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MECCANO MAGAZINE

A COUNTRY SMITHY

6d.

Next Month: "A BATTLEFLEET ACTION." By Capt. B. Acworth, D.S.O.

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With the Editor

An Old Lakeland Forge

Our cover this month shows a scene that once was common in every village throughout the country, but now unfortunately is comparatively rare. The old forge in the picture is situated in the heart of Lakeland, surrounded by hills. At one time, when the horse was still supreme on the road, it was a hive of industry. It stands on the roadside and is nine miles from the nearest station; and in the old days it was a common thing to see ten or twelve horses there waiting their turn to be shod.

The Royal Mail coaches used to run regularly with mails and passengers between Windermere and Keswick, 21 miles, and the horses required regular and skilful attention. Later, the coaches here and all over the country were replaced by motor transport and the shoeing trade was hard hit. Lots of smiths gave up altogether; others made drastic cuts in their staffs. Few new apprentices came forward to the trade, which takes seven years to learn. It was felt that it was a dying industry.

Since the outbreak of war, motor vehicles in their turn have been largely put off the road. To a small extent the horse has come into his own again, and with him the smith, who now usually finds himself short-handed.

This picturesque forge is always busy with horses and ponies coming seven or eight miles to be shod, from neighbouring villages from which the smiths have gone. In summer time visitors haunt the place. It fascinates them, and they seem to have real difficulty in tearing themselves away. The children love to blow the bellows and watch the smith bending his hot iron on the sounding anvil. Many notable people have visited the forge, among them the late Sir Oliver Lodge.

Troop-Carrying Gliders

Since Mr. J. W. R. Taylor's article on troop-carrying gliders, on page 224, was written, the "future operations" mentioned in the last paragraph have become a present reality. There is good reason to believe that even the wary Germans were unprepared for the vast masses of airborne troops that descended out of the dawn sky over Normandy on D-Day. Great numbers of gliders were used in the operation and one wave alone made a 50-mile long train of aircraft across the Channel, blackening the sky as far as the eye could see. The "Horsa" was most widely used, although many "Hadrians" also made the trip. In addition a new British tank-carrying glider—the General Aircraft "Hamilcar"—appeared, to provide our troops in the beach-head with invaluable armoured support. Little is yet known about this aircraft except that it has a wing span of 110 ft. and is usually towed behind a "Halifax" or "Stirling."

