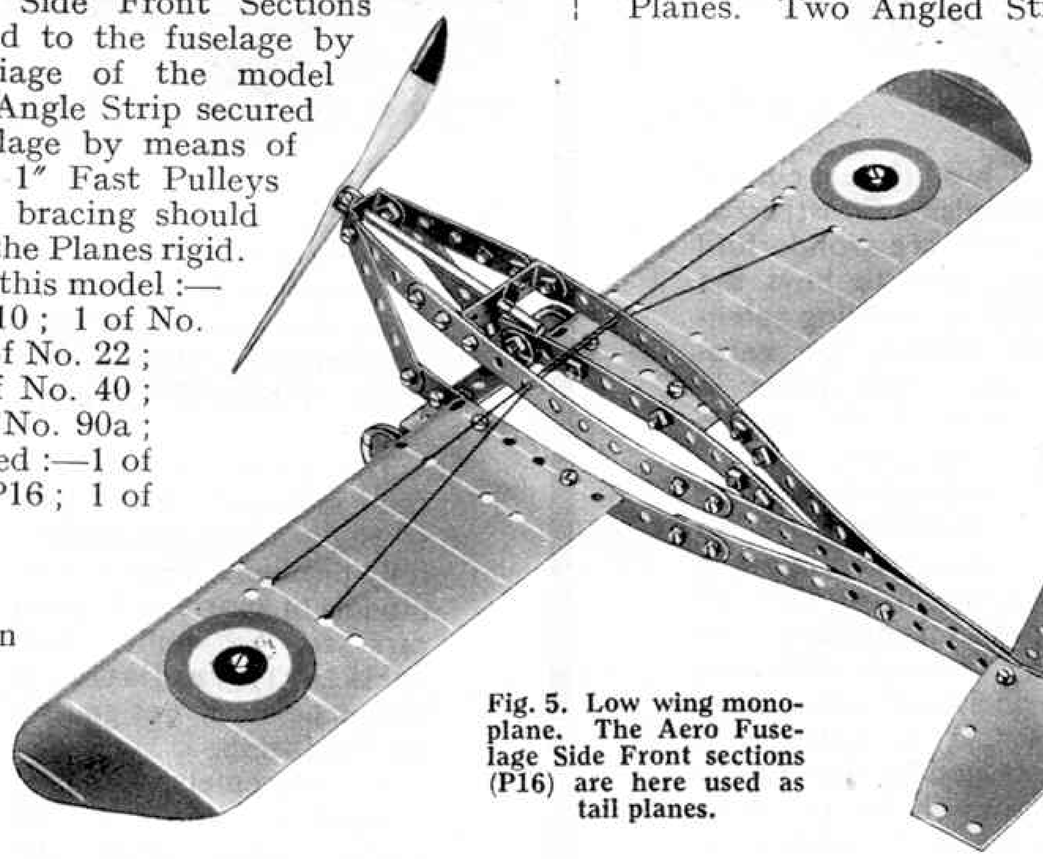


Fig. 5. Low wing monoplane. The Aero Fuselage Side Front sections (P16) are here used as tail planes.

Large Seaplane

The model shown in Fig. 4 is an imposing example of a large seaplane machine fitted with floats. The model incorporates a biplane empennage or tail unit, and makes use of both Large and Small Aero Main Planes.

The fuselage of the model is assembled from 12½", 5½" and 2½" Strips, the forward portion being carefully braced so as to ensure complete rigidity. The upper wing, made up of one Right-hand and one Left-hand Main Plane, is supported above the fuselage by means of struts consisting of Flat Brackets secured to ½" × ½" Angle Brackets, and 2½" × ½" Double Angle Strips. The tail unit consists of a Flat Trunnion to which two 5½" Braced Girders are fixed by means of Angle Brackets. The Floats are held to the fuselage by Strips and Trunnions, and the Large Propeller is mounted on a 3½" Rod journalled in the frame of the fuselage.

Standard Meccano parts used in this model :—4 of No. 1; 2 of No. 2; 8 of No. 5; 4 of No. 10; 1 of No. 11; 8 of No. 12; 1 of No. 16; 1 of No. 35; 37 of No. 37; 1 of No. 48; 2 of No. 100; 6 of No. 111c; 1 of No. 126a. Aeroplane parts used :—1 of No. P1; 1 of No. P2; 1 of No. P3; 1 of No. P4; 1 of No. P34; 2 of No. P42; 2 of No. P101.

Cabin Monoplane

Model-builders who follow the latest developments and innovations in British light aircraft design will have been interested in the new "Monospar" monoplane constructed by General Aircraft Ltd. This machine is fitted with a wing of patented construction that enables a great reduction in weight to be made while maintaining adequate strength, and its performance consequently is very high. A cabin with transparent roof is provided, and two Radial Engines are mounted on the wing.

The main features of this interesting machine have been brought out in the model shown in Fig. 6, an outstanding feature of which is the use of the Large Radial Engines (Aero part No. P46). Two of these Engines, complete with Propellers, are secured to the wing, and they give a very attractive appearance to the model. All the standard Meccano parts used in this machine will be found in a No. 2 Outfit.

The fuselage of the model is built up from 12½" Strips, 2½" Curved Strips being used to form the streamlined nose portion. The roof framework mounted on the fuselage is represented by two 12½" Strips and two 2½" Strips spaced apart by a 1½" × ½" Double Angle Bracket. The wing of the machine is built up from one Right-hand and one Left-hand Main Plane and two Extension Planes. Two Angled Struts (Part No. P30) are used to brace the wing to the Fuselage.

The landing wheels consist of 1" Fast Pulleys fitted with ⅝" Rubber Rings. These Wheels are mounted on ⅜" Bolts that are passed through the lower holes of 2½" Strips forming the undercarriage legs, and two 5½" Strips secured by Angle Brackets are used as bracing members for the legs. The tail wheel unit consists of two 1½" Strips and a ½" Loose Pulley. The Pulley is mounted freely on a ⅜" Bolt, and the upper ends of the Strips are attached to the fuselage by means of a further ⅜" Bolt.

The large Radial Engines are secured to the wings by means of Engine Brackets (Aero part No. P61).

Standard Meccano parts used in this model :—6 of No. 1; 4 of No. 2; 2 of No. 3; 7 of No. 5; 2 of No. 6a; 1 of No. 11; 12 of No. 12; 2 of No. 22; 1 of No. 23; 46 of No. 37; 6 of No. 37a; 2 of No. 48; 2 of No. 48a; 4 of No. 90a; 4 of No. 111c; 2 of No. 155. Aeroplane parts used :—1 of No. P1; 1 of No. P2; 2 of No. P8; 1 of No. P10; 1 of No. P11; 2 of No. P30; 2 of No. P34; 2 of No. P46; 2 of No. P61.

The models illustrated in this article are designed to show the realism that can be obtained when a few of the special Aero Parts are used with a small Meccano Set. The models are consequently of a simple nature, but by using a greater quantity and variety of Aero Parts even greater realism will result. The constructor may, for instance, make use of some of the Aero Fuselage sections and thus give this portion of his model a more "solid" appearance than is provided by the use of Strips alone. Many of the models will be improved by the addition of a pair of Aero Tail Planes (parts Nos. P10 and P11), and a Rudder (part No. P32). Again, the forward portion of many of the models will benefit in realism if the special Aero Undercarriage sections (parts Nos. P58 and P59) are employed in place of an undercarriage composed of Meccano Strips.

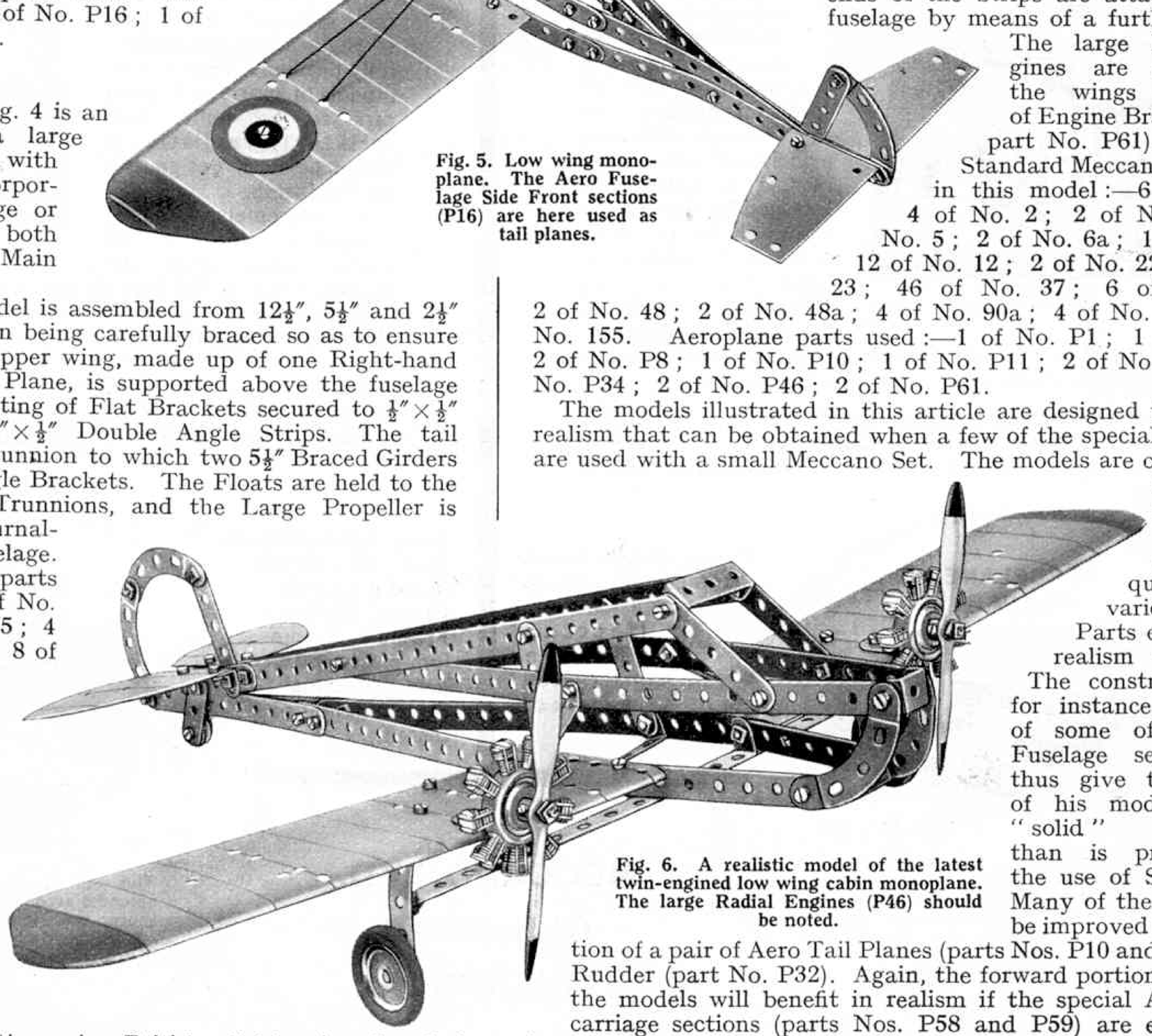
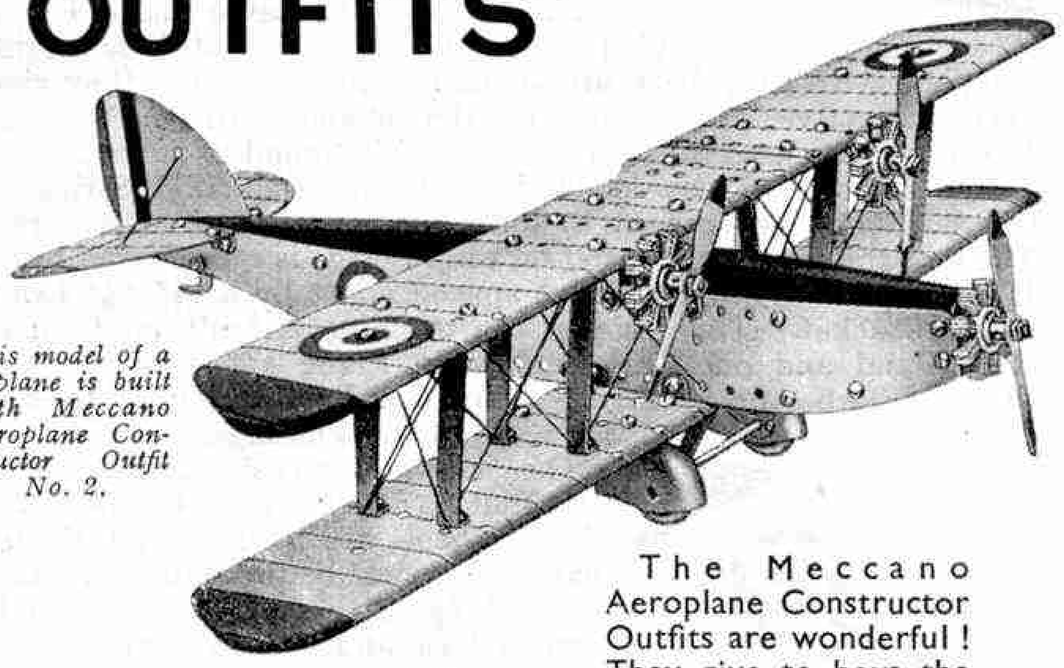


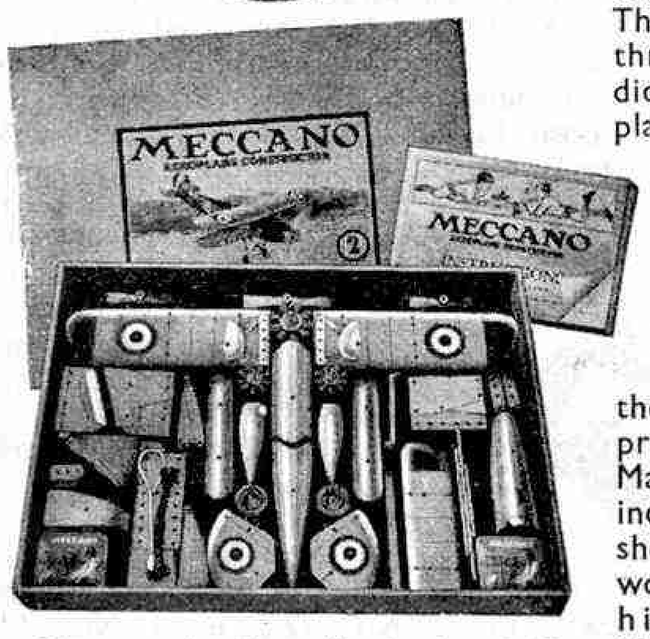
Fig. 6. A realistic model of the latest twin-engined low wing cabin monoplane. The large Radial Engines (P46) should be noted.

MECCANO

AEROPLANE CONSTRUCTOR OUTFITS



This model of a Biplane is built with Meccano Aeroplane Constructor Outfit No. 2.

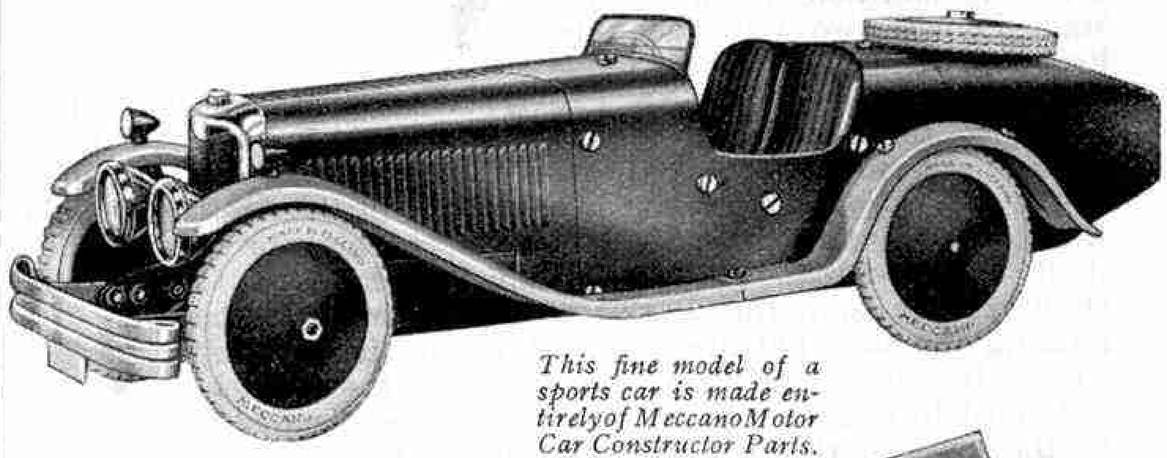


Meccano Aeroplane Constructor Outfit No. 2.

The Meccano Aeroplane Constructor Outfits are wonderful! They give to boys the thrill of building splendid models of aeroplanes. The parts in these Outfits enable aeroplane construction to be carried out on sound engineering lines. They are all interchangeable on the famous Meccano principle. The illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low-wing Monoplanes, Biplanes, Seaplanes and giant amphibian machines; in fact, models of almost every type of aircraft can be made with these splendid Outfits.

Meccano Aeroplane Constructor Outfit No. O Price **5**/–
Meccano Aeroplane Constructor Outfit No. 1 Price **9**/–
Meccano Aeroplane Constructor Outfit No. 2 Price **16/6**

MOTOR CAR CONSTRUCTOR OUTFIT



This fine model of a sports car is made entirely of Meccano Motor Car Constructor Parts.

Every boy who is keen on model-building will welcome this new Motor Car Constructor Outfit, the latest Meccano development.

The parts contained in this splendid Outfit are strongly made and beautifully finished. They enable models of sports and speed cars to be built, each strikingly realistic—a masterpiece of design and workmanship.

An extremely powerful clockwork motor is included which gives the models a run of 150 feet on one winding.



Meccano Motor Car Constructor Outfit.

The Outfit is available in three different colour combinations as indicated below. The beautiful colouring of the parts is another feature that makes this one of the most attractive toys ever produced. Please specify the colour you require when ordering, or, better still, ask your dealer to show you a specimen of each Outfit. Price **25**/–

Body: Choice of Red, Blue or Green. **Mudguards:** Cream. **Radiator Frame:** Chromium-plated. **Bumpers and Lamps:** Chromium-plated.

If you want to know something about aeronautics, buy a Meccano Aeroplane Constructor Outfit today.

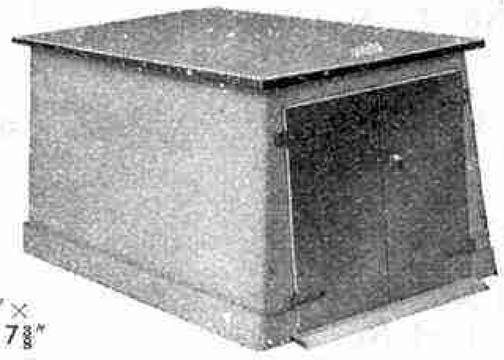
AEROPLANE HANGAR



29½" × 22" × 12¾"

This splendid hangar, with its realistic double sliding doors, has been specially designed to house model aeroplanes. It will accommodate six machines built with the No. O Meccano Aeroplane Constructor Outfit, or two built with either No. 1 or No. 2 Outfits. Price **25**/–

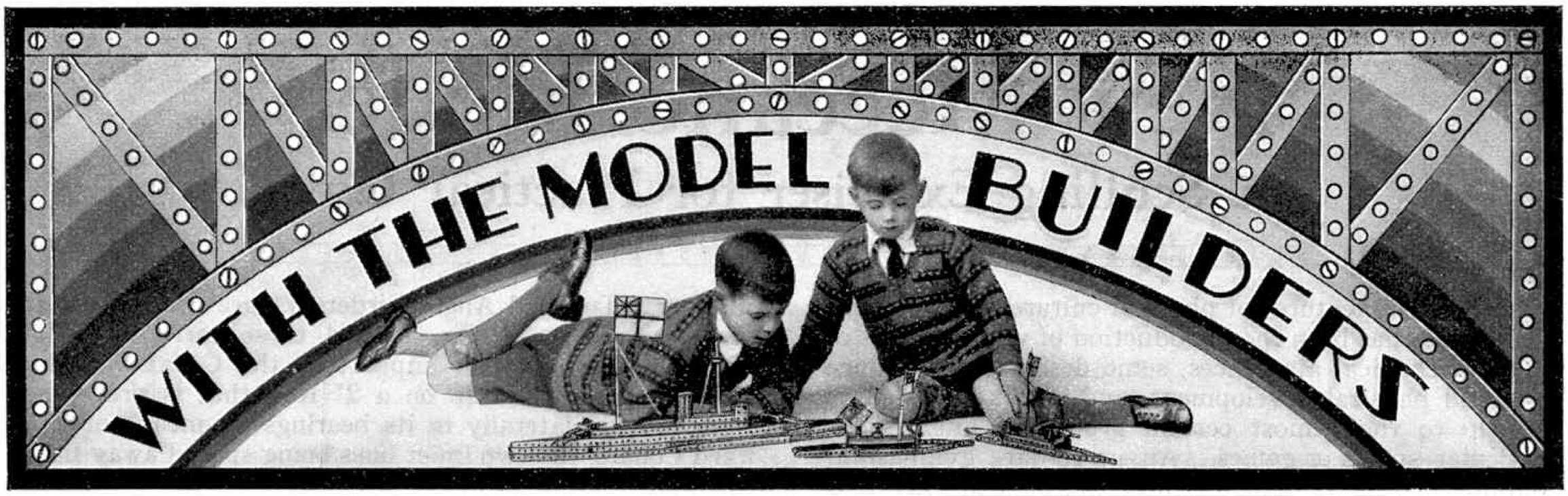
MOTOR CAR GARAGE



14⅞" × 9" × 7⅞"

This miniature garage provides splendid accommodation for a model motor car. It is strongly built, and its pebble-dash finish gives it an extremely attractive appearance. Price **10/6**

MECCANO LTD.
OLD SWAN
LIVERPOOL



THE NEW AERO WHEEL

Among the new Aero parts that have recently been added to the Aeroplane Constructor Outfits, the Landing Wheel (part No. P53) is of particular interest. The Wheel is of special construction, the boss and set screw being placed between the discs of the Wheel; and the part thus has the 'clean' appearance that is a feature of an actual aeroplane landing wheel. In order to give the complete assembly an up-to-date appearance the old small-section Rubber Tyre (part No. P44) has been discarded and a new tyre of thicker section representing one of the latest low-pressure aero tyres has been substituted. This new Tyre is specially designed to fit into the "well base" rim of the Aero Wheel, and consequently it cannot be fitted to a Meccano 1" Pulley used in model aeroplanes constructed from standard Meccano Parts, as was possible with the original Aero Landing Wheel Tyres.

Many Meccano model-builders will wish to fit aeroplane-type tyres—with smooth-treads as distinct from the studded treads of the Meccano Dunlop Tyres intended for model motor cars—and an excellent substitute for the smooth-treaded Tyre may be formed by a Meccano ⅝" Rubber Ring (Part No. 155). The Ring may be fitted to the groove of a 1" Fast Pulley Wheel, and it will be found to give a very realistic appearance to the complete assembly. For maximum realism, however, the Aero Wheel complete with Aero Tyres should be employed, and as the boss of the special Aero Wheel is drilled with standard Meccano bore, the Wheel may be used in models built partly with Meccano parts.

ELECTRICAL WIRING IN MECCANO

A model that incorporates one or more mechanical movements is very interesting to operate, and when electrical gear is included in addition the interest is increased to a considerable extent. The special Meccano Electrical Parts make electrification of Meccano models a simple matter, but one or two points must be kept in mind when wiring a model for electrical gear, if good results are to be obtained.

In order to light an electric lamp or energise a solenoid, it is necessary to use two separate conductors from the apparatus to the dry battery or accumulator. In models built in metal, however, it is possible to simplify the circuit and use the frame of the model itself as one of the conductors. This is known as the "earth return" system, and it is employed extensively in actual engineering, as for example in motor cars, electric locomotives, etc.

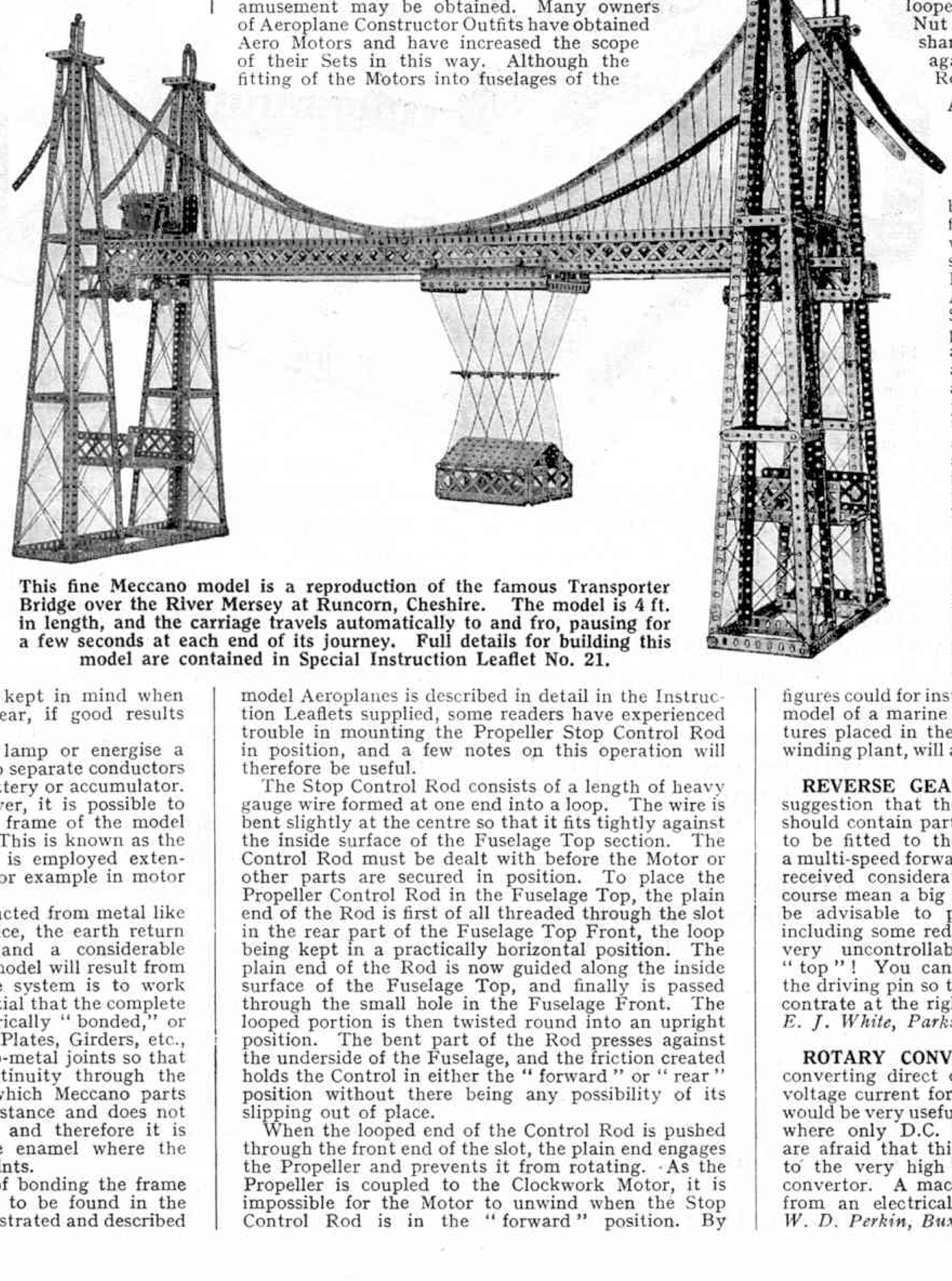
As Meccano models are constructed from metal like their prototypes in actual practice, the earth return system is equally applicable, and a considerable simplification of the wiring of a model will result from the use of this method. If the system is to work satisfactorily, however, it is essential that the complete framework of the model is electrically "bonded," or in other words, that the Strips, Plates, Girders, etc., are bolted together with metal-to-metal joints so that there is complete electrical continuity through the framework. The enamel with which Meccano parts are finished is an insulating substance and does not permit the flow of electricity; and therefore it is necessary to scrape away the enamel where the parts come in contact at the joints.

An instance of the necessity of bonding the frame of the model in this manner is to be found in the Meccano aer al bombing game illustrated and described on pages 774-775 of the October, 1932, "*M.M.*" The current feeding the solenoids in the aeroplanes in the model is led to the coils by means of the frame of the revolving axle, and this makes it possible to use only two insulated collector rings. If in building this model all the joints are not bonded, the current will be unable to reach the solenoids and consequently the model will not work.

Electrical wiring in Meccano is quite a simple operation, and provided that reasonable care is taken in carrying out the work excellent results may be obtained.

FITTING THE AERO MOTORS

By fitting either the No. 1 or No. 2 Aero Motor to a model built with Aeroplane Constructor parts, a great deal of additional interest and amusement may be obtained. Many owners of Aeroplane Constructor Outfits have obtained Aero Motors and have increased the scope of their Sets in this way. Although the fitting of the Motors into fuselages of the model Aeroplanes is described in detail in the Instruction Leaflets supplied, some readers have experienced trouble in mounting the Propeller Stop Control Rod in position, and a few notes on this operation will therefore be useful.



This fine Meccano model is a reproduction of the famous Transporter Bridge over the River Mersey at Runcorn, Cheshire. The model is 4 ft. in length, and the carriage travels automatically to and fro, pausing for a few seconds at each end of its journey. Full details for building this model are contained in Special Instruction Leaflet No. 21.

The Stop Control Rod consists of a length of heavy gauge wire formed at one end into a loop. The wire is bent slightly at the centre so that it fits tightly against the inside surface of the Fuselage Top section. The Control Rod must be dealt with before the Motor or other parts are secured in position. To place the Propeller Control Rod in the Fuselage Top, the plain end of the Rod is first of all threaded through the slot in the rear part of the Fuselage Top Front, the loop being kept in a practically horizontal position. The plain end of the Rod is now guided along the inside surface of the Fuselage Top, and finally is passed through the small hole in the Fuselage Front. The looped portion is then twisted round into an upright position. The bent part of the Rod presses against the underside of the Fuselage, and the friction created holds the Control in either the "forward" or "rear" position without there being any possibility of its slipping out of place.

When the looped end of the Control Rod is pushed through the front end of the slot, the plain end engages the Propeller and prevents it from rotating. As the Propeller is coupled to the Clockwork Motor, it is impossible for the Motor to unwind when the Stop Control Rod is in the "forward" position. By drawing the Control Rod back to the rear end of the slot, however, the plain end of the Control is disengaged from the Propeller, which consequently is free to rotate.

In models of the monoplane type where the wing does not cover the front portion of the fuselage, the looped end of the Stop Control is readily accessible and may be operated with ease by means of the fingers. In biplane models it is not so easy to move the Control, however, as the upper plane partly covers the Control; and it is here that the Stop Control Extension supplied with the Motors should be used. This part consists of a short rod bent up at one end and threaded at the other. To fit the Extension to the looped end of the Control Rod, a standard Nut is first of all screwed on to the Extension and the threaded portion passed through the looped end of the Control, a second Nut being screwed on to the threaded shank. The nuts are finally locked against the looped end of the Control Rod by means of Spanners.

AN ENGINEERING STAFF IN MINIATURE

Set No. 4 in the Modelled Miniatures Series is of particular interest to Meccano model-builders. The Set consists of six figures each representing a typical worker in an engineering shop, shipyard, etc. There are two Fitters, a Greaser, an Engine Room Attendant, an Electrician and a Storekeeper. One of the Fitters is provided with a set of buff overalls, and the other is clothed in blue; and the Engine Room Attendant is attired in a blue boiler-suiting jacket and trousers. The Electrician is dressed in blue overalls and a blue cap, and carries in one hand a small drum of electric cable, and in the other a black case representing an insulation testing machine. The Greaser is provided with a buff boiler-suit, and carries an oil can of the well-known "K" type, a smaller version of the Meccano Oil Can No. 2. Finally there is the Storekeeper wearing a buff dust coat and carrying a "stock list" in one hand. These figures look very effective when placed in suitable Meccano models. Some of the figures could for instance, be arranged around a working model of a marine engine, while several of the Miniatures placed in the engine house of a model pit-head winding plant, will add a "life-like" touch to the scene.

REVERSE GEAR.—We were interested in your suggestion that the Meccano Motor Car Constructor should contain parts that would enable a reverse gear to be fitted to the models. The idea of providing a multi-speed forward and reverse gear-box has already received consideration, but this addition would of course mean a big increase in the cost. It would not be advisable to provide a reverse action without including some reduction gearing as the car would be very uncontrollable when running backward in "top"! You can test this for yourself by moving the driving pin so that it engages with the teeth of the contrate at the right-hand side of the car. (*Reply to E. J. White, Parkstone.*)

ROTARY CONVERTER.—A special machine for converting direct current from house mains to low-voltage current for feeding the Meccano 6-volt Motor would be very useful to constructors who live in districts where only D.C. current supply is available. We are afraid that this is impracticable, however, owing to the very high cost of manufacture of a rotary convertor. A machine of this type may be obtained from an electrical store for about £10. (*Reply to W. D. Perkin, Buxton.*)

New Meccano Model

A Sculling Exerciser for Practical Use

ONE of the features of physical culture during recent years has been the introduction of various kinds of mechanical appliances, some designed to produce all-round physical development, and others intended to develop to the utmost certain groups of muscles for particular sports or games. An up-to-date gymnasium contains many examples of these mechanical aids, and among them one of the most interesting is what is known as the sculling exerciser. This appliance, as its name implies, is of great value to oarsmen, but in addition it is useful for anyone who wishes to improve his physical condition. An exerciser of this type fitted with a sliding seat brings into action almost every voluntary muscle in the body, and it enables deep rhythmical breathing exercises to be carried out without any abnormal strain being placed on the heart.

The Meccano model described in this article has as its original one of the latest types of sculling exerciser, and it is capable of being used by either a boy or an adult.

Construction should be commenced with the two main girders, each of which is built up in the following manner. Three 24½″ Angle Girders are placed end to end, and two 24½″ and two 12½″ Angle Girders are then bolted to these as shown in Fig. 2, thus forming a long reversed angle girder. Two of these are constructed, and when joined together they form a very strong flanged channel section girder. If desired the joints in the complete girder may be further strengthened by the use of 2″ Strips. When both main girders are complete they are secured together by a number of 12½″ Angle Girders, one of which is placed at every 13th hole. In order to add strength to the structure a double 12½″ Angle Girder is placed at every fifth position. Two inner rails, each of which is built up from three 24½″ Angle Girders, are now fitted, and are placed 11 holes apart, Bolts being used to secure them at every point where they cross a 12½″ Angle Girder.

A 5½″ × 2½″ Flat Plate 2 is now fitted to each of the main girders at a point 16″ from the end of the frame, and these two Plates carry 7½″ Angle Girders, the upper ends of which are joined together by two 12½″ Angle Girders 6, bolted together to form a channel section girder. Two vertical 6″ Rods 2 are also fitted, and are held in place by means of Couplings.

The guide-pulley system is constructed in the following manner. Two 7½″ Angle Girders 11 are first bolted in place as shown in Fig. 2, and these carry one Flat Trunnion of each pair supporting the Collar 9. This Collar is free to rotate on a 2″ Rod that is prevented from moving laterally in its bearings by means of four fixed Collars, the two inner ones being spaced away from the Flat Trunnions by means of four Washers. These inner Collars each support a Pivot Bolt carrying two loosely mounted Collars, and they are held in a downward position by means of a Small Fork Piece 10. This Fork Piece is secured to a Threaded Pin mounted on the inner flange of one of the main girders of the model. The complete arrangement forms a very efficient guide for the cord connecting the springs with the handles.

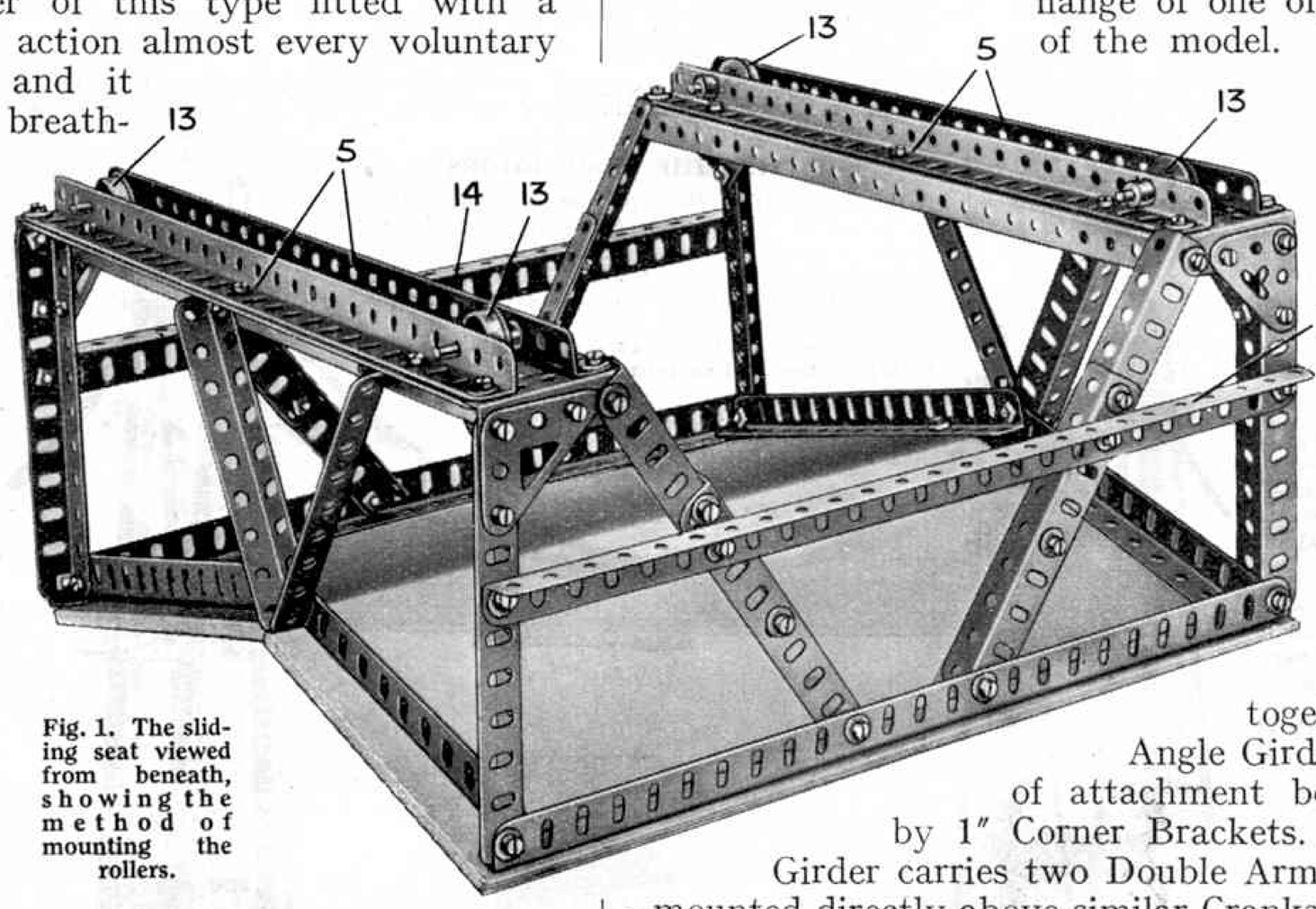


Fig. 1. The sliding seat viewed from beneath, showing the method of mounting the rollers.

The Flat Trunnions 12 are now fitted and each of these carries a 2″ Angle Girder. These two short Girders are connected together by a 12½″ Angle Girder, the two points of attachment being strengthened by 1″ Corner Brackets. The 12½″ Angle Girder carries two Double Arm Cranks that are mounted directly above similar Cranks on the inner rails of the frame of the model. A 2½″ Rod is held securely in each pair of Double Arm Cranks, and these form supports for the deep groove pulleys 1. These pulleys are each built up from two 4″ Circular Plates placed one on each side of a 3″ Pulley Wheel. The three parts are held securely together by means of four ½″ Bolts, each Bolt being fitted with two locknuts in order that the 3″ Pulleys may not be crushed. The complete pulleys are carried loosely on their respective Rods between two Collars.

The exercising spring, or springs, for the arms may now be fitted, the arrangement of which is shown clearly in Fig. 2. The springs employed on this model are Terry's rubber strands fitted with patent non-slip clips, but if desired steel springs may be used. If neither of these is available six or eight strands of ¼″ square elastic may be used.

The spring is attached by one of its clips to the end 12½″ cross girder of the frame and the remaining clip has an 8″ Rod 4 passing through it. Two ½″ fast Pulleys 3 are then placed on each side of the clip and clamped securely on the Rod. This Rod is fitted at each end with a small Flanged Wheel free to rotate between two Collars, and in this manner a cross-head is formed

that prevents the spring from catching on the $12\frac{1}{2}$" cross girders. In Fig. 2 the Flanged Wheels are shown at the side of the inner rails, but normally they run on the up-turned edge of the Girder forming the rails.

The two $\frac{1}{2}$" fast Pulleys 3 are now fitted with their cords, which are passed once round the pulleys, the loose end then being bound or sliced to the running end. These cords are passed round their respective pulleys 1 and under the Collars 9, the remaining ends then being attached to $\frac{1}{2}$" fast Pulleys in a similar manner to the fittings at 3. The fast Pulleys are each secured on a $1\frac{1}{2}$" Rod that is carried in the centre holes of the $4\frac{1}{2}$" channel section girder forming the base of the handle 8.

The construction of the handles is shown clearly in Figs. 2 and 3, but it should be noted that the 4" Rods supplied with the Wood Rollers are removed and $4\frac{1}{2}$" Rods fitted in their place. When the exerciser is in operation the Rods 2 prevent the cords from chafing on the Plates 7.

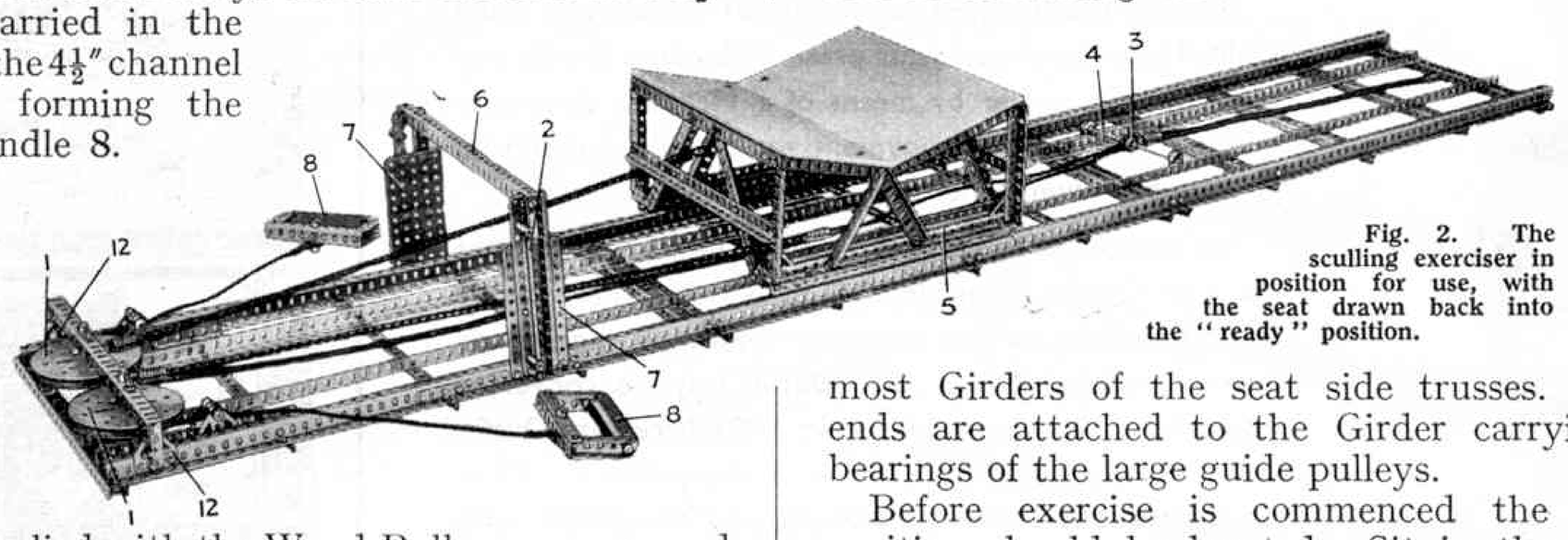


Fig. 2. The sculling exerciser in position for use, with the seat drawn back into the "ready" position.

The construction of the sliding seat may now be commenced, and Fig. 1 should be referred to at this stage of the construction. Each pair of side girders 5 are constructed as shown in the illustration, the necessary connections being made between the two by means of 2" Angle Girders at each end and a 2" trip in the centre. Each outer corner of the double girders carries a vertical $5\frac{1}{2}$" Angle Girder held rigidly in place by means of two large Corner Brackets, and the opposite Girders of each side are then joined together across their ends by means of two $12\frac{1}{2}$" Angle Girders. Four bracing members are fitted as shown in the photograph, each consisting of two $4\frac{1}{2}$" Angle Girders overlapping five holes. In order to give extra gripping power, Bolts, passing through the slotted holes of the girders, should carry a Washer under their heads, as they are likely to be forced through the holes if any pressure above normal is applied.

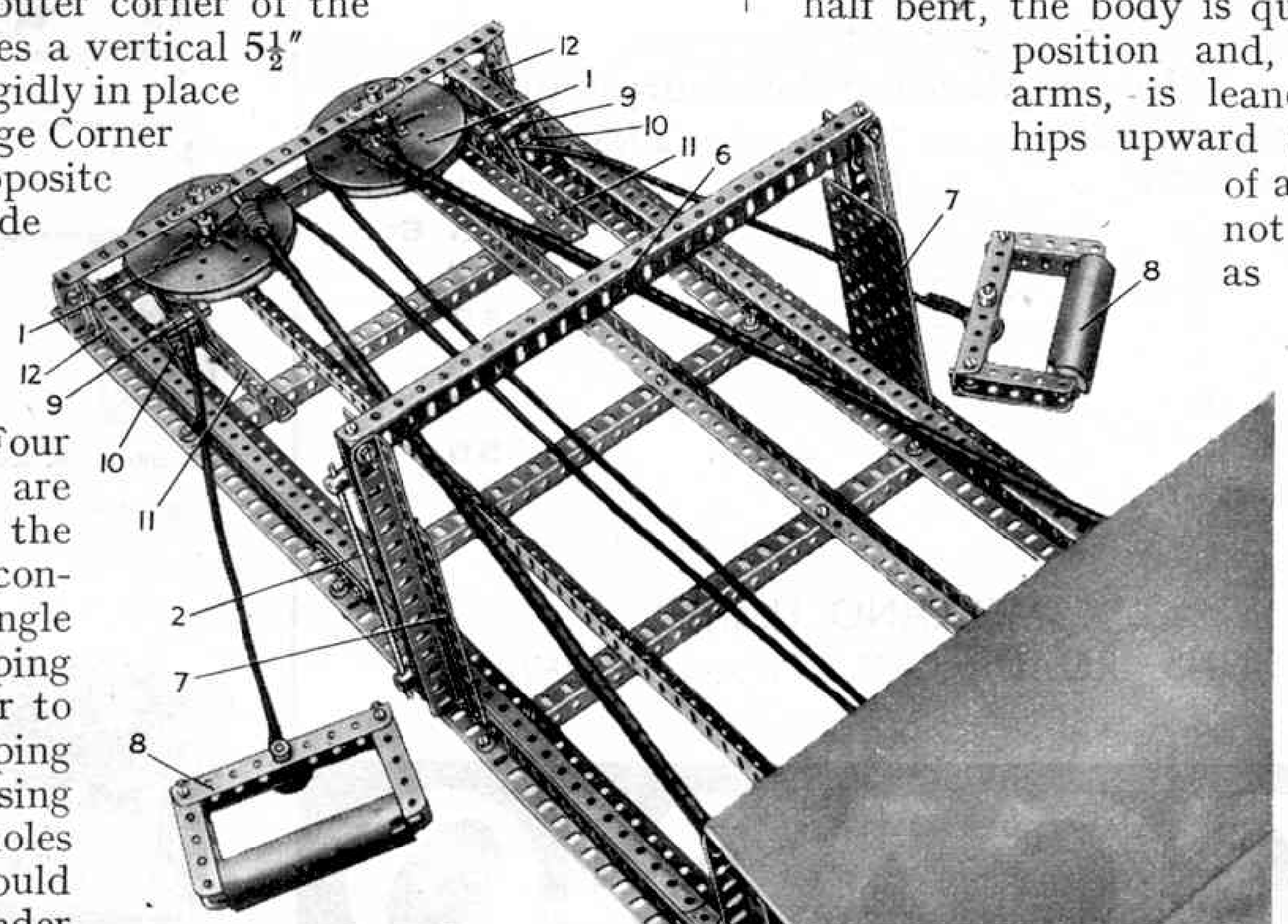


Fig. 3. A plan view of the fore portion of the machine, showing the guide-pulley arrangement.