This Month's Special Articles

Mass Miniature Radiography

New Weapon in the Fight against Disease

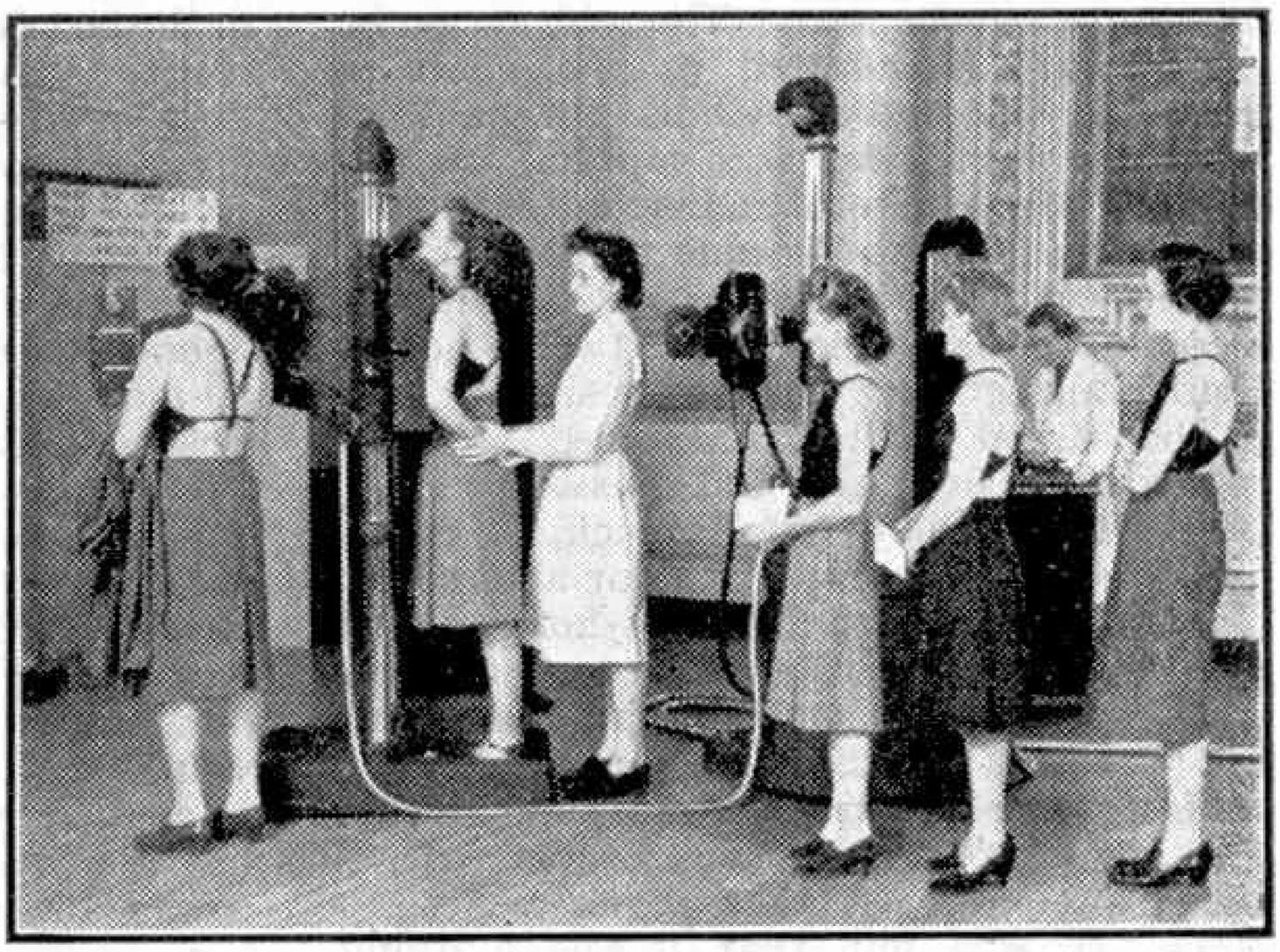
By T. R. Robinson

MODERN scientific medical research is becoming increasingly concerned with the prevention, rather than the cure, of our various ills and diseases, for it is far wiser to seek to maintain a high standard of health than to heal the injury caused by illness. A particularly notable instance of progress along these lines is to be found in mass miniature radiography, a new and powerful weapon in the fight against tuberculosis. This development of radiography, or X-ray work, has been made possible by advances in several widely differing branches of technical science, which have been brought together in rather a novel manner.

X-rays are generated in a special vacuum tube, somewhat resembling a large radio valve, in which a high-voltage discharge from a heated metallic filament, called a "cathode," strikes a metal plate, called an "anode," at a tremendous speed. It is the collision of the discharge with the anode that sets up the rays, which have the ability to pass through many substances opaque to ordinary light. They are invisible to the eye, but they affect a photographic film in somewhat the same way as light does, and their presence can be made visible by allowing them to fall on a screen coated with certain metallic salts that glow brightly when the rays strike them.

Although the X-rays can penetrate opaque substances, they are partly absorbed in so doing, and various materials have differing powers of absorbing the rays. If part of a human body is placed between the generating tube and the screen or photographic film on which the rays fall, features such as bones, muscles and organs appear as shadows, the densities of which differ in accordance with the different powers of absorption of the various kinds of tissue. When a "fluorescent" screen is used, the shadows are visible to the eye, but with a film they are recorded as shadow prints.

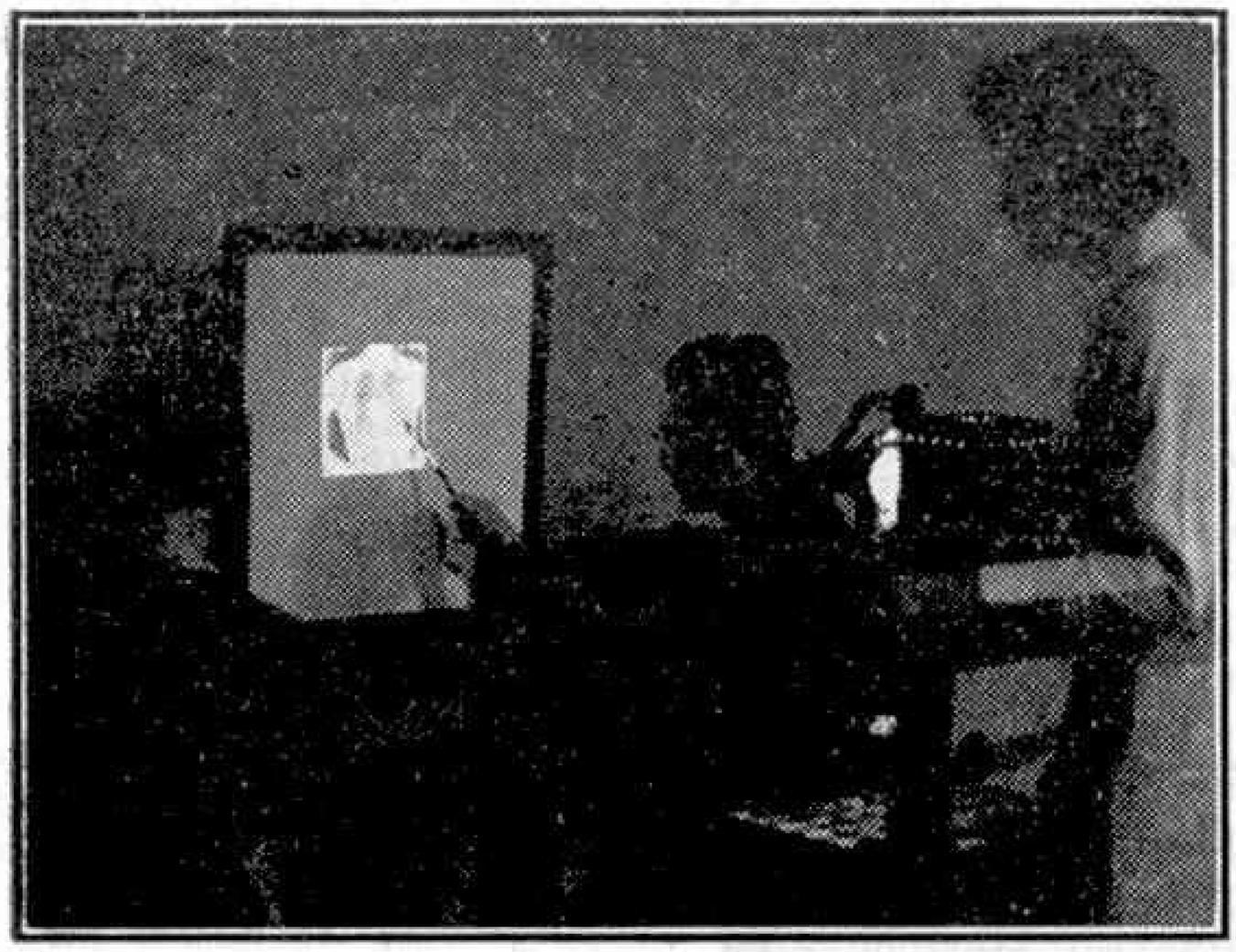
With the usual method of X-ray examination, the shadow image is almost the same size as the limb or part of the body being examined, and in most cases this calls for a large screen or photographic film. A screen does not give any permanent record, and a photographic film of the required size, measuring 15 in. by 12 in. or more, is costly and presents difficulties in handling. For this reason,



A group undergoing examination by mass miniature radiography, in which the X-ray image on a fluorescent screen is photographed by a miniature camera.

the use of radiography has so far been limited to some extent to the recording of cases already diagnosed, for X-ray photography of a large number of people in order to detect possible disease is out of the question, owing to the time and expense involved.

The new "mass radiographic" method overcomes this difficulty by using a special automatic camera, taking standard 35 mm. cinema film, to photograph the X-ray shadow image appearing on a normal sized fluorescent screen. With the help of this photo-radiographic equipment, it is easy to make individual records of every one of a group of people, such as men in a regiment, or children in a school, and a



Viewing the X-ray image photographs projected on a screen.

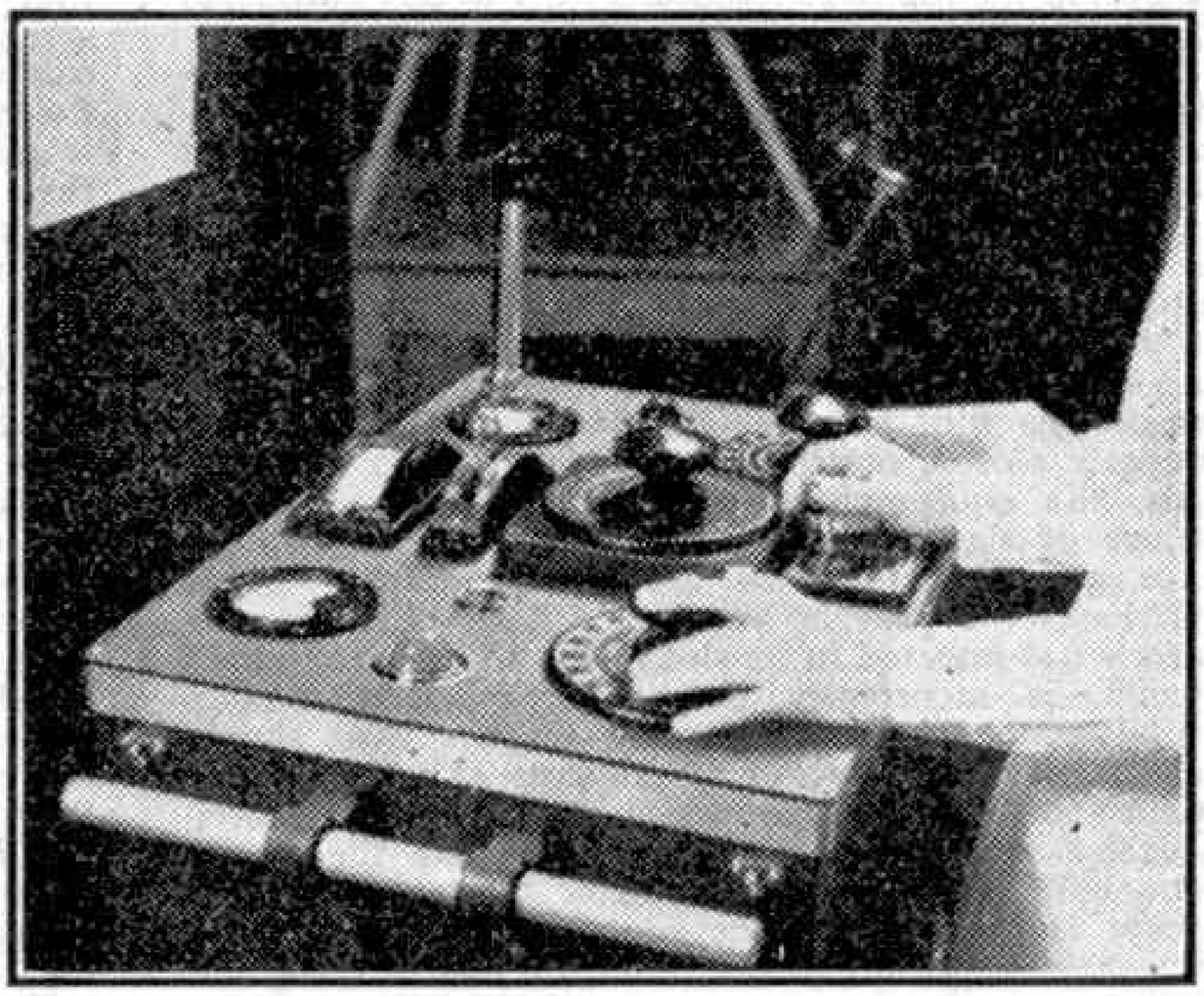
subsequent viewing of the film by a skilled radiologist will reveal diseased conditions where these exist. As each photo-radiograph carries an identifying number, the person concerned can be located if necessary, and subjected to a further and more detailed examination.