A truss is now built on each side of the frame from two $4\frac{1}{2}$" Angle Girders and the two legs are spaced $4\frac{1}{2}$" apart. The foremost leg is fitted in place $3\frac{1}{2}$" from its end of the side girder. The apex of the truss carries the inner ends of a $5\frac{1}{2}$" and a $7\frac{1}{2}$" Angle Girder, the outer ends of which are attached to the $5\frac{1}{2}$" corner girders of the seat. Two three-ply boards are now required, the measurements of which are $7\frac{1}{2}$" × $12\frac{1}{2}$" and $5\frac{1}{2}$" × $12\frac{1}{2}$" respectively, and these are secured to the seat, as shown in Fig. 1, by means of $\frac{3}{8}$" Bolts carrying Washers under their heads. The rollers of the seat, of which there are four, are composed of $\frac{3}{4}$" Flanged Wheels rotating loosely on 2" Rods. These Rods are held in place by means of Collars in the third holes from each end of the down-turned flanges of the side girders.

Care must be taken to see that the Flanged Wheels rotate freely on their respective Rods, for if the Rods turn in their bearings unnecessary friction will be caused. The Flanged Wheels run on the inner corners of the two main girders of the model, which form very smooth and level-running rails.

The seat is operated against the combined action of two springs clipped at one end to the foremost Girders of the seat side trusses. The opposite ends are attached to the Girder carrying the upper bearings of the large guide pulleys.

Before exercise is commenced the correct body position should be learned. Sit in the groove of the seat with feet on the ground and alter the position until the easiest sitting posture is found. The feet are then raised on to the rest 6 and both brought as near together as possible. Bend the body well forward from the hips and grasp the two handles 8, after which the legs are straightened with a vigorous jerk. This movement is followed through by a long pull with the arms, the movement of which must start slowly and end with a snap. When the arms are approximately half bent, the body is quickly brought into an upright position and, with the last snap of the arms, is leaned backward until from the hips upward the body takes up an angle of about 15°. The exercise should not be practised violently at first, as this is apt to destroy the rhythm of movement.

The model shown in Fig. 2 is fitted with one spring, but if desired two or three may be used. It should be noted that the tension on the seat is only just sufficient to return the seat carrying the person exercising. In training for rowing it is better to dispense with the spring and to substitute toe straps. The movement will then be identical with that experienced in a racing skiff.

As the springs are fitted with quick-release clips they may be detached from the sculling exerciser, together with the two handles, and used as chest expanders.

The following are the parts required to build the Meccano Sculling Exerciser :—

4 of No. 1a	2 of No. 15a	4 of No. 62b	4 of No. 146a
12 " " 6	2 " " 16b	4 " " 63	4 " " 147b
26 " " 7	8 " " 18a	2 " " 70	1 piece of thin board $7\frac{1}{2}$" × $12\frac{1}{2}$"
40 " " 8	2 " " 19b	2 " " 106	1 piece of thin board $5\frac{1}{2}$" × $12\frac{1}{2}$"
8 " " 8b	6 " " 20b	10 " " 111a	3 rubber or steel chest expanders.
6 " " 9	4 " " 23a	2 " " 111c	
16 " " 9a	320 " " 37	2 " " 116a	
8 " " 9d	18 " " 37a	6 " " 126a	
6 " " 9e	118 " " 38	8 " " 133	
3 " " 14	34 " " 59	4 " " 133a	



Boys, get an Accessory Outfit— and build more models!

Think of the hundreds of additional models you could build if you converted your present Meccano Outfit into the one next higher by means of a Meccano Accessory Outfit. The fun and enjoyment you already obtain from your hobby would increase tremendously.

The purpose of Meccano Accessory Outfits is to connect the main Outfits from No. OO to No. 7. They may be well described as the stepping stones to bigger and better models. A No. OO Outfit may be converted into a No. O by adding to it a No. OOa Accessory Outfit, and a No. Oa would then convert it into a No. 1. Thus, no matter how small the Outfit you commence with you may build it up by degrees until you possess all the parts contained in the largest Outfit.

An Accessory Outfit No. OOOa is not supplied, but details of the extra parts required to build all the models in the No. OO Manual will be found in the Instruction Folder included in the No. OOO Outfit.

GET THE ACCESSORY OUTFIT YOU WANT TO-DAY—AND HAVE MORE FUN!

Prices of Meccano Accessory Outfits

No. X1a converts a	No. X1	Outfit into a	No. X2		**1/–**
,, OOa	,,	,,	OO	,,	,,	,,	O	**1/6**
,, Oa	,,	,,	O	,,	,,	,,	1	**5/6**
,, 1a	,,	,,	1	,,	,,	,,	2	**7/–**
,, 2a	,,	,,	2	,,	,,	,,	3	**12/6**
,, 3a	,,	,,	3	,,	,,	,,	4	**26/–**
,, 4a	,,	,,	4	,,	,,	,,	5	**17/6**
,, 5a*	,,	,,	5	,,	,,	,,	6	**55/–**
,, 6a†	,,	,,	6	,,	,,	,,	7	**235/–**

* Carton. † Enamelled cabinet.

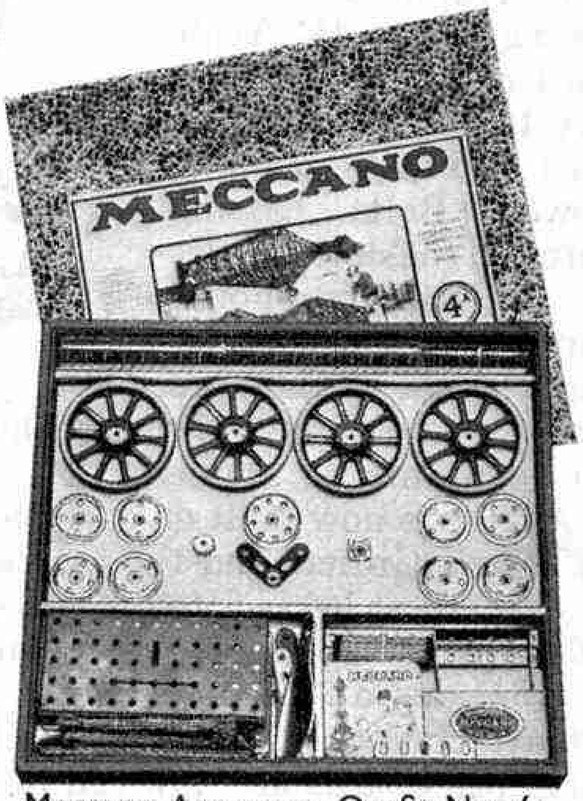
MECCANO LIMITED,
BINNS ROAD, OLD SWAN, LIVERPOOL



Meccano Accessory Outfit No. 2a
Price **12/6**

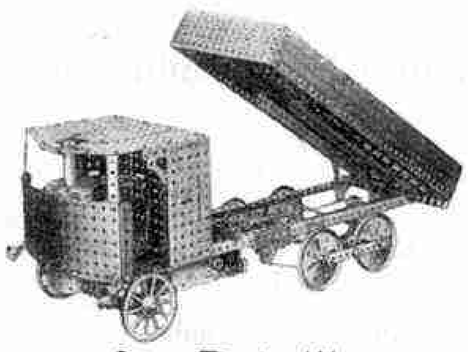


Meccano Accessory Outfit No. 3a
Price **26/–**

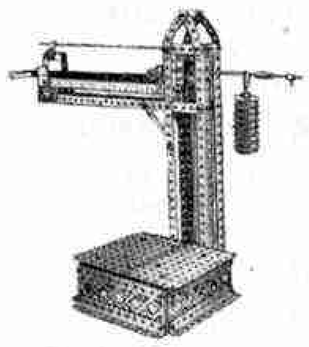


Meccano Accessory Outfit No. 4a
Price **17/6**

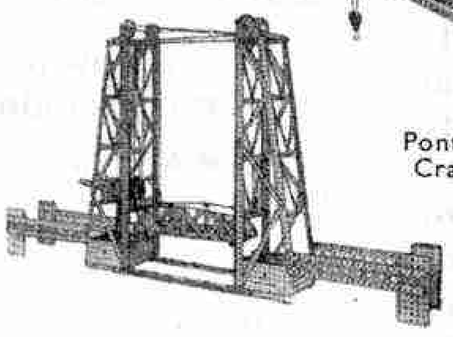
MECCANO



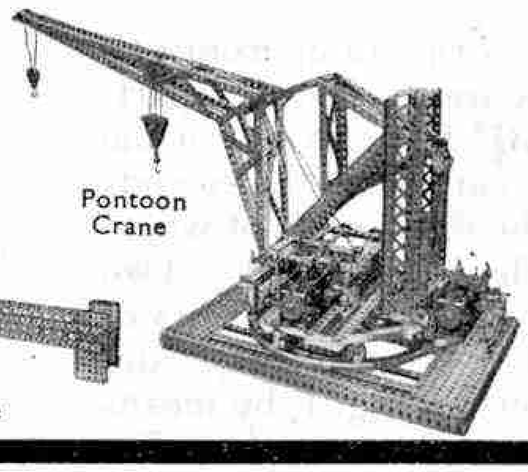
Steam Tipping Wagon



Platform Scales



Vertical Lift Bridge



Pontoon Crane

Model-Building Contests Results

By Frank Hornby

"May" Competition (Overseas Section)

In this Competition, which was announced in the May 1932 issue of the "*M.M.*," competitors were allowed to submit models of any kind whatever, and no restrictions were made as to the size of Outfit or number of parts to be used in building the models. As a result of the liberty competitors thus enjoyed, the entries covered a wide range of subjects, including such greatly differing examples of engineering as cranes, fairground attractions, calculating machines, and an Indian type wool balling machine.

The standard of construction of the majority of the entries was very good indeed and the judges had some difficulty in deciding the principal prize-winners. The full list of awards that have been made in the Overseas Section is as follows :—

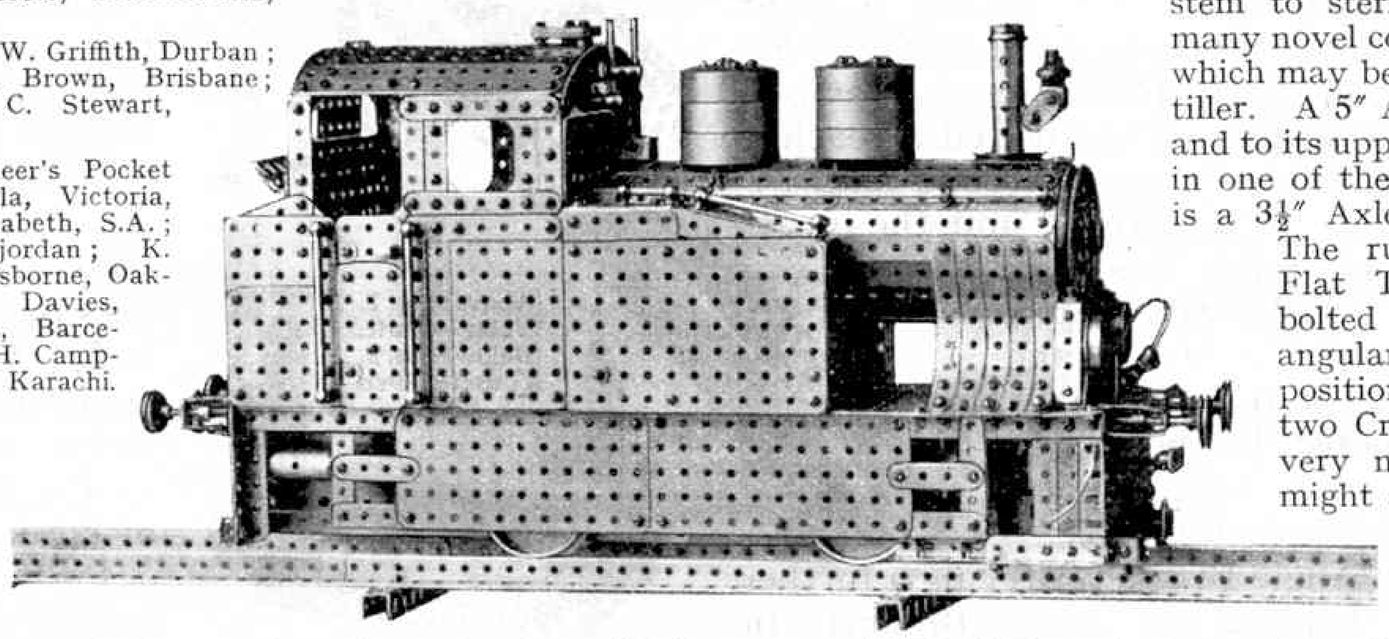
FIRST PRIZE, Meccano or Hornby goods value £3-3s.: Frank van Bulck, Brussels. SECOND PRIZE, goods value £2-2s.: Edwin Cass, Lachine, P.Q., Canada. THIRD PRIZE, goods value £1-1s.: B. Rietti, Rheinfelden, Switzerland.

FIVE PRIZES of goods value 10/6: J. Anglada Roca, Barcelona; G. Burton, Gotha, Germany; N. Paola, Durban; J. Ringnalda, Leeuwarden, Holland; A. Cloete, Bloemfontein, O.F.S.

FIVE PRIZES of goods value 5/-: W. Griffith, Durban; L. Ghyssaert, Courtrai; G. Brown, Brisbane; J. Pienaar, Johannesburg; C. Stewart, Durban.

TEN PRIZES of Meccano Engineer's Pocket Books: D. Harrison, Benalla, Victoria, Aust.; H. Wilmot, Port Elizabeth, S.A.; T. Robson, Amman, Transjordan; K. Orams, Blenheim, N.Z.; L. Osborne, Oakleigh, Victoria, Aust.; L. Davies, Johannesburg; J. Franquesa, Barcelona; N. Variava, Bombay; H. Campbell, Capetown; B. Choksi, Karachi.

CERTIFICATES OF MERIT: B. Hyde, Johannesburg; M. Rankin, Melbourne; G. Chandra, Bareilly, India; P. Morgan, Christchurch, N.Z.; P. Rajagopal, Jaffna, Ceylon; J. Burkitt, Branxton, N.S.W.; E. McIntosh, Southbrook, N. Canterbury, N.Z.; W. Jackson, Que Que, S.A.; D. Wilson, Calcutta; M. Ayson, Invercargill, N.Z.; A. Eden, Ashburton, N.Z.; H. Sohoni, Poona City, India; P. Rose, Pinetown, Natal; M. Leigh, Auckland.



A model of a tram-locomotive in the streets of Holland. It was built by J. Ringnalda, Leeuwarden, and careful selection of the parts used has given the model a very neat and solid appearance.

The judges were particularly pleased with the splendid workmanship, design and detail, displayed in a level-luffing "Demag" Crane, and rewarded its builder, Frank van Bulck of Brussels, with First Prize. As it has not been possible to illustrate the model, owing to the fact that the photographs submitted were not sufficiently clear for reproduction, I will try to convey some idea of its appearance by a short description. The model is fitted with level-luffing gear, stands over 6 ft. in height, and uses over 1,600 nuts and bolts in its construction. Readers who are not familiar with the use and operation of level-luffing mechanism are advised to refer to the "*M.M.*" for September 1931, in which the operation of the gear is described in connection with the Meccano Super Model Automatic Grabbing Crane.

The great advantage of a level-luffing crane is that the load remains at a constant height or level during the luffing of the jib. In the ordinary type of crane a considerable amount of power is required to raise the jib on account of its weight and the effect of the load, and it is to eliminate some of this waste of power that many cranes are fitted with level-luffing gear and a balanced jib. The balanced jib overcomes the difficulty of the dead weight of the jib, and the level-luffing gear counteracts the effect of the load by making the crane hook maintain always the same height from the ground while the jib is being luffed.

Van Bulck's model has a large overhanging curved jib, the overhang allowing plenty of space between the crane superstructure and the load, so that cumberous loads may be handled easily and may be hoisted as high as the jib head pulleys if necessary. The luffing mechanism is operated by Rack Strips, a form of construction that is novel so far as Meccano models are concerned and is very effective in use.

The jib is mounted on a travelling gantry and revolves on a Roller Race, the gantry itself being fitted with four bogies, two of which are driven through the main gear-box by means of an Electric Motor. The constructional details of the luffing motion are as follows. To the right arm of the jib are fixed two $6\frac{1}{2}$" Rack Strips each bolted between two $9\frac{1}{2}$" Strips, the two units thus formed being connected together by $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. A Worm Wheel meshes with a 57-teeth Gear Wheel, on the Rod of which are also two $\frac{1}{2}$" Pinions that operate the Rack Strips. A Rod with two loose Collars, each placed between a Collar and a $\frac{1}{2}$" Pulley Wheel with boss, holds the Rack Strips on the Pinion Wheels. The jib is balanced by a counterpoise sliding on vertical guides at the rear of the jib, the counterpoise being raised by a double rope that is led over the jib head and securely anchored to the right arm of the jib.

The Second Prize model is a six metre sloop built to a scale of 1 in. to 1 ft. The prize was awarded chiefly on account of the skilful manner in which the numerous difficulties met with in this class of work had been overcome. From stem to stern the model incorporates many novel construction features, among which may be mentioned the rudder and tiller. A 5" Axle forms the rudder post, and to its upper end is secured a Coupling in one of the transverse bores of which is a $3\frac{1}{2}$" Axle that serves as the tiller. The rudder is made from four Flat Trunnions overlapped and bolted together to form a rectangular blade, and this is held in position on the post between two Cranks. The whole makes a very neat assembly and readers might advantageously adopt similar construction in building models of their own.

Third Prize was won by a Swiss competitor with a model flying machine roundabout. The main attraction of this entry lies in its very solid construction and neat finish. The model consists of two passenger cars in the shape of aeroplanes suspended from the ends of a girder beam, which is pivoted at its centre on a Roller Bearing supported by a centre tower. Two Electric Motors drive four-bladed tractor screws fitted to the front of each car, and the roundabout attains a speed of 30 revolutions per minute. The cars are illuminated by miniature electric lamps.

Among the other prize-winning entries is a model of a tram-locomotive of a type seen in Holland. It was built by J. Ringnalda of Leeuwarden and is illustrated here. This entry was accompanied by a photograph of the actual tram-locomotive and I can assure readers that the model is a very faithful reproduction. It is chiefly remarkable on account of the perfect fitting of the parts used, which has given the model a very solid and neat appearance.

Results of the Special "Bridge" Contest

The full list of prize-winners in the special "Bridge" Competition, which was organised in connection with the article "*Meccano Helps American Engineers*" in the May 1932 "*M.M.*," is as follows :—

FIRST PRIZE: Two competitors tied for prize of £1-1s. and have each received 10/6: John Gooch, Twickenham; L. Ghyssaert, Courtrai, Belgium.

MECCANO ENGINEER'S POCKET BOOKS: A. Beck, Rotterdam, Holland; E. Read, Johannesburg; L. Eustratiadi, Istambul, Turkey; W. Trenholm, Eaglescliffe, Co. Durham; F. Nunn, Colchester; K. Burt, Leven, Fife.

John Gooch submitted a model of the vertical lifting bridge that was described in the "*M.M.*" for June 1931. This bridge crosses the James River in the United States. In Gooch's model the span is raised and lowered by a Clockwork Motor situated in one of the shore towers and connected by gearing to two winding drums at the foot of the towers. Safety gates are provided and fall into position when the span is raised.

Ghyssaert's model is a reproduction of a swing bridge.

Meccano "X" Series Models

Further Examples of Model Construction

The Meccano "X" Series Outfits contain an entirely new set of parts that make possible the construction of an almost unlimited range of models. Although the "X" parts are on a smaller scale than standard Meccano Parts, they embody the same system of equidistant holes, but the perforations are spaced only $\frac{1}{4}$" apart and there are three rows to each Strip. This new system of parts simplifies model-building so that even our youngest readers will have no difficulty in constructing working models, which may be set in motion by an "X" Clockwork Motor. The "X" Series Parts can be used in conjunction with standard Meccano parts.

LAST month we gave details of the new Meccano "X" Series Outfits and explained the uses of the various parts. We illustrate here more examples of models built with these small Outfits, and readers who have not yet become acquainted with the "X" Series parts will be able to understand the general principles of model-building with them from the new models described below.

Water-Chute

The fascinating model shown in Fig 1 represents the popular pleasure beach attraction well known to most Meccano boys. The chute is made by bolting a $5\frac{1}{4}$" Strip to each end of a $2\frac{3}{4}$" Strip for each side member, and the two long strips so formed are bolted at each end to $\frac{3}{4}$"$\times\frac{1}{2}$" Double Angle Strips. At one end Angle Brackets are fixed to the Strips, and the other end is raised by $4\frac{1}{4}$" Strips braced by the addition of $1\frac{1}{4}$" Discs. A $2\frac{1}{2}$" Screwed Rod spaces the lower ends of the Strips, and also holds an Angle Bracket at each end.

The boat is constructed by bolting two $1\frac{3}{4}$"$\times\frac{1}{2}$" Double Angle Strips between two $1\frac{3}{4}$" Strips, and to each Double Angle Strip is bolted an Angle Bracket carrying a further $1\frac{3}{4}$" Strip. The bolts holding the Angle Brackets in position also hold two $2\frac{3}{4}$" Strips to the underside of the boat. These Strips fit between the Strips forming the sides of the chute and serve as guides for the boat. To make it slide freely a little oil should be applied to the top edges of the sloping Strips.

Parts required for the Water-Chute model :—4 of No. X404 ; 2 of No. X405 ; 4 of No. X407 ; 4 of No. X409 ; 6 of No. X421 ; 1 of No. X435 ; 2 of No. X455 ; 2 of No. X457 ; 2 of No. X475 ; 28 of No. 37a ; 24 of No. 37b.

Pen Rack

The simple model shown in Fig. 2, if put to practical use, will prove a boon to those forgetful Meccano boys who are always mislaying their pens and pencils !

A frame is built up by securing $1\frac{3}{4}$"$\times\frac{1}{2}$" Double Angle Strips across the ends of two $4\frac{1}{4}$" Strips. A $2\frac{3}{4}$" Strip is bolted to each and made to slope backward, and four $1\frac{3}{4}$" Strips are secured in the positions shown to support the pens. A piece of cardboard may be fixed in the bottom of the rack so that the frame forms a receptacle for pins, paper clips, etc.

Parts required for the Pen Rack :—2 of No. X405 ; 2 of No. X407 ; 4 of No. X409 ; 2 of No. X455 ; 8 of No. 37a ; 8 of No. 37b.

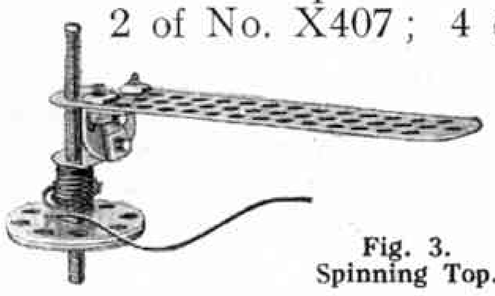
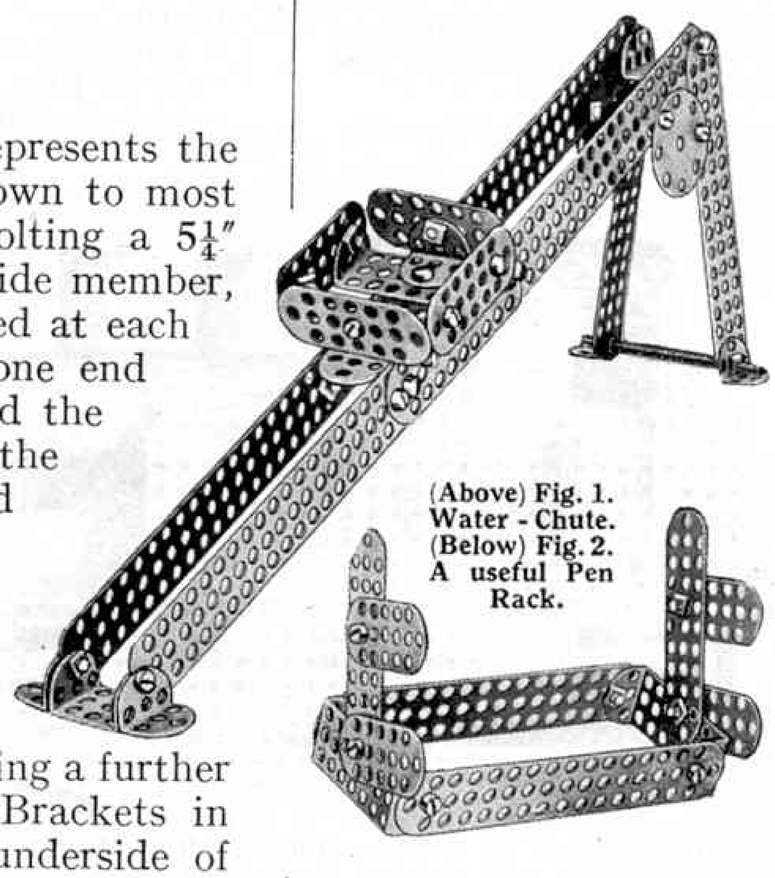


Fig. 3. Spinning Top.

Spinning Top

The Top (Fig. 3) consists of four $1\frac{1}{4}$" Discs and two $\frac{3}{4}$" Discs fixed near the end of a Screwed Rod by two nuts. A $4\frac{1}{4}$" Strip forms the handle and a bearing for the Rod is made by means of two Angle Brackets. To spin the Top a length of Cord is wound round the Screwed Rod, as shown, and given a sharp pull before the handle is removed.

Parts required for Spinning Top :—1 of No. X405 ; 2 of No. X421 ; 1 of No. X435 ; 4 of No. X475 ; 2 of No. X477 ; 6 of No. 37a ; 4 of No. 37b ; Length of Cord.



(Above) Fig. 1. Water - Chute. (Below) Fig. 2. A useful Pen Rack.

Step Ladder

Little description is necessary for the model illustrated in Fig. 4. The Double Angle Strips should be placed in position first, and afterwards a $2\frac{1}{2}$" Screwed Rod inserted through holes in the side members to carry a $2\frac{3}{4}$" Strip at each end. A second Screwed Rod connects these Strips lower down, and they are also tied to the ladder by short lengths of cord.

Parts required for Step Ladder:—2 of No. X405; 2 of No. X407; 2 of No. X435; 2 of No. X455; 12 of No. 37a; 4 of No. 37b; short length of Cord.

Catapult

The model Catapult appearing in Fig. 5 will project small missiles quite a considerable distance. The base is made of two $5\frac{1}{4}$" Strips secured to $1\frac{3}{4}$"$\times\frac{1}{2}$" Double Angle Strips, and each carrying two $2\frac{3}{4}$" Strips. The latter Strips form bearings for the $2\frac{1}{2}$" Screwed Rod that carries the moving arm. Each end of the Rod is fitted with lock-nuts to hold it in place.

Two $5\frac{1}{4}$" Strips are spaced apart at one end by a $\frac{3}{4}$"$\times\frac{1}{2}$" Double Angle Strip and at the other by a 1" Screwed Rod. A $4\frac{1}{4}$" Strip is placed between them and secured by Angle Brackets, and a $\frac{3}{4}$"$\times\frac{1}{2}$" Double Angle Strip and two Angle Brackets are fixed at the top to form a receptacle for missiles. Several rubber bands are placed between the 1" Screwed Rod at the lower end of the arm, and a Rod fixed to the $5\frac{1}{4}$" Strips of the base.

Small objects such as bolts should be placed at the top of the arm, which is then depressed. When it is released, the rubber bands bring it up sharply until the lower end strikes the $2\frac{1}{2}$" Screwed Rod and the missiles are shot forward.

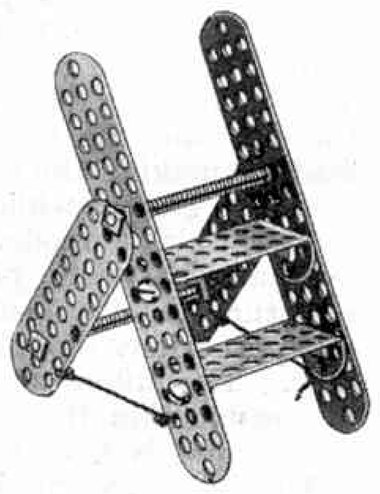


Fig. 4. Step Ladder.

Parts required for Catapult :—4 of No. X404 ; 1 of No. X405 ; 4 of No. X407 ; 4 of No. X421 ; 2 of No. X435 ; 1 of No. X438 ; 2 of No. X455 ; 2 of No. X457 ; 27 of No. 37a ; 11 of No. 37b ; Rubber Bands.

Coster's Barrow

To construct this model (Fig. 6) the $4\frac{1}{4}''$ Strips forming the sides should first be secured to a $1\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strip, and the same securing bolts hold the $1\frac{3}{4}''$ Strips forming the legs of the barrow. The $2\frac{3}{4}''$ Strips at the other end are spaced apart by a Double Angle Strip, and their lower ends form bearings for a Screwed Rod carrying a $1\frac{1}{4}''$ Disc at each end. The $2\frac{3}{4}''$ Strips are braced by the addition of $1\frac{3}{4}''$ Strips held in place by a Screwed Rod, which also adds additional strength to the side members. Two $2\frac{3}{4}''$ Strips serve as the platform and are fixed at one end to the Double Angle Strip, and at the other to Angle Brackets.

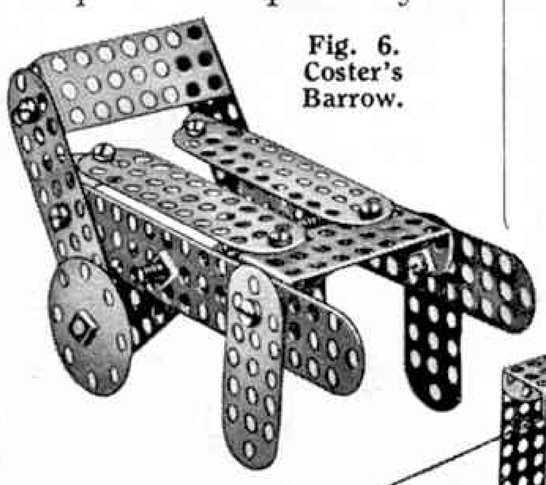
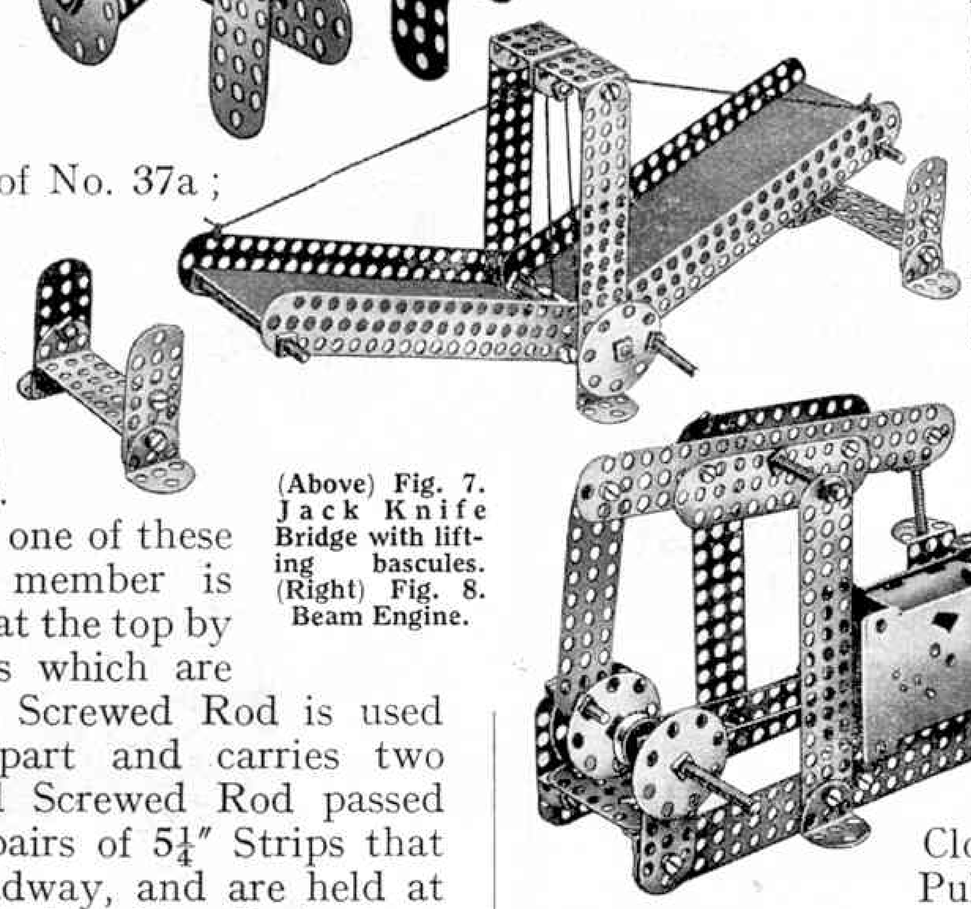


Fig. 6. Coster's Barrow.

Parts required for Coster's Barrow :—2 of No. X405 ; 4 of No. X407 ; 4 of No. X409 ; 2 of No. X421 ; 2 of No. X435 ; 2 of No. X455 ; 2 of No. X475 ; 18 of No. 37a ; 10 of No. 37b.

Jack Knife Bridge

In actual practice bridges of this type are used for spanning waterways where it is necessary to raise the roadway for river traffic. In Fig. 7 is illustrated a model of one of these bridges. The central vertical member is made of two $4\frac{1}{4}''$ Strips connected at the top by two $\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strips which are spaced apart by a Washer. A Screwed Rod is used for spacing the lower ends apart and carries two Angle Brackets ; and a second Screwed Rod passed through the Strips carries two pairs of $5\frac{1}{4}''$ Strips that form the sides of the lifting roadway, and are held at their outer ends by Screwed Rods. The Rod about which they pivot carries a handwheel consisting of a $1\frac{1}{4}''$ Disc and $1''$ Screwed Rod, and forms the winding "drum" for the cords which raise the bascules. Pieces of cardboard should be placed between the $5\frac{1}{4}''$ Strips for the roadway.



(Above) Fig. 7. Jack Knife Bridge with lifting bascules. (Right) Fig. 8. Beam Engine.

The end piers are made of $1\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strips and $1\frac{3}{4}''$ Strips, and if sufficient parts are available approaches may be made by securing longer Strips in position for the sides.

Parts required for Jack Knife Bridge :—4 of No. X404 ; 2 of No. X405 ; 4 of No. X409 ; 6 of No. X421 ; 4 of No. X435 ; 1 of No. X438 ; 2 of No. X455 ; 2 of No. X457 ; 1 of No. X475 ; 38 of No. 37a ; 15 of No. 37b ; a short length of Cord ; Cardboard.

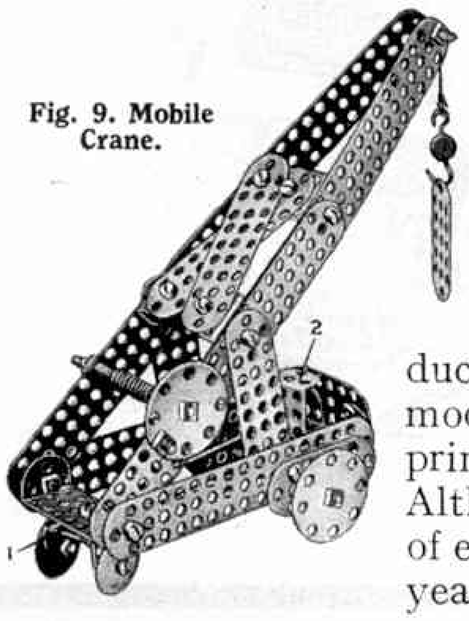


Fig. 9. Mobile Crane.

Beam Engine

A type of steam engine that was most successful in the early days of steam is reproduced in model form in Fig. 8. This model shows the general working principles of the beam engine. Although rarely used now, this type of engine proved its utility for many years until replaced by the modern horizontal engines that occupy far less space.

To build the model the frame should first be put together, and for the base of this two $5\frac{1}{4}''$ Strips are spaced apart $1\frac{3}{4}''$. The Double Angle Strip at one end supports a second similar Strip representing the cylinder. A Screwed Rod slides in this and carries at its upper end an Angle Bracket that is pivoted to the beam. The latter is made of one $5\frac{1}{4}''$ Strip and two $2\frac{3}{4}''$ Strips, and a $2\frac{1}{2}''$ Screwed Rod held in the centre is supported at each end on $4\frac{1}{4}''$ Strips that are bolted vertically to the base.

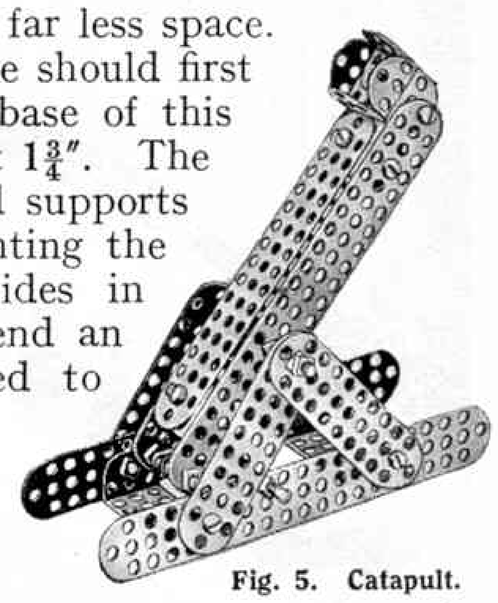


Fig. 5. Catapult.

Bearings for the crankshaft are formed by two $1\frac{3}{4}''$ Strips, and the crankshaft is made up of a $2\frac{1}{2}''$ and a $1''$ Screwed Rods, each of which carries a $1\frac{1}{4}''$ Disc at its inner end. The two Discs serve as cranks and are connected by a $1''$ Rod that forms the crank-pin. This is held in position by two nuts at each end and passed through the end hole of a $2\frac{3}{4}''$ Strip, pivoted to the end of the beam. The crankshaft also carries two Discs serving as a flywheel, and a $\frac{1}{2}''$ Pulley fixed by a nut. The Pulley is connected by a rubber band to the driving pulley on the Clockwork Motor. The Motor is fixed in position by bolting it to the Double Angle Strips and an Angle Bracket.

Parts required for the Beam Engine :—3 of No. X404 ; 2 of No. X405 ; 3 of No. X407 ; 3 of No. X409 ; 6 of No. X421 ; 3 of No. X435 ; 2 of No. X438 ; 2 of No. X455 ; 4 of No. X477 ; 39 of No. 37a ; 16 of No. 37b. Clockwork Motor complete with Pulley and Driving Band.

Mobile Crane

The travelling body is made of two $4\frac{1}{4}''$ Strips that are bolted at each end to $1\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strips. At the front a $1\frac{3}{4}''$ Strip secured to Angle Brackets forms the dashboard. Two $1\frac{3}{4}''$ Strips bolted to the side members carry a $2\frac{1}{2}''$ Screwed Rod, on each end of which is a $1\frac{1}{4}''$ Disc. Two $\frac{3}{4}''$ Discs are free to rotate on bolts that are each fixed by two nuts to the $\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strip 1, which is pivotally attached to the Double Angle Strip holding the sides together. Two cords are attached to the part 1 and also to a similar part 2, which is pivoted by a $1''$ Rod to the Double Angle Strip at the front of the model.

Parts required for Mobile Crane :—4 of No. X404 ; 2 of No. X405 ; 4 of No. X407 ; 4 of No. X409 ; 6 of No. X421 ; 2 of No. X435 ; 2 of No. X438 ; 2 of No. X455 ; 2 of No. X457 ; 3 of No. X475 ; 2 of No. X477 ; 39 of No. 37a ; 23 of No. 37b ; 1 of No. 38 ; 1 of No. 57c ; Short length of Cord.

Machine Gun

Parts required :—4 of No. X407 ; 1 of No. X409 ; 2 of No. X421 ; 1 of No. X435 ; 2 of No. X455 ; 1 of No. X477 ; 13 of No. 37a ; 3 of No. 37b.

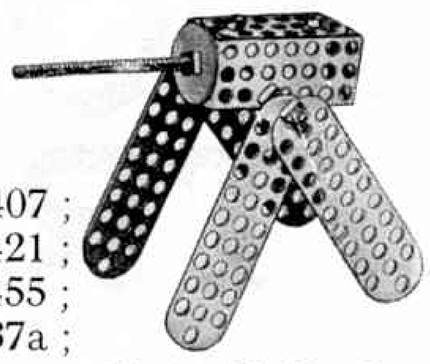


Fig. 10. Machine Gun.

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NEW LOCOMOTIVES FOR OLD

Boys! Here is a plan to secure a fine new Hornby Locomotive in exchange for your old one.

First of all, study carefully the latest Hornby Train Catalogue, and select from it the new up-to-date Hornby Locomotive you want. Then pack up your old Hornby Locomotive and send it to us addressed "Special Service Department," Meccano Ltd., Old Swan, Liverpool. Your order for the new Locomotive and the necessary remittance should be enclosed. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the list given below from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase. It is important to note that the catalogue price of the new Hornby Locomotive you purchase **must not be less than double the Part Exchange allowance made for your old Locomotive.**

If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you a descriptive leaflet and any other information you require.

EXCHANGE YOUR OLD HORNBY LOCOMOTIVE TO-DAY!

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES	
M2930 Locomotive	1/–
MO Locomotive	1/4
M1/2 Locomotive No. 3031	2/3
M3 Tank Locomotive	3/9
No. O Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan	20/–
OBSOLETE TYPES	
George V Locomotive / No. OO Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan	20/–



HORNBY TRAINS

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MECCANO LIMITED
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"New Year" Model-Building Contest

For Models Built from Standard Meccano Parts

There must be many thousands of boys who received presents of Meccano Outfits at Christmas and are now enjoying their first experience of the pleasures of model-building. We wish to encourage these newcomers to Meccanoland to use their imagination and inventiveness in building models from their own ideas, and accordingly we announce a competition in which prizes are offered for the most original and best-built models sent to us. Every competitor has an equal chance in this Contest, no matter what size of Outfit he possesses, and the conditions of entry have been made as simple as possible.

All a competitor has to do is to think of a new model and then to set to work to construct it as neatly and realistically as possible from standard Meccano parts.

When the model is completed it is only necessary to obtain either a photograph or a good drawing of it and send this to us. *The actual model must not be sent.* The photograph or drawing need not be the competitor's own work, but it is absolutely essential that the model itself should be the result of his or her own unaided efforts. Entry forms are not required and there are no fees to be paid. The competition is open to readers of all ages living in any part of the world.

The judges will award the prizes for those models that are the most original in subject and are neatly designed and proportioned, and which are built on correct mechanical principles.

"New Year" Model-Building Contest

The prizes in Sections A and C. are :—
First Prize, Cheque for £3-3s.-0d.
Second Prize, Cheque for £2-2s.-0d.
Third Prize, goods value £1-1s.-0d.
Ten Prizes of goods value 5/–.
Ten Prizes of "Famous Trains," by C. J. Allen.

The prizes in Section B are :—
First Prize, Cheque for £2-2s.-0d.
Second Prize, goods value £1-1s.-0d.
Third Prize, goods value 10s.-6d.
Ten Prizes of "Famous Trains" by C. J. Allen.
Ten Prizes of Meccano Engineer's Pocket Books.

The Contest will be divided into the following three Sections :—A, for competitors living in the British Isles and over 14 years of age ; B, for those living in the British Isles and under 14 ; C, for competitors of all ages living Overseas. A separate set of prizes as announced in the accompanying panel on this page will be awarded in each Section.

Models of any kind whatever may be submitted, so that competitors have a very wide choice of subjects. Those that really "work," or that may be put to some practical use, will stand a better chance of winning prizes than models that are not built to work or which do not reproduce the movements of their prototypes. Any number of parts may be used in building models, but good solid construction will count more than mere size alone.

Before posting their entries competitors must take care to write their age, name and full address clearly on the back of each photograph or drawing submitted. Entries from competitors living in the British Isles must be marked with a large letter "A" or "B" indicating the Section for which they are intended. Overseas entries must be marked with a letter "C."

Home competitors entering Sections A and B must post their entries in time to reach this office not later than 28th February, 1933. The closing date for Overseas competitors is 29th April, 1933. Envelopes should be addressed "New Year" Model-Building Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool.

Prizes for Models Built from Meccano "X" Series Parts

Large numbers of readers will now be proud possessors of the new Meccano "X" Series Outfits, and for their benefit we announce this month a special model-building competition. In this Contest only models built entirely from "X" Series parts may be submitted ; models built partly of standard Meccano parts are not eligible.

To enter the Contest it is only necessary to build a new model of any kind whatever, and then to send either a photograph or a drawing of the model to us. The model must be built by the competitor himself, but the drawings or photographs may be prepared by the competitor's parents or friends if necessary. *The actual model must not be sent.*

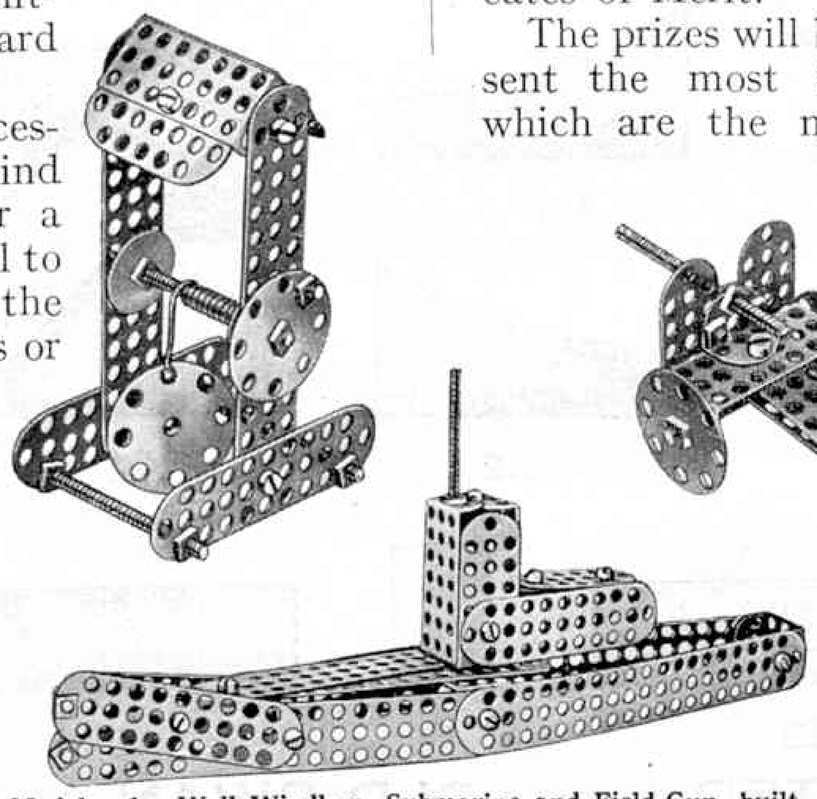
The Contest will be divided into three Sections—A, for competitors under 10 living in the British Isles ; B, for competitors over 10 living in the British Isles ; and C, for competitors of all ages living Overseas.