The apparatus designed to produce "mass miniature radiographs," as these X-ray records are called, is made up of two separate units coupled together to work in unison, and operated from a control table. One unit consists of the X-ray tube, its adjustable support, and the high-tension transformer that supplies the tube with current. The other is made up of a tapering light-tight tunnel, carrying the fluorescent screen at one end and the electrically operated automatic camera at the other. This assembly also is carried on supports that permit it to be adjusted for height, so that it can be brought to levels to suit various people.

Many ingenious constructional features are embodied in both units, particularly in the camera unit, which has several interlocking devices designed to guard against failure or accidental mishandling. The X-ray tube is mounted in a protective housing, and on this is fitted what is called a diaphragm-box, which limits the area of the X-ray beam to the fluorescent screen on the other unit. The housing is attached to a guide that can be slid up and down a vertical column mounted on the top of the casing of the high-tension transformer, and the tube, housing and guide are counterpoised to give easy adjustment.

The tunnel, screen and camera on the other unit are similarly mounted and counterpoised, this time between two vertical columns rising from the base of the unit. As it is essential to ensure that the X-ray tube and the fluorescent screen correspond perfectly in height when adjusted to various levels, the two units are linked by a steel cable that passes from one unit to the other through a flexible metallic tube. This cable is so designed that when the camera and screen are moved up or down, the X-ray tube makes a corresponding movement and so is always in the correct relative position. The alignment of tube and screen can be checked by an optical sighting attachment of the periscope type, which is inserted in a socket in the wall of the diaphragm box.

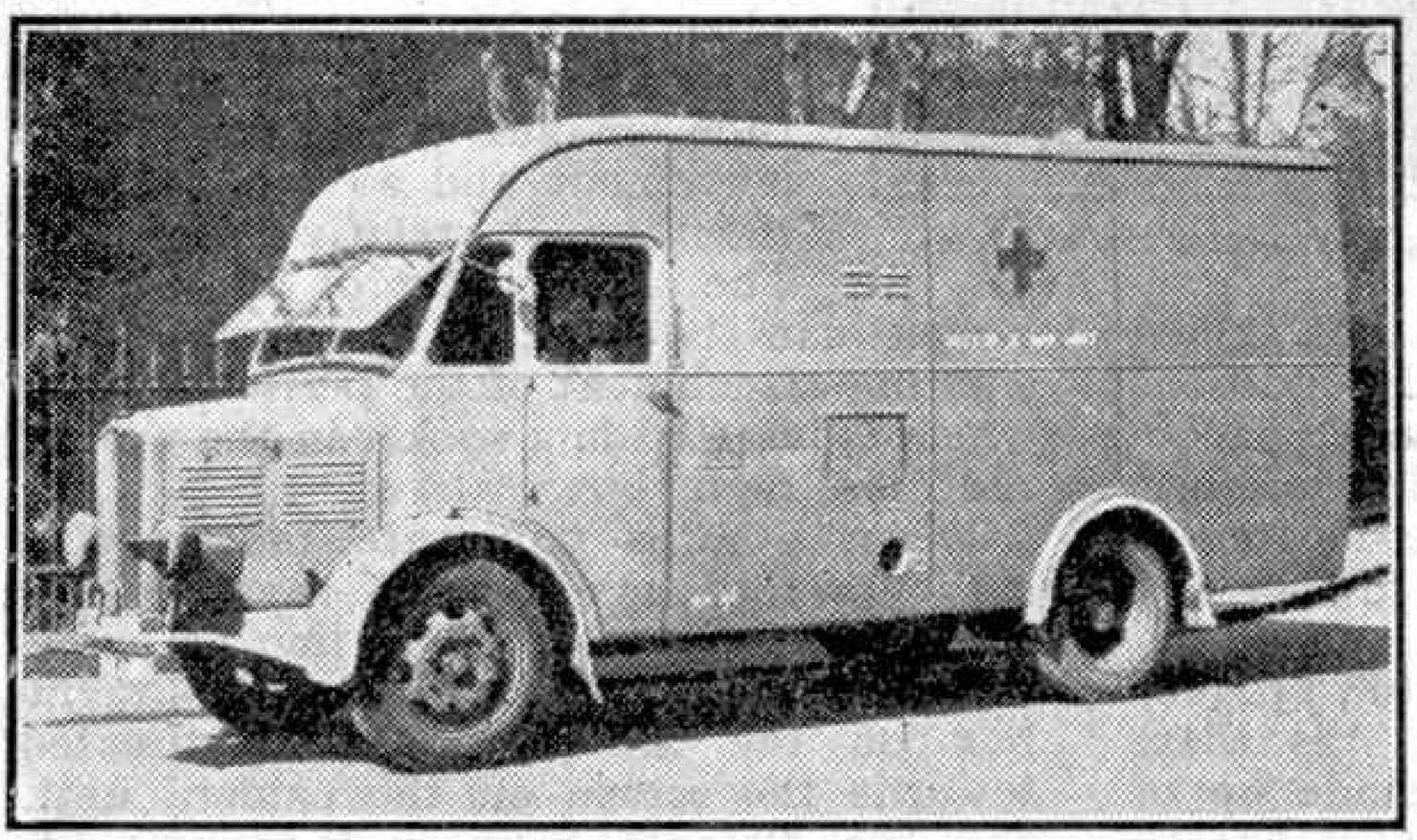
When a mass miniature radiographic survey is to be made, the X-ray tube and camera units are set up in line with one another, with the opening in the diaphragm-box on the X-ray tube unit directed towards the screen on the camera unit, and the distance between the units adjusted to about 3 ft. The people to be examined are asked to strip to the waist and are then assembled in order. Each is given a card bearing a clearly printed serial number, and then, under the direction of the radiographer, they step



The control table of the mass miniature radiographic equipment. The sighting periscope is seen in its socket at the far corner of the table.

one by one on to a platform on the base of the camera unit. A recess on this platform automatically directs the subject's feet into such a position that the body will be properly centred in relation to the screen and brought closely against it, and a slight adjustment of the height of the screen is all that is necessary as a final correction.

As each person to be examined steps forward in turn the proper numbered card is inserted in a special slot in the upper side of the tapered tunnel, and all is then ready for the exposure to be made. This is done by the operation of a switch on the control table, the switch-lever working in an "L" shaped slot and having two positions, "Prepare," and "Exposure." When the lever is moved downward to the "Prepare" position, and held there, a small lamp mounted in the casing of the identification card slot is switched on, lighting up the number and causing it to be photographed on the film. The movement also starts up the rotor of the X-ray tube, to which



A Dennis van equipped for mass miniature radiography in remote places.

reference is made later. As soon as the patient is steady, the switch lever is moved sideways to the "Exposure" position, and the picture is taken. When released, the switch lever returns to its original position automatically, and as it does so, it energises a small driving motor in the camera that moves the film forward one space or "frame," thus automatically preparing for the next exposure. Up to 200 exposures can be made in an hour.

The safety interlocks mentioned earlier are a considerable help in making the progress of photo-radiographing a number of people a smooth and rapid one. The camera, which somewhat resembles a "miniature," but is entirely automatic and built as an integral part of its unit, has several electrical interlocks at various points. Thus no exposure can be made unless film is threaded through the gate, and the take-up spool is acting correctly. If for any reason the film becomes misplaced, the gate is not properly closed, or the winding on after an exposure fails, the equipment will refuse to work, and the failure of signal lights on the control table will at once give warning and locate the defect. Other interlocks will prevent any action if the identification card is not inserted in its slot in the top of the camera tunnel, is incorrectly positioned, or if the lamp illuminating the serial number on the card should fail. Another safety device prevents exposures being spoiled by the sighting periscope having been accidentally left in the diaphragm-box on the X-ray tube unit after the setting up of the apparatus. A socket is provided on the control table to hold the periscope when not in use, and the controls will not operate unless it is replaced in this socket.