The following prizes will be awarded in each Section :—First, Meccano or Hornby goods value £2-2s. ; Second, goods value £1-1s. ; Third, goods value 10/6. Ten Prizes of goods value 5/–. Ten Prizes of Meccano Engineer's Pocket Books and Certificates of Merit.

The prizes will be awarded for those models that represent the most interesting and novel subjects and which are the most neatly and solidly constructed.

Intending competitors will be well advised to refer to the article that appeared on pages 960 and 961 of the December 1932 "*M.M.*," and also the article on page 48 of this issue, which contain hints on building models with the "X" Series parts.

Competitors in Sections A and B must post their entries so as to reach this office not later than 28th February, 1933. The closing date for Section C is 29th April, 1933. Envelopes should be addressed "X Series" Model-Building Contest, Meccano Ltd., Old Swan, Liverpool.



Models of a Well Windlass, Submarine and Field Gun, built from Meccano "X" Series Parts.

Hornby Series
For 2-ft. radius layouts only.

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COUNTRYSIDE SECTIONS

Real Scenery for your Railway!

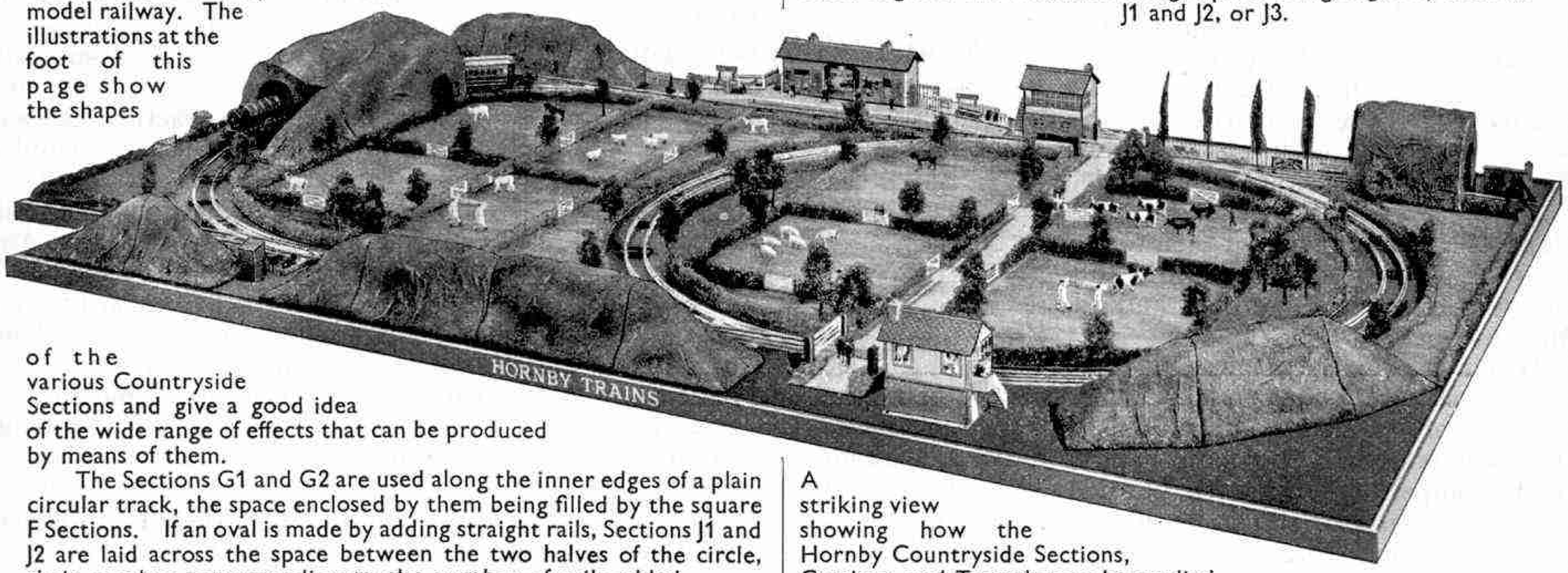
The new Hornby Countryside Sections provide model railway owners for the first time with scenery in a ready-made form that is suitable for any kind of 2 ft. radius layout. Splendid scenic effects may be obtained by arranging the Countryside Sections round a layout, and inserting here and there the Hornby miniature animals—cows, sheep, horses and pigs—Modelled Miniatures No. 2. The realistic effects produced in this manner add enormously to the attractiveness of any model railway. The illustrations at the foot of this page show the shapes of the various Countryside Sections and give a good idea of the wide range of effects that can be produced by means of them.

The Sections G1 and G2 are used along the inner edges of a plain circular track, the space enclosed by them being filled by the square F Sections. If an oval is made by adding straight rails, Sections J1 and J2 are laid across the space between the two halves of the circle, their number corresponding to the number of rails added.

The No. 1 Level Crossing necessitates the use of road Section H, the breadth of which is equal to the length of the Crossing. Similarly a half-rail requires the narrow field Section J3. Section H fits under the sloping approach of the Crossing, and a packing piece R is used on the opposite side to preserve the level.

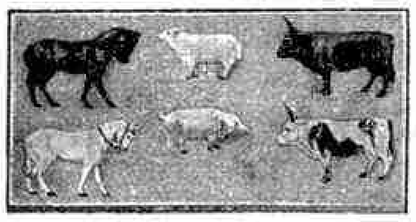
Triangular Sections K1 and K2 fit between the arms of the Right-Angle Crossing, so that " figure eight " layouts can be easily made up.

Curved Sections L1 and L2, and M1 and M2, are available for the outer edges of the track, the straight parts being edged by Sections J1 and J2, or J3.



A striking view showing how the Hornby Countryside Sections, Cuttings, and Tunnels may be applied to a layout is given in the above illustration.

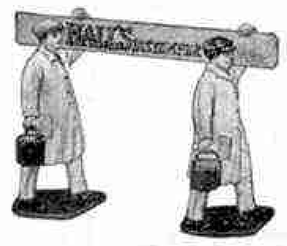
Ask your dealer to show you the new Hornby Countryside Sections



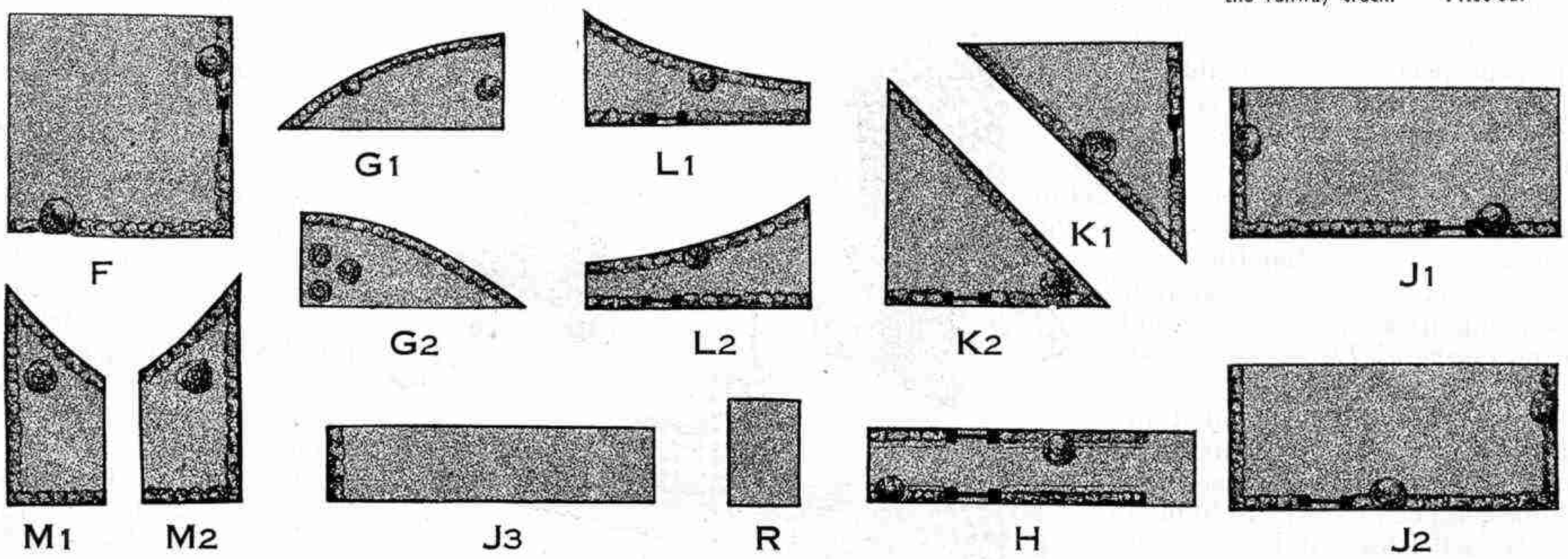
MODELLED MINIATURES No. 2
FARMYARD ANIMALS
Comprises six animals—Sheep, Pig, two Cows, and two Horses.
Price per set 1/6

PRICE LIST OF COUNTRYSIDE SECTIONS

Fields F	Box of four	10/-
Fields G1 and G2 ...	Box of eight (four G1 and four G2) ...	11/-
Roads H and Supports R	Box of two H with R Supports	5/6
Fields J1 and J2	Box of four (two J1 and two J2) ...	11/-
Fields J3	Box of two	2/-
Fields K1 and K2 ...	Box of four (two K1 and two K2) ...	8/-
Fields L1 and L2 ...	Box of four (two L1 and two L2) ...	7/-
Fields M1 and M2 ...	Box of four (two M1 and two M2) ...	5/-



MODELLED MINIATURES
No. 13
HALL'S DISTEMPER ADVERTISEMENT
This miniature of a well-known lineside advertisement is intended to be placed in the fields adjoining the railway track. **Price 9d.**



MECCANO LIMITED — OLD SWAN — LIVERPOOL



New Year Greetings

This month I have the pleasure of wishing all members of the Guild and of Meccano Clubs "A Very Happy New Year!" Looking backward I find that the Guild has made wonderful progress during 1932. Every day throughout the year my mail bag has been crammed almost to overflowing with bright letters from keenly interested Meccano boys in all parts of the world, and also from officials and members of clubs eager to tell me of the splendid times they have had. There is no doubt that those who have not yet joined this great movement are missing much of the fun to be obtained from their hobby, and I hope they will send in application forms without delay. A cordial welcome also will be given to boys who make their first acquaintance with Meccano at this time of the year, and I hope that many new recruits for the Guild will be enlisted from this source.

In spite of the wonderful progress of the Guild during the past year, I am looking forward to even greater things during 1933. These can be achieved if members play their part in the effort. The first day of the New Year is an excellent time for good resolutions, and I should like every member to make up his mind now to take every opportunity of spreading knowledge of the Guild among his friends, and of urging them to help him in forming a Meccano Club if there is not one within easy reach. If this resolution is carried out in the true spirit of the Guild, 1933 will be the greatest year in its history.

Progress in the Transvaal

The formation of an association of Meccano clubs in Johannesburg and district is an instance of the splendid vitality of the Guild. The chief purpose of the Transvaal Meccano Clubs Union, as this organisation is called, is to help in the formation of new clubs in various centres, and to give advice and assistance in order to ensure their success. Good fellowship among the clubs in the Union is to be encouraged by joint meetings and inter-club competitions, and displays are to be organised at public exhibitions.

The formation of the Union is a wonderful step forward, and the clubs responsible are to be congratulated on their enthusiasm and foresight. The new organisation has already scored a wonderful success with a splendid Meccano and Hornby Train display at an Exhibition of models, hobbies and handicrafts arranged by the "*Johannesburg Star*" for raising funds to enable poor children to have a holiday at the seaside. The central feature of the display was a large model of a dockyard and railway, and this proved so fascinating that it was surrounded throughout by crowds of admirers, eager to see it in motion.

The Exhibition was opened by Lord Clarendon, Governor-General of South Africa. Lady Clarendon also was present and showed great interest in the Union's exhibit. She asked many questions about the work of Meccano clubs, and afterwards congratulated Mr. O. Roberts, Chairman of the Union, on the impressive display contributed by the organisation.

Meccano Club Leaders

No. 63. Mr. F. T. Newman



Mr. F. T. Newman has been Leader of St. Saviour's (Raynes Park) M.C. since its formation. Affiliation was secured in May, 1932. An excellent club spirit is encouraged by means of well-organised games and visits, and members show great keenness and ability in Model-building Competitions.

An Interesting Exhibition in London

The Second Annual Exhibition of the South Croydon and Purley M.C. will be held on Saturday, 7th January, 1933, in the Public Hall, Church Street, Croydon. This exhibition is organised by the South Croydon and Purley M.C., but it represents the combined efforts of members of the club and of the Croydon High School and Elm Road (Beckenham) organisations. Proceedings commence at 1.30 p.m. and the charge for admission is 6d., children 3d.

This event is a further proof of the growing tendency of Meccano clubs to work together, and I am glad to find that the officials and members of the organisations concerned have realised that a large joint Exhibition is far more impressive than three smaller displays. A central Exhibition arouses greater public interest than a local gathering and is therefore more helpful in recruiting. The clubs taking part in the Croydon Exhibition hope to gain many new members, and have arranged a special open Model-building Competition in order to encourage Meccano boys living in this district. Full details of this contest may be obtained from the organiser, Mr. J. Harris, 76, Mayfield Road, Sanderstead, Surrey.

An interesting and commendable feature of this Exhibition is that a proportion of the proceeds is to be given to local hospitals. It is hoped that from 2,000 to 3,000 visitors will be present, and they will be given a cordial welcome. Officials and members of other Meccano clubs are specially invited, and I have been asked to point out that East Croydon, the nearest station to the hall in which the Exhibition is to be held, is only 20 minutes by rail from London.

I am particularly pleased to read of the open competition arranged by the Croydon clubs. This will attract Meccano boys who have not yet taken part in club activities, and will help them to realise the advantages of membership. Thus it forms an ideal recruiting scheme, and I hope that other clubs will not overlook its value in this respect.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested in becoming members should communicate with the promoters, whose names and addresses are given below :—

BARNOLDSWICK—Mr. E. Greenwood, C. of E. School.
BARRY—Rob Cochrane, 89, High Street, Barry, Glam.
BRISTOL—H. J. Shipley, 3, Egerton Brow, Bishopston.
ERITH—S. Tice, 7, Barnehurst Avenue, Northumberland Heath.
GRIMSBY—G. E. Dale, 9, Crescent Street.
LONDON—John Glanfield, "Bowdon," 27, Ranulf Road, Hampstead, N.W.2.
NEW ZEALAND—O. H. Roach, 509, Whitehead Road, Hastings.
STOCKPORT—A. Davy, 19, Ingleton Road, Edgeley.
TORQUAY—V. A. Howe, 15, Rosery Road, Chelston.
TORQUAY—Douglas Miller, "Penrice," Burridge Road.

BOYS! JOIN THE MECCANO GUILD

President:
MR. FRANK HORNBY

The Meccano Guild is an organisation for boys started at the request of boys and conducted as far as possible by boys. At its head—guiding and controlling, and taking a personal interest in it—is the President, Mr. Frank Hornby, inventor of Meccano and Managing Director of Meccano Limited, and it is ready to be of service to each individual member, and to help or give advice whenever requested. Membership of the Guild enables Meccano boys to get the best out of life.

The three great objects of the Guild are to make every boy's life brighter and happier; to foster clean-mindedness, truthfulness, ambition and initiative; and to encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles. Every boy undertakes to promote these objects.

A Meccano boy who joins the Guild, becomes a member of a great brotherhood of world-wide extent, every member of which has promised to observe its great objects; wherever he happens to be, even in strange countries he will know that he has met a friend whenever he sees the little triangular badge. Thus the Guild brings together Meccano boys all over the world.

THE GUILD BADGE

Membership of the Guild is open to every boy possessing a Meccano Outfit or Hornby Train Set who satisfactorily fills in the application form. The only conditions are that members shall promise to observe the objects of the Guild and to wear their badges on all possible occasions.

The Meccano Guild badge is beautifully enamelled in blue and white. The ordinary form is made for wearing in the lapel of the coat, but brooch badges are issued to members who prefer to pin them in position, and applicants who wish to have this form of badge should indicate this when sending in their forms. In addition to the badge, each member receives a handsome Membership Certificate printed in orange and black.

HOW TO BECOME A MEMBER

In order to join the Guild all that is necessary is to fill up the form of application, and to forward it to the Secretary of the Meccano Guild, Binns Road, Old Swan, Liverpool, from whom an application form may be obtained if desired. A remittance to pay for the membership badge should be sent along with the completed form of application. The price of the badge is 7d. post free in the United Kingdom and 1/- post free overseas (25 cents Canada). The applicant is then duly enrolled as a member of the Guild and his badge of membership is sent to him. Each member has the personal interest of the President and is entitled to the friendly advice and assistance of the Secretary.

Boys living overseas should write to one of the Meccano agents at the following addresses: CANADA: Meccano Ltd., 34, St. Patrick St., Toronto. AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W. NEW ZEALAND: Models Ltd., P.O. Box 129, Paykel's Building, Anzac Avenue, Auckland. SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.









MECCANO CLUBS

Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters. At the present time there are over 300 affiliated clubs in various towns and villages in this country and overseas, together with many others not yet affiliated. Each club has its Leader, Secretary, Treasurer and other Officials, all of whom, with the exception of the Leader, are boys.

Every Guild member should join a club if possible, for only in association with other Meccano boys is he able to obtain the greatest fun from his hobby. If the nearest club is too far away for him to join, or if he is unable to join it for any other reason, he should consider the possibility of forming a new club in his own district. A special booklet entitled "How to run a Meccano Club" is now ready, and will be sent to any reader (post free) on receipt of 2d. in stamps.

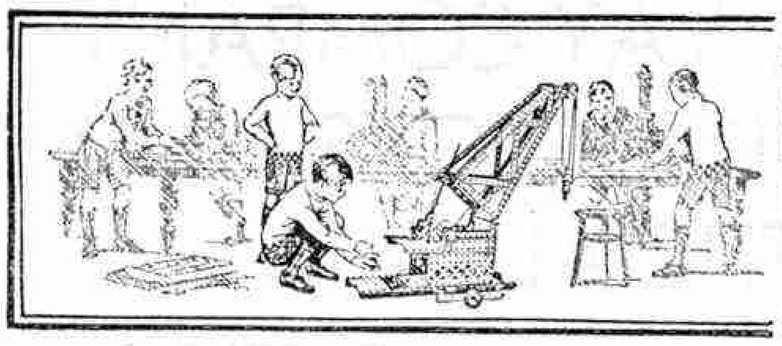
When a Meccano Club has been successfully launched and good progress is being made, affiliation with the Guild is granted. A beautiful club certificate, suitable for framing and hanging in the club-room, is presented, and the club becomes entitled to such privileges as the loan of interesting lectures and large models built at Headquarters.

THE CORRESPONDENCE CLUB

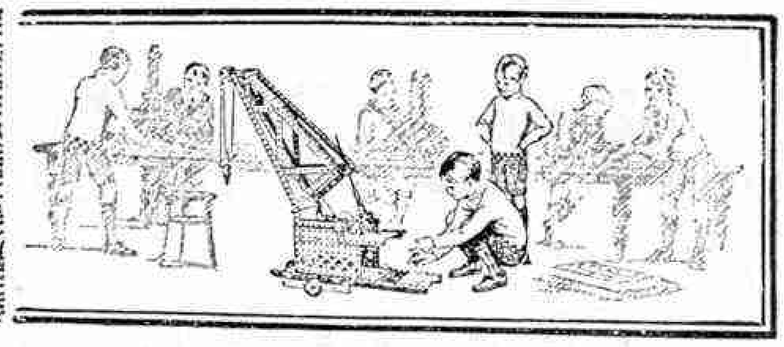
Members of the Guild are eligible to join the Correspondence Club, by which they are placed in communication with other Guild members in some other part of the country or abroad. To those boys who are interested in foreign languages the Correspondence Club presents a splendid opportunity of obtaining a correspondent in the particular country in the language of which they are interested. Stamp collectors also find the club of value. Full particulars and enrolment form will be sent on application to the Guild Headquarters.



THE SUN NEVER SETS ON THE MECCANO GUILD



CLUB NOTES



Constantine M.C.—Members have been greatly interested in the construction of a club-model of a giant Mechanical Shovel that loaded grain in a realistic manner. Arts and crafts have been introduced and members are making articles for sale on behalf of club funds. Club roll: 18. *Secretary:* R. J. Thomas, Bridge, Constantine, Falmouth.

Gate House M.C.—Members are reported to be building bigger and better models than ever, and those prepared for the recent Exhibition were of a high standard. A special meeting was devoted to a Lantern Lecture entitled "*Legend Land*" given by Mr. M. Matthew, President of the club. A magazine has been started, all contributions being by members. Club roll: 12. *Secretary:* G. V. Roebuck, Gate House, Ingatestone, Essex.

Mallow M.C.—An unusual feature was a meeting at which the history of the club from the date of its foundation was told by one of the members, the story being of the greatest interest to recruits. The club's stock of Meccano parts has been greatly enlarged. The parts are kept in boxes that are carefully labelled and indexed, and many of them have been put to excellent use in building a model of a Skyscraper, five ft. in height, that incorporates a lift, a clock, a flag-staff and verandahs to each of its floors, in addition to a well-equipped garage. Club roll: 10. *Secretary:* W. J. Roche, 8, Spa Walk, Mallow.

Old Charlton M.C.—Model-building Evenings are devoted to special subjects, those set in contests at recent meetings being Road Vehicles and "Useful Things." This plan encourages members to be original in design. Attractive lectures on "*Rubber*," by Mr. Baxter, and "*Applied Electricity*," by the secretary, have been given. Club roll: 27. *Secretary:* B. Stevens, 53, Mount Street, Charlton, S.E.7.

St. Feock M.C.—Model-building, Leatherwork and Fretwork are the chief activities. In the Fretwork section a model railway is being constructed and handbags are being made on Leatherwork Evenings. Members have built excellent Meccano models for entry in a Model-building Competition in which the prize is a model Aeroplane. Club roll: 10. *Secretary:* J. Rogers, West Trevilla, St. Feock, Nr. Truro.

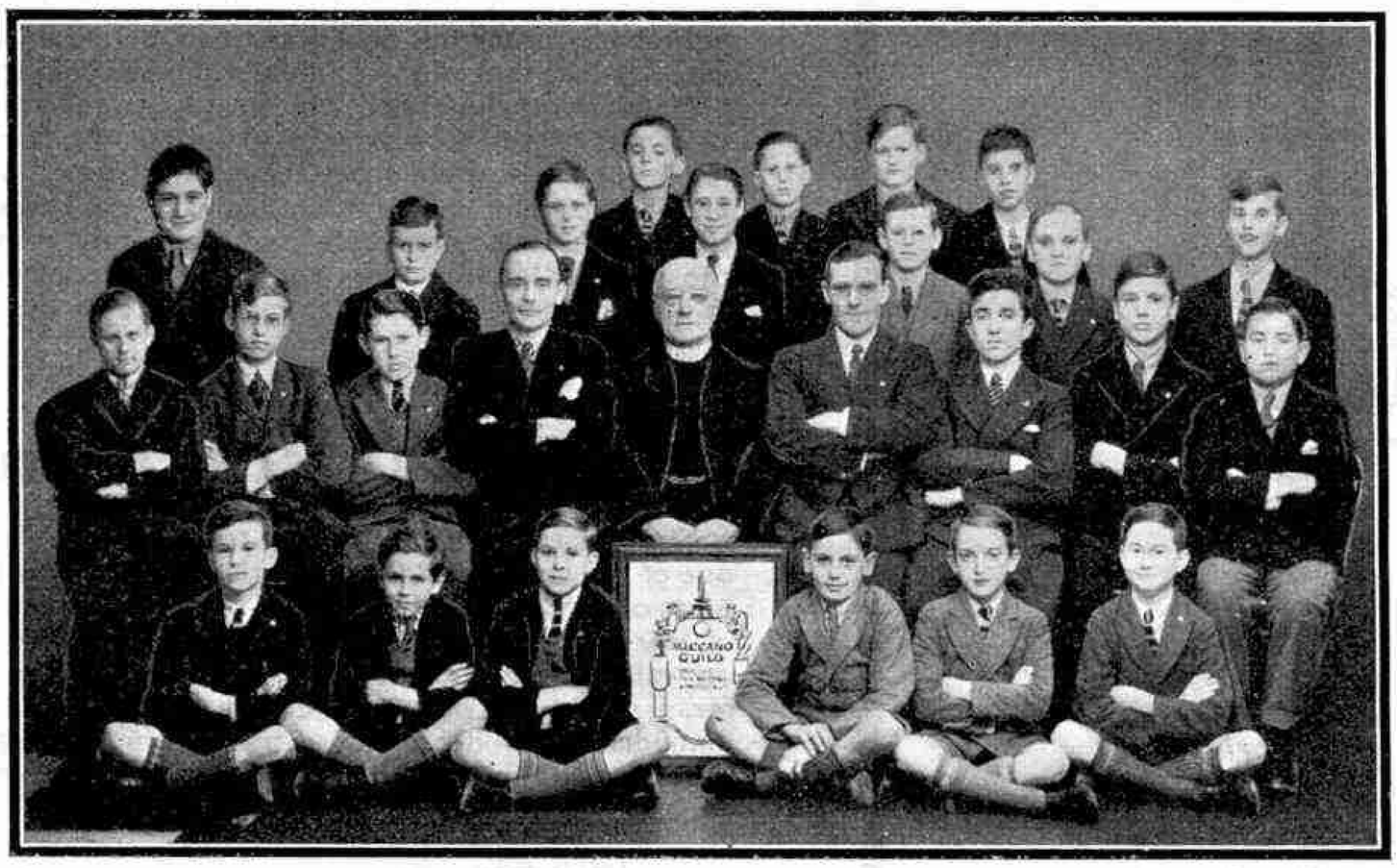
Kendal M.C.—Models constructed for the Exhibition held last month included a Destroyer and Electric Locomotive, a Paddle Steamer and a three-masted Yacht. An excellent Hornby Train layout also was prepared and the most attractive sideshow was a Cinematograph Display. The Derricking Crane and Ship Coaler on loan from Headquarters completed an excellent display that was highly appreciated by visitors. Club roll: 13. *Secretary:* L. Haslam, c/o 34, Park Avenue, Kendal.

New Bradwell M.C.—Football is being taken very seriously. Members train steadily and trial matches have enabled a good team to be built up. Work in the club room has included Model-building and other hobbies in addition to indoor games. Cycle runs are arranged when the weather is suitable. Club roll: 36. *Secretary:* R. Bellchambers, 29, King Edward Street, New Bradwell, Bletchley.

Park Modern M.C.—In a Meccano Crane Building Competition, entries were judged in accordance with the age of competitors and the number of parts available. A Lantern Lecture on "*The Story of the Omnibus*" was given by Mr. J. Bright, Leader of the club. A Table-Tennis Tournament has been held and the tables used for this are employed as supports for the club's Hornby Train layout, on which clockwork and electric engines have been tested for speed and hauling power. The club makes good use of the episcope, by means of which drawings, photographs and cuttings of engineering interest brought by members are shown on a screen. A Visit has been paid to the Barking Power Station. Club roll: 22. *Secretary:* F. Tingey, "Hillcrest," 11, Shirley Gardens, New Barking.

Wealdstone Methodist M.C.—Model-building Evenings at which preparations were made for the club's recent Exhibition, and Cinematograph Shows and Lantern Lectures have formed regular features of the programme. At a meeting of special interest, Mr. Bishop described his work as driver of "*The Royal Scot*" on its non-stop runs between Euston to Carlisle, and told the story of his experience when he drove the Royal Train from Carlisle to Euston. A Lantern Lecture on "*Light Railways*" given by Mr. C. F. Klapper also was greatly appreciated. Club roll: 45. *Secretary:* Mr. G. Richardson, 19, Wareham Road, Wealdstone.

Elm Road (Beckenham) M.C.—The subject of a recent Model-building Contest was "*Anything that Works.*" The models submitted in this showed great variety and the task of judging them was by no means easy. A Lantern Lecture on "*London's Omnibuses*" was given and other meetings have been devoted to Hornby Train operation and Games.



Our photograph shows a group of members of the St. James' (West Streatham) M.C., with Mr. G. Haygreen, Leader, the Rev. J. Fisk-Moore, President, and Mr. C. Mizen, secretary, in the centre of the second row. The club was affiliated in February, 1932, and has made excellent progress under the able guidance of Mr. Haygreen.

The Annual General Meeting was made the occasion of a successful Social. Club roll: 30. *Secretary:* D. Tiney, 64, Clock House Road, Beckenham, Kent.

Sid Vale M.C.—The winter session opened with a Social Evening; tea was provided and this was followed by music and games. A Model Carnival has been held, each member contributing a tableau built of Meccano parts. Model-building Competitions have included a Simplicity Contest and one in which Motor Vehicles were constructed. Club roll: 25. *Secretary:* R. Gliddon, Sheffield House, Sidmouth.

Eston Scouts M.C.—The club has been divided into four "Gangs" named "Nuts," "Gears," "Pinions" and "Rods" respectively. These compete in Model-building and other Contests based on the current issue of the "*M.M.*" One competition was a Treasure Hunt, clues being given to initial letters of paragraphs in the "*M.M.*" that revealed the hiding place of the prize, which consisted of a large slab of toffee! The Exhibition was a great success, visitors being specially interested in the Transporter Bridge on loan from Headquarters, and in the Aeroplane Bombing Game described in the October issue of the "*M.M.*," a small charge being made for entrance in a prize competition. A feature of the Exhibition was a display of models built from Meccano "X" Outfits. Club roll: 25. *Secretary:* C. Moore, 15, William Street, Eston, Yorks.

St. Mary's (Bocking) M.C.—The models shown at the club's Exhibition were kindly judged by Col. H. E. Cowie, O.B.E. and Mr. H. Green of Courtaulds. Prizes were given by friends of the club and a collection realised £2 8s. 6d. Talks by members, Wireless Plays and Social Evenings have been held in addition to an Aeroplane Model-building Contest and other competitions. A visit to the match factory of Messrs. Bryant & May has been kindly arranged by the Very Rev. E. Rogers, President of the club. Club roll: 20. *Secretary:* B. A. Holdaway, Church Street, Bocking.

King's School (Peterborough) M.C.—Model-building activities have included Workshop and Crane Nights. Visits have been paid to the Gas Works and the New England Railway Yard, where the newly-erected coaling plant was inspected. Club roll: 36. *Secretary:* C. Shallcross, Monsville, Garton End, Peterborough.

Ashburton (Croydon) M.C.—This newly affiliated club has made an excellent start. An "Open Evening" was held in order to show parents and friends of members the objects of the club and the manner in which these are being carried out. Models built by members were on view and the display aroused great interest. Club roll: 30. *Secretary:* Denis O'Hanlon, Ashburton School, Croydon.

AUSTRALIA

Kookaburra M.C.—The club's certificate has been framed and given a place of honour in the club room. Members' crystal wireless sets are now in working order. Debates and Model-building form the chief items in the programme, one interesting evening being devoted to the construction of representations of birds, each member being required to name the creatures he exhibited! A Musical Evening by members and a Mock Trial in connection with an alleged robbery in the streets of Adelaide also attracted great interest. Club roll: 10. *Secretary:* R. Culley, 8, Eastwood Terrace, Eastwood, South Australia.

Thebarton Technical High School M.C.—A Lecture on "*Liquid Air*" by Mr. E. S. H. Gibson, Leader of the club, was made particularly interesting by a demonstration, the liquid air for this being kindly supplied by the Western Oxygen Company. The proceeds of a collection taken at this meeting have been used for the purchase of a Meccano Outfit. Other talks have been given by members on various subjects, and Mr. L. Waterhouse, Vice-President, gave a Lantern Lecture on "*Coal and the Coal Miner*," this being arranged in connection with the local Health Week. Visits have been made to the Observatory and other interesting trips have been arranged. *Secretary:* A. Smart, c/o Thebarton Technical High School, Thebarton, South Australia.

CANADA

Rosemount M.C.—Splendid progress has been made and membership has considerably increased. An Exhibition was recently held, when models that attracted special attention included a Meccano Loom built by the Vice-President of the club and two models on loan from Meccano Ltd., Toronto. Visitors were also greatly attracted by the ingenious models constructed by members. Club roll: 31. *Secretary:* J. Watson, 974, Athol Street, Regina, Sask.

DENMARK

Copenhagen M.C.—A Lantern Lecture by Mr. V. Pedersen on "*The Little Belt Bridge*" was followed by a simple Contest in which members were required to name 12 Meccano parts illustrated on the screen. A demonstration of the uses of various Meccano parts was then given. At other meetings models were constructed by members for an Exhibition arranged by Messrs. Thorngreen, the local Meccano dealers. An excellent lecture was given by a member on the "*Visit of Swedish Aeroplanes to Copenhagen.*" Club roll: 20. *Secretary:* F. Severin, Rud Berghsgade 17, Copenhagen.

GERMANY

Berliner M.C.—Model-building activities have included the construction of a representation of the Ship's Hoisting Gear at Nieder-Finow, on the Berlin-Stettin Canal. Work on the construction of a permanent Hornby Train Layout also has been commenced. The club room was decorated before fitting the baseboard, and scenery is now being laid out. Members specialise in electrical work, and the club's railway is to be electrically operated. Club roll: 13. *Secretary:* H. Kobrak, Alt Moabit 38 c, Berlin

HORNBY RAILWAY COMPANY

The Hornby Railway Company is a world-wide fellowship of Hornby Train owners, and was formed to enable members to get as much fun as possible from their miniature railways. Its President is Mr. Frank Hornby, inventor of Meccano, and Managing Director of Meccano Limited.

A REAL RAILWAY COMPANY WITH BOY DIRECTORS AND OFFICIALS

How to Become a Member of the Hornby Railway Company

Every boy who possesses a Hornby Train Set should join the H.R.C. and thus become entitled to wear the badge of membership, which is beautifully enamelled in colours and has as its central feature a tiny representation of a train. All that he has to do is to fill in the application form—a copy of which is enclosed in every Train Set, or may be obtained from the Secretary of the H.R.C., Liverpool—and to return this together with a remittance of 6d. (overseas 10d.) to pay for the badge. Immediately on receipt of the completed form the applicant is enrolled as a member of this great organisation, and a handsome certificate to that effect is forwarded to him along with his badge.

Members of the H.R.C. are entitled to many privileges. The chief aim of the Company is to enable its members to get as much fun as possible from their miniature railways. This can best be done by helping them to make their layouts and operations as realistic as possible, and competent railway experts on the staff at Headquarters therefore are continuously engaged in advising members how to make the best use of the material at their disposal.

Join a Local Branch

The greatest fun is obtained from Hornby Trains by joining one of the many local Branches that have been formed in various parts of this and other countries. These Branches are composed of Hornby Train owners who meet together in order to carry out railway operations on a more extensive scale than is possible for a single individual. Every member should join a Branch immediately, or if one does not exist in his neighbourhood, he should try to induce other enthusiasts to help him to found one.

Write for full details to the Secretary, Hornby Railway Company, Binns Road, Old Swan, Liverpool.





Branch Notes

TEDDINGTON.—Interesting special tracks have been laid down at each meeting and the skill of members in pulling up their trains at certain points and in other railway operations has been tested, marks being awarded in a competition that terminated last month. Mr. Craig of the local Y.M.C.A. kindly gave interesting talks on railway topics and superintended track work. The Branch is outgrowing its present accommodation, and it is hoped to secure a suitable shed that may be transformed into a workshop, as members are keen to carry out constructional work and to lay down a large permanent track. Secretary: Mrs. B. Armitage, 37, Cambridge Road, Teddington.

SAINT NICHOLAS (BIRMINGHAM).—During holidays last year almost every famous train in Great Britain was seen by one or more members, and their running has been keenly discussed at club meetings. Track work is vigorously pursued, train operation being varied by locomotive trials. New Street Station has been visited and among other locomotives were seen a re-built "Claughton," with smoke deflectors, a standard "Mogul," and many former Midland Railway types. A specially interesting visit was paid to the General Post Office, Birmingham. Secretary: J. E. Wilson, 23, Meadow Hill Road, King's Norton, Birmingham.

WHITGIFT SCHOOL.—As membership has largely increased, two sections have been formed, and these engage in track work and discussions alternately. A visit has been paid to Croydon North Signal Box, where demonstrations were given of the manner in which trains of various classes are passed from one section to the next. During this visit members saw one of the new experimental six-coach units, each including a Pullman car, that are to be used on the electrified Brighton line. Lectures have been given on "*Dynamos and Motors*," and "*The Railway Museum, York*," slides for the latter being kindly loaned by the L.N.E.R. Secretary: M. M. Young, The Corrie, Manor Way, Purley, Surrey.

LORDSHIP LANE.—From six to eight locomotives are employed at track meetings, and colour-light signals operated from the centre of the track are being fitted in order to improve operations. The timetables worked out give intervals of 20 seconds between trains. A Tank Locomotive on loan from Headquarters was a special feature of the recent successful Exhibition. Secretary: R. Carrington, 49, Russell Avenue, Noel Park, Wood Green, N.22.

STREATHAM COMMON.—Further progress has been made with the extension of the Branch track, and a satisfactory service is now run on the single main line in operation. Four trains are run and great vigilance is required in controlling them, but more realistic running will be possible when the work of doubling the track has been completed. Junior and Senior sections have been formed. The members of these are described as "Atlantics" and "Pacifics" respectively, and the sections use the Branch track at alternate meetings. An excellent magazine has been produced. Secretary: L. J. Ling, Brooke House, Rotherhill Avenue, Streatham, S.W.16.

HANWELL BROADWAY.—Successful track meetings run in accordance with prearranged timetables have been held. The advantages of this plan were shown at a meeting for which no special plans had been made, the track being laid down on members' arrival, for running was very unsatisfactory and everything seemed to go wrong! A larger Branch room has been obtained, and the programme is now to contain a greater proportion of track meetings as the result of persistent demands from members. Secretary: C. Gray, 3, Boston Road, Hanwell, W.7.



A group of members of the Lordship Lane School (Wood Green) Branch, No. 226, with the Chairman, Mr. C. E. Wellman, and the secretary, R. Carrington, who are seen in the back row. The Branch was incorporated in April, 1932. Meetings are held weekly for track running, and visits to important railway stations and works are arranged at regular intervals. Members also are keenly interested in Meccano Model-building, and excellent railway accessories built of Meccano parts have been entered in special Contests, and afterwards employed on the Branch layout.

AUSTRALIA

SYDNEY.—At a typical track meeting a 30-second passenger service was operated on the layout, 10 locomotives and 38 coaches being employed. The meeting continued for 1½ hours, and 180 trains were run in each direction. The Branch track is continually being extended, and passenger and goods services of all kinds are operated. A lecture on "*The Story of Railway Signalling*" was given by Mr. H. Matthews, Chairman of the Branch, and a visit has been paid to the Eveleigh Locomotive Workshops and Running Sheds, where members were interested in the "graveyard," in which engines await scrapping. Secretary: W. J. T. Watson, 595, Parramatta Road, Leichhardt, N.S.W.

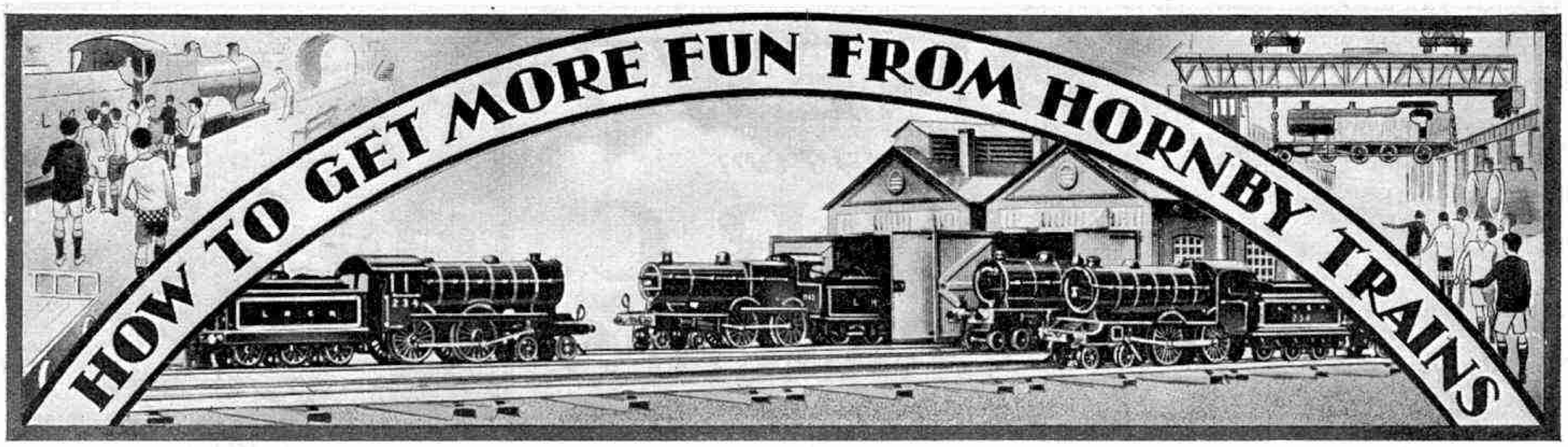
Proposed Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

MIDDLESBROUGH—Walter K. Hall, 21, Hambledon Road, Linthorpe.
NEW ZEALAND—Burton Sharp, 298, Highgate, Maori Hill, Dunedin.
OXFORD—M. Weatherall, 29, Holywell.
PERTH—J. Hetherington, 21, Darnhall Drive.
SHOREHAM-BY-SEA—J. R. Bishop, "Silverton," Lower Beach Road.
SOUTHSEA—B. Tickell, St. John's College, Grove Road South.
TORQUAY—H. W. Heath, 14, Princes Road West.
WALLINGFORD—Charles W. Grant, Sotwell Hill.
WATFORD—G. W. Warren, 36, Blackwell Drive, Oxhey.
WIGAN—D. Betley, 15, Somerville Road.

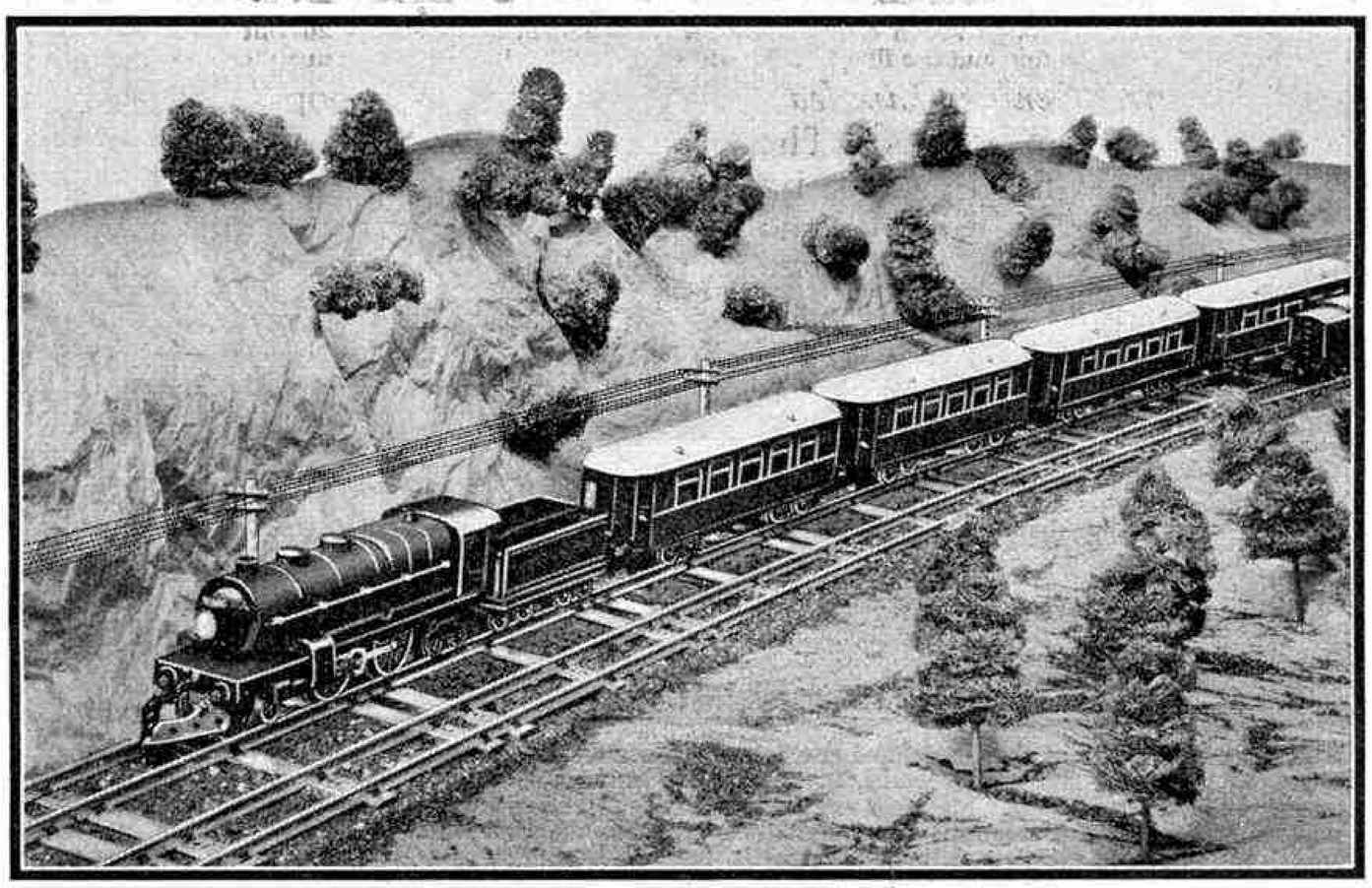
Incorporated Branch

236. ST. SAVIOURS—Mr. F. T. Newman, 23, Crossway, Grand Drive, Raynes Park, S.W.20.



LI.—AMERICAN TRAINS ON HORNBY LAYOUTS

CONSIDERABLE interest was aroused some time ago when various items of rolling stock of American type were introduced into the Hornby Series. Readers in search of novelty on their layouts were quick to realise the possibilities of the different vehicles, and soon found employment for them for special purposes, in conjunction with English pattern equipment already in their possession. The British type of train is naturally more popular in this country, but there is always a large number of enthusiasts who have a leaning towards unusual features, or to the locomotives and rolling stock of other countries. Thus the great popularity of the famous "Riviera" Blue Train Set is explained, and there are of course many corresponding goods traffic vehicles of continental type.



A Hornby Locomotive "Americanised" as described on the "In Reply" Page. The scenery in this photo represents the wild country often passed through by American railways.

To many model railway owners, train operation as practised on the North American Continent is a subject of interest. Their imaginations are stirred by the long distances run, the wild country traversed, the huge engines employed, and the enormous tonnage of the trains, both passenger and freight, as compared with those with which we are familiar in this country. Thus many boys try to reproduce in miniature as far as possible the main features of American railway practice. Imagination must be brought into play here and there—the miniature railway hobby would lose much of its charm without it—but a great deal can be done with numerous items now included in the Hornby Series. This we propose to show in this article, which will deal with general considerations and with passenger trains; while next month its continuation will give special attention to freight services and operations.