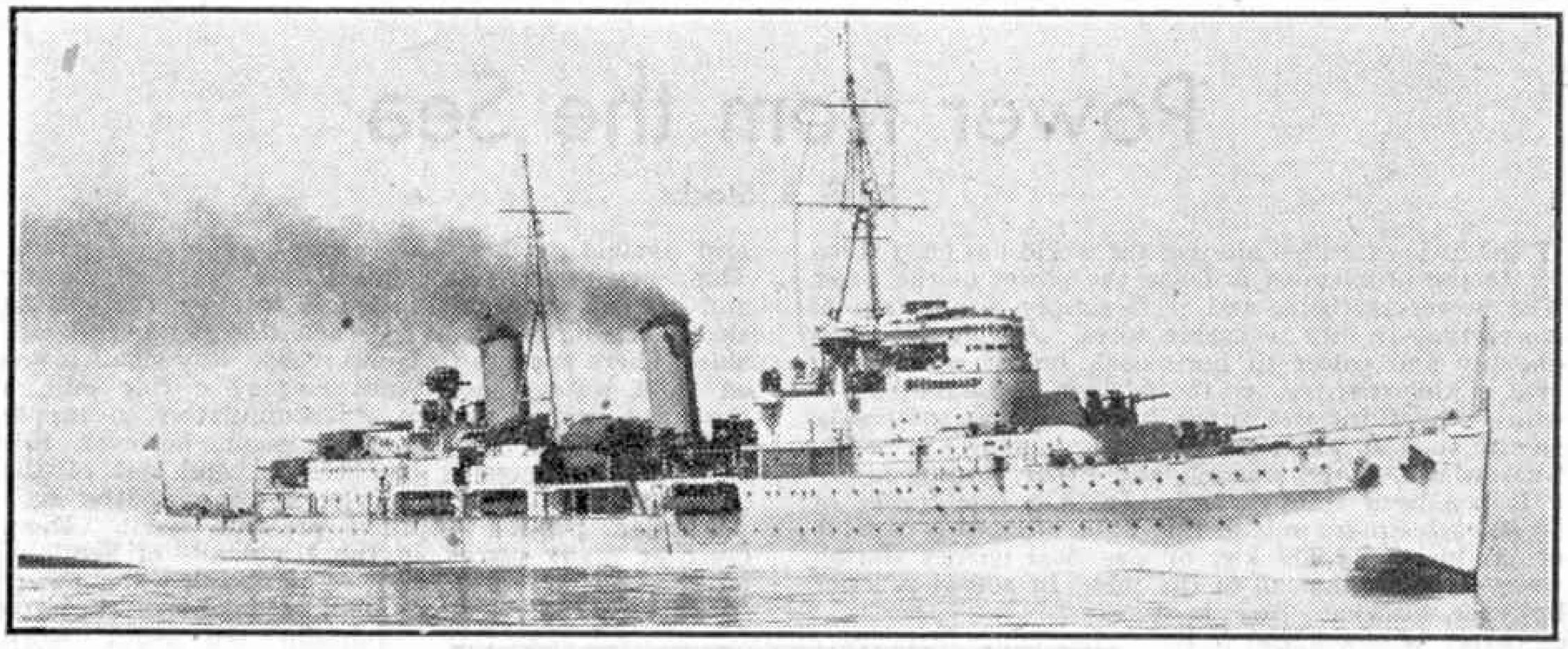
As the photo-radiographs taken on 35 mm. film are small, and the detection of diseased conditions demands the greatest possible sharpness of detail, a special lead grid is fitted in front of the fluorescent screen to cut out blurring caused by secondary radiation. The camera is protected from direct radiation by a lead glass screen. In addition, the lens of the camera has its surfaces treated with a fluoride coating that greatly increases the light transmission and reduces the scattering of incident light. The lens is a new British 2 in. f/1.5 product of Taylor, Taylor and Hobson Ltd. that has proved to be superior to any other similar type of lens. The film used is specially chosen for its fine grain and high sensitivity. It is loaded into magazines, or "cassettes," which are mounted on the camera by slides, and the exposed film cassette has an automatic guillotine, which severs the film immediately before the cassette is removed from the camera. The normal advance of the film, frame by frame, is automatic, but a hand-operated lever is also provided, and there is a double advance spacing switch that allows the film to be moved forward two spaces after each 10 exposures, so that the film can be cut up into lengths if necessary.

The X-ray tube has a rotating anode. This is used to minimise the overheating and pitting which would occur if the high-voltage discharge from the cathode were to fall continually on the same spot on the anode. The method of rotating the anode is very ingenious. As it is inside the exhausted X-ray tube, it cannot be driven mechanically, so it is made in the form of a rotor, mounted on anti-friction bearings and provided with a conical tungsten face at one end. Outside the tube, at a point where it encloses the rotor, is an electro-magnetic stator assembly, consisting of coils and pole pieces. Alternating current is supplied to the coils, and the magnetic field set up penetrates the walls of the tube and causes the anode to revolve by induction, at almost 1,500 r.p.m., in much the same way as the rotor of an ordinary A.C. induction motor.

When the exposures on a length of film are completed, this is removed from the camera, developed and projected, frame by frame, by a projector giving images about 5 in. by 5 in. in size. By examining the exposures, the radiologist can rapidly detect any that show signs of disease or abnormality, and the identification numbers of these are noted. A more complete diagnosis can then be made by re-examining the suspected exposures, and, if the existence of disease seems probable, the person concerned is located so that full size radiographs can be taken.

The particular value of mass miniature radiography lies in the way in which it is able to show the presence of disease before the person concerned has had any idea of its presence, and often so early that it can be treated and permanent injury avoided. It has already proved useful in the Services, and more recently in the examination of large groups of industrial personnel. Its application is now being greatly increased by the construction of mobile equipments carried in motor vans to visit more isolated centres. These equipments are completely self-contained. The vans themselves are sturdy commercial vehicles, the interiors being fitted out to serve as dark rooms and projection rooms, as well as to carry the complete equipment. Power to operate the apparatus will be taken from the mains where possible, but the vans will also be equipped with a generating set operated from the engine through a power take-off. The radiographs will not be taken in the vans; any suitable building will be used.

We are indebted to Ilford Ltd., Radiographic Department, for information in this article, and for our illustrations, and also to Watson and Sons Ltd. for technical assistance.



H.M.S. "Belfast"

Our "Town" Class Cruisers

By Denis Rebbeck, M.A. (Cantab.), M.I.N.A.

GREAT BRITAIN requires large numbers of cruisers to protect her convoys voyaging to and from this country, to supplement the capital ships in their actions against the "heavies" of the German Navy, to provide covering fire during landings on enemy coastlines, and hundreds of other tasks in wartime when a battleship would be too big or unsuitable for some reason or other, and when destroyers would not be large enough to fulfil the assigned task.

The Royal Navy has been fortunate in having such fine cruisers to call upon as the "Town" or "Southampton" class, which included such famous ships as the *"Birmingham," "Glasgow," "Gloucester," "Liverpool," "Manchester," "Newcastle," "Sheffield"* and *"Southampton."* In addition mention must also be made of the Improved Southampton class, which included the *"Belfast"* and the *"Edinburgh."* These ships have a displacement of over 9,000 tons, overall length 584 ft., and have a heavy armament of twelve 6 in. guns in triple mountings, eight 4 in. guns, and six (tripled) 21 in. deck torpedo tubes. The shaft horse power developed by the engines, which are Parsons geared steam turbines, is 75,000, the speed of the ship being 32 knots. These cruisers are improved and enlarged "Amphions" and are rather un-British in appearance; they were built in reply to the Japanese "Mogami" class, though they have fewer 6 in. guns than the Jap cruisers. Hangars for three aircraft, with one catapult, form an extension aft of the bridge structure, and the characteristics of these ships include the raking funnels and masts and the tripod masting.

Some of these fine ships have unfortunately been lost in this war, as already reported in the Press. The *"Edinburgh"* had to be sunk by our own forces after being totally disabled by German torpedoes when escorting a convoy which was returning from Northern Russia on 2nd May, 1942. The *"Gloucester"* was sunk after being attacked by enemy aircraft off the island of Crete in the eastern Mediterranean on 22nd May 1941. The *"Manchester"* was attacked and torpedoed by Italian motor torpedo boats off the Tunisian coast on 12th August 1942, and the *"Southampton"* was lost as the result of catching fire when in action with German bombers on 10th January 1941. Although this makes dismal reading, yet on the other hand these ships have given a good account of themselves in action with the enemy, and some, such as the *"Belfast"* and the *"Sheffield,"* have earned undying fame for their participation in an important Naval engagement at the end of last year.

H.M.S. *"Belfast,"* which appears in the photograph, was built under the 1936 estimates, her keel was laid down on 10th December 1936, and she was launched from Harland and Wolff's shipyard in the city whose name she proudly bears, on 17th March, St. Patrick's Day, 1938, when the launching ceremony was performed by Mrs. Neville Chamberlain, the wife of the then Prime Minister. This fine ship was completed just before war broke out in 1939, and was unfortunately (Continued on page 250)