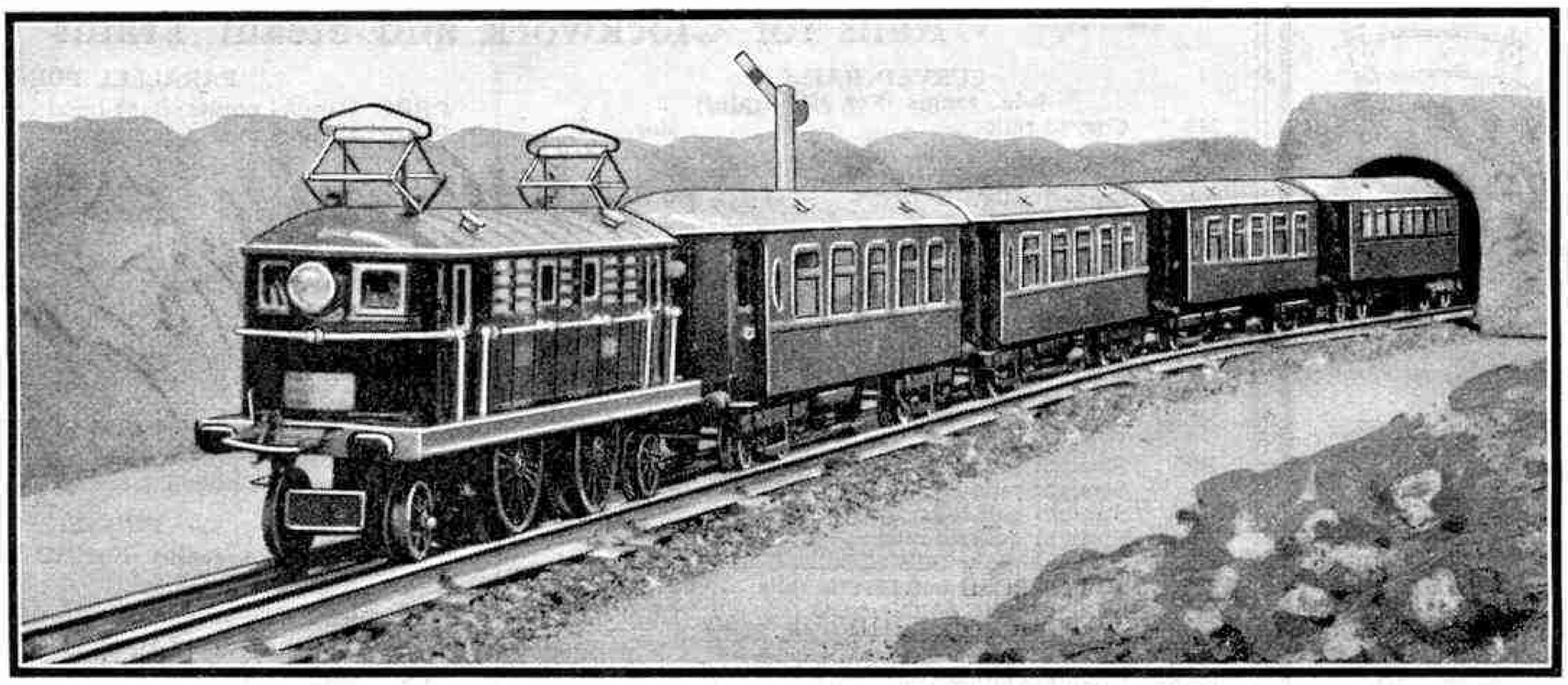
There is a great deal to be said in favour of American railways as prototypes. The single-track main lines common on many layouts are typical of American conditions, except of course in the neighbourhood of cities and in the more densely populated areas. Station equipment, except for the biggest terminals, may be relatively simple, and for the remote parts of the line this applies also to signalling arrangements. The "lonely" appearance of many layouts, due to the bareness of the scenery, will be quite in order for an American miniature line, but the exact opposite should apply in the neighbourhood of a city, where skyscrapers should more or less fill the background. Again, full play may be given to scenic effects in the way of big mountain ranges—which strike an exaggerated note on English layouts—and extensive forests, deep canyons and similar features. On the engineering side the sharp curves and steep gradients usual in miniature practice are characteristic of American lines.

Readers may wonder how the scheme can be completed in the absence of an actual American-type engine in the Hornby Series. Here the experimentally-minded enthusiast gets his opportunity, and those interested should turn to the "In Reply" columns on page 61 of this issue, where a scheme for Americanising a Hornby Locomotive is described. As regards rolling stock, the American-type Pullmans already in the Hornby Series are of course four-wheeled vehicles, but this is an advantage in that a long train of them may be hauled by one engine, as is common in America. Their relatively small proportions, too, will cause the engine to produce an impression of enormous size. This is well shown in one of our photographs, where a passenger train of these coaches is leaving a station. They are available finished in two colours, yellow or green, and with each colour there is a choice of names, "*Washington*" or "*Madison.*" The yellow cars are the more striking, but the green ones perhaps appear more railwaylike.

Where larger bogie vehicles are required, the English L.M.S.R. or L.N.E.R. No. 2 Saloon Coaches may be used, as they are of the end-vestibuled centre-corridor pattern found on American trains. In addition, the sleeping car

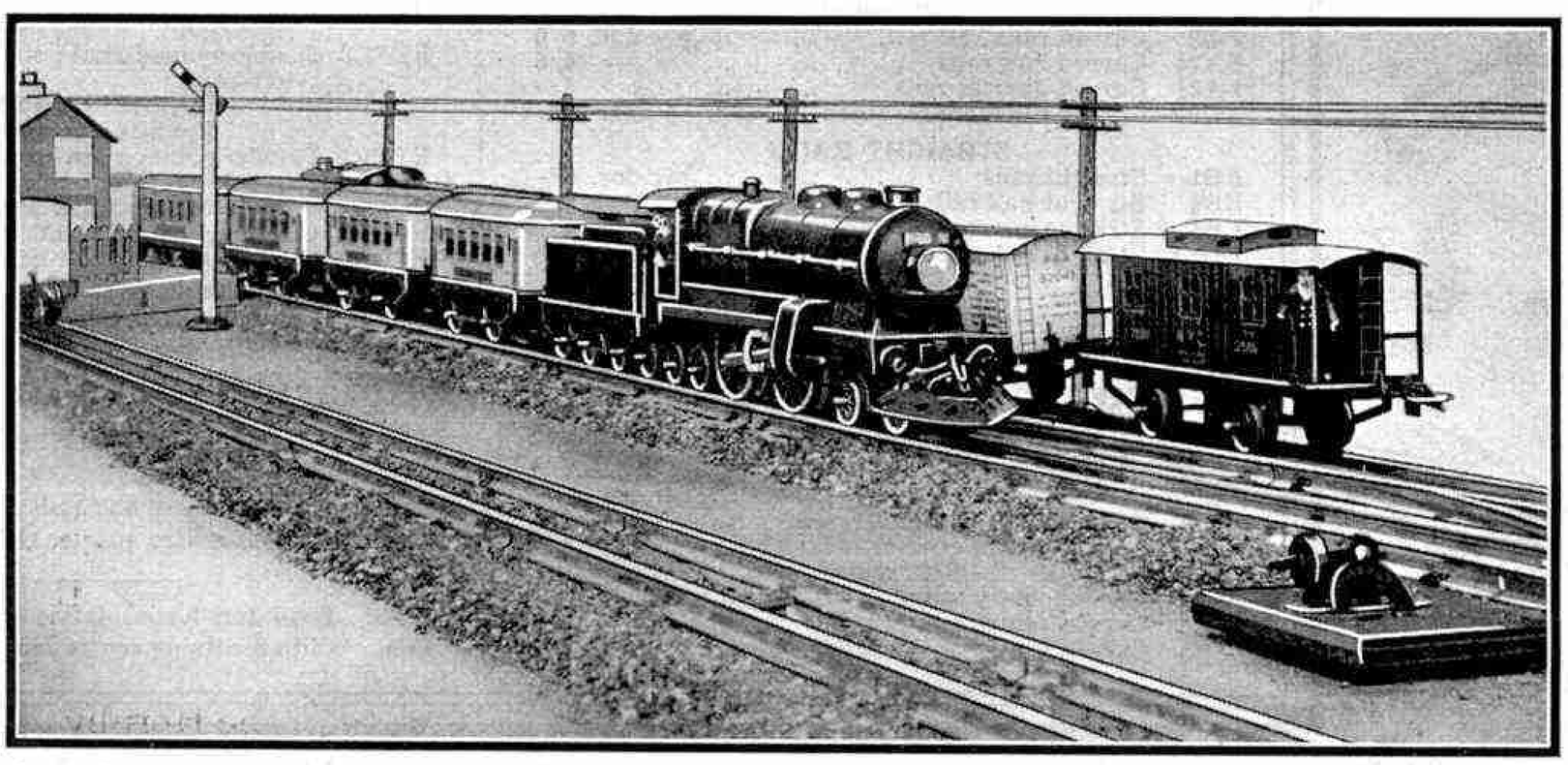
of the "Riviera" Blue Train may be added, as its outlines and general construction are very similar to those of American coaches, the somewhat small windows, in particular, being a feature. It can of course be vestibuled together with the other coaches mentioned, and its deep blue colour will serve to indicate its special purpose. To represent the American "baggage" car, a No. 2 Luggage Van may be included in the train.

Any of the crack trains of the American lines may thus be represented reasonably well, and it will add to the interest if the miniature reproductions are allotted suitable names, as are their prototypes. The "*Empire State Express*" and the "*Twentieth Century Limited*" of the New York Central have long been famous. The "*Overland Limited*" has its purpose disclosed by its name, and is operated from Chicago to San Francisco and Los Angeles, crossing the famous Sierra Nevada Mountains. Then there are fanciful titles such as "*The Gold Coast Limited*"; and the very businesslike "*Merchants Limited*" between New York and Boston.



A single track section of main line through rough country, with a train hauled by a Hornby 20-volt Locomotive. The "upper-quadrant" signals in this and the illustration below are M Signals with their semaphores reversed.

As regards the employment of stock lettered to represent British groups, it may be pointed out that in certain cases, such as the Southern Railway, the same title applies to an American railway, so that the English lettering is not in this case a disadvantage. Again, "L.N.E.R." may quite well stand for such a title as "Lehigh and New England Railroad." Alternatively enthusiasts may think out imaginary titles to suit their own systems in the case of these and other letterings, without spoiling the effect of the whole scheme, for American lines are well known for their diversity of titles.



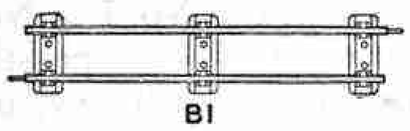
A wayside station with a train of American Pullman Cars leaving. A freight train is shown on the loop line waiting to gain the single track ahead after the passenger train has gone.

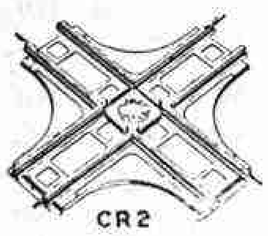
In connection with the Pullman and sleeping facilities on American lines it must be remembered that the attendants are invariably negroes, the Pullman Car Company being entensive employers of coloured labour. Therefore, to be quite correct, the Train Attendants, Waiters, and Hotel Porters of Modelled Miniatures Set No. 5 might be modified by means of a little brushwork to give them dark brown faces and hands.

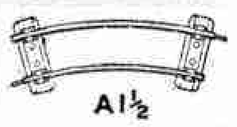
As regards local traffic, tank engines are not used much in the United States. Local and branch work may therefore be carried out by the smaller tender engines of the Series, suitable examples such as the No. 1 or No. 1 Special being perhaps Americanised as far as possible. Either of these engines, preferably in black livery, may be used for local work as well as for yard shunting, or "switching" as it is called in America. Switching engines, incidentally, do not as a rule carry a cowcatcher or pilot. They have at each end what is sometimes known as a "scoop," or small platform suspended from the buffer beam, on which yard or trainmen may ride.

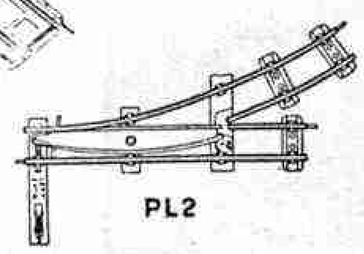
The recently-introduced Swiss Federal type locomotives, both clockwork and electrically-driven, and also the LE 2/20 Locomotive, may be used quite reasonably on a layout of this kind to represent the many giant types of electric locomotives operated in the States. Readers will remember the description that appeared in the "*M.M.*" in December, 1930, of "*The Olympian*," the famous express of the Chicago, Milwaukee and St. Paul Railroad. This is electrically hauled through the Cascade Mountains, and a representation of it in miniature would be very fascinating. A Hornby LE 2/20 Locomotive would look very impressive on this work, hauling a train made up as previously described. These new engines are particularly suitable for American-type layouts, as they are fitted with overhead bow collectors, or pantographs as they are sometimes called. It is interesting to note that these locomotives can be made more American-looking by providing a Hornby Pony Truck at each end in exactly the same manner as described in the "*M.M.*" for last July on the "In Reply" Page, under the heading "Double-Ender Tank Locomotives." The engine illustrated has been so treated, as is evident from the photograph. The alteration in appearance as a result is very striking.

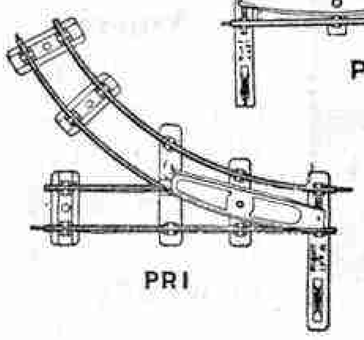
RAILS, POINTS & CROSSINGS



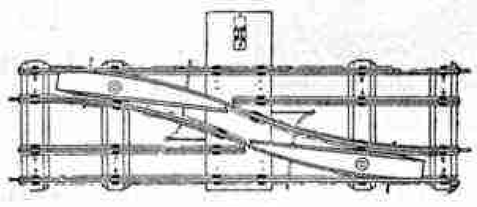


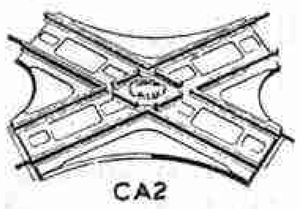


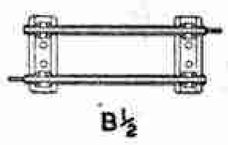


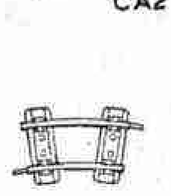


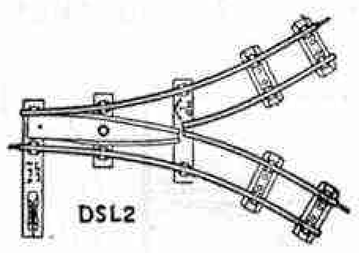


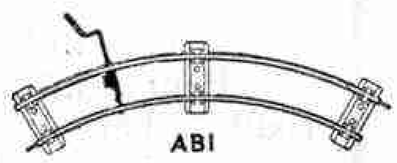


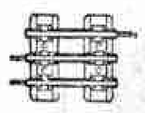


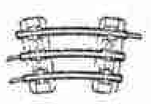


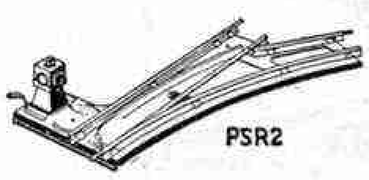


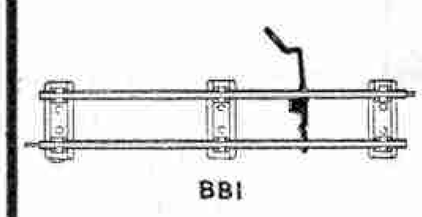


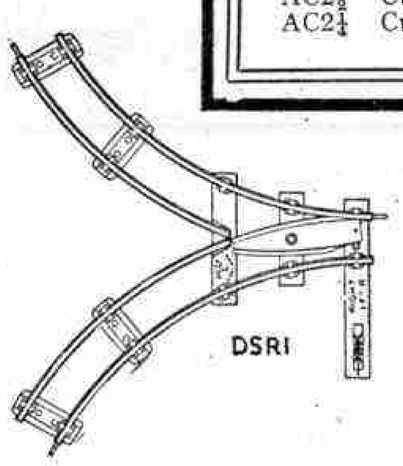


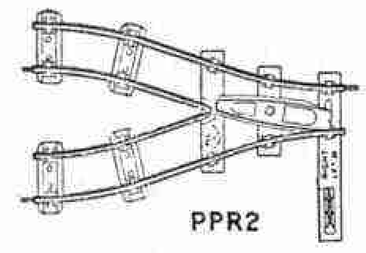


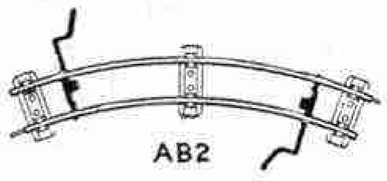


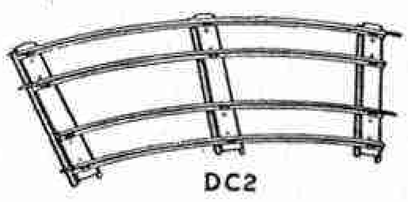


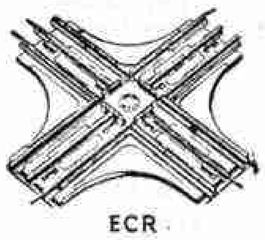




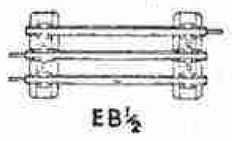


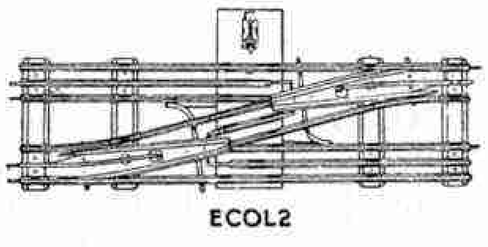


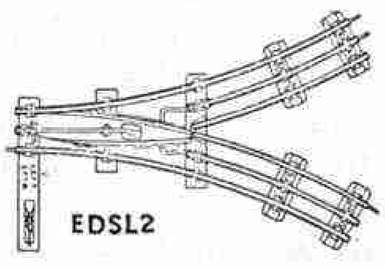


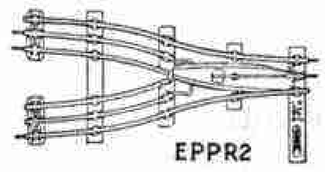


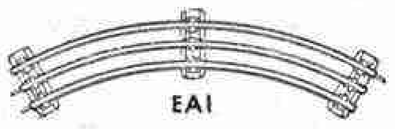


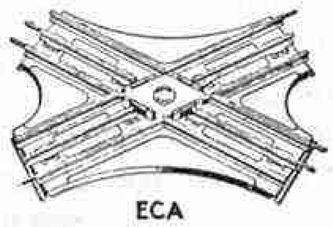


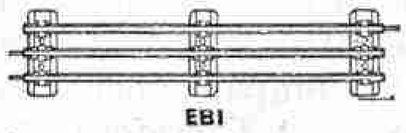












Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. They make possible an almost endless number of realistic and railway-like layouts. Only the finest materials are used in their manufacture.

GAUGE 0

ALTERNATE PEGS

Rails for Clockwork and Steam Trains

CURVED RAILS

9-in. radius (For MO Trains)

M9	Curved rails	doz.	3/-
MB9	Curved brake rails	each	3½d.

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.	7/6

STRAIGHT RAILS

BM	Straight rails (for MO Trains) ...	per doz.	2/9
B1	Straight rails	„	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.	6/6

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

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

For 2-ft. radius curves

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

PARALLEL POINTS

PPR2	Parallel points, right-hand... ...	per pair	5/-
PPL2	Parallel points, left-hand		

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/-
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	2/-
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9

CROSSOVER POINTS

COR2	Crossover points, right-hand ...	per pair	12/-
COL2	Crossover points, left-hand ...		

POINTS

9-in. radius (For MO Trains)

MR9	Right-hand points	per pair	3/-
ML9	Left-hand points		

1-ft. radius

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

2-ft. radius

PR2	Right-hand points	per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base, right-hand ...	per pair	8/6
PSL2	Points on solid base, left-hand ...		
RCP	Rail connecting plates	½ doz.	2d.

Rails for Electric Trains

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails	„	4/-

2-ft. radius

EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/-
EDC2	Curved rails, double track ...	½ doz.	9/-

STRAIGHT RAILS

EB1	Straight rails	per doz.	6/-
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/-
EDS1	Straight rails, double track ...	½ doz.	8/6

CROSSINGS

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

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

For 2-ft. radius curves

EPPR2	Parallel points, right-hand	per pair	8/6
EPPL2	Parallel points, left-hand		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/-
ECOL2	Crossover points, left-hand		
TCP6	Terminal connecting plates (6 volt)	each	1/6
TCP20	„ „ „ (20 volt)	„	1/6

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

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. radius

AC1	Curved centre rails	per doz.	1/-
AC1½	Curved centre half rails	„	9d.
AC1¼	Curved centre quarter rails ...	„	6d.

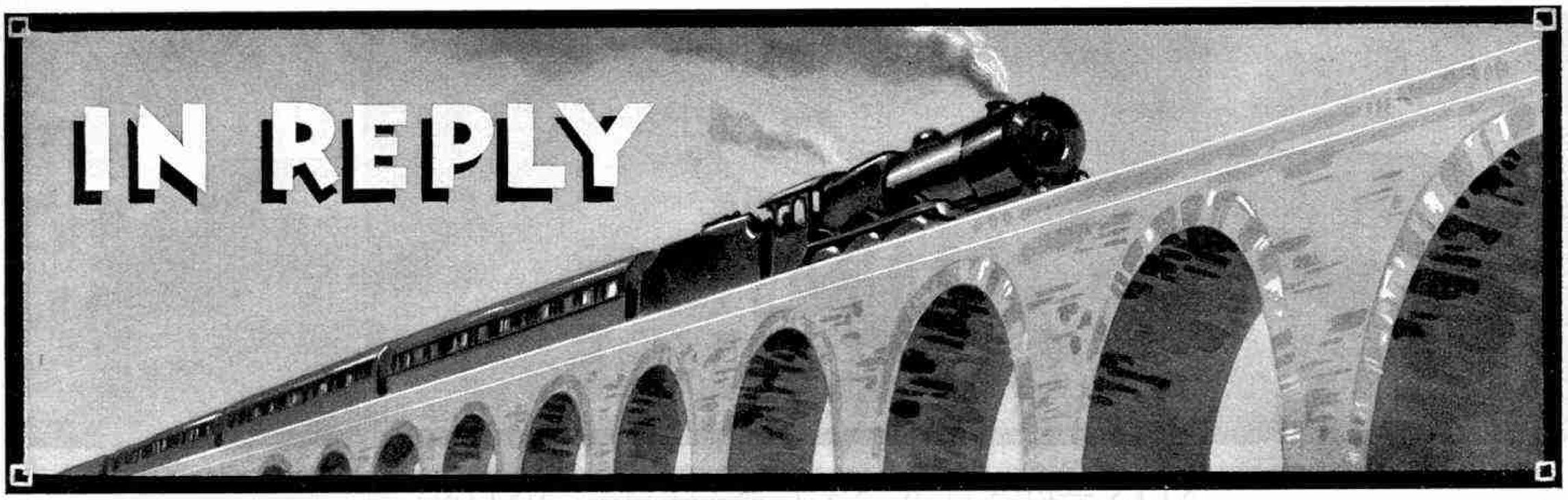
2-ft. radius

AC2	Curved centre rails	„	1/-
AC2½	Curved centre half rails	„	9d.
AC2¼	Curved centre quarter rails ...	„	6d.

STRAIGHT CENTRE RAILS

BC1	Straight centre rails	per doz.	1/-
BC½	Straight centre half rails	„	9d.
BC¼	Straight centre quarter rails ...	„	6d.
ICR	Insulators for insulating centre rails	„	3d.
CCR	Clips for fixing centre rails ...	„	6d.

Manufactured by - - MECCANO LIMITED - - OLD SWAN - - LIVERPOOL



Suggested Hornby Train Improvements

AMERICANISING A HORNBY LOCOMOTIVE

Many suggestions have been received, particularly from Overseas readers, for the introduction of a true-to-type Colonial or American locomotive. This no doubt would be attractive, especially to those who possess any of the American-type rolling stock of the Hornby Series, or whose layouts are intended to represent the practice of railways Overseas. It would be difficult to select a suitable prototype, however, in which the various features desired by Hornby Railway owners could be incorporated. Further, the large size and elaborate nature of many Overseas locomotives would make a true-to-type reproduction comparatively costly.

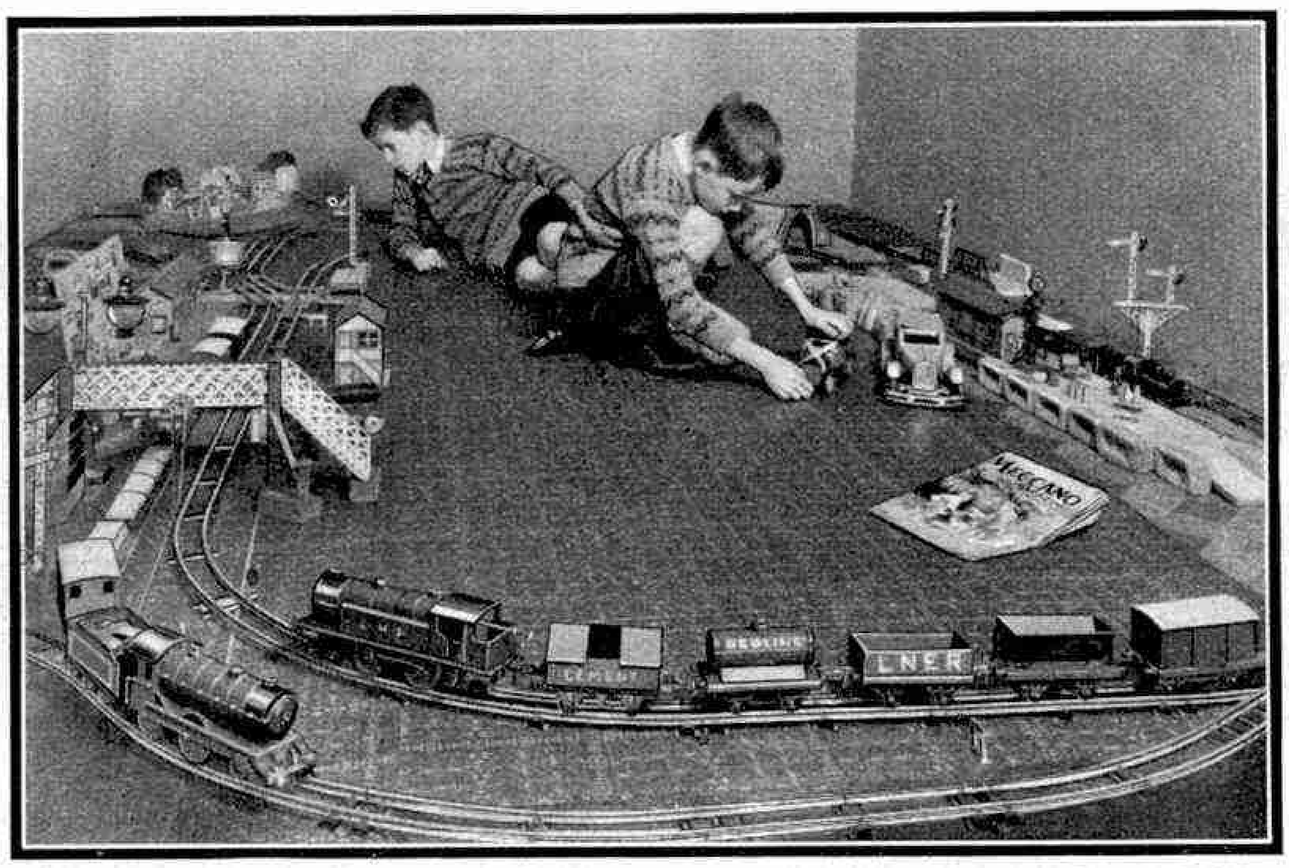
In the absence of a specially-designed locomotive, sufficiently good effects may be obtained by adapting an engine already included in the Series, namely, the well-known Nord 4–4–2 of the "Riviera" Blue Train Set. This locomotive has many typically French characteristics, but it is surprising how simply their effect may be changed by a few alterations that are quite easy to carry out. The boiler mountings closely resemble those of American practice, and the Belpaire type of fire-box is a feature of engines of the Pennsylvania Railroad.

The first step in the transformation is to provide at the leading end a "pilot," or cowcatcher as it is commonly called. Boys handy at metalwork will have little difficulty in doing this, but those who are not should obtain a Meccano Architrave, Part No. 108, and cut the longer arm of it so that both arms are identical. To do this a nick should be filed half through, and judicious bending will then do the rest, the arm finally being trimmed up with a file. The part is now bent so that it is divided into two equal portions, the arms including an angle of 75 degrees.

The pilot-to-be is now taking shape, as will be realised by trying it against the locomotive. The buffers of the latter are now removed, and it should be noted that they can be replaced later with standard brass buffers as used on Metropolitan Coaches, if the engine is again to become a European type. Next two Angle Brackets should be opened out to slightly more than 90 degrees and attached to the buffer beam with Meccano Nuts and Bolts through their slotted holes, so that the other portions of the Brackets point forward. The bent Architrave is now attached and carefully adjusted in the correct position. It must clear the rails by about 5/16" so that it will not collide with brake stops where these are used, or prove a nuisance on the inevitable ups and downs when temporary tracks are in use or where gradients are incorporated on a permanent line.

The characteristic headlight of American engines may be imitated successfully by a Meccano Chimney Adaptor bolted on through a hole pierced in the centre of the smoke-box door. An Angle Bracket is attached by the same bolt, so that one foot of it comes below the Chimney Adaptor, and between the two a Flat Bracket is secured to imitate the actual headlight support. As thus modified the engine is now conveniently American, and looks reasonably like a "high-wheeled" "Atlantic" or 4–4–2 locomotive. A further embellishment would be to remove the two-wheeled trailing truck under the cab and the dummy downward projection of the firebox and grate, and to replace these by a spare bogie of the pattern used on the tender of the Nord locomotive. This may be obtained separately if required, the price being 1/7 including postage. A 2" Strip is lock-nutted to the centre of the bogie, a Meccano Washer being interposed, so that the Strip is free to move. The other end of the Strip is passed over the rear mechanism-holding bolt, adjustment for height being easily carried out by means of Washers.

We now have an outside-framed four-wheeled trailing truck that gives the impression of the engine being fitted with a booster-driven truck, as are the "Hudsons" or 4–6–4s, 4–8–4s, and many other types in modern practice. Further fittings may be added if desired, for the modern American engine carries quite an array of pipes, pumps, feed-heating fittings and other gadgets. The tender, being bogie fitted, is suitable without structural alteration, and there is no necessity to interfere with the painting scheme, although it would be a good plan to paint black the various parts used for the pilot and headlight.



An interesting photograph showing two Hornby enthusiasts, Alan and Peter Le Claire, of Worksop, busy with their layout. Their equipment has developed from a simple set to the joint L.M.S.R. and L.N.E.R. layout shown above.

DOUBLE ARM SIGNALS

Most readers will be familiar with the Double Arm type of Signal that is included in the Hornby Series, in which two arms or semaphores, one "home" and one "distant," are mounted on the same post, the "home" being uppermost. In actual practice such a signal is commonly seen in busy areas, being used where a section between two "home" signals is so short that the "distant" signal could not be situated at the usual spacing from the "home" to which it applies. The difficulty is therefore got over by placing the "distant" arm on the same post as the preceding "home" signal. When a train approaches a double arm signal, and the "home" arm alone is down, the "distant" at danger shows that a stop at the next "home" signal is likely; but of course this may show "line clear" by the time the train reaches it. When both "home" and "distant" arms are down the driver knows that he has a clear road past the next "home" signal, and therefore that he may run on with every confidence at normal speed.

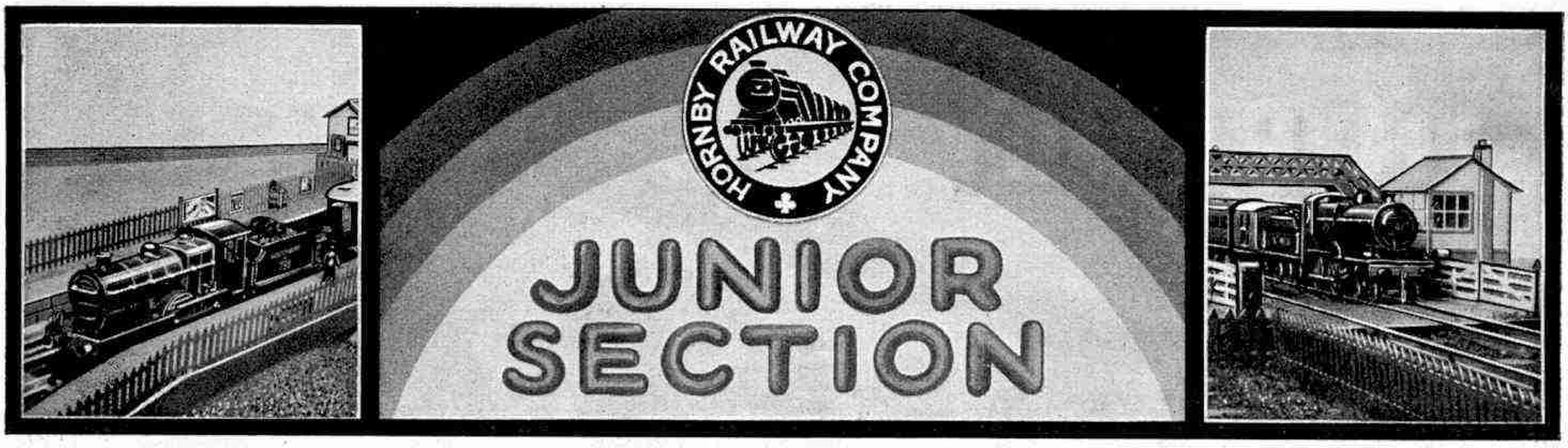
The "home" arm is worked from the adjacent cabin in the ordinary way, but the "distant" is worked from the cabin in advance, as it applies to the next "home" signal. Matters are so arranged that the "distant" arm cannot fall unless the 'home" arm on the same post is down, and naturally the "distant" is not operated unless the next "home" arm is down also. When the first "home" arm is restored to danger after the passage of the train, the "distant" below is caused to show danger also, as otherwise a conflicting indication would be given. The special arrangement that secures this effect is known as "slotting," and is worked by means of the ordinary levers and counterweights at the foot of the post, together with an auxiliary weight. This explains the collections of weights on such signals that have sometimes puzzled readers.

For ordinary hand operation of the Hornby Double Arm Signals, it is convenient and realistic to be able to return both arms to danger at once, and generally fulfil the conditions of slotting. This is easily effected in the following manner. The operating lever of the "home" arm at the front of the post is bent backward gently. The arm is now put in the "off" or down position, and similar bending, but towards the front, is carried out on the "distant" lever behind the post, so that it crosses above that of the "home." The "distant" arm may then be put down, and if the "home" lever is operated to return that signal to danger, the "distant" lever is carried with it, so that both arms display the same indication. Slight adjustment will be necessary in the operating wire of the "home" arm, as its lever now comes under the "distant" lever, and its travel is slightly restricted in consequence.

L.N.E.R. (NORTH EASTERN) 4-4-0 LOCOMOTIVE.—We agree that the engines you mention, the former N.E. Class "R1," now "D21," would be very pleasing in model form, but there is little likelihood of their addition to the Hornby Series. The G.C. pattern "Director" engines are of more recent construction and have been added to since grouping. In any case the former "R1" engines have been largely supplanted by the familiar Class "D49" "Shires," now so popular in the No. 2 Special Series of Hornby Locomotives. (*Reply to G. Milner, Leeds.*)

DOUBLE BOGIES FOR HORNBY METROPOLITAN LOCOMOTIVES.—This is an interesting suggestion, and there is no doubt that your arrangement of the driving gear of the Hornby Metropolitan Locomotives, both clockwork and electric, would be more correct. The method at present used is satisfactory, however, and enables standard mechanisms and motors to be provided in these engines. We hardly think that the expense incurred in the alterations you propose would be justified by the slight improvement in the outward appearance of the engines. (*Reply to T. Walker, Aylesbury.*)

"SOUTHERN BELLE" PULLMAN SET.—A train set as suggested by you to represent the "Southern Belle" headed by a No. 2 Special Tank Locomotive would hardly be worth while in view of the electrification of the Brighton line. However, there is no reason why those who require such a set should not purchase the components separately and add the complete train to their existing equipment. Further additions to the range of Train Name Boards are having consideration, but we cannot say which titles will be selected, though each group will be represented, as is the case with the existing Boards. (*Reply to B. Watson, Purley.*)



XLIX.—FEATURES OF SCOTTISH INTEREST

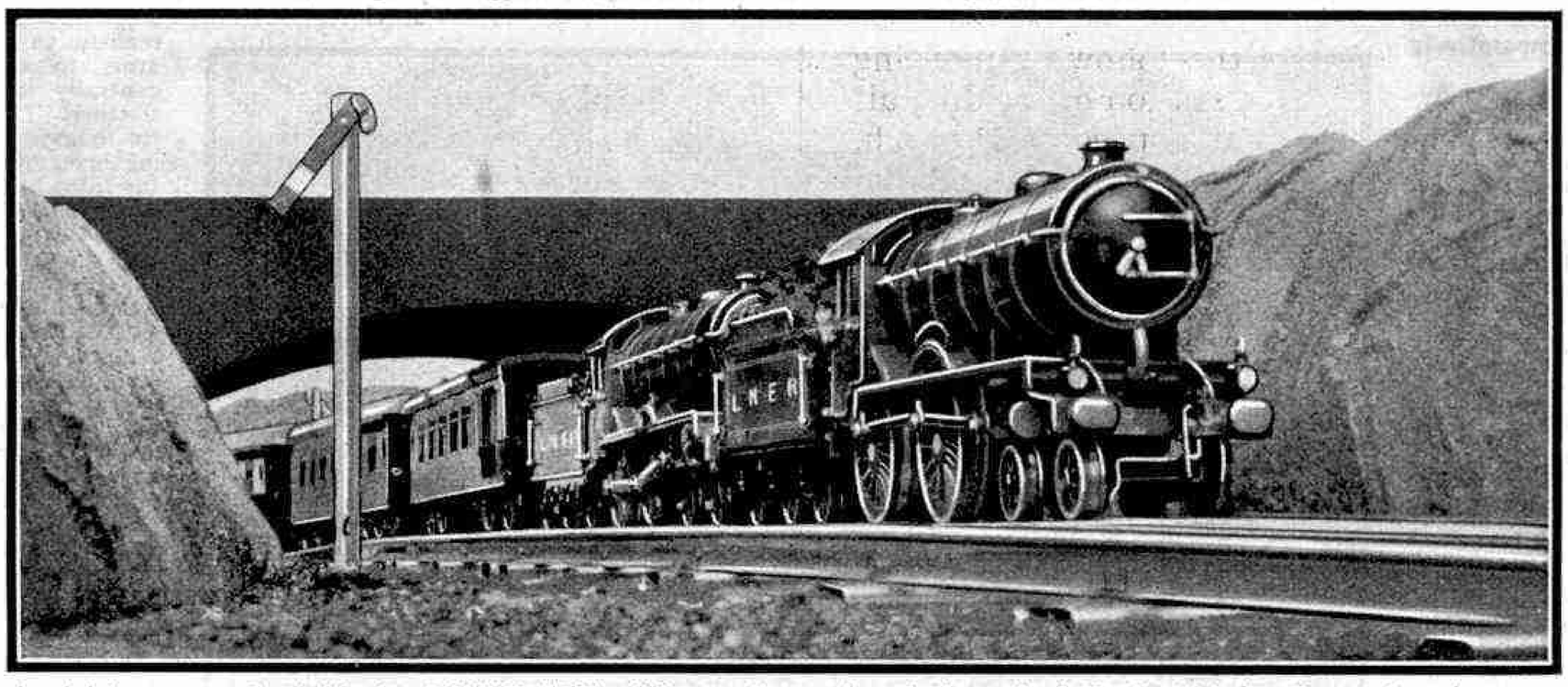
SCOTTISH interest in the New Year is proverbial, so that we think this is a suitable opportunity to devote our attention to matters applying to Scottish railway practice, and to suggestions for their reproduction on Hornby railways. An article on Scottish services appeared in the *"M.M."* for last July, and repeated requests for a further article have caused us to return to the subject this month. Apart from the characteristic features of the roads, and their difficult nature in many parts, there are interesting points in train working and general operation that are well worth mentioning.

For some years, in connection with the various International Rugby games arranged to be played at the Scottish headquarters at Murrayfield, it has been the custom for the L.M.S.R. to operate all-Pullman specials from Glasgow to Edinburgh and back. These are the only all-Pullman trains on the system, and this fact adds greatly to the interest of these unique trains. Each "Rugger Pullman," as it is familiarly termed, is keenly observed by railway enthusiasts. The well-appointed cars with their famous names, such as *"Mary Beaton," "Flora Macdonald," "Helen Macgregor"* or *"Lass o' Gowrie,"* double-headed perhaps, for the road is hard, by a couple of glistening Compounds, make a very fine sight. Such a train, on account of its special interest, is well worthy of reproduction occasionally on a Hornby L.M.S.R. system, and every effort should be made to have the engines and rolling stock as spick and span as possible. One of our photographs shows a miniature "Rugger Pullman" at full speed, and its handsome appearance is quite clear. Specials of ordinary stock of course do their share, and should not be forgotten by those who may make a feature of this kind of special traffic in connection with sporting events.

It will be noted that the leading engine carries the distinctive pattern of route indicator used on Caledonian and G. & S.W. sections of the L.M.S.R. This is of semaphore type, and the movable arms at the "three o'clock" position show that the train is providing a Glasgow and Edinburgh service. The method of making such an indicator for a Hornby L.M.S.R. engine was described in the *"M.M."* last July in the article previously referred to.

Numerous through sleeping car services are run between Scotland and England and vice versa. Such trains as *"The Night Scot"* of the L.M.S.R., and the *"Aberdonian"* of the L.N.E.R., immediately suggest themselves. We have previously described how Hornby No. 2 Saloon Coaches may be made to appear like sleeping cars, the transparent window strips being covered with tracing paper to look like the windows of "sleeper" compartments. If provided with electric light in addition—this was dealt with in detail in the *"M.M."* of February last year—the appearance of a miniature *"Aberdonian"* on a Hornby layout would be extremely realistic and interesting. To complete the effect, special roof boards should be made to fit such coaches, though there may be some difficulty in lettering these as completely as in real practice. The actual boards bear the following:—"Sleeping car—Inverness, Perth, Dundee and Edinburgh (Wav.) to King's Cross via Tay and Forth Bridges." Some modification will be necessary in miniature, but the reference to the Tay and Forth Bridges should be retained if possible as an interesting characteristic.

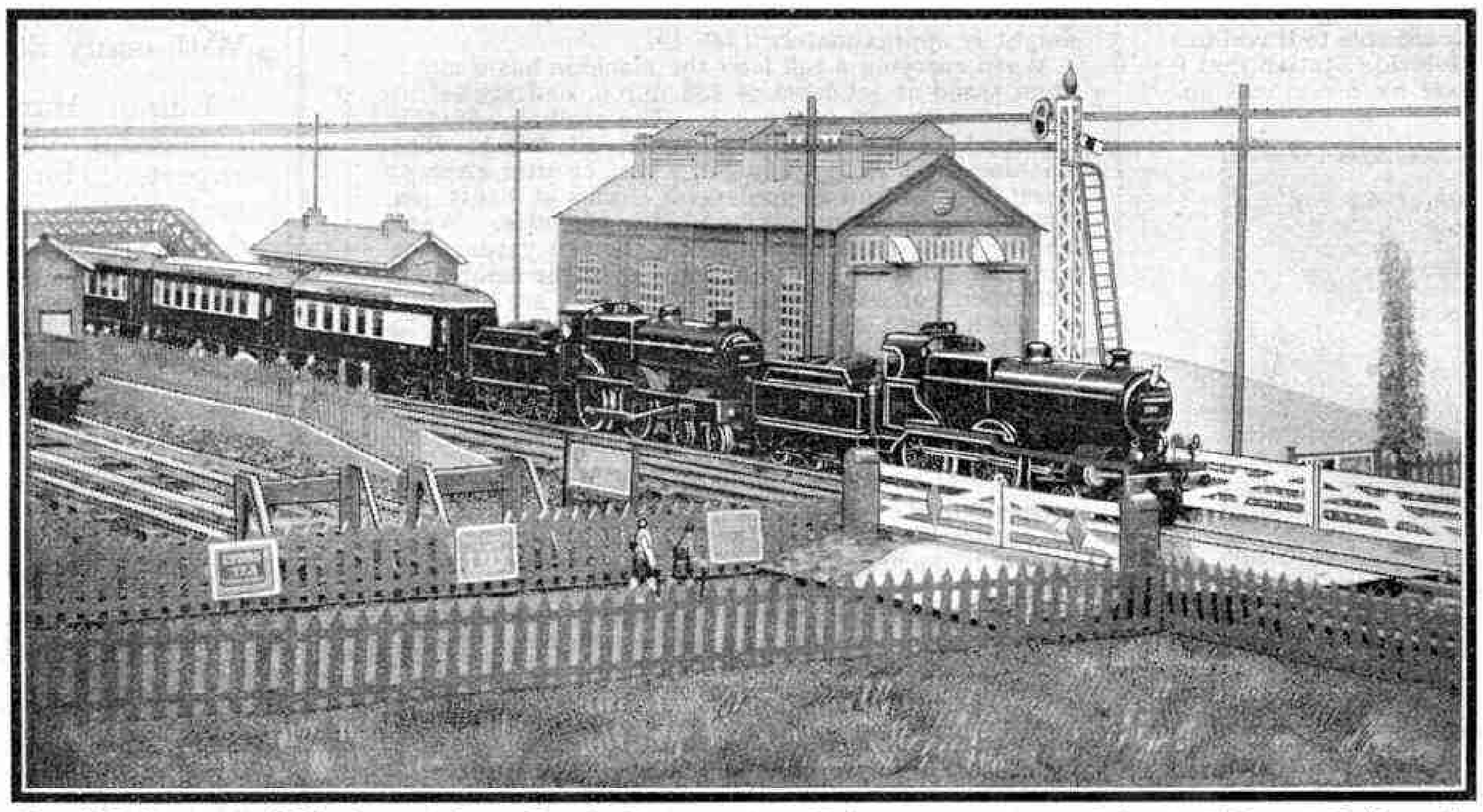
At the opposite end of the scale are the diminutive trains operated on out-of-the-way branch line services. Usually small and ancient tank, or even tender, engines are employed; so that any one of the older engines of the Hornby Series that is still in working order, and perhaps a special favourite with its owner, may be



A miniature express hauled by two L.N.E.R. "Shire" Locomotives. In actual practice in the Scottish Area two such engines may not run together except between Berwick and Edinburgh.

retained for such duties. No 1 Coaches will be suitable vehicles for these trains, and where traffic is light a mixed train may be run with a goods wagon or two attached to the rear of the passenger portion. There are several quaint branch lines in more or less remote parts of Scotland the operation of which is worthy of study and, if possible, reproduction in miniature.

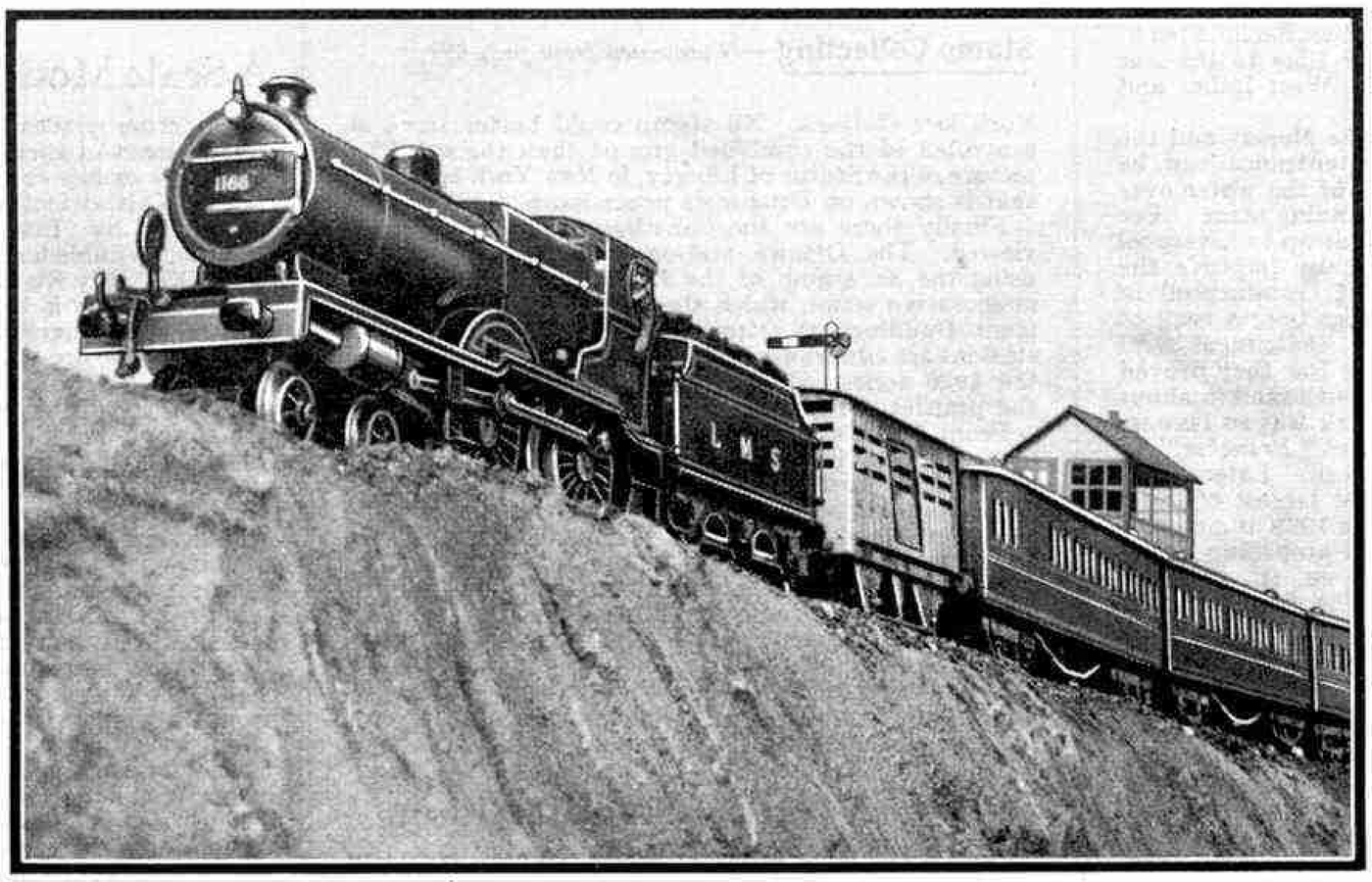
Both groups in Scotland operate important perishable services southward in the carriage of fish from Mallaig, Aberdeen and other fish centres. The L.M.S.R. vehicles marked "Aberdeen and Broad Street Fish Traffic" are familiar sights, while the 12 noon fish train of the L.N.E.R. from Mallaig is well known for its speedy schedule. It reaches King's Cross early on the following morning after a journey of 597 miles, even a section of the difficult West Highland line being covered at a speed of 32 m.p.h. A number of Hornby Fish Vans hauled by a No. 1 Special Tender engine will reproduce this train satisfactorily in miniature as far as conditions north of the Border are concerned, but express engines are often used on the southern section of the run. Readers will remember that an interesting photograph of such a train appeared in the "*M.M.*" in May last year in the second instalment of "Tommy Dodd's" article dealing with the "*Covered Wagons of the Hornby Series.*"



An all-Pullman special in charge of two Hornby Compounds. This represents successfully the "Rugger Pullman" of real life that runs from Glasgow to Edinburgh as described in this article.

A point that should not be missed on layouts supposedly situated on Scottish soil is the scope for scenic effects afforded. Rugged mountains and bleak moorland may form an appropriate background, and will contrast strikingly with the industrial surroundings that may exist on other parts of the line. One of our photographs shows an L.M.S.R. train on a high and exposed embankment. Exaggeration of such features is a fault, but their incorporation in a reasonable and realistic manner will add considerably to the charm of the scheme. Rock chippings and similar materials may be used to good purpose, and will give an appropriate character to the surroundings.

The hill-climbing power demanded of Scottish locomotives means that gradients, either real or imaginary, should be allowed for in the scenic effects, and in any case they should be indicated by the appropriate Hornby Gradient Posts. In a similar manner we may follow the example of the L.M.S.R. at Druimuachdar Summit on the Highland section, and indicate the Summit point and height above sea level—in this case 1,484 ft. Actual gradients may necessitate the employment of banking engines, and this is a particularly interesting feature of working. Careful arrangements must be made and the train handled with care, so that derailments are not caused by faulty coupling or other causes. Rear-end assistance is regularly given on the 10-mile climb to Beattock Summit on the L.M.S.R., and of course the severe gradient of Cowlairs Incline out of Queen Street, Glasgow, on the L.N.E.R., requires the employment of banking engines in the rear of outgoing trains.



An L.M.S.R. stopping train on a lofty embankment. Rugged features of this kind may be incorporated with good effect in layouts that represent Scottish practice.

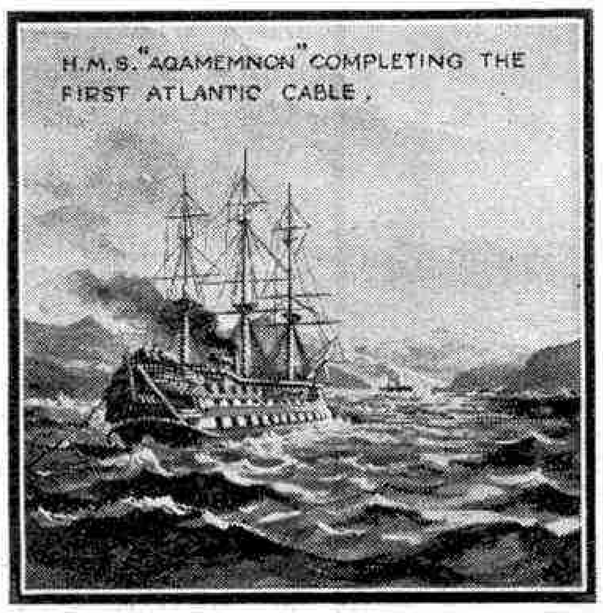
Mention of the L.N.E.R. recalls the restrictions that are imposed on the operation of the well-known 4–4–0s of class "D49," or "Shires" as they are popularly known. These engines are only allowed to work from Edinburgh to Berwick, Carlisle, Aberdeen, Perth, and to Glasgow via Falkirk. They must not work on such routes as the West Highland line, and two of them must not be run coupled together anywhere except between Berwick and Edinburgh. In special circumstances the practice may be tolerated, so that occasionally this feature may be reproduced in miniature. One of our illustrations shows a Pullman express headed by two Hornby No. 2 Special "Yorkshire" Locomotives, the special requirements of the occasion being considered such as to justify the employment of the two engines.

In dockside areas and shipping districts there is a surprising number of small tank engines specially intended or used only for such work. Some of these are of great age, but others may be quite modern, such as the little 0–6–0 side tanks of the L.M.S.R. Nos. 11270-9. These, with their outside cylinders and Walschaerts valve gear, are essentially up to date, and a photograph of one of them at work at Leith Docks

(*Continued on page 64*)

The Port of Liverpool—(*Continued from page 8*)

and mooring chains, the shore ends of which are in the river wall. The southern half of the stage is used for the traffic of the Mersey ferries, and the northern half is reserved for sea-going passenger ships. The level of the deck of the stage is from 6 ft. to 8 ft. above the water, and for the ferry passengers gangways are arranged in fixed positions. Movable gangways are used for the transatlantic and other vessels, and there are also high level bridges adapted to the towering decks of ocean liners. A special floating bridge 550 ft. long is provided for heavy traffic. Ocean-going passengers from towns on the L.M.S.R. are able to travel to a special station known as the Riverside Station that is connected with the landing stage by permanent and



H.M.S. "Agamemnon" shared with the U.S. warship "Niagara" the task of laying the cable that in 1858 connected Europe and America by telephone for the first time.

movable gangways. Thus they are able to pass direct from train to steamer or vice versa without leaving shelter.

Many of the world's most important ocean steamship companies have begun their career in Liverpool, and many others that have made their headquarters here have grown to greatness. Notable examples are the Bibby Line, founded in 1807; the Blue Funnel Line, started in 1852, and the Booth Line, founded in 1866. The famous White Star and Cunard Lines have been associated with the Port from their early days, and in spite of the rivalry of Southampton many of their finest ships regularly sail from Liverpool to Canada and America. Among other important lines with regular sailings from Liverpool are the Canadian Pacific Steamship Ltd., to Canada; the Anchor Line to the Far East and the Harrison Line to the West Indies and South America.

The class of ships able to enter the Mersey and the period of time during which the entrance can be navigated depends upon the depth of the water over the Bar, about 13 miles from the landing stage. For many years the Bar was a great handicap to Liverpool shipping, and to lower it and thereby improve the approach to the river dredging was commenced in 1890 as an experiment. Two hopper barges each of 500 tons capacity were fitted with centrifugal sand pumps, and when set to work at the Bar they proved capable of filling their own hoppers with sand in about 30 minutes. The result of their work was so favourable that in 1893 a new vessel, the "*Brancker*," of 3,000 tons capacity, was set to work. Later other dredgers were added to the fleet, the largest of these being the "*Leviathan*," completed in 1909 at a cost of £150,000. She is a twin screw self-propelling vessel with a hopper capacity of 180,000 cu. ft., and can fill herself with 10,000 tons of sand in 50 min. when dredging from a maximum depth of 70 ft.

Dredging has been carried out at the Bar over an area about 8,000 ft. long by 2,000 ft. wide, the latter being the average width of the buoyed channel through the Bar. The depth of water there at low level of spring tides has been increased from 11 ft. in 1890, to about 25 ft. to-day. Ships can now come over the Bar at practically any state of the tide, and proceed by way of the Queen's and Crosby channels into the Mersey. If they are passenger liners they are then able to go alongside the Landing Stage for disembarkation. The Crosby Channel has been made straighter and more easily navigable for large ships by the construction of training banks, built primarily to prevent erosion. A training bank consists of a layer of small lumps of hard stone deposited along the face of the bank, below low water level, to clothe its slope and protect the underlying sand.

In conclusion a few figures will be sufficient to show the immense growth in the trade of Liverpool that has taken place since the 18th century. In 1757 the number of ships entering the port was 1,371, and by 1931/2 (year ended July 1) the number had risen to 19,363, with a tonnage of 19,080,728. In 1931 Liverpool exported more goods than any other port in the country, London being second; and the import trade was second only to that of London, and far above that of any other English port.

We are indebted to the courtesy of the Mersey Docks and Harbour Board, Liverpool, for much of the information contained in this article.

Aircraft Developments—(*Continued from page 23*)

normal side-by-side type, the rudder bars having a parallel motion. All moving parts are fitted with ball bearings. If required the second pilot's controls may be quickly and easily detached. A photograph showing the interior of the cockpit is published on page 24 of this issue.

The "Monospar" has a span of 40 ft. 2 in and is 26 ft. 4 in. in length and 7 ft. in height. When the wings of the machine are folded for garaging purposes the overall span is 14 ft. 10 in. The weight empty is 1,300 lb. and fully loaded 2,300 lb. The full disposable weight is approximately 1,000 lb.

When carrying a full load the machine has a maximum speed at sea-level of 132 m.p.h. and cruises at between 112 and 115 m.p.h. The stalling speed is 44 m.p.h. and the landing speed 46 m.p.h. The machine takes off in still air in 7 sec., or after a run of about 84 yds., and at sea-level it climbs at 900 ft. per minute, the maximum ceiling being 18,000 ft. When landing the normal run in still air is 110 yards, with partial braking. The normal range of the machine is 500 miles, but when the additional tanks are installed as previously mentioned, this may be increased to more than 1,000 miles.

Junior Section—(*Continued from page 63*)

appeared in the "*M.M.*" for June, 1930. Such engines are commonly known as "pugs" in Scotland, and the term is frequently applied to all tank engines, even of the main line variety. M3 and No. 1 Tanks may thus be given plenty to do where dockland areas are served by the line, and any veterans of the older No. 1 or even "Zulu" varieties may be made use of.

Another point of interest is the fact that there is still quite a number of wagons still running with the lettering of their pre-group owners still displayed. This seems to apply especially to Scottish wagons and suggests a scheme that may appeal to some readers. All Hornby wagons have of course long been finished in the styles of the present "Big Four," but two of them at any rate can be adapted to represent stock belonging to pre-amalgamation concerns that have not yet been repainted. For instance, let us consider the initials G.W. on perhaps a Hornby No. 0 or No. 1 wagon; the initials used on the wagons of the Glasgow and South Western Railway may be produced by adding "& S." between the present G. and W. by any boy handy with a paint brush. Similarly the "E" of N.E. may be persuaded to assume the form of the "B" of N.B. with equally effective results. Two old wagons lettered in this way will add further realism to a miniature line by giving the impression that it has been established many years.

Stamp Collecting—(*Continued from page 69*)

York key stations. No stamp could better serve as a symbol of the combined groups than the splendid picture of the Statue of Liberty, in New York Harbour, that is shown on Uruguay's peace issue of 1919.

Finally there are the Canadian stations to be reviewed. The Ottawa station may be included by using the 3c. stamp of the 1927 Confederation commemorative series, which shows a view of the Parliament Buildings at Ottawa. Winnipeg's short wave stations are admirably represented by the 20c. stamp of the 1926 series, which shows a harvesting scene on the prairies.

From Canada we travel back in a floating radio station, a great liner such as is shown on the 1f.75 stamp of Belgium's Anti-tuberculosis issue of December, 1929. This stamp might well be taken to link up the importance of the ocean liners' wireless installations, for it shows the liner's aerials.

A search through the stamp album and an up-to-date schedule of world radio stations will bring more and more suitable stamps and wireless stations to light, so many indeed that acceptance of the radio "fan's" offer to write up the collection will keep him away from his tuning knobs for many evenings to come!

Gibbons' Atlas Stamp Album

Among the wide range of stamp albums provided by Stanley Gibbons Ltd., one of the most interesting is the "Atlas" album sold at the remarkably low price of 1/–. It would be difficult to find an album more suited to the early needs of the new collector. It contains over 100 ruled pages, which provide accommodation for 3,750 stamps, and is illustrated with 400 full-sized stamp reproductions selected to solve the beginner's difficulties in identifying the less common stamps. The album is bound in a strong pictorial cloth cover, obtainable in chocolate, red, green, blue, or violet. It may be obtained from any stamp dealer, or direct from Stanley Gibbons Ltd., Dept. S15, 391, Strand, London, W.C.2.



Your Editor's Book

The Book of Natural Wonders

By ELLISON HAWKS, Author of *The Book of Electrical Wonders*, etc. With many illustrations. 7/6 net.

"Ellison Hawks is an adept at explaining the technical to the non-expert. Here he deals with rocks and rivers and mountains and deserts and earthquakes. There is an interesting account of the great meteor crater of Arizona and the researches which are still going on."—*Observer*.

"A first-class book. Mr. Hawks writes clearly and persuasively."—*Sunday Times*.

Everyman's Wireless

By C. L. BOLTZ. Illus. 7/6 net.

By a practising instructor of wireless, this book is for the intelligent amateur who wants more than the ordinary wireless hand-book. It has been highly praised by *World Radio*, *The Wireless World*, etc.

(*Prospectus on application.*)

HARRAP

39, Parker St., London, W.C.2

A Scale Model Aeroplane that Flies

Model aeroplanes that will fly are now fairly common, but in most of them good performance is attained by the more or less complete sacrifice of realistic appearance. This defect does not exist in a new model produced by International Model Aircraft Ltd., Merton, Wimbledon. This machine is known as the "FROG" (Fly Right Off Ground) Mark IV Interceptor Fighter, and it is built to a scale of $\frac{3}{8}$ in. to 1 ft. A feature of the machine is that the wings, undercarriage and airscrew are attached to the fuselage by special "push on" arrangements, so that if the machine nose dives on to hard ground these parts merely fall off and remain undamaged. Elastic is employed to drive the model, and an ingenious arrangement is provided to obviate the necessity of twisting the airscrew for five minutes, as is necessary with many models. The winding is done by means of a small handle that operates a train of gears inside a patented winder and so turns the propeller. The machine has an overall length of 9.275 in. and a span of 11.6 in., and the airscrew rotates at 2,800 r.p.m.

Our tests unfortunately were made in unfavourable weather conditions, but in spite of this the model rose from the ground in from 2 ft. to 5 ft. and flew at high speed a distance of 70 or 80 yds. at a height of about 50 ft. Given a good day we think that the makers' claim for a flight of 100 yds. at 50 ft. would be realised.

The "FROG" is supplied at the low price of 10/6, complete with two bottles of lubricant, one for the gear-box bearings and the other for the elastic.

Diaries for 1933

Specimens of the 1933 diaries issued by Charles Letts & Co. show that there is no deterioration in the high standard of the firm's products. The School-Boy's Diary is published this year in a 1/– edition, which contains all the old features that have made this diary so popular. The Boy Scout's Diary (1/–) has a new picture cover, and the Motor Cycling Diary (1/–) is also issued in a 2/6 edition that includes road maps. The Wireless Diary (1/–) should appeal to all wireless enthusiasts, for in addition to the usual features of a diary it contains many pages of notes of practical value on the maintenance of wireless receivers. All the diaries are well printed and produced in an attractive and durable form.

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.

AN INTERESTING SIGNALLING CONTEST

The signalling of railways is a subject that at first is apt to be a little bewildering, but subsequently becomes a most fascinating study. All railway signalling is based on definite principles, and once these are grasped it becomes easy to follow the working of actual installations. Many of the mechanical and electrical mechanisms now in use on railways are exceedingly complicated in construction, but the operations they carry out are really simple and are based on the same principles that govern the working of an ordinary manually-operated cabin.

The principles of signalling have been dealt with in the "*M.M.*" on many occasions, and we are sure that most H.R.C. members have a fair working knowledge of the subject. In order to enable them to test their knowledge, and at the same time to provide an interesting holiday problem, we announce this month a special Signalling Contest. The illustration on the centre of this page shows a portion of a railway track with main lines and a terminal bay for local trains. The problem is to indicate the signals that will be required to enable all the operations possible with this layout to be carried on efficiently and safely.

Competitors should not tear the page out of their magazines, but should make a copy of the layout on a sheet of paper. It will be found easier to work out the necessary signalling scheme if a copy is made a good deal larger than the original, and it would simplify matters if the signals were marked in red or some other distinctive colour. If the competitor considers it advisable to add a few words of explanation that would make certain matters perfectly clear, he may do so.

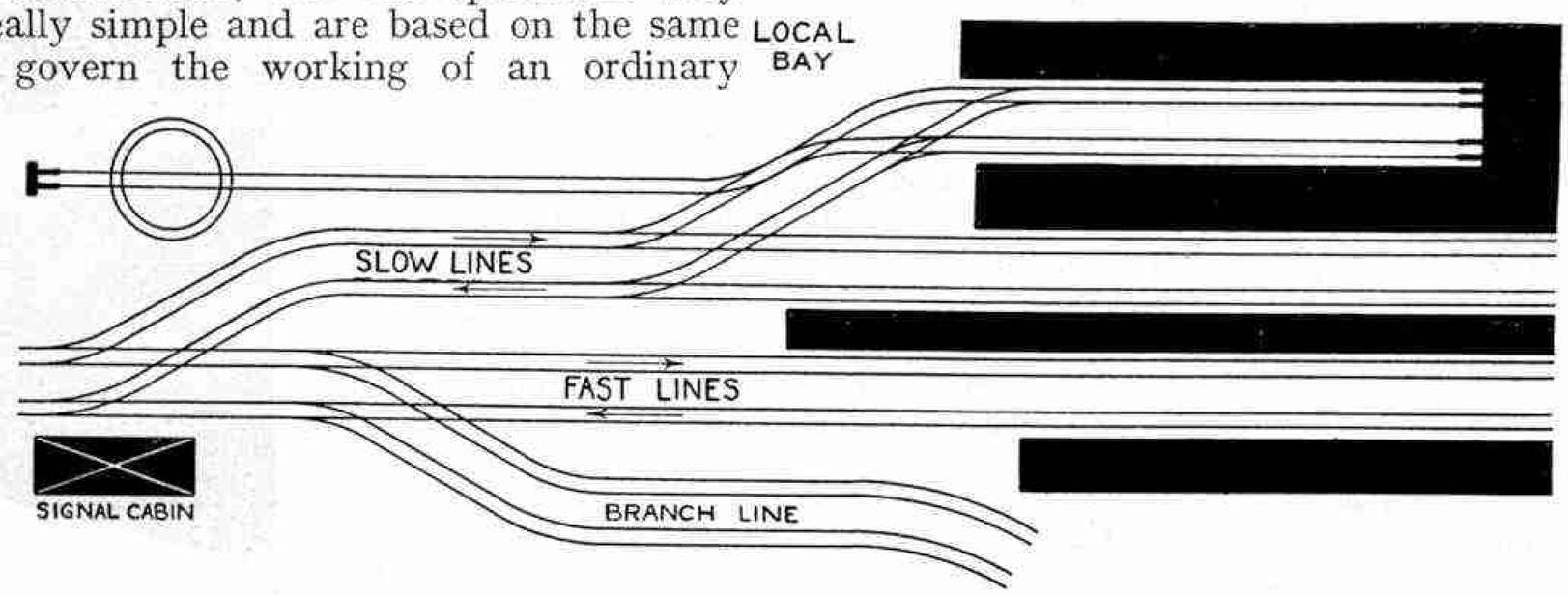


Diagram of the track to be signalled for efficient and safe working.

The Contest will be divided as usual into two sections—Home and Overseas. Prizes of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors in each section who submit the most complete and correct signalling scheme. In addition a number of consolation prizes will be awarded to entries that are very near to prizewinning standard. In the event of two entries being equal in regard to completeness and correctness, the prize will be awarded to the one that is the more neatly-prepared and legible.

Envelopes containing entries should be clearly marked "*H.R.C. New Year Signalling Contest*" in the top left-hand corner, and addressed to Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool. The closing date for the Home Section is 31st January, and for the Overseas Section 29th April.

The name and full address of the competitor, together with his H.R.C. membership number, should be clearly written on the back of each entry.

Railway Joke Contest

December is the most jovial month of the year, and probably more jokes and "tall stories" are told around firesides during this month than at any other time.

It was at a Christmas party that I first heard the following good railway story. As the train was moving out of the station a furious passenger cried: "Why didn't you put my luggage in as I told you?" The porter replied: "Eh, mon; yer luggage is no such a fule as yersel'. Ye're in the wrong train!"

Doubtless our readers will hear many new railway jokes this Christmas, and we would like to share them. Prizes of Hornby Train Goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively are offered to the senders of the best four railway jokes in each Section, Home and Overseas. A number of copies of "*Famous Trains*" by C. J. Allen will be awarded as consolation prizes. The jokes should be addressed "*H.R.C. Railway Jokes Contest*," Meccano Ltd., Binns Road, Old Swan, Liverpool. Closing dates: Home Section, 31st January. Overseas Section, 29th April.

Voting Contest

The various competitions put forward on this page continue to be immensely popular, and the splendid response by H.R.C. members month by month suggests that all the subjects are favourites! In order to help us to decide what particular type of contest is most popular with the majority of readers we have decided to announce this month a Voting Competition on this point.

Every entrant for the Competition is required to state:—

(1) Which of the main 12 H.R.C. Contests that have appeared during 1932 is his favourite.

(2) What he considers are the eight most popular of these Contests in the order of their popularity.

Prizes of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors in each Section, Home and Overseas, who give the most accurate forecasts of the final order of voting.

Competitors should complete their entries on one sheet of paper only, on the back of which should appear the competitor's name, full address and H.R.C. membership number. Envelopes should be clearly marked "*H.R.C. Voting Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st January. The closing date for the Overseas Section is 29th April.

COMPETITION RESULTS

HOME

October "Errors Contest No. 3."—First: C. G. Trimmer (16052), Gillingham, Kent. Second: D. Whyte (28698), High Burnside, Glasgow. Third: N. Cordingley (4572), Northwood, Middx. Fourth: R. Barbary (5580), Mevagissey, Cornwall.

October "Layout Planning Contest."—First: D. F. Cleminson (8922), Chiswick, London, W.4. Second: C. E. Wrayford (6039), Newton Abbot, Devon. Third: M. Blakelock (9776), Huddersfield. Fourth: F. Hodson (9430), Bolton, Lancs.

OVERSEAS

July "Impossible Train Contest No. 3."—First: R. Pascaud (29988), Chaumont, Hte Marne, France. Second: F. Van Bulck (1875), Forest-Brussels, Belgium. Third: G. Hallack (17578), Capetown, S. Africa. Fourth: J. Fabrie (30032), Wijk-Maastricht, Holland.

July "Summer Photo Contest No. 2."—First: F. Eagle (28845), Byculla, Bombay, India. Second: A. McIntyre (30925), Winnipeg, Canada. Third: F. L. Bingen (28995), Maastricht, Holland. Fourth: H. J. Borgman (29579), Maastricht, Holland.

Solutions of December Puzzles

No. 1. The motoring terms were: Valve, tyre, saloon, puncture, spanner, license, radiator, windscreen, horn, brake, spring, chassis, bonnet, clutch, accelerator.

No. 2. Farmer Brown's puzzling letters make the sentence: "The season is backward" (The "C's" on "is" backward).

No. 3. To make this sentence comprehensible, it is best to put the words written by Brown and Smith in quotation marks and to put hyphens where "had had" is used. The sentence now becomes: Brown, where Jones had-had "had," had-had "had-had." "Had-had" had-had more weight with the examiners.

No. 4. The verse was taken from Gray's "Elegy Written in a Country Churchyard." It was:

Full many a gem of purest ray serene
The dark unfathomed caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air.

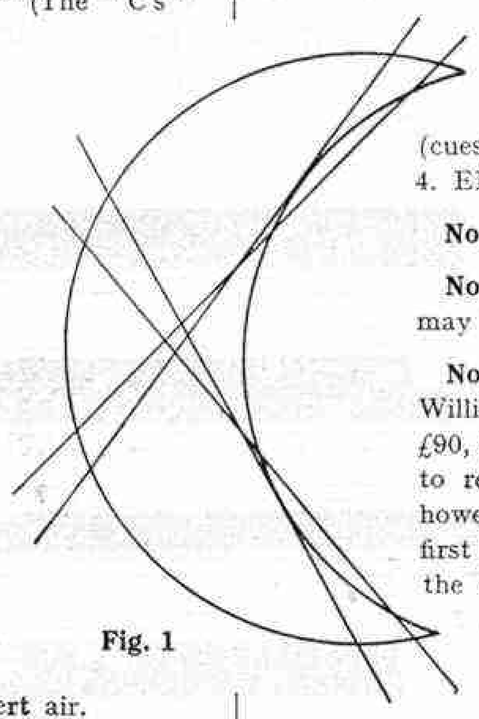


Fig. 1

No. 5. This puzzle was a little more difficult than many of a similar type, for the letters making up the names of the sports and games were not in their correct order. The sports, beginning with the outer ring, were: Yachting, swimming; football, chess; tennis, hockey; and whist.

No. 6. The keys were grouped so that the numbers on them were 78—345—26910.

No. 7. The magic square is:

492
357
816

No. 8. One of the coins was not a halfpenny, but the other was!

No. 9. The trains had to cover 400 miles before they met, and as their joint speed was 100 m.p.h. they would travel for four hours before meeting. In this time the "Puss Moth," travelling at a speed of 110 m.p.h., would cover 440 miles.

No. 10. The words were B, BE, BET, BEAT, BEAST, BASTER, BOASTER.

No. 11. Below are the names of the ten well-known men:

Blenkinsop, Campbell, Cobham, Dickens, Faraday, Gallagher, Jardine, Mollison, Shackleton, Stevenson.

No. 12. To cut a chain of 30 links into six five-link lengths, most people would cut every fifth link. This would necessitate six cuts at 5d. and six re-solderings at 7½d., giving a total cost of 6/3 for which sum a new chain could be bought. If, however, instead of cutting every fifth link, every sixth link is removed, five five-link chains are left and the sixth can be made from the five links left over. This means five cuts and five re-solderings, making a total cost of 5/2½d., or a saving over the other methods of 1/0½d.

No. 13. Fig. 1 gives the solution to this puzzle.

No. 14. Claudius, King of Denmark, was obviously the biggest poultry dealer, for in "Hamlet" Act 1. Sc. 5, it is stated that he did "murder most foul!"

No. 15. The first words that should have been written down are: Pitch, emigrate, strife, pantry. From these the following concealed words should have been struck out: Pit, grate, rife and pant, leaving the word Chemistry.

No. 16. This was a trick cross-word. Each of the clues down gave the word "Quiet." This made the clues across, 1. QQQQQ (cues); 2. UUUUU (use); 3. IIIII (eyes); 4. EEEEE (ease); TTTTT (tease).

No. 17. Meccano.

No. 18. The method of doing this puzzle may be seen in Fig. 2.

No. 19. After working for three years Williams would have earned £50, £70 and £90, giving a total of £210. Had he chosen to receive a rise of £5 every half year, however, he would have earned £25 the first half-year and £30 the next. During the second year he would have earned £75 and during the third, £95. This gives a total of £225, or an extra £15.

No. 20. The bill was:

Horse for a day	9/6
Hay for the horse	2/6
A' shoein' him	3/6
A' taking him home again	6d.
	16/-

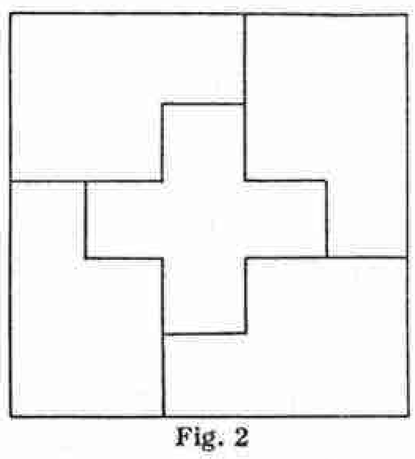


Fig. 2

No. 21. Nothing.

No. 22. For solution see Fig. 3.

No. 23. The 49 cigarette ends would make seven cigarettes, but if the ends of these made-cigarettes were kept, there would be enough to make an eighth one.

No. 24.

F A R A D A Y
E I I L O R E
A R C A D I A
R Y E S O A T

This gives the names Faraday and Arcadia.

No. 25. There words were:

GLISSADES
LOGICAL
LODGE
PER
S
ITS
FURZE
IMPALES
NICKNACKS
SOUTHDAKOTA

The concealed bombing aeroplane was the "Sidestrand."

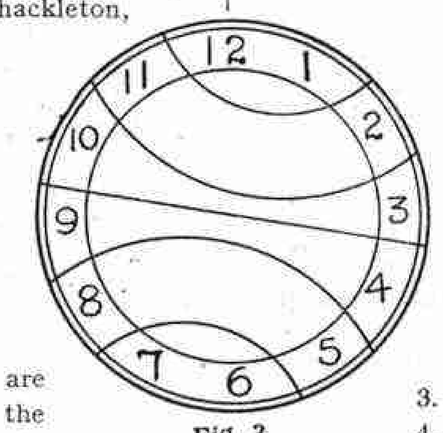


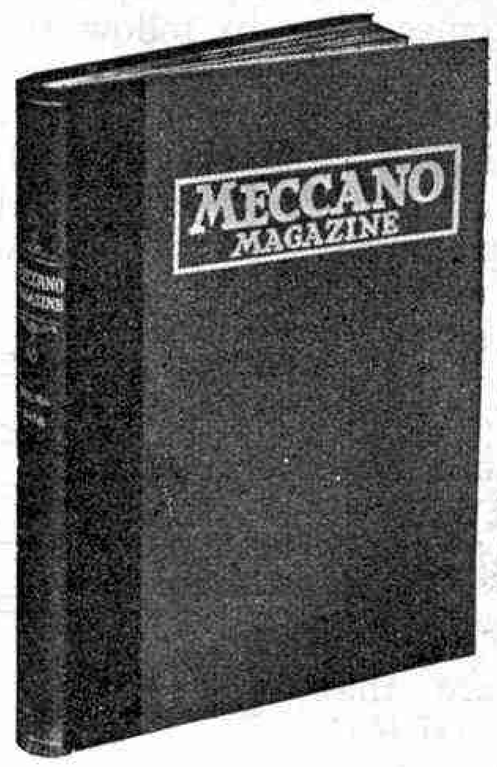
Fig. 3

No. 26. The jumbled letters made up the following aeroplanes:

1. Boulton and Paul "Sidestrand."
2. De Havilland "Fox Moth."
3. Comper "Swift."
4. Vickers "Virginia."
5. Armstrong Whitworth "Atalanta."
6. Blackburn "luebird."
7. Supermarine "Southampton."
8. Short "Kent."
9. Avro "Avian."
10. Hawker "Tomtit."
11. Vickers "Viastra."
12. Short "Valetta."
13. Handley Page "Hannibal."

Binding the "M.M."

There are two methods of binding the "*M.M.*" to preserve back copies from the mutilation that inevitably will be theirs should they be handled for any lengthy period without protection. First there is the spring-back binder system, that permits the copies to be inserted or removed from the binding case at will. This is intended primarily as a temporary arrangement for the protection of copies during the currency of their volume.



Handsome spring-back cases specially prepared for the "*M.M.*," with the name blocked in gold letters on the front cover, can be obtained from Meccano Limited, Binns Road, Old Swan, Liverpool, price 3/– and 4/6 for sizes large enough to hold 6 and 12 copies of current issues respectively.

Permanent binding cases for back numbers of the Magazine can be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases are 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 above. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding Six or Twelve Copies

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.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., carriage paid.

Competition Corner



WHICH WERE THE MOST POPULAR COVERS IN 1932?

Among voting contests none has retained so high a degree of favour among our readers as the annual Cover Voting Contest held to decide the order of popularity of the coloured covers of the previous year's issues.

In the above illustration the coloured covers that appeared on the various issues of the "*M.M.*" during 1932 are reproduced in a reduced form in their order of publication—January to June in the upper row, and July to December in the lower. The reproductions are intended for reference purposes only. They convey nothing of the brilliancy of the colour of the originals, but new readers will find them of great assistance in forming their judgment. Those readers who possess copies of the 1932 issues, or are able to obtain them, should make a careful study of the originals before completing their entries.

Referring to each cover by its month of issue, each competitor is asked to write the following two things on a post card :—

A. The 1932 cover he likes best of all.

B. His idea of the order of popularity of the covers as decided by the massed vote of all the competitors.

This list must cover the whole year, every month being included. The name of the month must be given, and its number in the volume. Competitors need not place their own favourite cover at the head of list B, unless they believe that it will prove to be the popular choice of the remaining competitors. They should place it in the position in which they anticipate it will be placed by the massed vote.

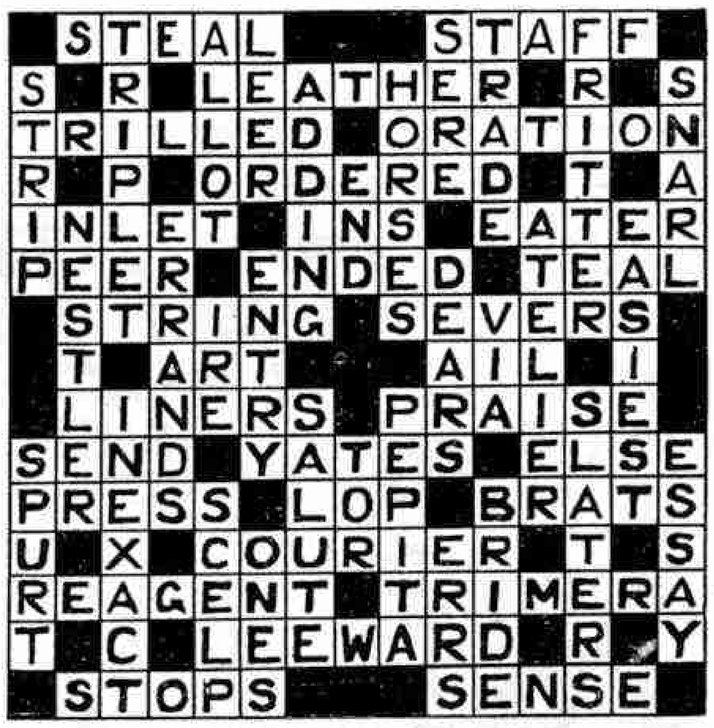
The entrant's name and address must be added to the card, which should be addressed " Cover Voting Competition, Meccano Magazine, Binns Road, Old Swan, Liverpool." No competitor may submit more than one entry.

Prizes of Meccano products, to be chosen by the winners, to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors whose lists most accurately forecast the final result. In addition there will be a number of consolation prizes for entries not in order of merit. In the event of a tie for any of the prizes, preference will be given to the entry displaying the neatest or most novel presentation. Closing date, 31st January. Overseas, 29th April.

January Drawing Contest

As most of our readers know, we have recently experimented with our drawing contests by throwing them open for subjects of any type. It is yet too early to judge the effect, and so many readers have asked that the contests be continued monthly during the winter season at least, that we are taking a specific subject this month—" A Public Building." This is the only engineering subject that we have not previously used in a Drawing Contest.

The entries will be divided into two sections, A, for those from readers aged 16 and over, and B, for those from readers under 16. Prizes of Meccano products—or Artists' Materials, as the winners prefer—to the value of 21/– and 10/6 will be awarded in each section. Entries should be addressed to " Buildings Drawing Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool." Closing date, 31st January. Overseas, 29th April.



JUNE CROSSWORD PUZZLE. The Overseas section now having closed, we reproduce above the solution to the June Crossword Puzzle.

COMPETITION RESULTS

HOME

September Photo Contest.—First Prizes: Section A, W. M. Hunter (Lewisham, S.E.13); Section B, W. J. R. Peacock (Cheltenham). Second Prizes: Section A, F. H. Culverhouse (Sheffield); Section B, V. W. Jackson (Wellingborough). Consolation Prizes: R. A. Batty (Liverpool); G. F. Deakin (Plymouth); S. Garbutt (Altrincham); H. C. Kelynack (London, W.4); J. MacNaughtan (Kirkcaldy); J. Robertson (Dalmuir); S. H. Robinson (Londonderry).

October Drawing Contest.—First Prizes: Section A, A. E. Lukey (Camden Town, N.W.); Section B, F. Hampson (Southport). Second Prizes: Section A, E. Whitaker (Leeds); Section B, A. J. Goldfinch (Wallasey). Special Prizes: Section A, A. Holden (Luton); Section B, G. Emerson (West Drayton).

OVERSEAS

July Photo Contest.—First Prizes: Section A, J. Credie (Capetown); Section B, L. A. Seton (Montreal). Second Prizes: Section A, A. A. Boult (Auckland); Section B, D. M. Tripp (Geraldine, N.Z.). Consolation Prizes: P. L. Bargellini (Florence); H. L. Clarke (Auckland);

Sketchograms.—First Prizes: Section A, R. N. Anlezark (Griffith, N.S.W.); Section B, S. S. Sacks (Capetown). Second Prizes: Section A, S. D. Kurlawala (Bombay); Section B, M. McCrorie (Dunedin, N.Z.). Consolation Prizes: S. F. Desai (Bombay); G. Eustratiadi (Istambul); J. E. Marshall (Thames, N.Z.); D. W. Nicoll (New Plymouth, N.Z.); P. G. Piddington (Victoria, B.C.).

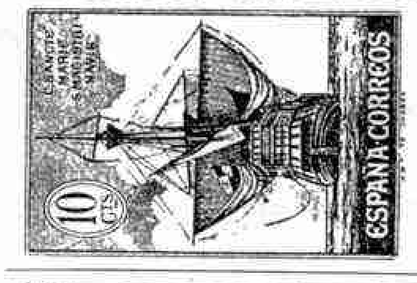
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10	Dutch Indies...	2d.	4	Kedah	2d.
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Hi! Boys-look at this!

---CONTENTS---

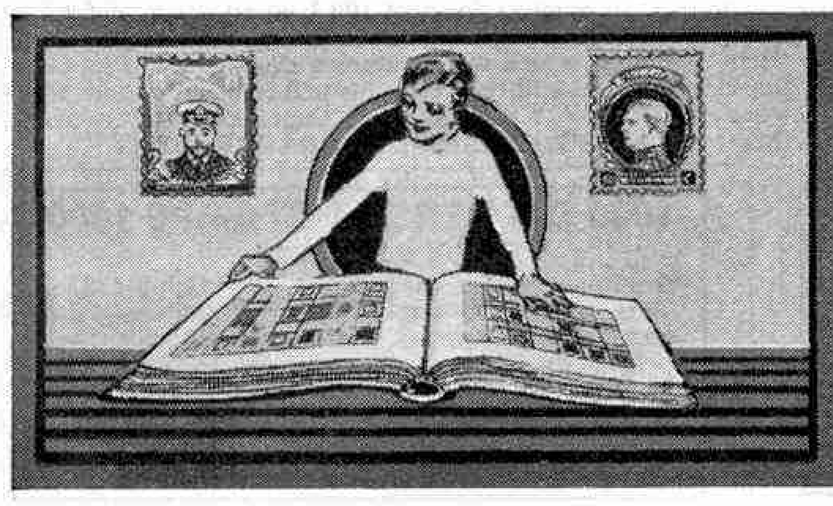
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Stamp Collecting

A STAMP COLLECTOR'S RADIO GUIDE

WE have claimed on many occasions that Stamp Collecting can be associated with every other well-known hobby. A young reader—a very keen stamp collector—mentioned this claim in the course of a recent conversation with a chum whose interests lie in the radio field, and was promptly challenged to justify the claim by linking radio and stamp collecting.



We cannot pretend that stamp collecting will add greatly to the radio "fan's" technical knowledge, but the association of the two hobbies is not quite so difficult as might seem to be the case at first sight. A pictorial guide to foreign radio stations would be very easy to form. There are, indeed, far more stamps suitable to such a purpose than we can illustrate in a single article on the topic. Such a guide, written up with the wavelengths, call signs and general notes concerning the stations, would prove a most interesting record.

Great Britain is outside our field of consideration. Her broadcasting system may be held up to the world as a model but, in the absence of any suitable British pictorial stamp, "Broadcasting House" must remain unrepresented and our guide must be strictly foreign.

A short tour of the radio world takes us first to the continent of Europe. There are rather more than 325 official stations in regular operation, ranging from Kaunas (Lithuania), working on 1935m., down to Radio Coloniale (Paris) on 19.68m. In Russia alone there are 28 stations, the most important being those at Moscow, which might well be represented by the view of the famous Kremlin shown on the 1, 2, 3 and 5 rouble values of Russia's 1913 issue commemorating the tercentenary of the Romanoff Dynasty. Another Russian issue that might be included in the collection would be the Popoff commemorative series issued in October, 1923. The name of Popoff, one of the early pioneers of wireless, is commemorated by a Moscow station that bears his name.



The next most highly developed country is Germany, with 27 stations. Probably the best known of these is Kčnigs Wusterhausen, relaying Berlin on a wavelength of 1635m. We have no illustration that will place Königs Wusterhausen in our collection, but Berlin, 419.5m., can be shown by the view of the Berlin General Post Office on Germany's issue of 1900 celebrating the 100th anniversary of the birth of King William I. The Cologne station may be covered with one of two stamps, the 10,000m. stamp of the 1923 issue showing a close view of Cologne Cathedral, or the 2Rm. stamp of the 1924 issue, a view of the cathedral from the further bank of the Rhine.



Passing South through Belgium on our way to France, the Brussels station on 509m. must be included in our collection. The view of the Town Hall, Brussels, shown on the 192 Express stamps, or better still the splendid view of St. Gudule Cathedral, Brussels, on the 1f.75 stamp of the 1928 issue, would serve our purpose.



France, of course, has many stations clamouring for consideration. The famous station at the Eiffel Tower, 1445.7m., must be included, and by taking the 200r. stamp of the Brazilian air series of 1929 we can obtain a view of the Tower itself. This series was partially in commemoration of Santos Dumont's air pioneering work, and the selected stamp shows his airship flying round the Eiffel Tower. It is not a good picture, unfortunately, but it must be included, for views of actual radio stations are few and far between. To symbolise the Paris stations as a whole, we have chosen as an illustration the 2Fr. value of the current French issue, picturing the Arc de Triomphe.



Spanish stations may be represented by Madrid on 424m. and Barcelona on 252m. There is a view of the Madrid G.P.O. on the 1920 series commemorating the holding of the 7th Congress of the Universal Postal Union at Madrid, while the 10c. of the 1929 Seville-Barcelona Exhibition series will serve excellently to cover Barcelona.

While we are on the Mediterranean coast we must not omit the Italian stations. Rome, on 441m., is of course the principal of these, and as the great basilica of St. Peters must crystalise any vision or thought of Rome, the 60c. stamp of the 1924 Holy Year series is an automatic inclusion in the collection. This stamp would more rightly represent the Vatican City short wave stations.

Algiers across the Mediterranean is the most important station in North Africa. The 1Fr. stamp of the 1926/9 series, showing a view of the bay of Algiers, is a suitably representative stamp. At the Southern end of the African continent there are the Capetown, Durban and Johannesburg stations, working on 363m., 410m. and 443m. respectively. Johannesburg is the most highly powered of the three, but the only associated stamp is the 10/– value of the current issue, showing a view of Capetown and Table Bay, and thus the Capetown station alone is represented.

A quick passage across the Pacific brings us within range of the Australian stations. We cannot do better than select the Sydney Harbour Bridge issue of 1931 to represent the several important Sydney stations—there are two first-class and four second-class stations in Sydney on the medium waves alone. The Hobart station, 516m., uses the 2d. value of Tasmania's 1899 issue, while New Zealand's "A" class stations are represented by Dunedin, 463m., and the Dunedin exhibition stamp of 1925.

Before this brief radio stamp tour of the world ends we journey through the American continents, singling out just one or two stations for reference. The Guatemala City station deserves priority of consideration, for it links up with one of the very few genuine "radio" stamps we are able to produce, the 30c. stamp of Guatemala's 1919 issue, on which there is a splendid view of the station's aerial equipment at Inalambrico.

The United States is served more intensely by wireless than any other country in the world. Each of the great cities possesses several stations, the most important being those controlled by the National and the Columbia Broadcasting Companies from their New

(Continued on page 64)



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For further Stamp Advertisements, see page 88



Stamp Gossip

and Notes on New Issues



New Gabonese Designs

In days gone by every new issue of French Colonial stamps was greeted by an outburst of angry criticism. The standard of production has improved so much in recent years, and the frequency of output has been so greatly reduced, that not only is criticism disarmed, but the stamps are almost welcomed. The new series recently issued for use in the Gaboon Territory comprises four excellent designs, three of which are used by the 22 general stamps in the series, and the other for the postal dues. We reproduce the first of the general designs, showing a timber raft on the River Ogowe. The timber is being floated down from the inland forests to Port Gentil at the river mouth for export to Europe. The little huts that can be seen on the raft are the homes of the lumbermen for the duration of the trip down river.



The second design is a portrait of Monsieur Savorgan de Brazza, to whom France owes the Gaboon Colony. De Brazza was an Italian by birth, being born in Rome in 1852, but on attaining his majority he became a naturalised Frenchman and undertook the exploration of the upper reaches of the Ogowe on behalf of France. Six years later he made a treaty with the natives whereby Gaboon became a French protectorate, and the newly created capital of the territory was named Brazzaville after him. In 1885, when the boundary of the colony was defined with Belgium, he became the first Commissioner, but in 1897 ill-health compelled him to retire and he died in 1905 at the comparatively early age of 53 years.



The third design shows a picturesque native village of the M'Fan tribe, one of the more advanced African native races. They are not natives of the Gaboon territory, but their high physical and mental standard has resulted in their obtaining the ascendancy in the territory, and they are gradually ousting the Gabonese. The fourth design, used for the postage due stamps, shows a native woman of the Pahquine branch of the M'Fan tribe.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Manchukuo

One wonders how many of our readers could answer offhand a question as to the whereabouts of Manchukuo. Equally one wonders how few non-stamp-collectors realise how readily and simply the stamp album records the progress of world history.

Manchukuo is the new and semi-independent State formed by Japan in the recently-conquered Manchuria, and under its new name it enters the ken of stamp collectors for the first time. The values of its newly issued stamps are as in the current Chinese issue, but the "cents" and "dollars" of China disappear in favour of "fens" and "yuans," the yuan being worth approximately 1/6.

Only two designs are employed, that used for the values below 13 fens showing the La-Ma-Ta, a 2,000-year-old pagoda in the city of Mukden, the burial place of the Manchu Kings. The design of the values from 13 fens upward shows President P'u, who, as Hsuan T'ung, reigned as the Boy Emperor of China from 1909 to 1912.

* * *

The promised Hungarian "Celebrities" issue recently made its appearance, and is a set deserving of a place in every collector's album.



There is not space here to describe in detail all of the 12 stamps comprising the issue, but our readers will be glad to have the list of portraits included. They are as follows:—1f., Imre Madach (1823-1864), Poet; 2f., Janos Arany (1817-1882), Poet; 4f., Ignac Semmelweis (1818-1765), Physician; 6f., Lorand Eotvos (1848-1919), Physicist, specially distinguished by his invention of the balance that bears his name and which is used in measuring variations of gravity; 10f., Istvan Szechenyi (1791-1860), Soldier and Statesman; 16f., Ferenz Deak (1803-1876), Lawyer and Statesman; 20f., Ferenz Liszt (1811-1886), Pianist and Composer; 30f., Lajos Kossuth (1802-1894), Statesman; 32f., Istvan Tisza (1861-1918), Statesman; 40f., Mihaly Munkacsy (1844-1900), Painter; 50f., Sandor Korosi Csoma (1784-1842), Explorer; 70f., Farkas Bolyai (1775-1856), Mathematician and Scientist.

* * * *

We reproduce the design of a striking plaque-like portrait of President von Hindenburg, recently issued by Germany on a new series of stamps. The series consists of seven stamps ranging from 4 to 50 pfennigs in value.

Roumanian Jamboree Issue

Those of our readers who attended the International Scout Jamboree at Birkenhead in 1929 will be interested to know that Roumania issued a special series of six postage stamps to celebrate a National Scout Jamboree held last autumn.

As our illustration of the 2 lei value shows, the designs were most interesting and beautifully reproduced. The remaining stamps were as follows:—25b. + 25b., Scouts in Camp; 50b. + 50b., Semaphore Signaller; 1L. + 1L., Tracking; 3L. + 3L., Portrait of King Charles; 6L. + 6L., Composite of King Charles and Prince Michael.

San Marino's Garibaldi Commemoratives

In our last issue we referred to San Marino's intention to issue a further series of Garibaldi commemoratives, to mark the 50th anniversary of his death. The set, now issued, consists of eight stamps sharing two designs, that illustrated here being used for the four low values, 10c., 20c., 25c. and 50c. This shows a portrait of Garibaldi and a facsimile of his "order of the day" issued on the arrival of his troop of revolutionaries at San Marino in 1849, seeking refuge from the pursuing French and Austrian forces.

The second design, used for the 75c., 1L.25, 2L.75 and 5L., shows Garibaldi arriving at the gates of the city.

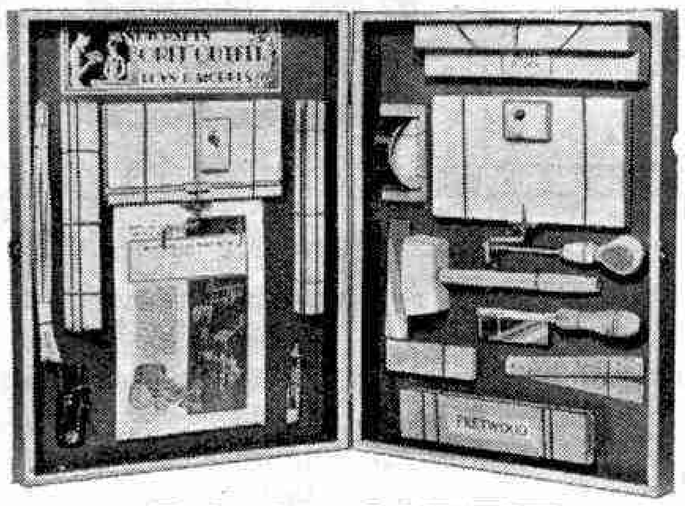
* * *

In our last issue we referred to the friction created by the Bolivian Chaco boundary dispute with Paraguay. The stamp that is causing so much heart-burning in Bolivia is reproduced here. It will be noted that the Chaco territory is plainly described as Chacq Paraguayo, while all the country's ports on the Bolivian side of the Rio Paraguay are clearly indicated. The propagandist nature of the stamp is intensified by the inscription at the foot: "El Chaco Boreal ha sido, es y sera del Paraguay (The Boreal Chaco has been, is and will be Paraguay's). This is, indeed, an extraordinary example of stamp publicity.



Boys! Start the New Year well by visiting

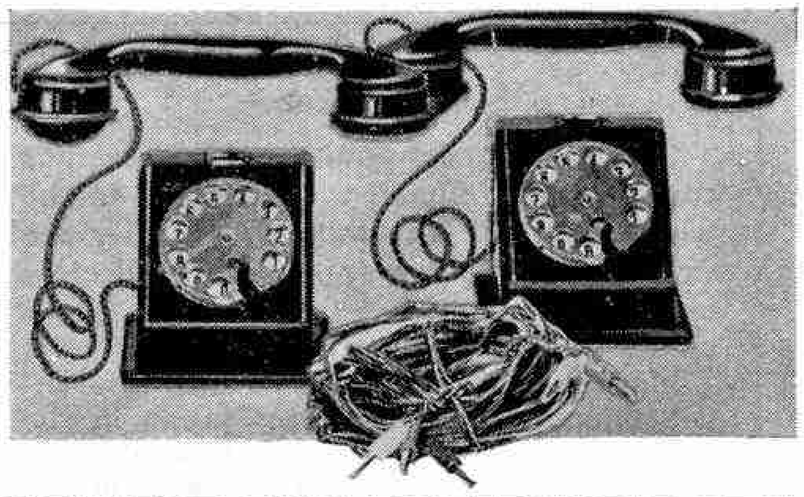
GAMAGES



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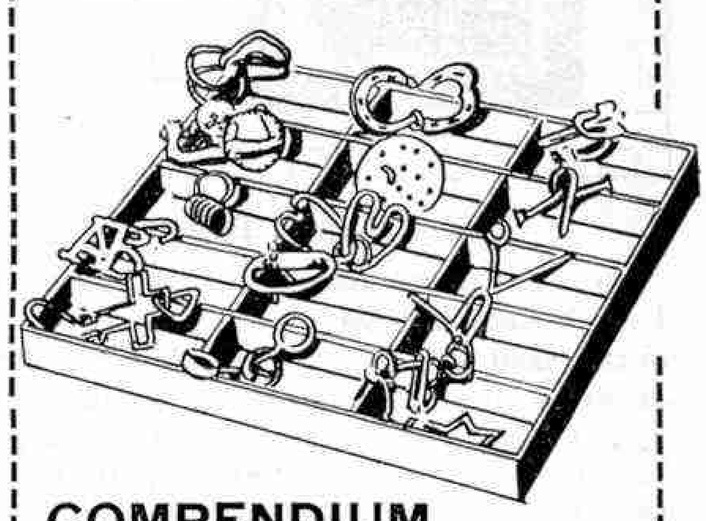
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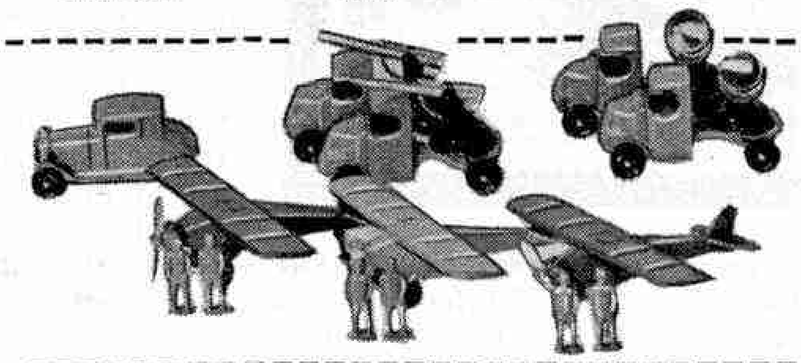


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Add the Finishing Touch

to your model car

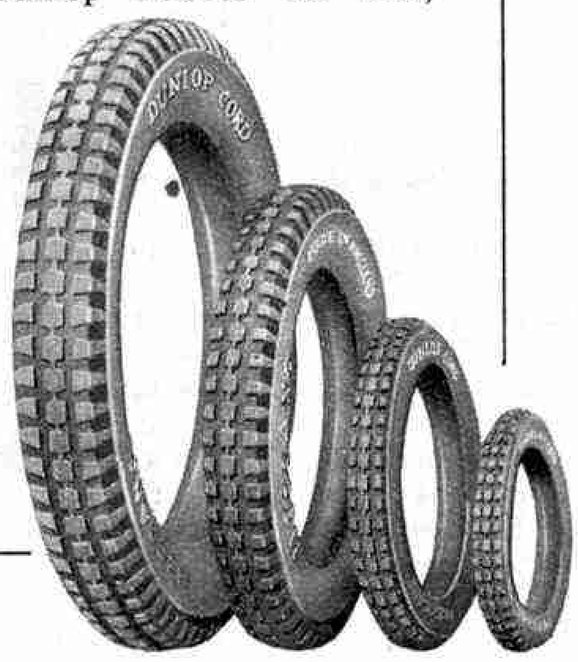
Any boy can build a perfect working model of a motor car with Meccano. All the intricate mechanisms of the car can be reproduced, and a final realistic touch given to the model by fitting the wheels with

Meccano Dunlop Tyres

These parts are obtainable in four different sizes, as follows :—

Part No.		Price each
142a, 2″	Dunlop Tyre, to fit 2″ Pulleys	4½d.
142b, 3″	,, ,, ,, ,, 3″ ,, ...	6d.
142c, 1″	,, ,, ,, 1″ ,, ...	3d.
142d, 1½″	,, ,, ,, 1½″ ,, ...	4d.

The tyres are specially made for Meccano Limited by the Dunlop Rubber Co. Ltd., and are perfect miniature reproductions of the famous Dunlop Cord Tyres. They may be obtained from any Meccano dealer. *"Fit Dunlop and be satisfied!"*



MECCANO LTD.
Binns Road, Old Swan
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For Your Party ....

KIA-ORA
LEMON ORANGE GRAPE FRUIT

The only real solution to the problem "What shall we drink" is Kia-Ora—the drink for *every* guest at every party. Not only because it is made from fine sun-ripened fruit and cane sugar, and is therefore the most refreshing and healthful beverage possible, but because it is so easy to prepare and very economical in use—a large bottle makes 24 to 30 drinks—simply by adding to one part of Kia-Ora, five parts of water, hot or cold. Your guests will especially appreciate Kia-Ora with hot water just before going home.

Large Bottle **2/-** Full half-size **1/1**

KIA-ORA LIMITED
Blackfriars, London, S.E.1



LOCOMOTIVE ENGINEERING

A young lady recently visited a locomotive works, and later told some of her friends how a locomotive is made.

"You pour a lot of sand into a lot of boxes," she explained, "and you throw old stove lids and things into a furnace, and then you empty the molten stream into a hole in the sand, and everybody yells and swears. Then you pour it out and let it cool and pound it, and then you put it in a thing that bores holes in it. Then you screw it together, and paint it, and put steam in it, and it goes splendidly; and they take it to a drafting-room and make a blue print of it. But one thing I forgot—they have to make a boiler. One man gets inside and one remains outside, and they pound frightfully; and then they tie it to the other thing, and you ought to see it go!"

"*The New Zealand Railways Magazine.*"

* * * *

The lady of the house was interviewing a new maid.

"And why did you leave your last situation?" she asked.

"Because I was told to do something I didn't like," replied the girl.

"Indeed! And what was that?"

"To look for another place."

* * * *

A fly was walking with her daughter over the head of a very bald man.

"How things change, my dear," she said. "When I was your age, this was only a footpath."

* * * *

Sergeant (addressing recruit): "How many times have I to tell you not to approach a horse from the rear without speaking to it. One of these days you'll get kicked on the head, and I'll have a lame horse on my hands."

* * * *

Foreman: "Now, then, Bill, what about carrying up some more bricks?"

Bill: "I ain't feelin' well, guv'nor; I'm tremblin' all over."

Foreman: "All right, then, get busy with the sieve!"

* * * *

Visitor: "What a big family you have, Mrs. Jones."

Mrs. Jones: "Yes'm, and the funny thing is that all the names begin with a haitch. There's 'Orace, 'Erbert, 'Enry, 'Ugh, 'Ubert, 'Arold, 'Arriet, and 'Etty—all except the last one, and we 'ad 'er named Halice."

* * * *

Lady (to butcher): "I'll take a pound of those sausages. Are they British?"

Butcher: "Yes, ma'am. The bulldog breed."

* * * *

The bore had been talking for what seemed like hours. "I'm afraid I'm wasting your time," he said at last.

"Oh, no," said his companion. "I haven't been listening."

* * * *

WET—AS USUAL



The well-dressed young man had had a rather unfortunate adventure with a newly-painted seat in the park. Crimson with rage he rushed over to the painter.

"Why don't you put 'Wet Paint' on your seats?" he shouted.

"That's what I am doin', ain't it?" retorted the painter.

THE ECHO ANSWERED

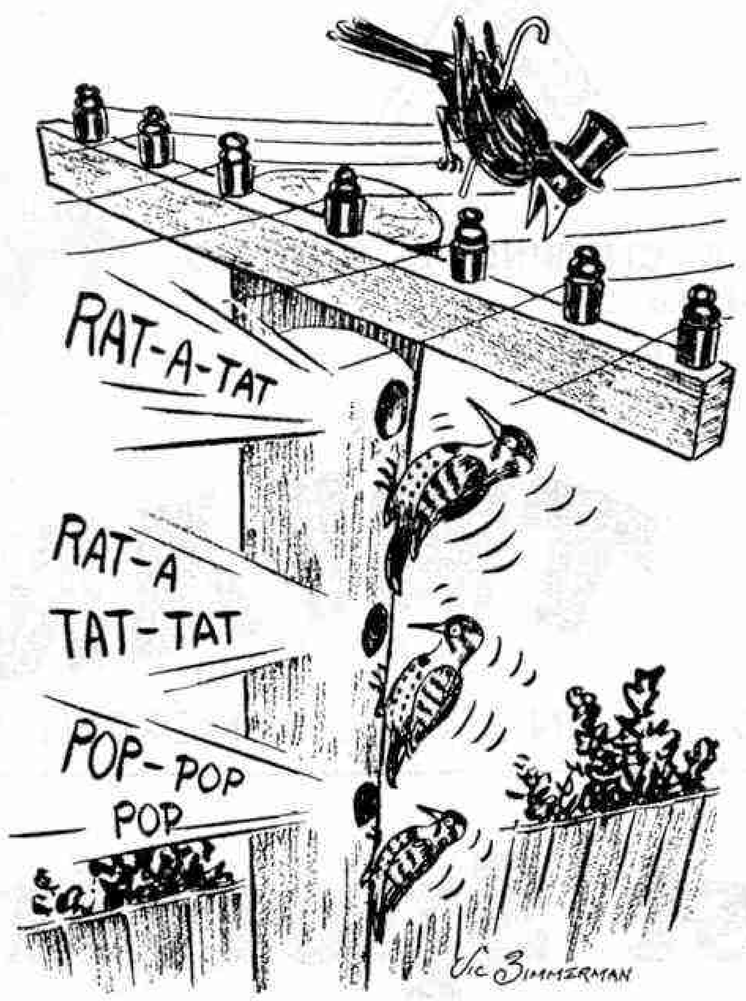
"There's a wonderful echo here," remarked the guide. "Just shout 'Two lemonades,' and see."

The tourist shouted and listened. "I hear no echo," he said.

"Oh, well," said the guide. "Here comes the man with our lemonades anyway."

* * * *

A RUSH JOB



Foreman Woodpecker. "I'll have to put on more drillers to finish these apartments by summer."

Courtesy, "*Compressed Air Magazine.*"

* * * *

Small Girl (to Customs Official searching her Mother's case): "Oh, you're getting warm, isn't he, Mummy?"

* * * *

The big game hunter was spinning yarns.

"As I was walking through the jungle I tripped and let my rifle fall. Before I had time to pick it up two lions attacked me. Without hesitation I grabbed each by the throat and . . ."

"Wait a minute," a listener interrupted, "how did you manage that, you have only one arm?"

The hunter was not at all perturbed.

"Yes, that's true," he replied, "but in the excitement of the moment I forgot about that."

* * * *

An official was paying a visit of inspection to a prison, and took a taxi to the gates.

When getting out of the cab he said to the driver: "You may call for me later, my man."

"Yes, sir," said the driver. "But how long are you in for?"

* * * *

"I trust we shall see a great deal of your friend when he comes to town. My daughter will be back from the country by that time. She's a wonderful pianist, you know."

"Oh, my friend won't mind that. He's as deaf as a post."

* * * *

"No, I ain't naturally superstitious, but when the score got to thirteen-nil, I said to myself, 'Bill, we're goin' to lose!'"

* * * *

Father (to son just home from school): "What lesson did you learn this morning?"

Boy: "Oh, grammar!"

Father: "What sort of grammar?"

Boy: "Well, Dad—cats and dogs are common hounds, but you and I are proper hounds."

UNSOLICITED TESTIMONIAL

"The first time I tried my hand at decorating I used your enamel, and I have stuck to it ever since."

* * * *

Clerk: "Excuse me, sir, but I have been here ten years, doing three men's work for one man's money, and now I want a rise."

Employer: "I doot I canna gie ye that, mon, but if ye'll tell me the names of the ither twa men, I'll sack 'em."

* * * *

"No," said the shopkeeper, "we can't take a gramophone back after a customer's had it a year. Anyway, what's the matter with it?"

"Weel," answered the Scot. "The needle broke last nicht."

* * * *

"Come along to my house this evening, old man. My daughter will play and sing, and at nine o'clock we have supper."

"Certainly. I'll be along at nine."

* * * *

Schoolmaster: "Now, boys, what did the Romans do for the Britons?"

"Small Boy: They civilised 'em, sir."

"And how did they do that?"

"Please, sir, they taught 'em how to fight."

* * * *

Country Stationmaster (to guard): "Late s'morning, bain't 'ee, Jarge?"

Guard: "Aye, Driver Williams stopped so long talking to signalman 'bout his garding, 'e let the engine go off the bile."

* * * *

Lady of the house: "Why didn't you come to mend the bell yesterday. When I telephoned to your shop in the morning I stated definitely that I wanted it done immediately."

Electrician: "I did come round yesterday, mum, but as I rang the bell three times and got no answer, I thought you were out."

* * * *

A man was asked by his wife to go to the greengrocer's for a turnip.

"How big do you want it?" he asked.

"As big as your head," was the reply.

On his way he met a friend, who discovered the object of his journey and said: "There's no need to buy one. Go up to my allotment and get one."

A little later the plot-owner was hailed by a friend. "Hi!" he said, "You've got a funny sort of gardener working on your plot. He's pulling all your turnips up and trying his bowler hat on them."

* * * *

The young assistant in the boot shop smiled happily as his customer departed from the establishment.

"What are you looking so pleased about?" asked a fellow-assistant.

"I've had my revenge," replied the other.

"Revenge for what?" queried his colleague, in surprise.

"That girl I've just finished serving was a telephone operator, and I gave her the wrong number in shoes," was the reply.

* * * *

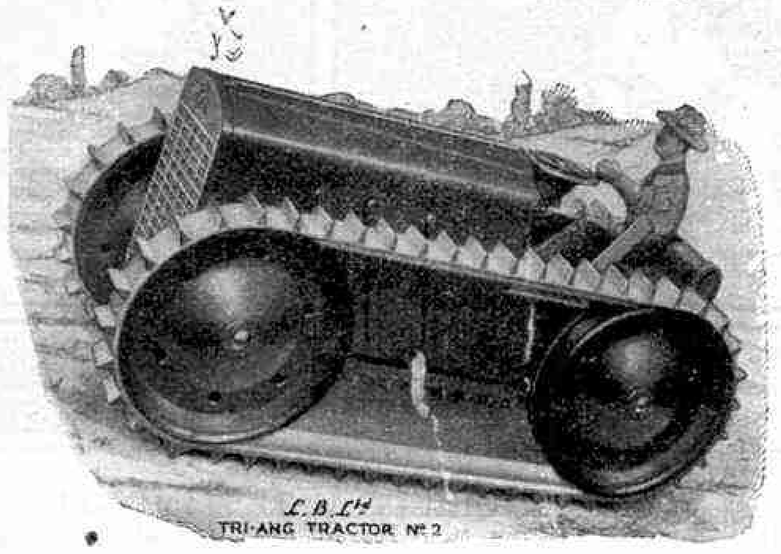
MISUNDERSTOOD



Policeman (to small boy getting a free view of football match): "Hi! What's the game!"

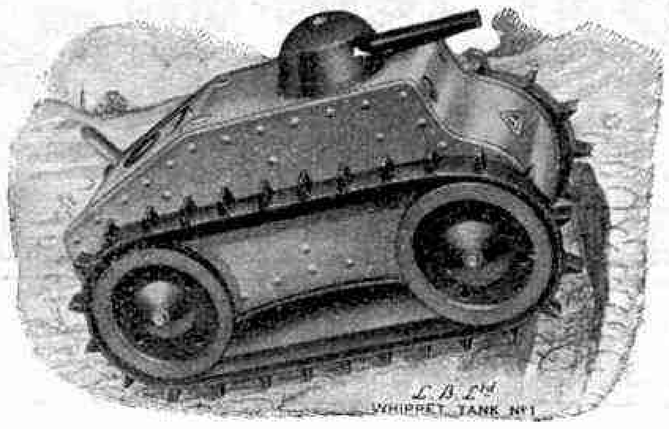
Boy: "No score yet."

New Tri-ang Powerful Clockwork Toys



TRI-ANG TRACTOR No. 2. - - 3/11d.

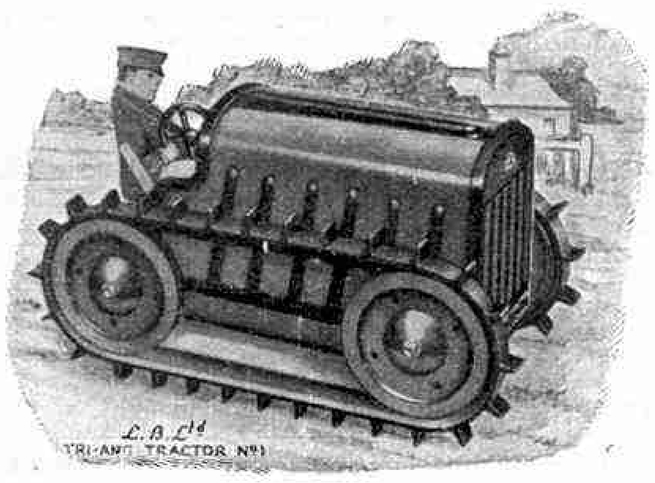
Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels. - - - - - - - - - Length 8½ ins.



"WHIPPET" CLIMBING TANK No. 1. - - - - - - 1/-

A miniature of a climbing fighting tank. Strong motor, control lever. Swivelling gun turret. Rubber bands. - - - Length 5¼ ins

A fine new range of clockwork toys to work with your models. Real precision jobs, British made—Tractors, Tanks and Motor Cars. There are other models besides those shown here, including Magic Sports, Saloon and Racing Cars. Get full particulars now.



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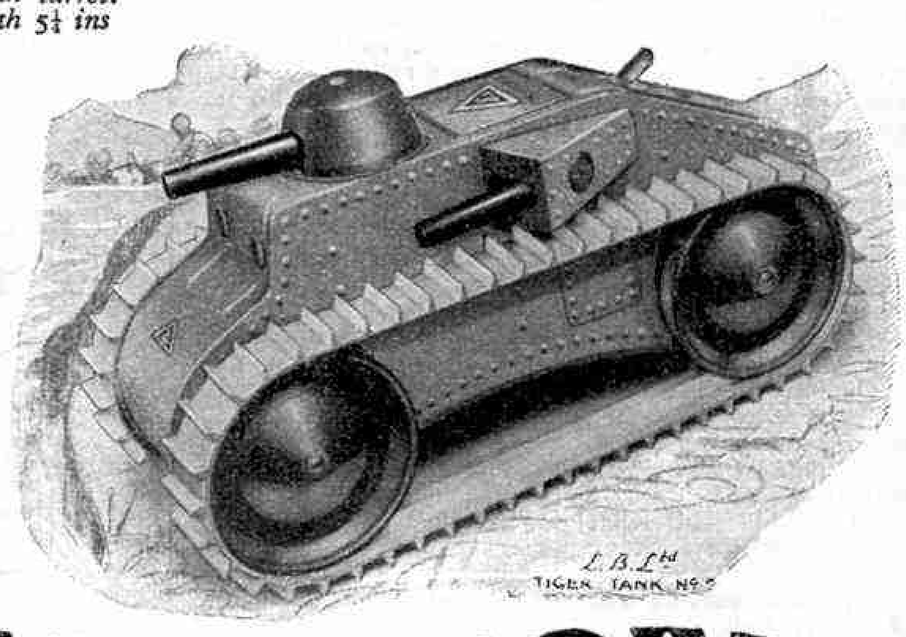
Climbs obstacles in a surprising way. Thick rubber bands. Control lever. - - - - - - - Length 5¼ ins.

L. BROS. LTD. LONDON BR OS ENGLAND

Regd. Trade Mark.

TIGER CLIMBING & FIGHTING TANK No. 2 - - - - - - 5/11

A powerful climber, made of steel, with wide rubber bands. Swivelling gun turret with firing device. Control lever. - - - - Length 10 ins.

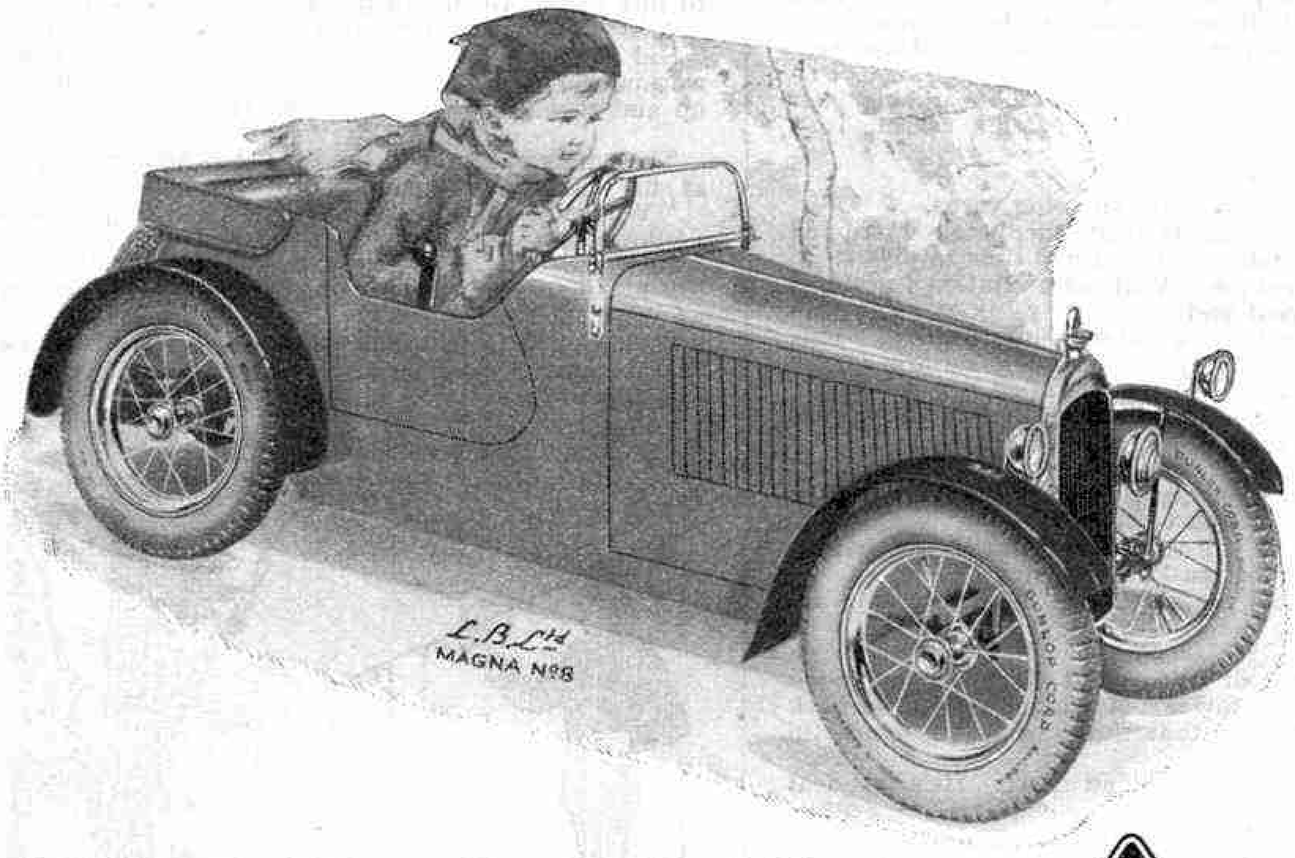


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The Latest Sporting Model



This is the Tri-ang **MAGNA No. 8,** a reproduction of the modern sporting car. It has a ball-bearing back axle, Dunlop 13×2¼" balloon pneumatic tyres, and spare wheel and tyre. Length overall 57"

Price **£5 5s. 0d.**

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Suitable for ages 4 to 8 years.

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Please ask to see the new **Patrol Cycle**

TRI-ANG
(REGD.
TOY MOTOR CARS

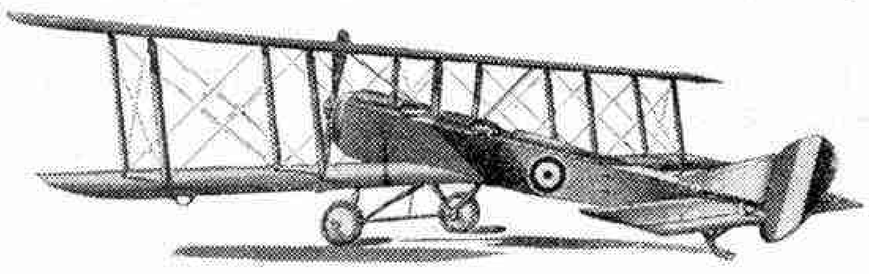
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FRETWORK MODELS

any Meccano boy can make

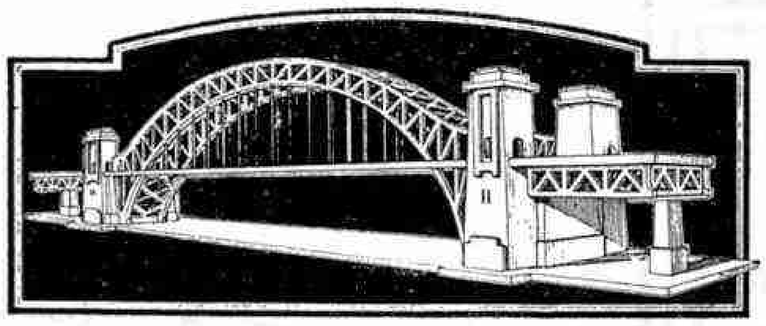
Look at all these models. Every one can be made in wood cut out with a Hobbies Fretwork Set. Patterns for all parts are printed full size on a large sheet ready to paste down and cut out. Real lasting models true to scale and simple to construct. A fascinating job for you. Merely one class of the thousands of things you can make in your spare time. A really jolly hobby and one which will earn you pocket money without trouble. Sets of Tools from 1/6, designs from 2d. each. Wood and all parts supplied at reason able prices.



A MODEL AEROPLANE

Design No. 111. Special Price 9d.

A real model cut out in wood, 14½ in. prop. to tail and wing span of 1 ft. 6 in. Everything supplied ready to cut out and put together for 4/9, or 5/3, post free. Hundreds have been made up by Meccano boys, without any trouble. You can't go wrong with the full size patterns. The wood alone costs only 2/- (post 6d.).



MODEL SYDNEY BRIDGE

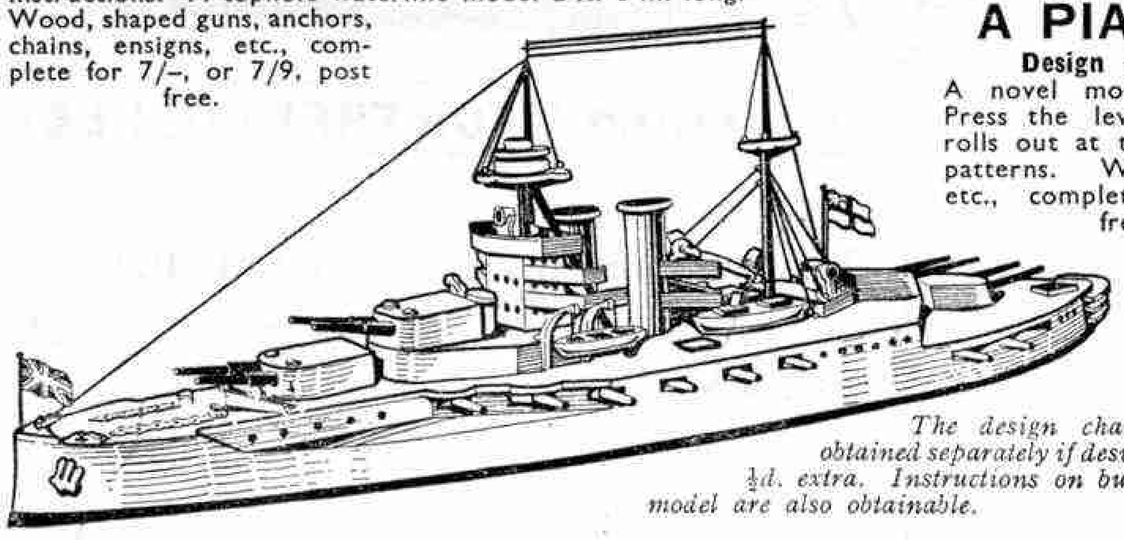
Design No. 1900. Price 4d.

An interesting model of the wonderful new bridge crossing Sydney Harbour. Made in whitewood, the model stands nearly 2 ft. long. Anyone can make it. Specially selected wood for all parts—2/3—post free 2/9.

MODEL BATTLESHIP

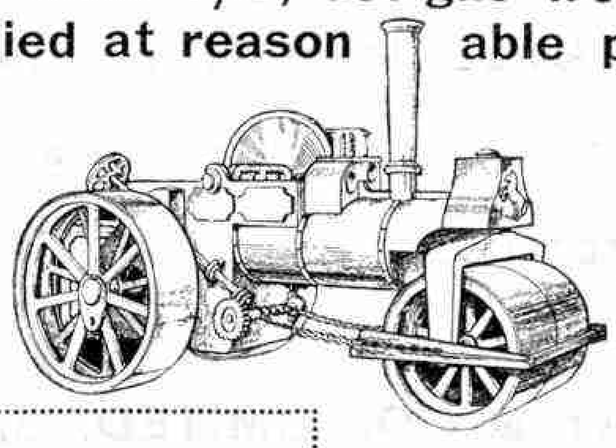
Design No. 91. Special Price 9d.

The design chart has complete parts set out with cutting instructions. A tophole waterline model 2 ft. 6 in. long. Wood, shaped guns, anchors, chains, ensigns, etc., complete for 7/–, or 7/9, post free.



The design charts can be obtained separately if desired, postage ½d. extra. Instructions on building each model are also obtainable.

A wide range of models in the 1933 Hobbies Catalogue. Now on sale. With free designs and 300 pages. Price 9d. complete.



STEAM ROLLER

Design No. 68. Special Price 9d.

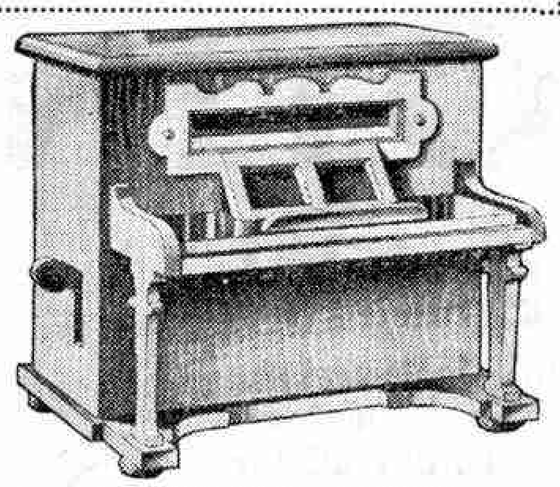
A model that is always popular and absolutely true to life. It is 16 in. long and funnel and chain are supplied ready to fit. The planed fretwood, axles, spindles, etc., cost only 5/9 (or 9d. extra by post) and the funnel and chain 1/–. The design sheet contains full cutting instructions.



ENGINE AND TENDER

Design No. 1830. Price 4d.

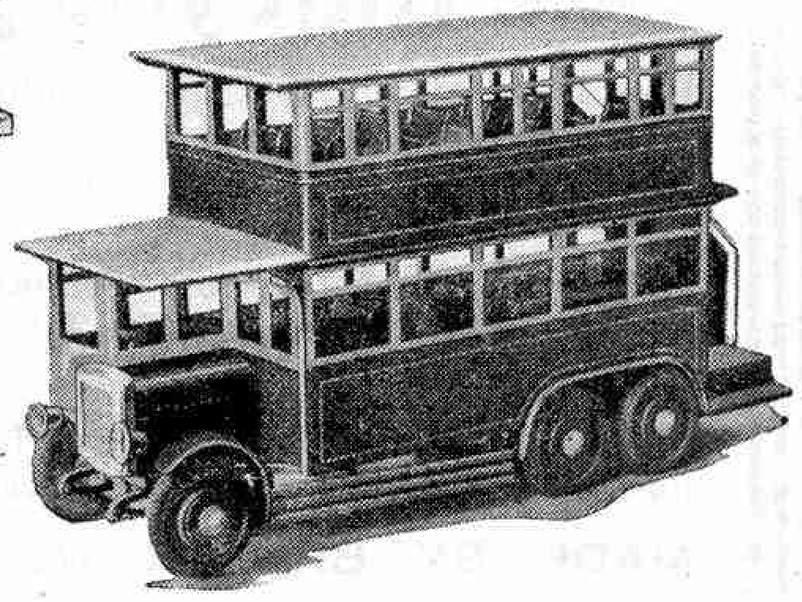
Another popular piece of work. The model is 1 ft. 9¾ in. long and is built of wood with metal wheels. The parcel (No. 1830) includes a finished boiler, buffers, steam dome, funnel, etc., ready shaped, and wire for handrail, couplings, etc. A straightforward design to make. The wood complete for 7/6, or 8/–, post free.



A PIANO BOX

Design No. 1873. 2d.

A novel model that "works." Press the lever and a cigarette rolls out at the front. Full size patterns. Wood, hinges, catch, etc., complete for 1/10½—post free, 2/4½.

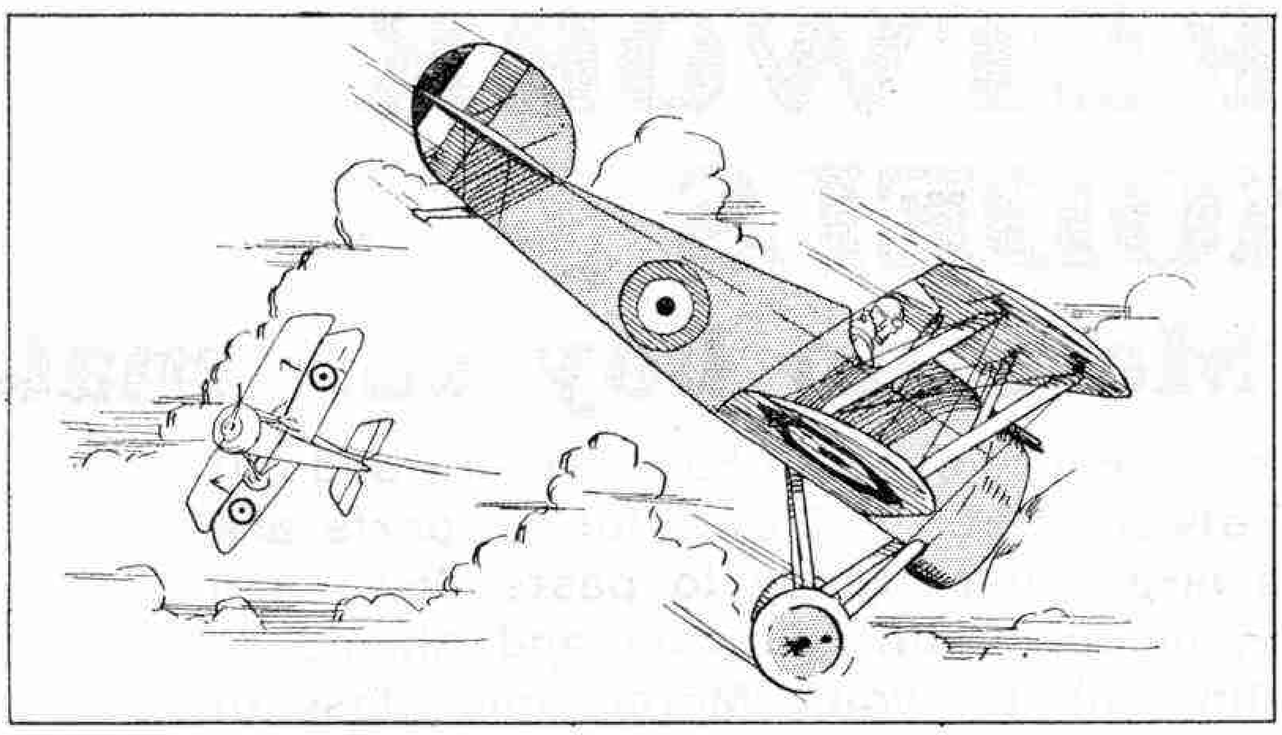


A DOUBLE-DECK 'BUS

Design No. 162. Special Price 9d.

Absolutely like the real thing! Wood for the whole thing is supplied for 12/6 and all the fittings—glass windows, rubber tyres, handrails, wheel caps, etc., are 4/6. The model makes a certain prize-winner. It stands over a foot high and is nearly 2 ft. long. Anyone with a fretsaw can build it.

Obtainable at Hobbies Branches in London, Glasgow, Manchester, Birmingham, Sheffield, Leeds, Brighton, Southampton. From any leading ironmonger, or by post from Hobbies Ltd. (Dept. 96), Dereham, Norfolk.



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Judges : SIR ALAN COBHAM, K.B.E., A.F.C., and Capt. W. E. JOHNS, Editor of "Popular Flying."

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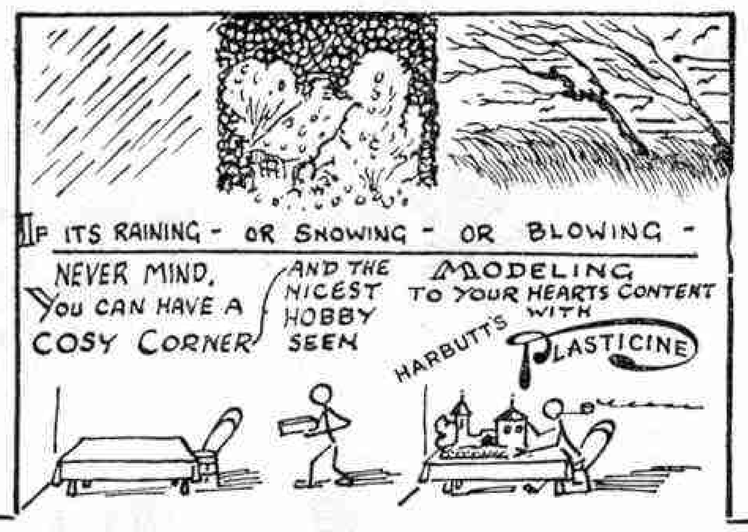
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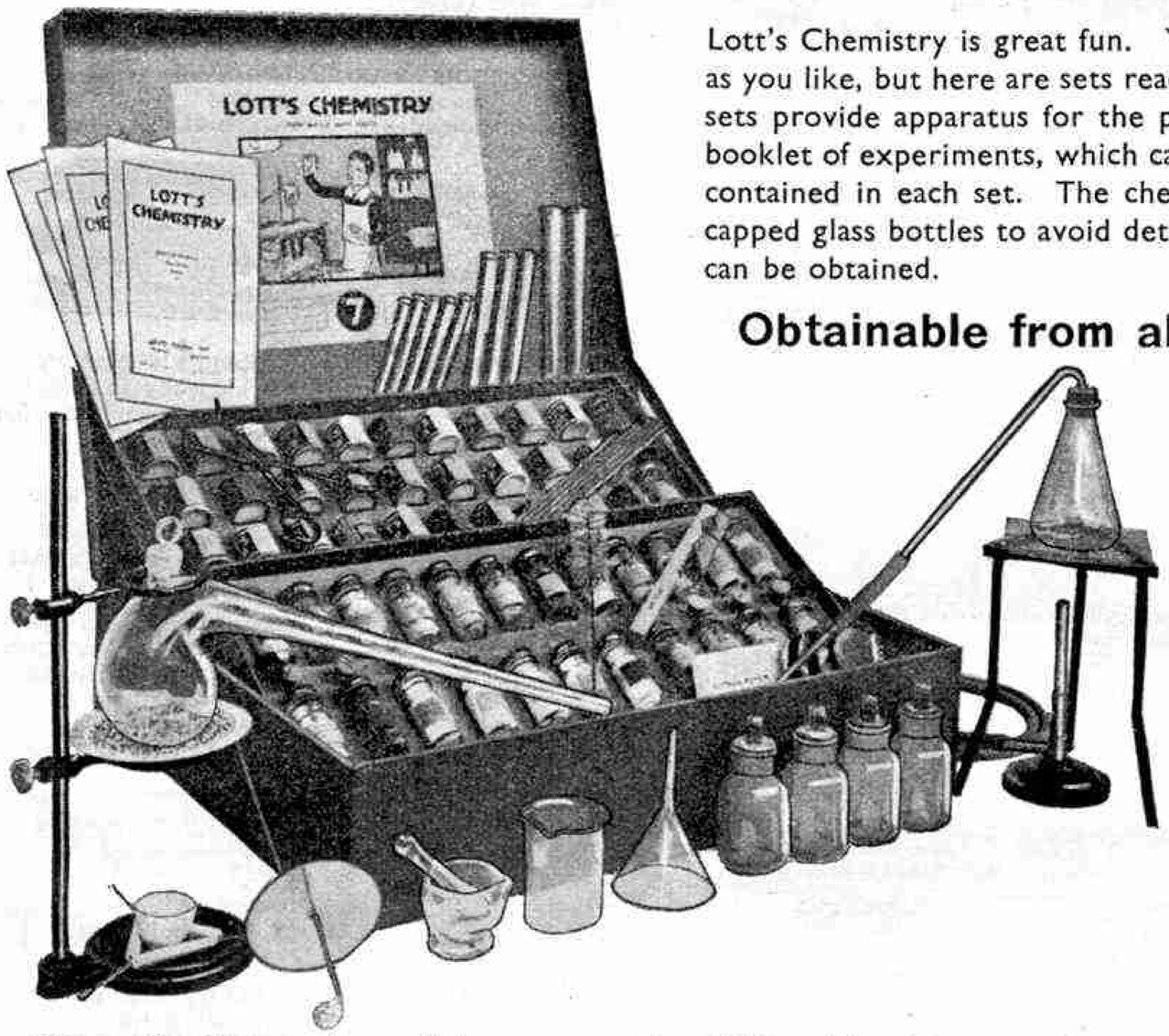
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Lott's Chemistry is great fun. You may not get much chance in the school "lab" to do as you like, but here are sets ready to hand that will give you endless pleasure. The larger sets provide apparatus for the preparation of Gases and other processes. An illustrated booklet of experiments, which can be performed with the contents of the respective box is contained in each set. The chemicals are packed in special lever lid cartons, and screw capped glass bottles to avoid deterioration. Spare supplies of the chemicals and apparatus can be obtained.

Obtainable from all leading Toy Dealers and Stores

BOX 1. Contains 18 chemicals, test-tubes, tin dishes, filter papers, litmus paper, magnesium ribbon, glass tubing, test-tube cleaning brush, and Book of 42 Experiments. **Price 3/6**

BOX 3. This set is a great advance over No. 2, as in addition to 30 chemicals, it contains a flask with rubber cork and delivery tube, porcelain crucible, glass funnel for filtering and extra test-tubes and glass tubing. The Book of 131 Experiments contains a number of unusually interesting reactions. The entire contents of the earlier sets are of course included in Box 3. **Price 10/6**

BOX 5. An especially fine set, Box 5 contains 43 chemicals, and apparatus for a remarkable range of 228 Experiments. The additional apparatus over and above the contents of the earlier boxes includes Retort Stand and ring (of great use in arranging the apparatus in a firm and convenient form), wire gauze, beaker and crucible tongs. Extra bottles of some of the chemicals most frequently used are also included. **Price 21/–**

Other Sets at **6/–**, **15/6**, and **31/6**

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HORNBY SERIES

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, strongly built and beautifully enamelled.

Ask your dealer to show you the full range of Hornby Rolling Stock.



OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/6**



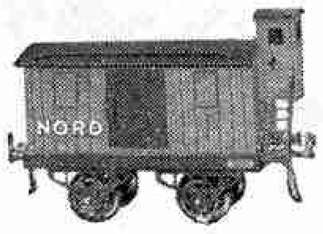
PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/6**



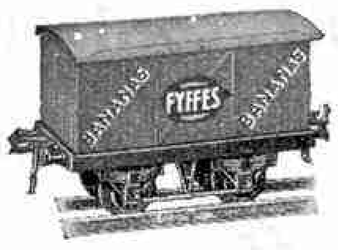
PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**



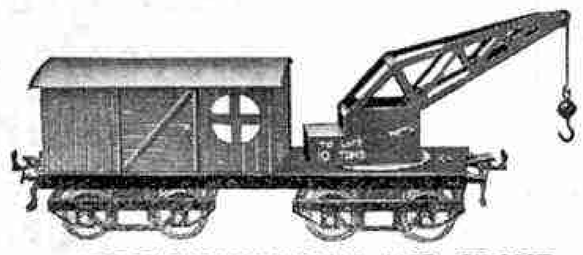
OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/6**



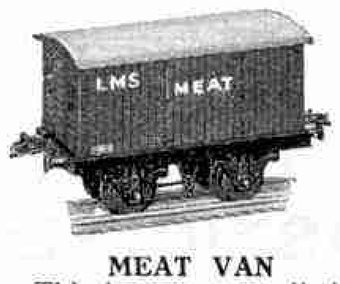
BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/–**



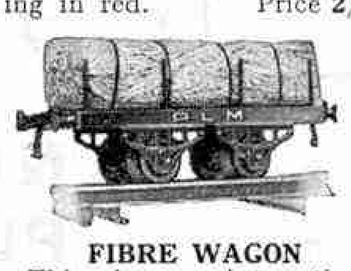
BANANA VAN
An attractive model, finished in yellow and green. Price **3/–**



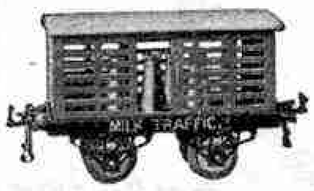
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**



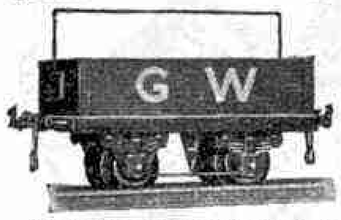
MEAT VAN
This is a very realistic model. Available lettered L.M.S. only Price **2/6**



FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/9**



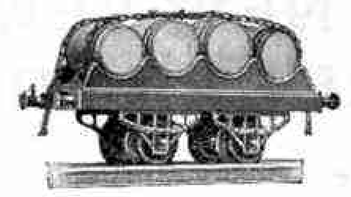
MILK TRAFFIC VAN No. 1
Fitted with sliding doors. Complete with milk cans. Price **3/–**



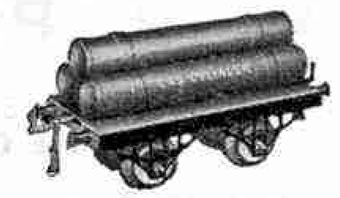
***OPEN WAGON "B"**
Similar to Hornby Wagon No.1, but fitted with centre tarpaulin supporting rail. Price **2/3**



MITROPA COACH No. 3
Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **15/6**



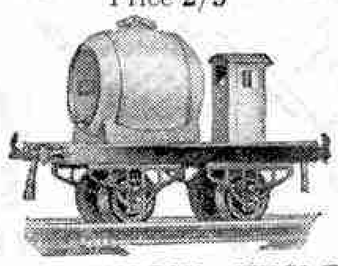
BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/9**



GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**



SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/–**



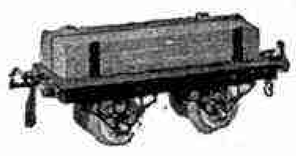
No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**



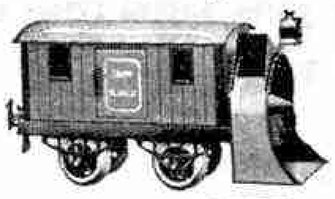
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/–**



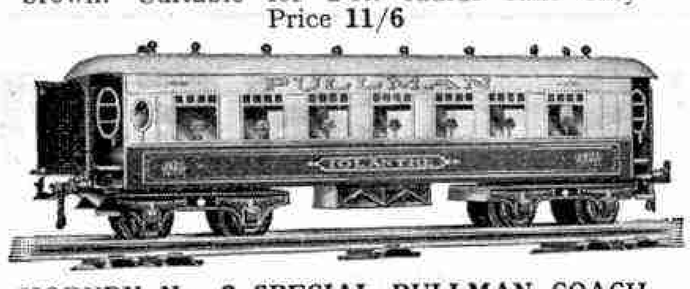
ROTARY TIPPING WAGON
Finished in blue and yellow. Price **3/–**



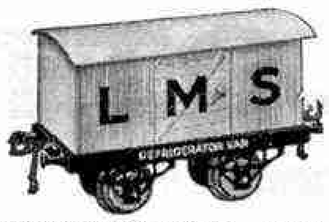
TIMBER WAGON No. 1
Beautifully enamelled in yellow and red. Price **1/9**



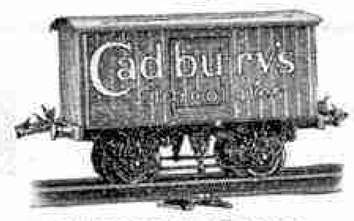
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



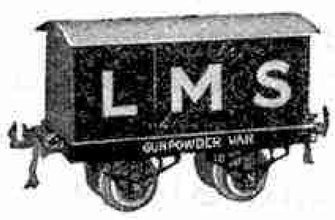
HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/–**



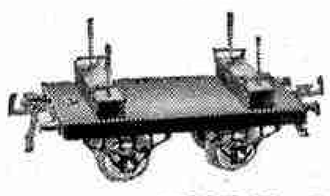
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/–**



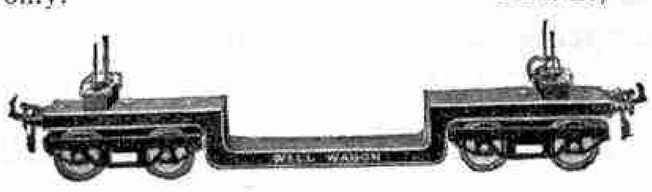
CHOCOLATE VAN "CADBURY'S"
This new van is beautifully enamelled in blue with orange roof. Price **3/–**



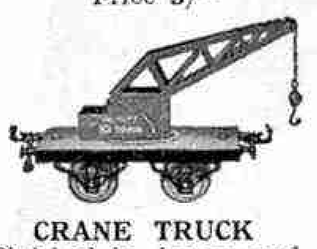
***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/–**



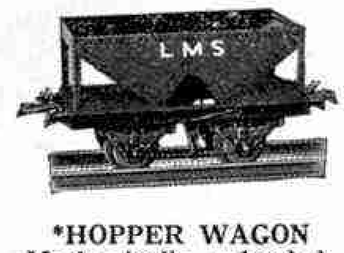
LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/–**



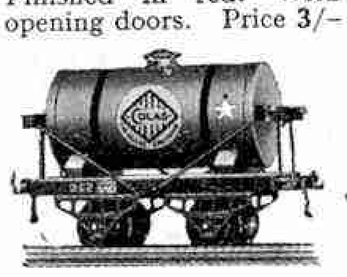
TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**



CRANE TRUCK
Finished in brown and blue. Price **3/6**



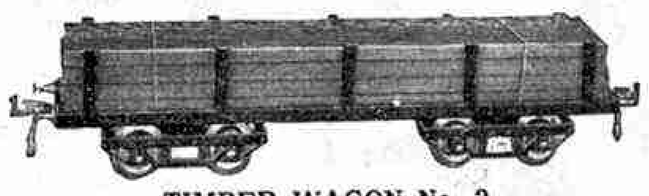
***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**



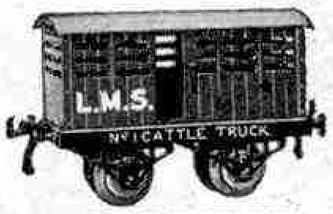
BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**



MITROPA COACH No. 0
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**



TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**



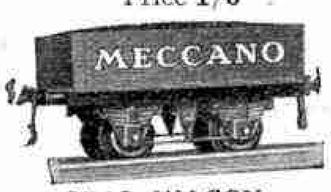
***CATTLE TRUCK No. 1**
Fitted with sliding doors. Very realistic design. Price **3/–**



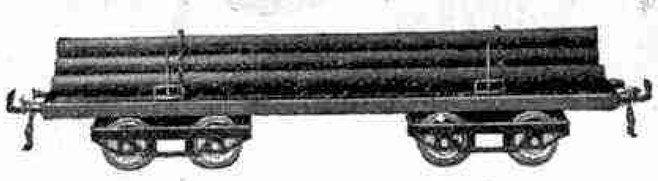
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/–**



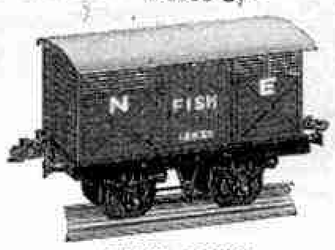
MILK TRAFFIC VAN No. 0
An attractive model. Available lettered G.W. only. Price **2/6**



COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**



LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/–**



FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **2/6**



SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/–**

In L.M.S., L.N.E.R., G.W. or S.R. lettering.

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

HORNBY SERIES

HORNBY ACCESSORIES

GAUGE 0

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



TUNNEL No. 0 (Straight)
Length 6 in., width 6⅛ in.
Price **1/6**

TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width 6¼ in. (as illustrated).
Price **2/-**

TUNNEL No. 2 (Straight)
Length 15⅝ in. Width 9½ in. Price **4/-**



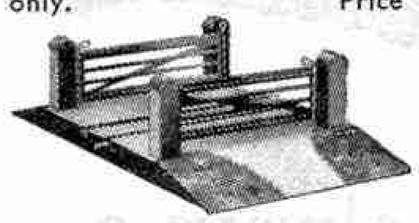
TUNNEL No. 5
(LEFT-HAND, CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks.
Base measurement: 15⅞ in. x 14¾ in.
Length of track 17¼ in. Price **7/6**

TUNNEL No. 6
(RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement 15⅞ in. x 14¾ in.
Length of track 17¼ in. Price **7/6**

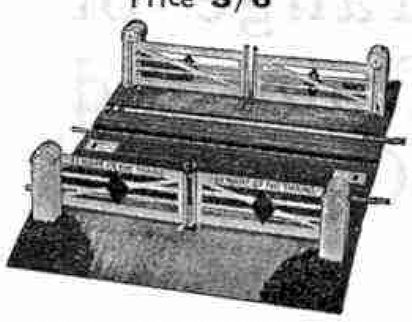


TUNNEL No. 3 (Curved)
Length 13 in. Price **4/6**

TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**



LEVEL CROSSING No. 1
Suitable for a single track only, and has gauge 0 rails in position.
Price **3/6**

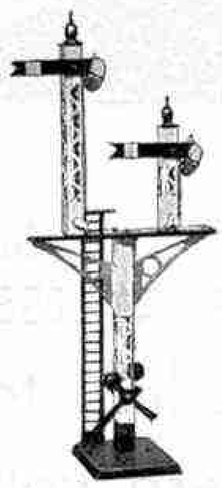


LEVEL CROSSING No. 2
Measures 13½ x 10¼ in., with two tracks of gauge 0 rails in position. Price **5/6**

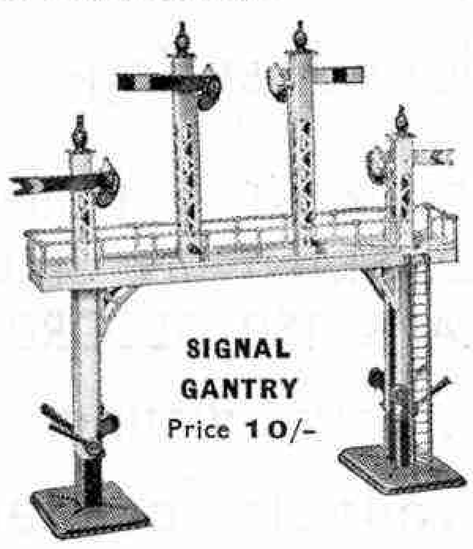
LEVEL CROSSING No. E2
(Electrical)
Similar to Level Crossing No. 2, excepting that a third rail is fitted in each of the two tracks.
Price **7/6**



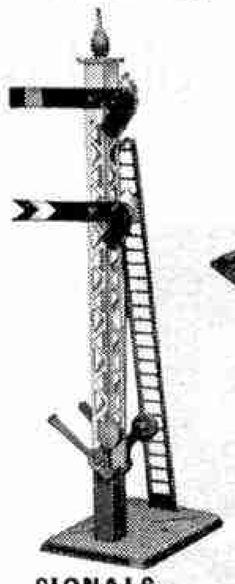
STATION No. 2
Excellent model, beautifully designed. Built up in three detachable sections. Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/-**



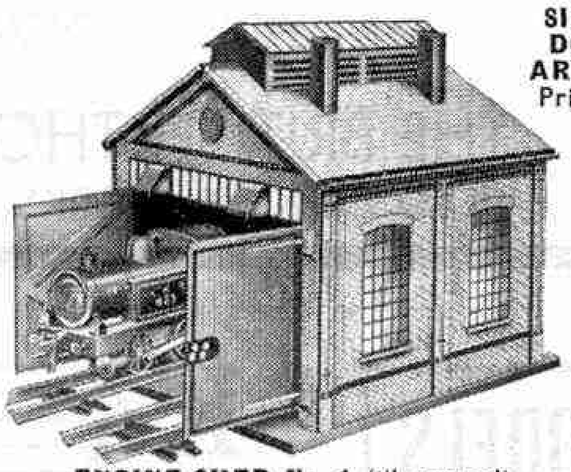
JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model.
Price **6/-**



SIGNAL GANTRY
Price **10/-**

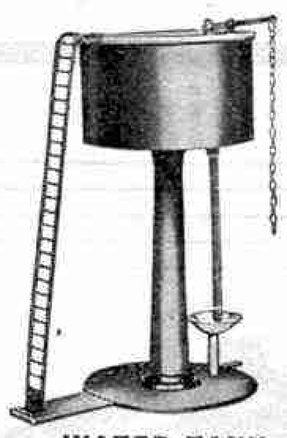


SIGNALS, DOUBLE ARM No. 2
Price each **3/-**



ENGINE SHED No. 1 (illustrated)
This Shed will accommodate Locomotives and Tenders of the M Series, and No. 1 Tank and No. 1 Special Tank Locomotives.
Price **15/-**

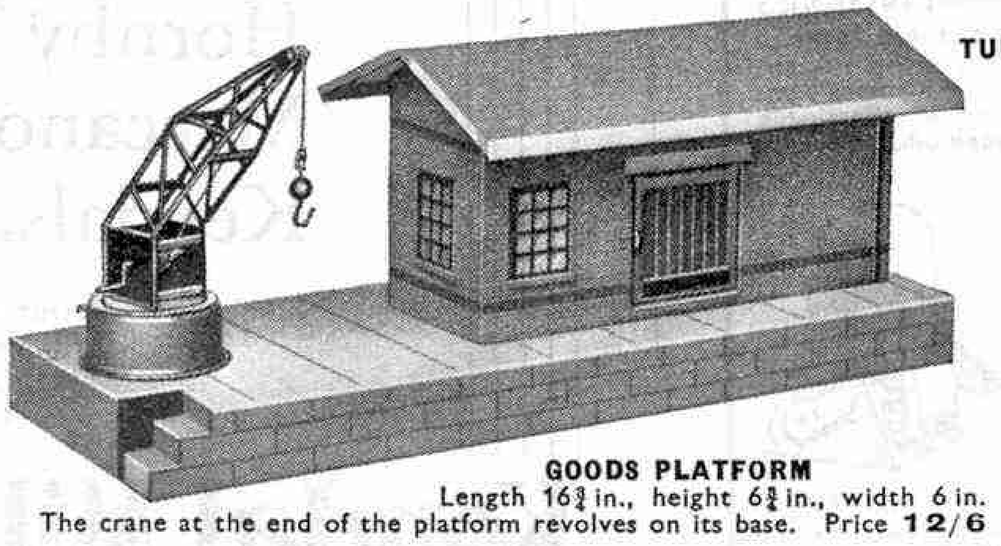
ENGINE SHED No. 2
This Shed will accommodate any Locomotive and Tender in the Hornby Series.
Price **22/6**



WATER TANK
Fitted with flexible tube and valve lever.
Price **8/6**



STATION No. 1
Length 16¾ in., width 6 in., height 6 in. This Station is a well-made model, richly finished in bright colours. By placing several of these Stations at intervals along the track, and using the Railway Station No. 2 as the main terminus, a very realistic effect is given to a miniature railway layout. Price **6/-**

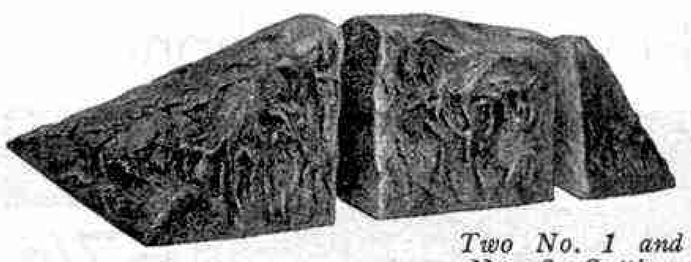


GOODS PLATFORM
Length 16¾ in., height 6¾ in., width 6 in.
The crane at the end of the platform revolves on its base. Price **12/6**



Cutting No. 4

CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 15⅝ in., width 15 in. Price **6/-**

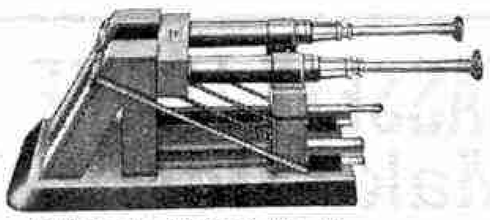


Two No. 1 and one No. 2 Cuttings are illustrated here.

CUTTING No. 1 (END SECTION)
(illustrated)
Base measurement: Length 7 11/16 in., width 6 in. Price, per pair **3/-**

CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1), between which they are fitted.
Base measurement: Length 10½ in., width 6 in.
Price **2/-**

CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**

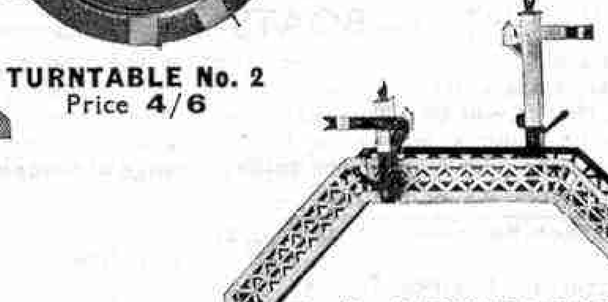


BUFFER STOPS No. 2
(Hydraulic type.) Price **5/6**

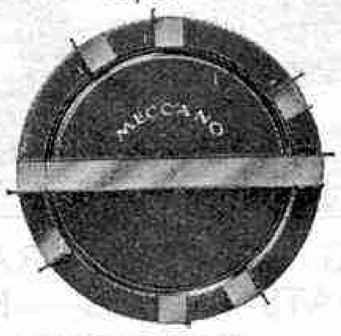


SIGNAL CABIN No. 1
Finished in colours. Price **2/9**

SIGNAL CABIN No. 2 (illustrated)
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price **4/6**



SIGNAL No. 1
Packed in pairs (one "Home," one "Distant").
Price, per pair **3/3**



TURNTABLE No. 2
Price **4/6**

No. 1 FOOTBRIDGE, WITHOUT SIGNALS
Price **4/-**

No. 1A FOOTBRIDGE, COMPLETE WITH SIGNALS Price **4/9**

No. 2 FOOTBRIDGE, COMPLETE WITH DETACHABLE SIGNALS
(as illustrated). Price **7/6**

Signals only (for Footbridge No. 2)
Price, per pair **3/9**

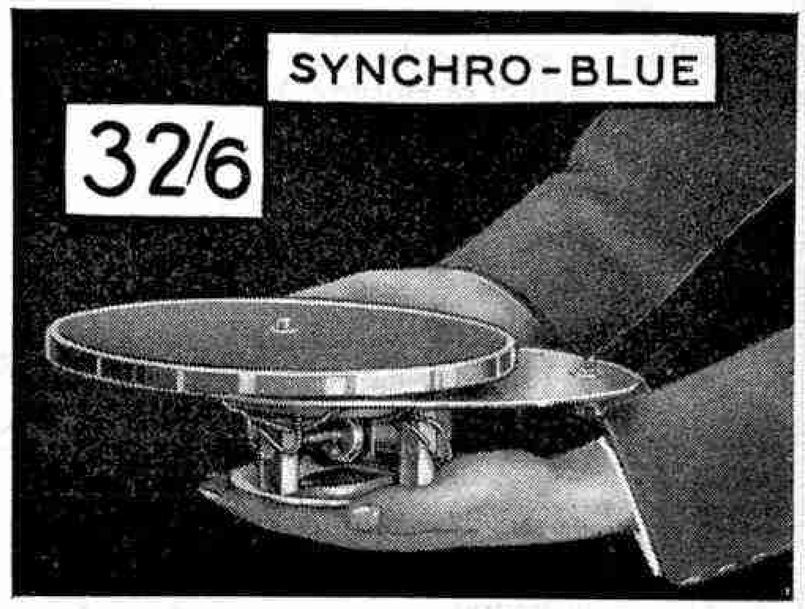
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Whether you want a model locomotive, such as the one pictured above, a complete railway, a stationary engine, a motor boat or sailing yacht, you can depend upon it that it will be "the real thing in miniature" if it comes from the Bassett-Lowke famous works at Northampton. Write for Catalogue to-day and feast your eyes on the splendid range of models offered.

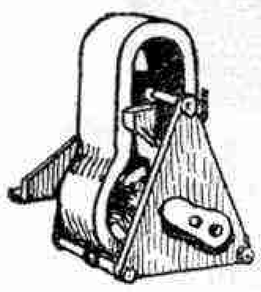
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Section A/17 Garden Railways and their equipment ..... 6d. post free
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Section S/17 Racing Yachts, Motor Boats, Ships' Fittings and everything for the model shipbuilder ..... 6d. post free

NOT DRY AS DUST LISTS, BUT EACH PACKED WITH PICTURES & THRILLS FOR THE MODEL ENTHUSIAST.

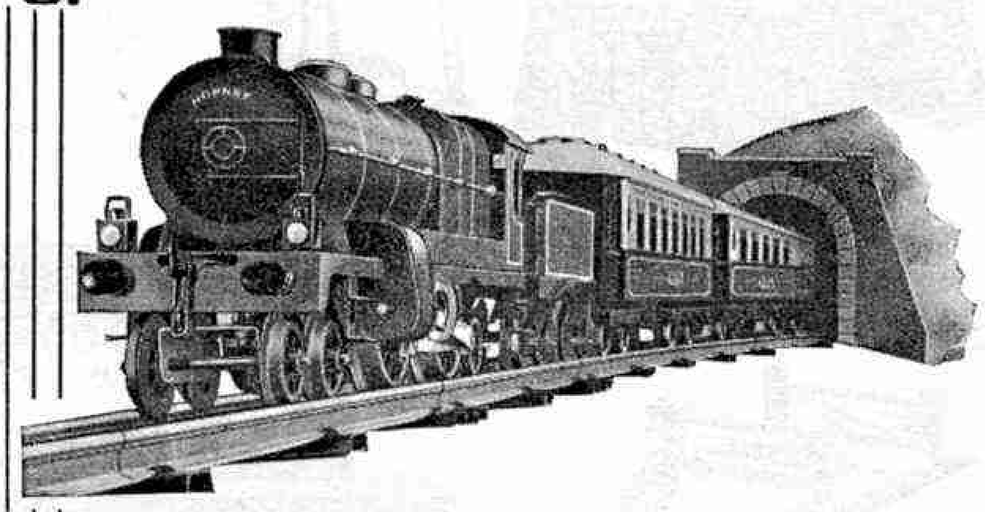
Bassett-Lowke Ltd., Northampton

London Branch: 112, High Holborn, W.C.1
Manchester Branch: 28, Corporation St.
Edinburgh: At Anderson's, 105, Princes Street



Permanent Magnet Boat Motor working off pocket dry battery. Price 7/6

K M & Co



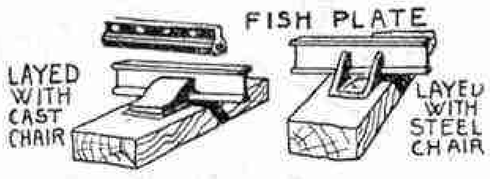
There is always a full range of Hornby Trains and Meccano Outfits at Kendals.

Your order, if sent by post, will receive the most careful attention, your satisfaction being guaranteed.

Kendal Milne & Co.
MANCHESTER 'PHONE: BLACKFRIARS 6666

Build your own Scale Model Railway Track

Costs you 11d. for three feet



Rustless steel rails, 36″ long ... ... per doz. **1/6**
Sleepers, wood, black ... ... per 100 **1/8**
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Full price list, post free 6d.
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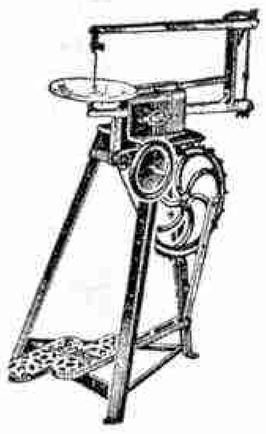
HOBBIES LTD. (C. Lucas) DEPOT



Fretwork Outfits from **1/6** to **21/-**

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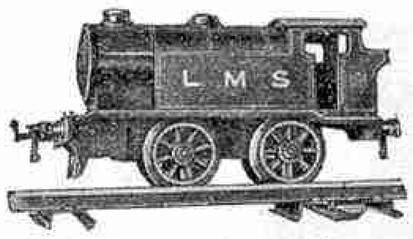
Timber, 3-ply, Mouldings, Tools, designs. Everything in stock.



WE HAVE TO MOVE
(because of the Mersey Tunnel).
We must reduce our stock and have great bargains for those who want them (no lists). Obsolete parcels of designs and wood at half-price. Six selected designs (4d. each), in packet, 6d. (post free 7d.).

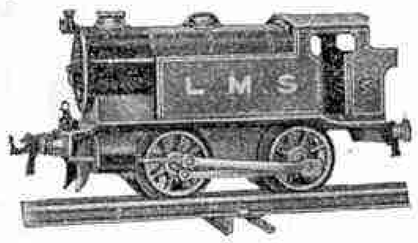
C. LUCAS, HOBBIES DEPOT, 35, Manchester St., Liverpool

HORNBY TANK LOCOMOTIVES



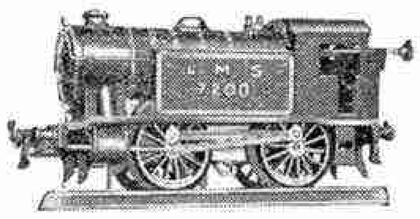
M3 Tank Locomotive

M3 TANK LOCOMOTIVE. This is the powerful Locomotive (reversing) supplied with the Hornby M3 Tank Goods Set. It is a handsome and extremely reliable model that will give long and excellent service. Available in either red or green. **Price, 7/6**



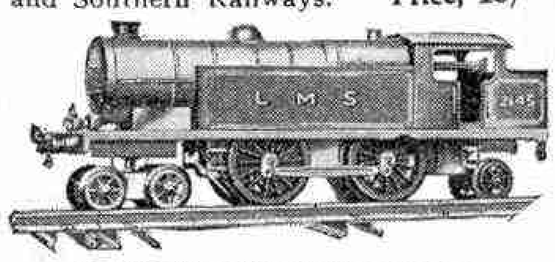
No. 1 Tank Locomotive

No. 1 TANK LOCOMOTIVE. This strong and durable Locomotive is capable of any amount of hard work. It is fitted with brake mechanism and reversing gear, and is supplied in colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Locomotives. **Price, 13/6**



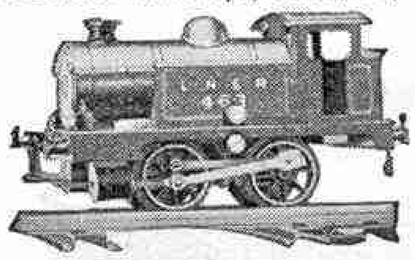
No. 1 Special Tank Locomotive

No. 1 SPECIAL TANK LOCOMOTIVE. This splendid Locomotive which is fitted with brake mechanism and reversing gear, has remarkable power and gives a very long run. It is available in the colours of the L.M.S., L.N.E., G.W. and Southern Railways. **Price, 18/-**



No. 2 Special Tank Locomotive

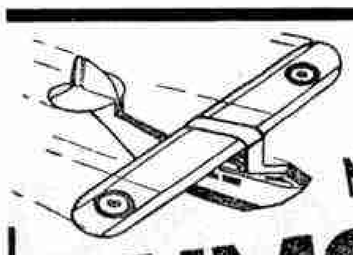
No. 2 SPECIAL TANK LOCOMOTIVE. This Locomotive has great length of run and exceptional pulling power. It is fitted with brake mechanism and reversing gear. In every respect it is a perfect model, beautifully finished in the colours of the L.M.S., L.N.E., G.W. and Southern Railways, **Price, 25/-**



No. 1 Electric Tank Locomotive

No. 1 ELECTRIC TANK LOCOMOTIVE. This Locomotive is of the permanent magnet type, and may be run from a 6-volt accumulator. It can be stopped, re-started, reversed and the speed varied by the operation of levers at the side of the track. It is supplied with a terminal connecting plate, speed and reverse control switch and 3 feet of flex, and it is available in the colours of the L.M.S., L.N.E., G.W., and Southern Railway Locomotives. **Price, 32/6**
This Locomotive cannot be run from the mains supply.

MECCANO LTD. - OLD SWAN - LIVERPOOL



Free!

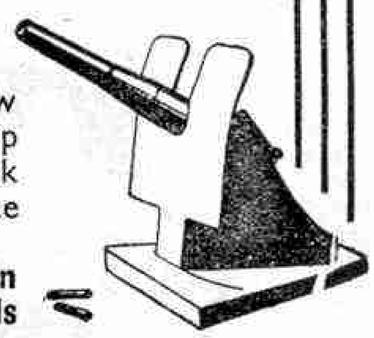
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GUMSTRIP MODEL MAKING BOOK

– EIGHT MODELS INCLUDING A FLYING BOAT AND AN ANTI-AIRCRAFT GUN THAT SHOOTS —

You can make these exciting models with strong, easily fixed Gumstrip. Send coupon below for FREE copy of "Gumstrip Model Making," the book that tells you how to make these fascinating toys.

Gumstrip is obtainable in various coloured coils from all stationers.



To Messrs. Samuel Jones & Co. Ltd.
Bridewell Place, E.C.4

Please send me a FREE copy of the Gumstrip Model Making Book

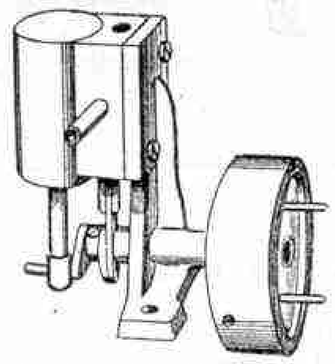
NAME.....

ADDRESS.....

M.M., Jan./33 .....

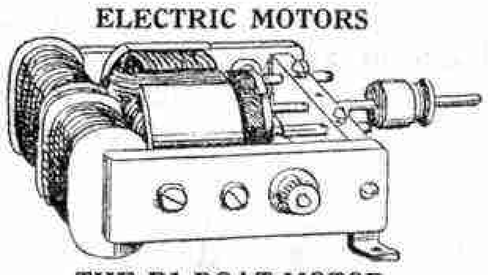
MODEL STEAM ENGINES and Fittings

HIGH CLASS



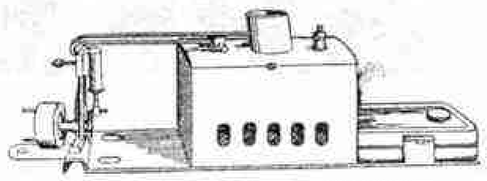
Marine Engine Piston Valve
S.A., ¼″ bore, ⅝″ stroke.
Accurately Made. Solid Brass.
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Larger size D.A., **7/6**

ELECTRIC MOTORS

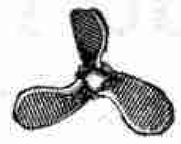


THE R1 BOAT MOTOR
Wound field magnets and wound armature. Very powerful.
Note the extended shafts for connecting propeller shafts. Also fitted with pulley for use when driving models.
Price **7/6**. Postage 4d.

BRITISH MADE



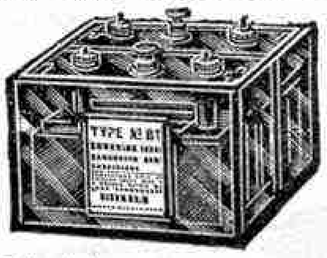
COMPLETE STEAM PLANT
Price **9/6**. Postage 6d.



PROPELLERS
Cast in Brass, and Machined.
1½″, **8d.**, 2″, **9d.**

PROPELLER SHAFTS
Complete with stern tube and packed glan.
Rigid type, 7″ long, **11d.**
Flexible type, 9¾″ long, **1/-**

BOAT type ACCUMULATORS



4 Volt, 4 Amp. **5/6**
4 Volt, 6 Amp. **6/6**
4 Volt, 10 Amp. **8/-**

We hold a good stock of Model Boats and Railway Accessories.
We have a well equipped workshop and undertake all Model REPAIRS.
WRITE FOR CATALOGUE, 2d.

F. YATES & SON LTD.
144, Church Street, Kensington, London, W.8



44 Pages

Price 9d. From any Meccano dealer

Every Meccano boy should have a copy of this Book of Prize Models. It contains illustrations and particulars of hundreds of prize models built by Meccano model building experts throughout the world—amazingly ingenious models of almost every kind of engineering subject, ranging from simple models that can be built with small Outfits to elaborate types that will appeal to older boys. They are all of outstanding interest and variety.

The principal object of the book is to keep Meccano model builders in touch with the latest improvements and developments in connection with their hobby. Practically all the new models and new movements shown have been submitted in recent competitions, including the last big £500 Model-building Competition.

Every Meccano boy should obtain a copy of the book as early as possible while supplies are available.

MECCANO LIMITED
Old Swan, Liverpool

How to obtain the Book

The Book of Prize Models may be obtained from any Meccano dealer or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free.

There are special Australian, New Zealand, South African and Canadian editions, which may be obtained from Meccano dealers in these countries at the following prices :—AUSTRALIA, Price 2/–. NEW ZEALAND, Price 1/–. SOUTH AFRICA, Price 1/–. CANADA, Price 25 cents.

Readers living in countries other than those mentioned above should order from Meccano Ltd., Old Swan, Liverpool, England, sending a remittance of 1/2 with their orders.

HORNBY SPEED BOAT



500 feet on one winding!

Boys, look at this splendid Hornby Speed Boat. Note the beautiful lines of her hull, the up-to-date fittings with which she is provided and the perfection of her design. On one winding of the powerful clockwork motor she will race away for a distance of 500 feet, smoothly riding the waves, just as real speed boats do.

The Hornby Speed Boat measures 16½ inches from bow to stern and 3½ inches in beam. She is available in three different colour combinations —Green and Ivory, Red and Cream, and Blue and White. Her motor is designed and made on the same lines as the motors of the famous Hornby Trains. She is a perfectly constructed model, with water-tight bulkheads that make her seaworthy and unsinkable. Price **12/6**

SPECIAL FEATURES OF THE HORNBY SPEED BOAT :

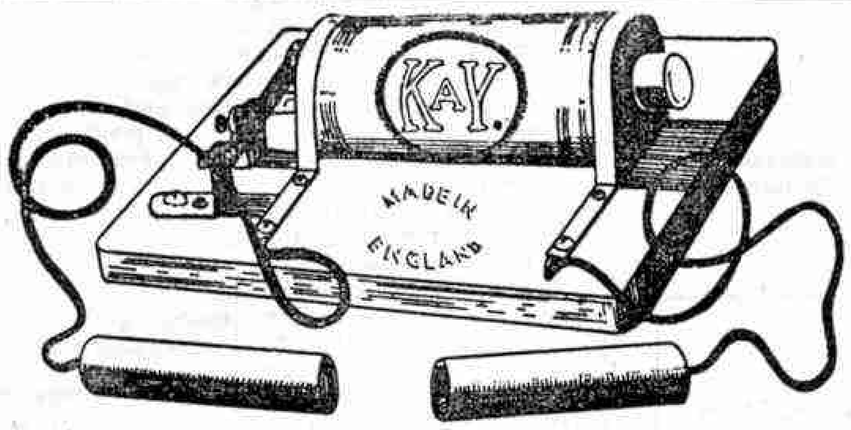
Perfect design. Beautiful Finish.
Powerful Clockwork Motor giving high speed and great length of run.
Unsinkable. 500 feet on one winding.
Up-to-date fittings, comprising Windscreen, Brass Ventilators, Adjustable Rudder, etc.



MECCANO LTD. - Old Swan - LIVERPOOL

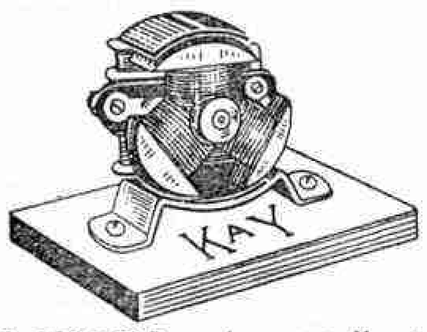
BRITISH MADE MINIATURE ELECTRICAL GOODS!

CHEAPEST AND BEST!

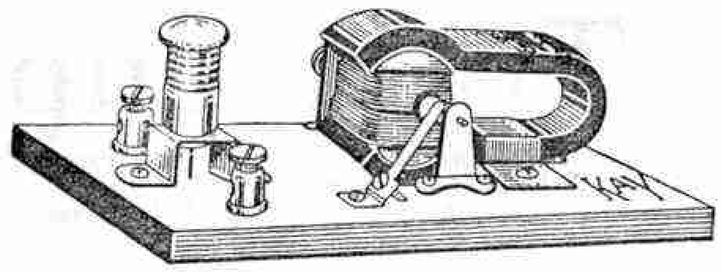


No. 1. INDUCTION COIL. A wonderful coil with variable strength. Mounted on Mahogany base ... **3/6** each

No. 2. INDUCTION COIL. A super coil with a compound core, battery holder, and switch ... ... **5/6** each



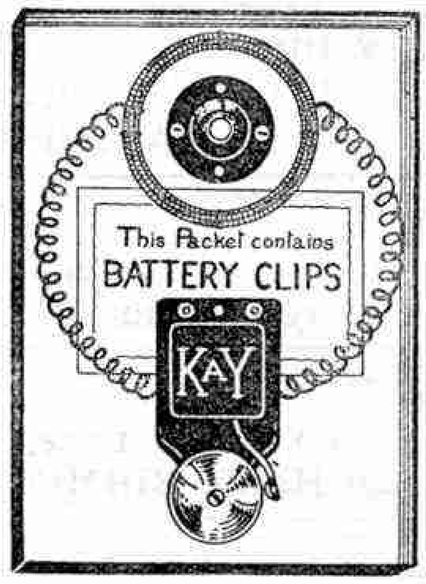
No. 1. ELECTRIC MOTOR. An excellent triple coil motor with twin brushes. Starts from rest ... ... **4/6** each



No. 1. DYNAMO. A splendid dynamo with a bulb holder and bulb attached. Very efficient ... ... **5/6** each

No. 3. DYNAMOTOR. Specially wired to work as either a dynamo, or as a motor ... ... **7/6** each

No. 1. BELL SET. Complete with double coil all steel bell, moulded bell push, battery clips, etc., **2/6** each



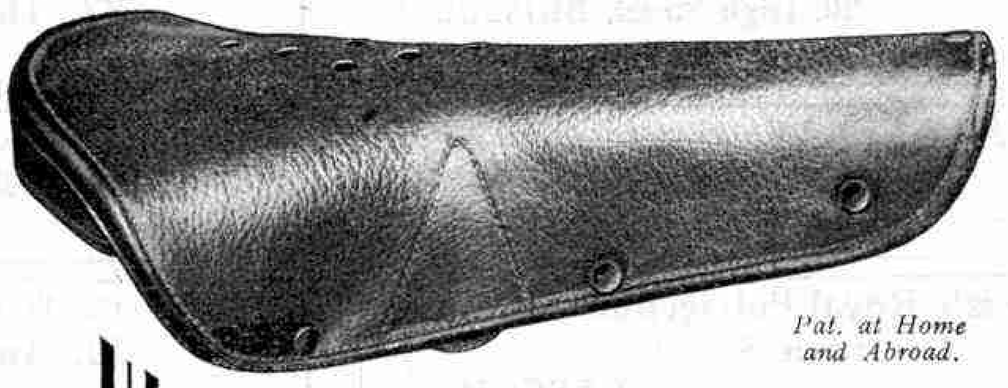
MADE BY THE MANUFACTURERS OF **KAY** CHEMISTRY AND ELECTRICAL OUTFITS.

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Start 1933 riding with the right saddle



Pat. at Home and Abroad.

The TERRY "CLUB"

Model is the very best you can fit on your bike. Your old saddle may have satisfied you, but if you never ride a perfect one you will never know the pleasures of real cycling.

Ask your dealer to show you the "Club" model.

Price 12/6 each

Be sure you mention your weight.

If unobtainable write to us.
List of specialities free.

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REDDITCH, ENGLAND. Est. 1855.

London: 27, Holborn Viaduct. Birmingham: 210, Corporation St. Manchester: 279, Deansgate.

TRADE MARK

Meccano and Hornby Train Supplies

All the dealers whose advertisements appear on this 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.

JOHN N. PIPER,
118, Union Street,
Tel. 2797 ABERDEEN.

HARRY BROWN,
1, Cross Street,
Tel. 2221 ALTRINCHAM.

J. BELL,
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Royal Avenue, BELFAST.

L. W. WALKER,
262, Green Lane,
Small Heath, BIRMINGHAM.

MERCER'S DOLLS' HOSPITAL,
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BLACKBURN.

JOHN TAYLOR,
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Tel. : Brighton 1357 BRIGHTON.

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BRISTOL.

SALANSON LTD.,
20, High Street, BRISTOL.
Optic House, 119, Queen St., CARDIFF.

E. A. ANELAY,
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Tel. 2925 DARLINGTON.

Lewis's Royal Polytechnic Ltd.,
Argyle Street,
GLASGOW.

R. WYLIE HILL & CO. LTD.,
20, Buchanan St. & Argyll Arcade,
GLASGOW, C.1.

YE OLDE TOY SHOPPE,
Chariot Street,
Tel. : Central 35031 and 533y1 HULL.

ROBOTHAM'S LIMITED,
32/4/6/8, Belvoir Street,
Tel. 60809 LEICESTER.

J. T. WEIGHTMAN,
198, Charnwood Street,
LEICESTER.

FREDERICK BECK,
22/6, Camden Passage,
Tel. : Clerkenwell 8403 ISLINGTON, N.1.

Bon Marché Ltd.,
Brixton,
Tel. : Brixton 6201 LONDON, S.W.9.

THE NEW COUNTY STORES,
67, York Road, S.E.1.
Tel. : Hop 6813 Nr. Waterloo Station.

SPASHETT'S TOY SHOPS,
LOWESTOFT and BECCLES.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

ALFRED'S
TOY SHOP,
77, NORTHUMBERLAND ST.,
NEWCASTLE-ON-TYNE, 1.

F. W. WARNER (N/c) LTD.,
Meccano and Hornby Train Centre,
Barras Bridge (Next Grand Hotel),
NEWCASTLE-ON-TYNE, 2.

W. MARK & CO. LTD.,
27, The Drapery,
Tel. 461 NORTHAMPTON.

BEECROFT & SONS,
16, Pelham Street,
Tel. 41434 NOTTINGHAM.

PEARSON & PEARSON,
12, Angel Row,
NOTTINGHAM.

E. DE LA MARE,
9/13, George Street,
Tel. 3456 OXFORD.

WILSON, GUMPERT & CO. LTD.,
57, Fargate,
Tel. 20489 SHEFFIELD.

OSBORN & CO. (So'ton) Ltd.,
9, High Street,
SOUTHAMPTON.

PICKERINGS,
28, High Ousegate,
Tel. 3678 YORK.

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 90,000 copies of the December number were distributed all over the world. You therefore reach this exclusive public for approximately one penny a thousand.

Life Story of Meccano—(*Continued from page 39*)

of this type call for the aid of outside printing houses.

Finally there is the Service Department to be considered. It is common knowledge that I have never considered our responsibility for our products to be ended after they have been sold by our dealers. I believe that it is part of the business of every manufacturer to do all he can to ensure that the users of his products shall secure the maximum possible service from them, and to that end we have established departments that look after our products "in sickness and in health," as it were. The Hornby Railway Company and the Meccano Guild serve our customers while their outfits are running normally, but even the best of machinery is liable to break down, and it is at this point that the Service Department takes charge.

All complaints and repair work are dealt with in the Department. The greater part of its work is concerned with Hornby Trains, and a staff of highly-trained employees, each one an expert in diagnosing and adjusting model locomotive faults, is kept in constant employment. In the course of a year many thousands of Hornby engines are received for repair, and it is interesting to note the wide range of types that come in. Many of them are of classes long obsolete, and showing every sign of having come to a standstill through sheer old age! I am proud of the service that these old engines have given, and of the fact that such early members of the Hornby family should be so greatly treasured by their owners. It is an interesting point that the average age of the locomotives that are returned for repair—exclusive of the comparatively small number dealt with under our guarantee—is between 18 months and two years.

The Service Department also administers the Part Exchange Scheme. This scheme, so far as it applies to Hornby locomotives, has been advertised so widely recently that it is unnecessary to refer to it here; but it is worth emphasising that a similar scheme has been in force for many years for the exchange of old Meccano parts and accessories. Any bent, rusty or broken Meccano accessories may be handed to a Meccano dealer in exchange for new at half price.

No description of the Meccano organisation would be complete without reference to the arrangements made to secure the comfort of the employees. Mass production at best is a monotonous occupation, but every effort has been made in the Meccano factory to relieve the monotony by providing working conditions as nearly ideal as it is possible to secure. On more than one occasion the Government have paid us the compliment of asking for the provision of photographs for inclusion in an official collection illustrating the highest standards of industrial welfare work. The Meccano factory is, first and foremost, an engineering works, but the grease and grime usually associated with engineering plants is conspicuous by its absence. It is the fact that 90 per cent. of our visitors comment upon the cleanliness and pleasant aspect of our factory.

A canteen is provided to enable our workpeople to secure hot mid-day meals at cost price, and nearly 750 meals are served each day. We have not yet reached the stage of using conveyors to carry meals to the employees at their tables, but that is only because a conveyor could not do the job as efficiently as the staff of waitresses who have to serve the whole of those meals in less than 15 minutes!

Many visitors have expressed their interest in the cloakroom accommodation provided for our workpeople. This consists of a series of steel "cages" around which the clothing is hung. These cages are locked during working hours, and no one is allowed inside except under supervision. Pilferage is thus ruled out, but an even more important feature is the protection afforded to the employees' health. The cages are fitted with steam pipes, and are so placed that air is in constant circulation through them, so that in wet weather garments are dry by the time their owners are ready to put them on again.
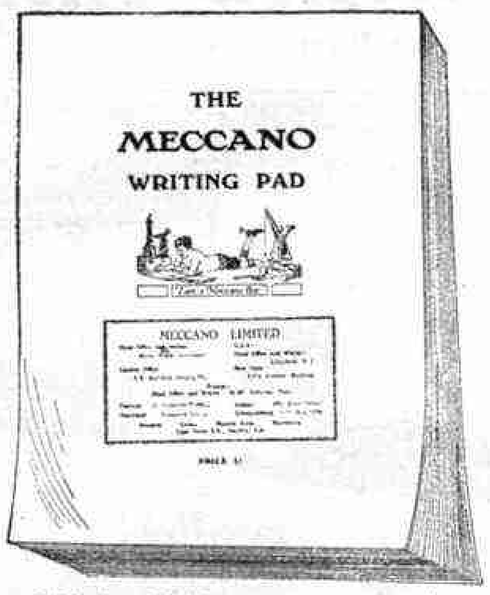
Kay Sports Company's November Competition

The following is the list of prize-winners in the Kay Sports Company's Competition announced in the November "*M.M.*":—First Prizes: Master R. M. Owen, 45, Stretton Road, Leicester; Master W. James, 69, Marion Street, Splott, Cardiff. Second Prizes: Master M. O. Mott, 21, Hilda Avenue, Tottington, Bury; Master T. F. Potter, Lambley House, Woodborough, Notts. Third Prizes: Master J. Tickle, 14, Harvills Hawthorne West, Hill Top; Master R. Griffin, 19, Bawdale Road, E. Dulwich, S.E.22.

Model Aeroplane Free to "M.M." Readers

Among the many special offers made by advertisers in the December "*M.M.*," one of the most interesting was that of a set of parts, including an elastic motor, for constructing a scale model of a De Havilland "Puss Moth" monoplane. The parts, which are of light card, build up an attractive and efficient model that is guaranteed to fly if the simple instructions are followed carefully. A few sets are still available, and while stocks last Daniel Neal & Sons Ltd., 3-5, Portman Square, London, W.1, will be pleased to send one free to any "*M.M.*" reader who writes, mentioning the "*M.M.*" and stating the date of his birth, and enclosing 3d. in stamps to cover the cost of postage and packing.

WRITING PADS
FOR MECCANO BOYS



These Writing Pads are very popular with Meccano boys as is shown by the large number of letters we receive each day written on the familiar tinted paper.

The Pads are supplied in two sizes, each consisting of 50 sheets and cover.

Prices—Large Size 1/- each (post free). Small Size 6d. each (post free).

ENVELOPES.

Special envelopes, appropriately printed and matching the writing paper in colour, are also available. These are suitable for both the large and the small sheets of writing paper.

Price, per packet of 50, 8d. post free.

Meccano Ltd., Binns Road, Old Swan, Liverpool.

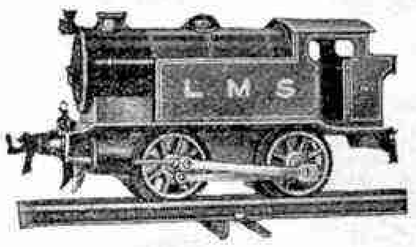
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Before commencing to operate a Meccano model, or to run a Hornby Train, all gears and bearings should be oiled thoroughly with Meccano Lubricating Oil. This oil is specially prepared and is of the right consistency for the purpose. Price per bottle 6d.

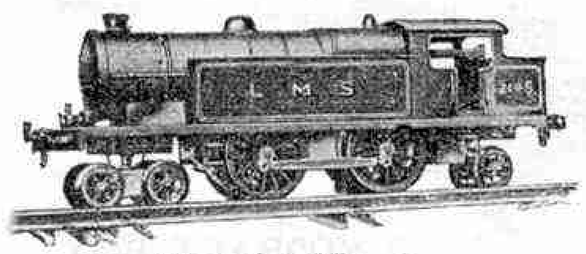
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This is a strong and durable Locomotive, capable of any amount of hard work. It is richly enamelled, highly finished, and is fitted with brake mechanism and reversing gear. Supplied in colours to represent L.M.S.R., L.N.E.R., S.R., or G.W.R. Locomotives. Gauge 0. Price **13/6**

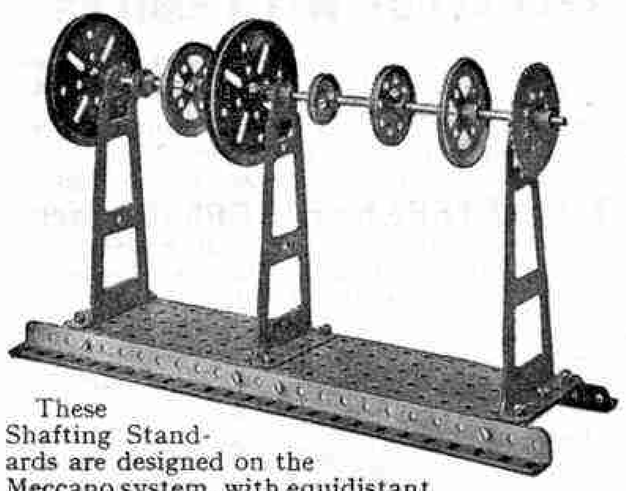


Hornby No. 2
Special Tank Locomotive

This Locomotive is fitted with a very powerful Clockwork mechanism, giving great length of run and exceptional pulling power. It is a perfect model in every respect and is beautifully finished in the colours of the L.M.S.R., L.N.E.R., G.W.R. and S.R. Gauge 0. Price **25/-**

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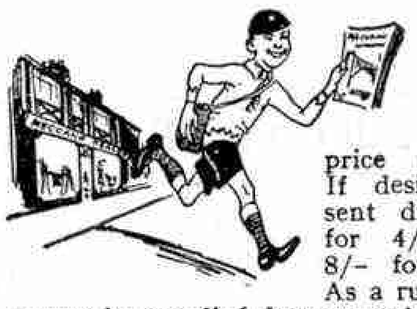


These Shafting Standards are designed on the Meccano system, with equidistant holes. Our illustration shows how strong and serviceable shafting may be constructed from Meccano parts with the aid of the Large Standard.

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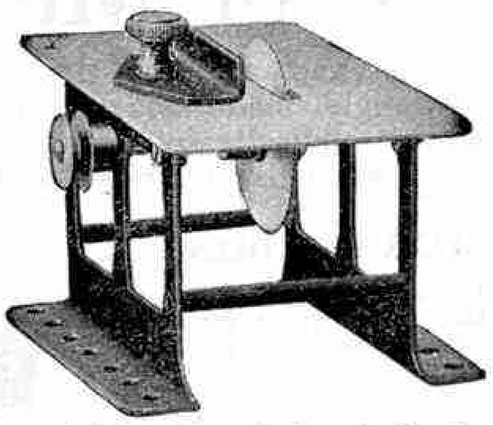
How to obtain the "M.M."



The *"M.M."* may be ordered from all Meccano dealers, or from any newsagent or bookstall, price 6d. per copy. If desired it will be sent direct, post free, for 4/- for six, or 8/- for twelve issues. As a rule back numbers cannot be supplied, because only sufficient copies are printed to fill standing orders. To prevent disappointment, therefore, place a regular order with your dealer, newsagent, or the publishers—

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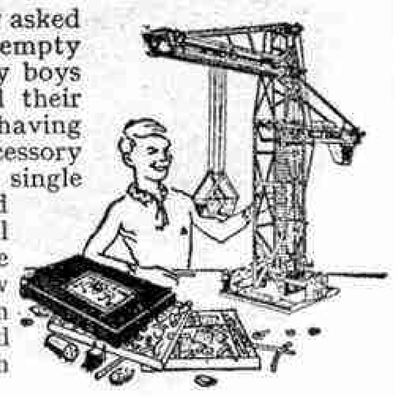


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We are frequently asked to quote prices of empty Meccano Cartons by boys who have damaged their own, or who, having purchased an Accessory Outfit, require a single carton or Wood Cabinet to hold all their parts. We therefore give below a full list of both Cartons and Cabinets with prices.



Carton No.	Price	Postage
00	4d.	4d.
0	4d.	4d.
1	1/-	6d.
2	1/4	6d.
3	1/8	9d.
4	2/11	9d.
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.

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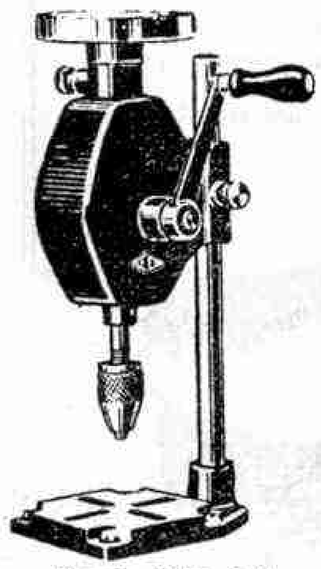
	Price	Postage
No 5	40/-	1/-
6	45/-	1/3
6A	52/6	*
7	145/-	*

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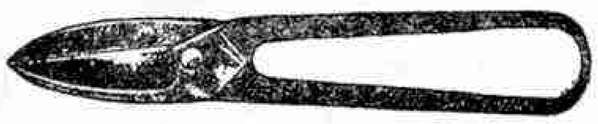
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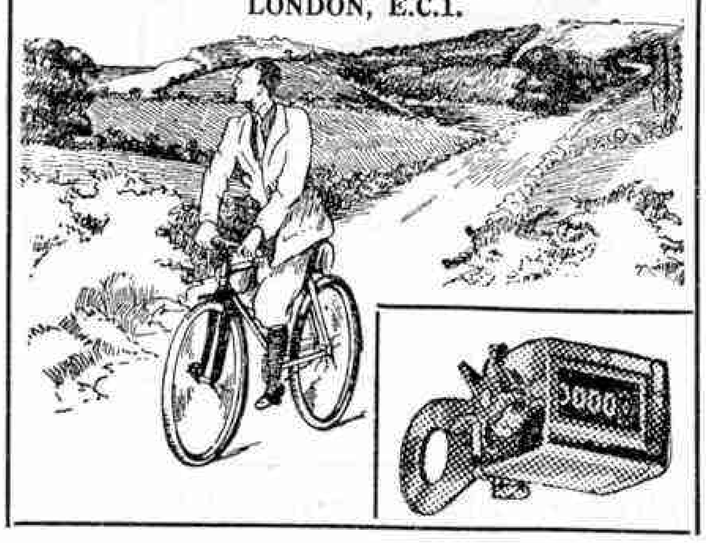
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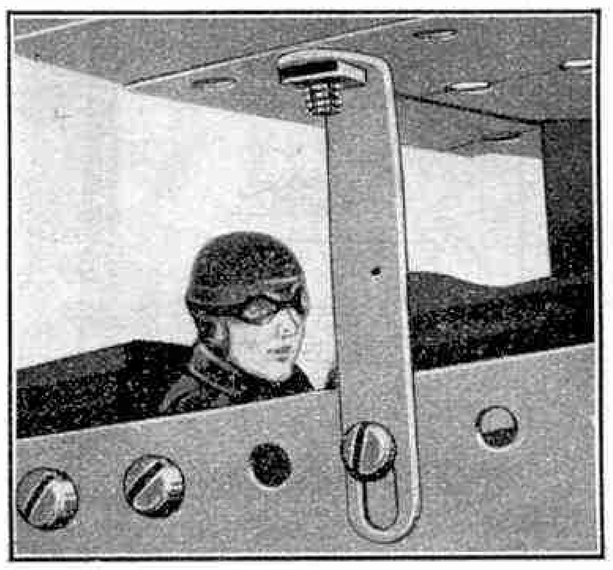
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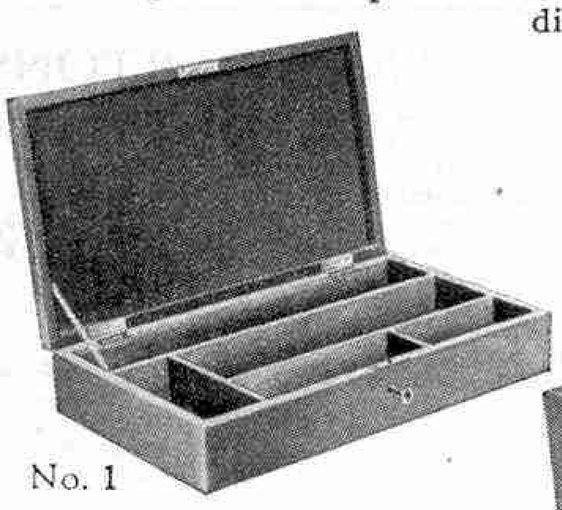
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P100	"	"	...	...	" **5d.**

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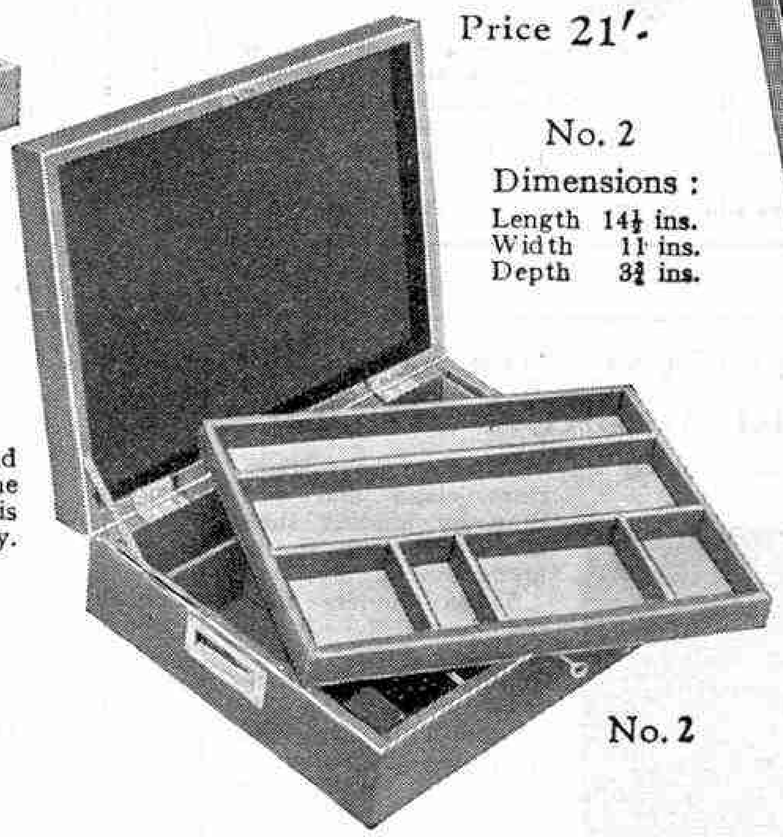
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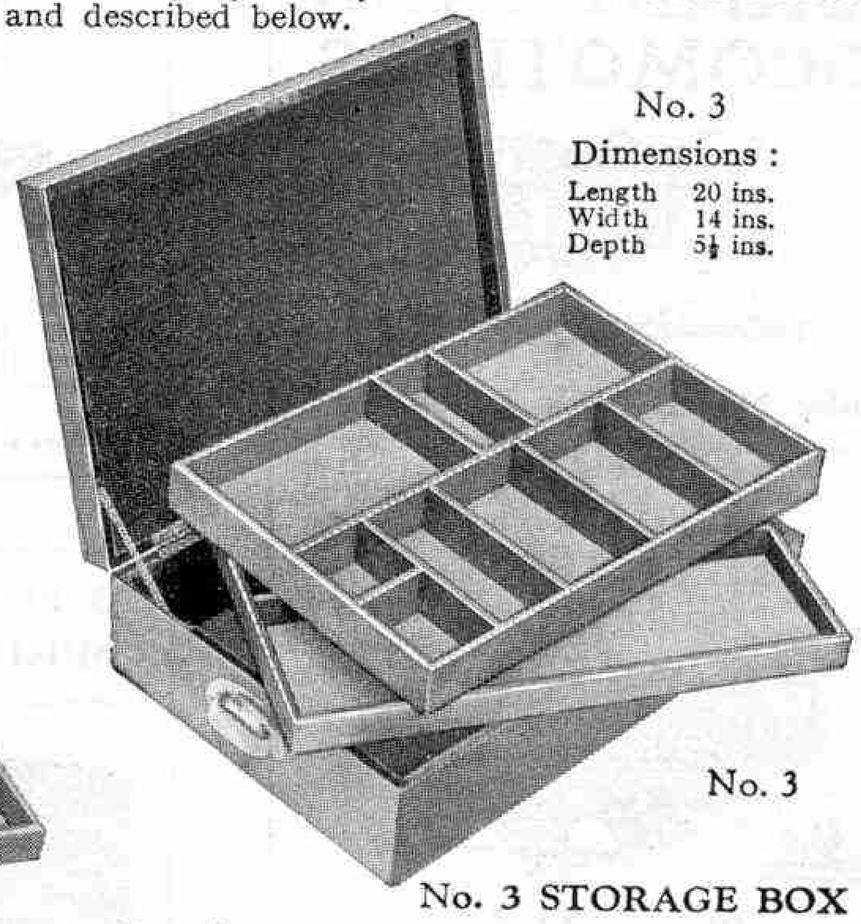
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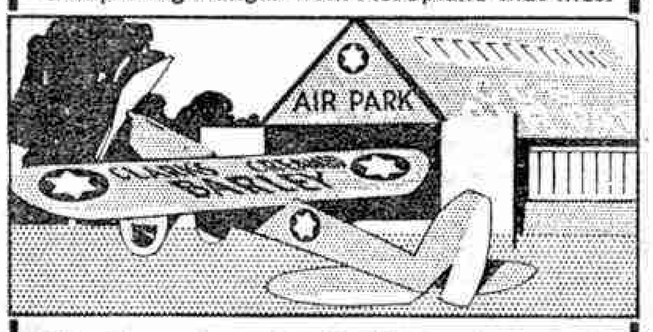
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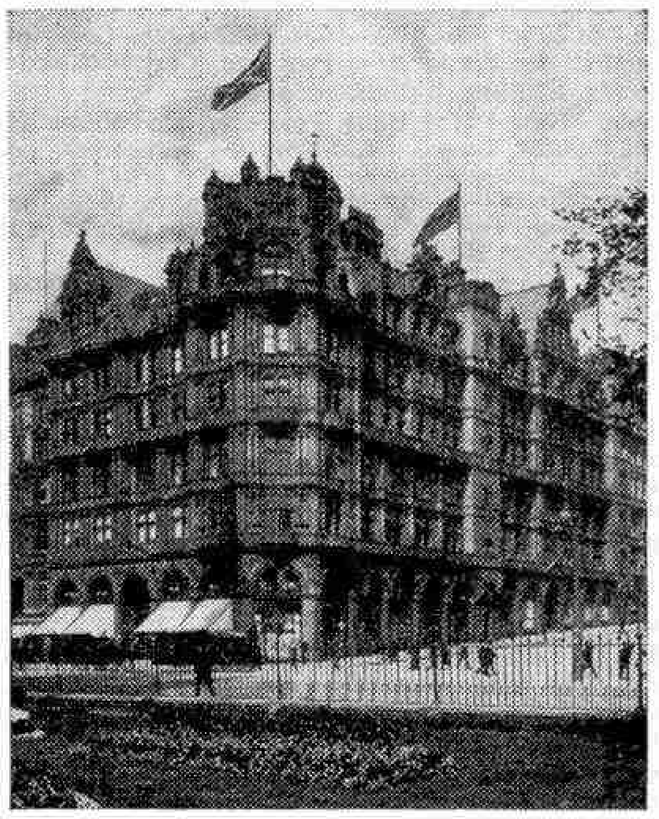
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The Ayr & Dalmellington Line, L.M.S.R.
Notes on Scottish Locomotives and Railway Working, 1895-1910. III.—Highland Railway.
The L.N.E.R. in Strathspey.
Locomotives of the Railway Operating Division, Royal Engineers, 1916-1919. Part V.
A Visit to the Nepal Government Railway.
New 0-4-2 Type Tank Locomotive, G.W.R.

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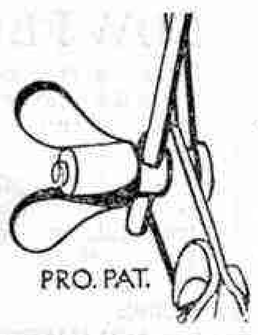


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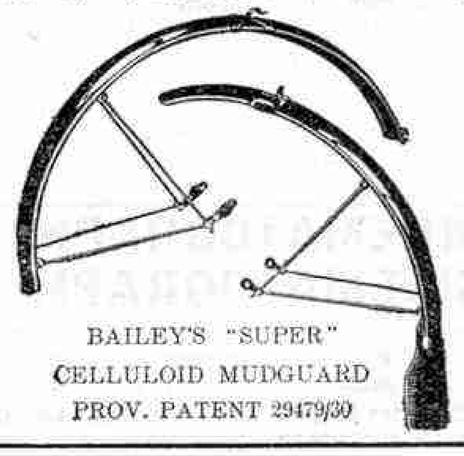
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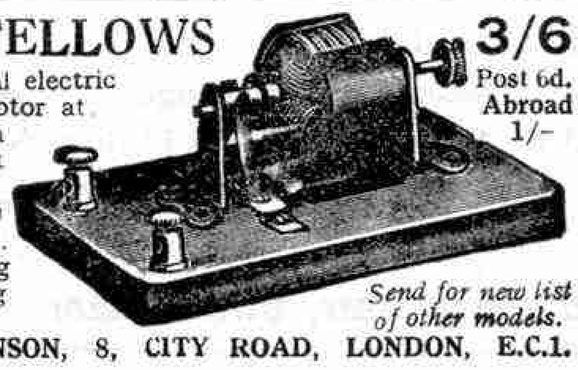
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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
OLD SWAN, LIVERPOOL, ENGLAND.
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.

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.

Send to FOYLES FOR BOOKS!
New and second-hand books on any subject. Catalogues free on mentioning your interests.
119-125, CHARING CROSS RD., LONDON, W.C.2
Telephone: Gerrard 5660 (seven lines).

Stamp Advertisements cont. from p. 70

BARGAIN HUNTERS! Here's your big opportunity. Thousands of different Colonial and Foreign Stamps at ¼d., ½d., and 1d. each. Write now for my attractive sheets. Never such value! Also medium and good class sent against references. Prices average ⅛th Gibbons.—Campbell, 1, Haldon Avenue, Teignmouth.

3 DIFFERENT TRIANGULARS FREE
to genuine collectors applying for our Approval Books. Discount given.
DEPT. 4, BROADWAY LIBRARY, HERNE BAY.

FREE! 7 GREECE pictorials (1927)
To Genuine Applicants for my " Peak " Approvals.
S. BACKHOUSE, 61, WARNER STREET, DERBY.

300 STAMPS including 50 Colonials, set Persia 4½d.—Cranwell, 54, Churchill Road, London, N.W.2.

2/6 SOUTH AFRICA PICTORIAL Free to Approval Applicants.—Sanders, 90, Newlands Av., Southampton.

Full Set (3) Italian Naval Academy Free to Approval Applicants.—Humphries, The Close, Bitterne, Hants.

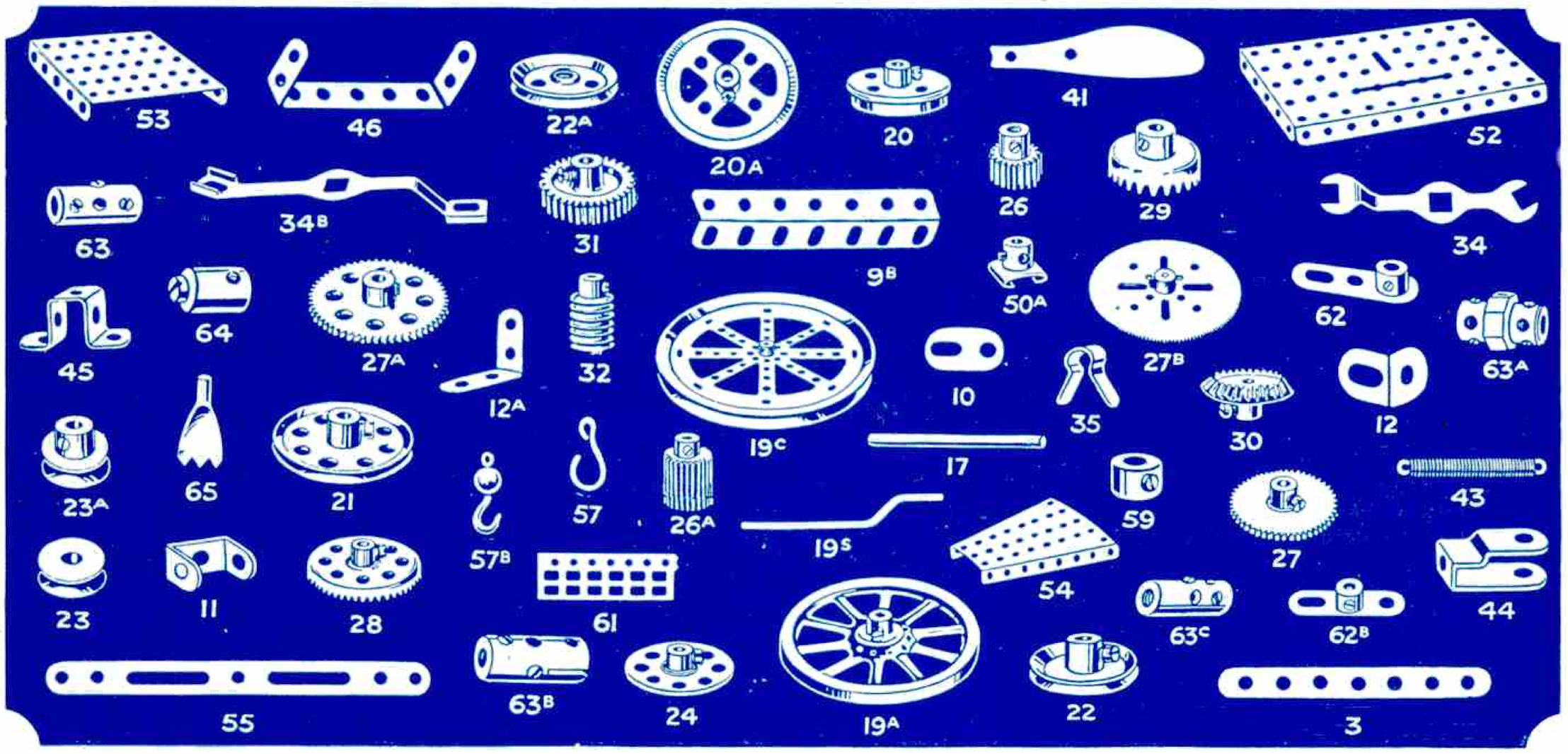
100 Different Stamps Free.—Send for ½d. approvals.—Cox, 21, Dennis Mansions, Westcliff.

Stamps! Packet 500 on approval. Pick any at ½d. each.—Wyk, 576, Chester Rd., Manchester.

500 World-Wide Stamps, incl. scarce Greenland, West Africa, Pictorials, Colonials, unused. Chance of finding many scarce stamps. Price 6d.—Way, Wilmslow, Ches.

20 DIFF. Liechtenstein including nice Picture Stamps, free to approval applicants. Enclose 1½d. postage.—Fred Clarke, 15, Darnley Street, Gravesend.

MECCANO
PARTS & ACCESSORIES



No.		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
7.	Angle Girders, 24½″ long ... ... each	0	8
7a.	„ „ 18½″ „ ... ... „	0	6
8.	„ „ 12½″ „ ... ... ½ doz.	1	9
8a.	„ „ 9½″ „ ... ... „	1	3
8b.	„ „ 7½″ „ ... ... „	1	2
9.	„ „ 5½″ „ ... ... „	1	0
9a.	„ „ 4½″ „ ... ... „	0	10
9b.	„ „ 3½″ „ ... ... „	0	8
9c.	„ „ 3″ „ ... ... „	0	8
9d.	„ „ 2½″ „ ... ... „	0	7
9e.	„ „ 2″ „ ... ... „	0	6
9f.	„ „ 1½″ „ ... ... „	0	6
10.	Flat Brackets ... ... „	0	2
11.	Double Brackets ... ... each	0	1
12.	Angle Brackets, ½″ × ½″ ... ... doz.	0	3
12a.	„ „ 1″ × 1″ ... ... ½ doz.	0	4
12b.	„ „ 1″ × ½″ ... ... „	0	3
13.	Axle Rods, 11½″ long ... ... each	0	2
13a.	„ „ 8″ „ ... ... „	0	2
14.	„ „ 6½″ „ ... ... „	0	1
15.	„ „ 5″ „ ... ... „	0	1
15a.	„ „ 4½″ „ ... ... 2 for	0	1
16.	„ „ 3½″ „ ... ... „	0	1
16a.	„ „ 2½″ „ ... ... „	0	1
16b.	„ „ 3″ „ ... ... „	0	1
17.	„ „ 2″ „ ... ... 3 for	0	1
18a.	„ „ 1½″ „ ... ... „	0	1
18b.	„ „ 1″ „ ... ... „	0	1
19.	Crank Handles, Large ... ... each	0	2
19s.	„ „ Small ... ... „	0	2
19a.	Wheels, 3″ diam., with set screws „	0	6
20.	Flanged Wheels, 1½″ diam. ... ... „	0	5
20b.	„ „ ¾″ „ ... ... „	0	4

No.		s.	d.
	Pulley Wheels		
19b.	3″ dia. with centre boss and set screw each	0	7
19c.	6″ „ „ „ „ „ „	2	0
20a.	2″ „ „ „ „ „ „	0	5
21.	1½″ „ „ „ „ „ „	0	4
22.	1″ „ „ „ „ „ „	0	3
23a.	½″ „ „ „ „ „ „	0	3
22a.	1″ „ without „ „ „ „	0	2
23.	½″ „ „ „ „ „ „	0	2
24.	Bush Wheels ... ... „	0	4
25.	Pinion Wheels, ¾″ diam., ¼″ wide „	0	6
25a.	„ „ ⅝″ „ ⅛″ „ „	0	8
25b.	„ „ ¾″ „ ⅜″ „ „	0	10
26.	„ „ ½″ „ ¼″ „ „	0	4
26a.	„ „ ½″ „ ⅛″ „ „	0	6
26b.	„ „ ½″ „ ¾″ „ „	0	8
	Gear Wheels		
27.	50 teeth to gear with ¾″ pinion ... „	0	6
27a.	57 „ „ „ ½″ „ ... „	0	6
27b.	133 „ „ „ ½″ „ (3½″ diam.) „	1	3
27c.	95 „ 2½″ diam. ... ... „	1	0
28.	Contrate Wheels, 1½″ diam. ... ... „	0	9
29.	„ „ ⅝″ „ ... ... „	0	6
30.	Bevel Gears, ⅞″, 26 teeth ... ... „	0	9
30a.	„ „ ½″, 16 „ } *can only be* „	0	6
30c.	„ „ 1½″, 48 „ } *used together* „	1	6
31.	Gear Wheels, 1″, 38 teeth ... ... „	1	0
32.	Worms ... ... „	0	5
34.	Spanners ... ... „	0	2
34b.	Box Spanners ... ... „	0	4
35.	Spring Clips ... ... per box (doz.)	0	3
35f.	„ „ ... ... „ (50)	0	9
36.	Screw Drivers ... ... each	0	3
36a.	„ „ Extra Long ... ... „	0	6
36b.	„ „ Special ... ... „	1	0
37.	Nuts and Bolts, 7/32″ ... per box (doz.)	0	3
37a.	„ ... ... „ „	0	2
37af.	„ ... ... „ (50)	0	7
37b.	Bolts, 7/32″ ... ... „ (doz.)	0	2
37bf.	„ „ ... ... „ (50)	0	7
37f.	Nuts and Bolts, 7/32″ ... „ (50)	1	0
37g.	„ „ „ ... „ (144)	2	9
38.	Washers ... ... (doz.)	0	1
38f.	„ ... ... per box (50)	0	3

No.		s.	d.
40.	Hanks of Cord ... ... 2 for	0	3
41.	Propeller Blades ... ...per pair	0	4
43.	Springs ... ... each	0	2
44.	Cranked Bent Strips ... ... „	0	1
45.	Double „ „ ... ... „	0	1
46.	Double Angle Strips, 2½″ × 1″ ... ½ doz.	0	6
47.	„ „ „ 2½″ × 1½″ ... „	0	9
47a.	„ „ „ 3″ × 1½″ ... „	0	10
48.	„ „ „ 1½″ × ½″ ... „	0	4
48a.	„ „ „ 2½″ × ½″ ... „	0	5
48b.	„ „ „ 3½″ × ½″ ... „	0	6
48c.	„ „ „ 4½″ × ½″ ... „	0	9
48d.	„ „ „ 5½″ × ½″ ... „	0	9
50a.	Eye Pieces, with boss ... ... each	0	4
52.	Perforated Flanged Plates, 5½″ × 2½″ „	0	5
52a.	Flat Plates, 5½″ × 3½″ ... ... „	0	5
53.	Perforated Flanged Plates, 3½″ × 2½″ „	0	3
53a.	Flat Plates, 4½″ × 2½″ ... ... „	0	3
54.	Perforated Flanged Sector Plates „	0	3
55.	„ Strips, slotted, 5½″ long „	0	2
55a.	„ „ 2″ „ „	0	1
56h	Instruction Manuals, No. 00-4 ... „	1	9
*56j	„ „ No. 5-7 ... „	1	6
56c.	Meccano Standard Mechanisms Manual „	1	0
56d.	„ Book of Prize Models ... „	0	9
56f.	„ Bound Manuals ... ... „	6	6
57.	Hooks ... ... 2 for	0	1
57a.	„ Scientific ... ... each	0	1
57b.	„ Loaded ... ... „	0	2
57c.	„ „ Small ... ... „	0	1
58.	Spring Cord ... ... per length	0	9
58a.	Coupling Screws for Spring Cord ... doz.	0	6
58b.	Coupling Hooks for Spring Cord ... each	0	1
59.	Collars with Set Screws ... ... 2 for	0	3
61.	Windmill Sails ... ... 4 for	0	6
62.	Cranks ... ... each	0	3
62a.	Threaded Cranks ... ... „	0	4
62b.	Double Arm Cranks ... ... „	0	3
63.	Couplings ... ... „	0	6
63a.	Octagonal Couplings ... ... „	0	8
63b.	Strip Couplings ... ... „	0	8
63c.	Threaded Couplings ... ... „	0	6
64.	„ Bosses ... ... „	0	2
65.	Centre Forks ... ... „	0	1

**Details and prices of the complete range of Meccano Manuals may be obtained from any Meccano dealer.*

The Meccano system is composed of some 250 real engineering parts, mostly made of steel or brass, each one of which has a definite mechanical purpose. These parts combine to form a complete miniature engineering system that enables practically any movement known in mechanics to be duplicated. A group of the parts from No. 1 to No. 65 is listed above.

New parts are always being invented in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual practice.

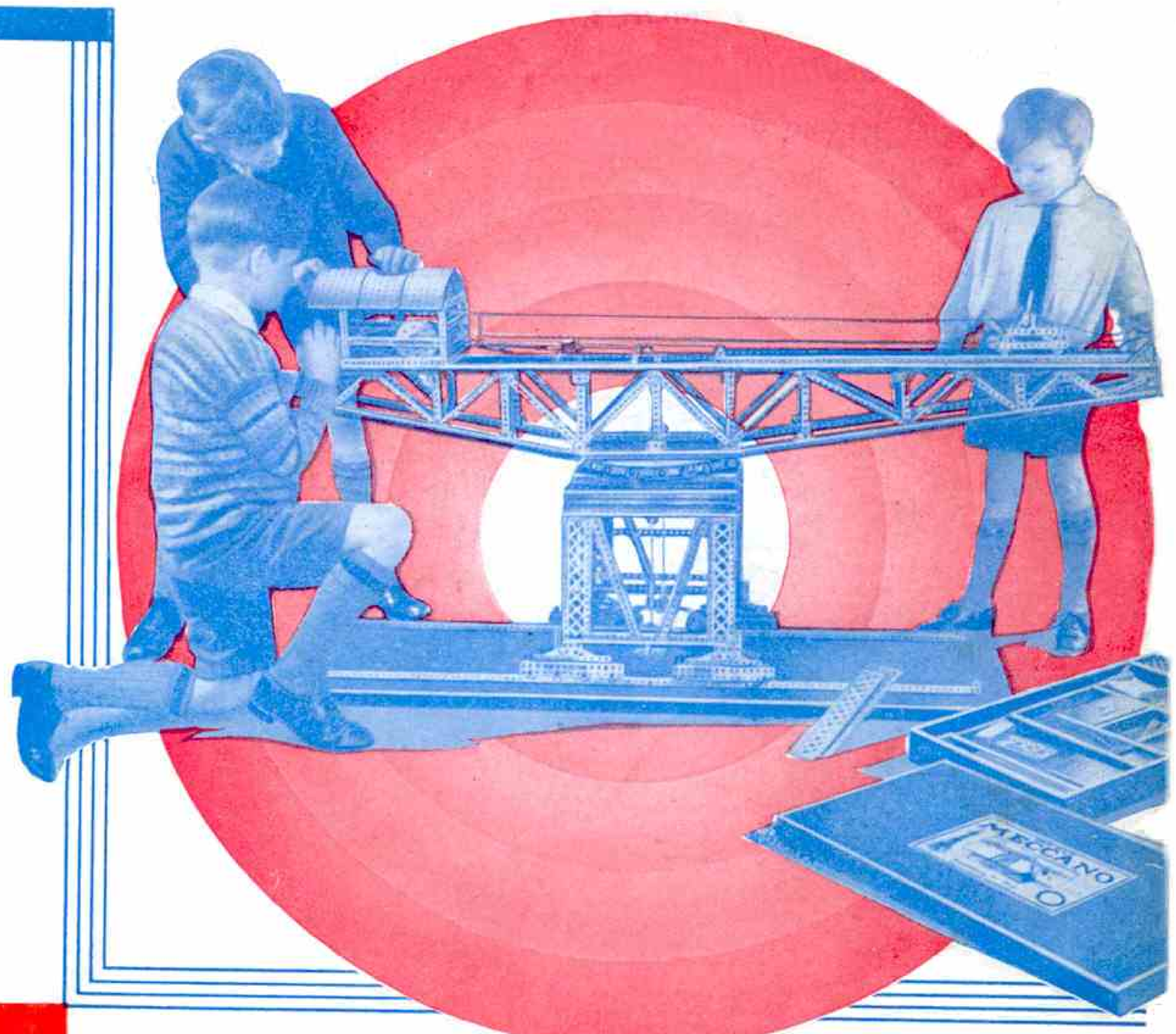
A complete list of all the parts in the system may be obtained from any Meccano dealer on application.

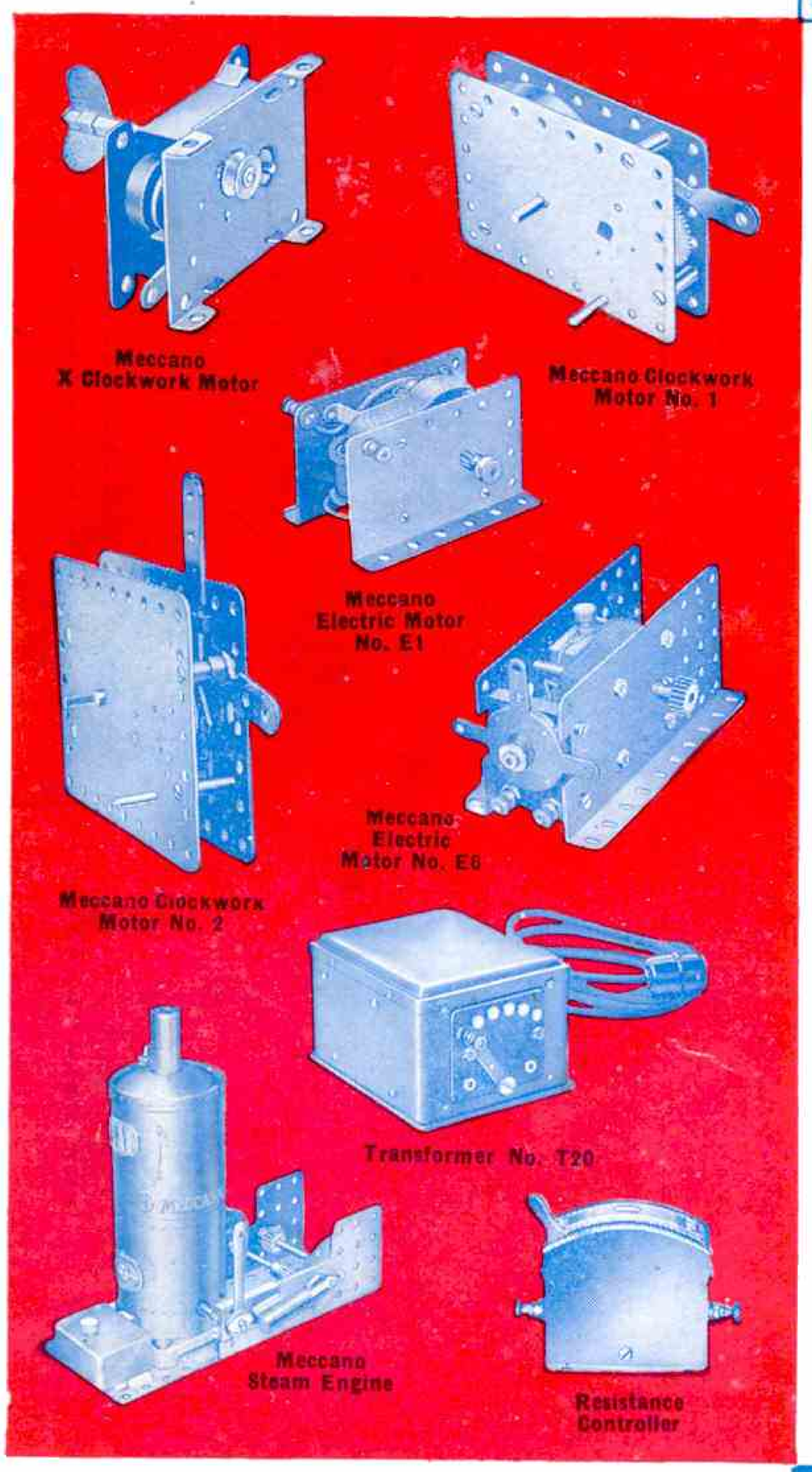
MECCANO LTD. — Binns Road — Old Swan — LIVERPOOL

Drive Your Models with Meccano Motors

Building a Meccano model is the greatest fun in the world. Excitement increases steadily as the model grows, part by part, under your hands. Finally there comes the greatest thrill of all. You connect your completed Crane, Motor Chassis or Traction Engine to a Meccano Motor or Steam Engine, and see it work in exactly the same manner as its prototype in real life!

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. Particulars and prices are given below.





MECCANO ELECTRIC MOTOR No. E1
(6 volt)

This is a highly efficient electric motor (non-reversing) that will give excellent service. A 6-volt Accumulator will operate it, but it may also be driven from the mains (alternating current only) through the 6-volt transformer described in the next column. Price **7/6**

MECCANO ELECTRIC MOTOR No. E6

This excellent reversing motor may be run from a 6-volt accumulator or, by employing the transformer described in the next column, from the mains (alternating current only). Price **15/6**

IMPORTANT—Meccano 6-volt Motors will not run satisfactorily from dry cells.

RESISTANCE CONTROLLER

By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. Price **3/9**

MECCANO X SERIES CLOCKWORK MOTOR (Non-Reversing)

A fine motor specially designed to drive with ease any of the X Series Models. It is non-reversing. Price **2/6**

MECCANO CLOCKWORK MOTOR No. 1
(Non-Reversing)

A long-running and highly efficient clockwork motor (non-reversing), fitted with brake lever. Price **5/-**

MECCANO CLOCKWORK MOTOR No. 1A
(Reversing)

This motor is similar in power and length of run to the No. 1 Motor, but is fitted with reversing motion. It has start, stop and reverse levers. Price **7/6**

MECCANO CLOCKWORK MOTOR No. 2
(Reversing)

This strongly-built reversing clockwork motor is a compact self-contained power unit. An efficient governor controls the powerful spring that is fitted on the motor, and ensures a long steady run at each winding. Price **10/-**

MECCANO STEAM ENGINE

On actual test this powerful steam unit has lifted over 56 lbs. The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risk of the spirit becoming heated. Price **25/-**

MECCANO ELECTRIC MOTOR No. E20a
(20-volt)

A specially fine motor, having greater power than the 6-volt motors, and capable of running for long periods without excessive heating. It is non-reversing. Price **16/6**

MECCANO ELECTRIC MOTOR No. E20b
(20-volt)

This is similar in power and efficiency to the E20A Motor, but is fitted with reversing motion and start and stop controls. Price **18/6**

6-VOLT TRANSFORMERS

These Transformers are specially designed for running the Meccano No. E1 or E6 Electric Motors and Hornby 6-volt Electric Trains. No. T6 is available for all standard supply voltages, from 100 to 250 inclusive, at frequencies of 50 cycles and upwards. Price **22/6**

No. T6a is also available for all standard supply voltages from 100 to 250 inclusive, at all standard frequencies. If required No. T6a can be wound for frequencies lower than 50 cycles. Price **30/-**

TRANSFORMER No. T20
(Output 20 V.A.)

This splendidly-designed transformer is intended for running the Meccano 20-volt Electric Motors and Hornby 20-volt Electric Locomotives. It has a five-stud speed regulator, and is available for all standard alternating current supply mains from 100 to 250 volts, 50-60 cycles. The supply voltage should be stated when ordering. Price **21/-**

TRANSFORMER No. T20a
(Output 35 V.A.)

This Transformer is similar in general design to the T20, but is provided with three pairs of plug sockets. The circuit provided by the first pair has a five-stud speed regulator incorporated. The second pair provide a steady output of 17 volts for lighting lamps. The third pair of sockets give the full output of the Transformer. Price **26/6**

ACCUMULATORS

The 6-volt 20-amp. Accumulator is specially suitable for running Meccano 6-volt motors and Hornby 6-volt Electric Trains. Price **28/6**

The 2-volt 20-amp. Meccano Accumulator is supplied for converting 4-volt Accumulators to 6-volt. Price **10/6**

MECCANO LTD. - OLD SWAN - LIVERPOOL

PUBLISHED BY MECCANO LTD., OLD SWAN, LIVERPOOL, ENGLAND.
Printed by John Waddington Ltd., Leeds and London.