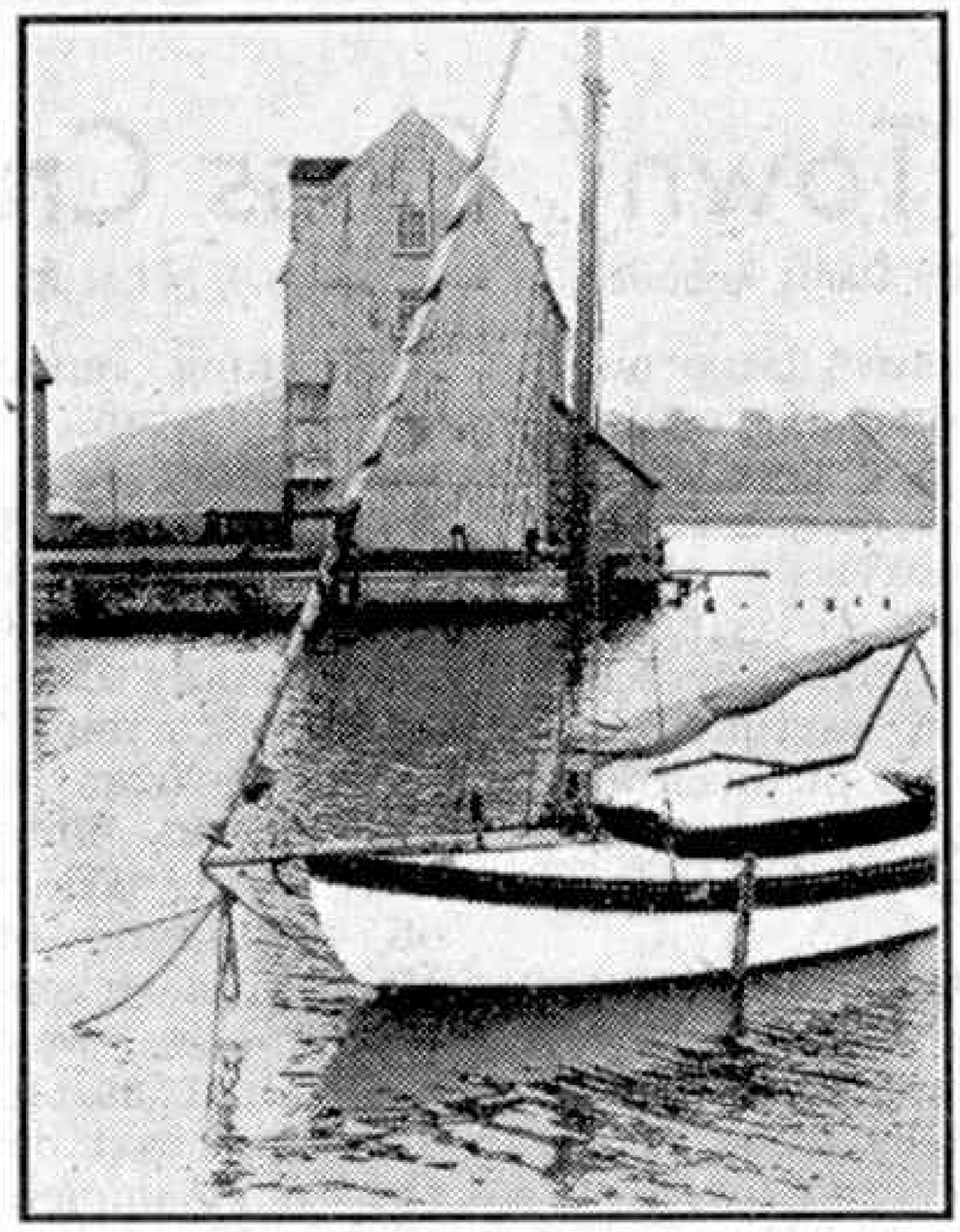
Power from the Sea

By G. R. Stocks

TOO little attention all over the world has been given to the problem of utilising the power of the tides. The power is there, and it is simply a question of converting it into a usable form. At present it is cheaper and easier to burn coal, but if we had no coal in this country, we should long ago have had to utilise the tides and other hydro-electric sources of energy such as waterfalls, which are already in use in Switzerland, Italy, Canada and other countries.

It has been computed that with a tidal range of 10 ft. each square mile of tide-water utilised is capable of producing 11,000 kw. of electrical energy during three hours of the fall of the tide. In actual practice however, owing to inefficiency of machines, it is estimated that under working conditions the maximum output would be less than a quarter of this, and would not exceed 25,000 kw.-hrs. in every day of 24 hours. Even this sounds very good, but there is a serious drawback yet to be overcome—the power is intermittent, and therefore useless for general purposes.

The method of obtaining power is simple and can be applied on tidal rivers and in estuaries and creeks. In the rudimentary form of tide-mill the rising tide is made to fill a large lagoon or millpond. At high water sluices are closed, and the tide water is trapped. When the tide has dropped sufficiently, the head of water is allowed to flow back to the sea through another sluice, by way of an undershot water-wheel or turbine coupled to an electric generator. Such a system is obviously very limited, since power is produced only on a falling tide.



The tide-mill at Woodbridge, in Essex, where power from the sea operated grain milling machinery.

A great improvement is effected by making the rising tide also pass through the sluice and operate the turbine as it fills the lagoon, the falling tide being utilised as before, but a smaller head of water is obtained in both directions, with consequent loss of power. Also, arrangements would have to be made for the rapid filling and emptying of the lagoon in the final stages of high and low water respectively. This system is feasible, but again for 12 hours out of the 24 no power is being produced. It is therefore only of advantage where the power can be used spasmodically, and in modern industry there are few such instances, particularly in war conditions.

To get over this intermittent working, various ideas have been put forward. A continuous working system could be evolved by the use of three lagoons or basins at different levels, one emptying into another. Again the head of water is reduced, with loss of overall efficiency. Slow-speed, reversible turbines would have to be provided, and complicated sluice arrangements would be unavoidable, but there seems no reason why it should not be done.

Another suggestion is to make use of the difference in tide time between say, the Thames, the Severn, the Mersey, and the Humber, and by means of a grid system to keep a constant supply of power. This, too, presents difficulties of a practical nature, and a more obvious solution is to store the surplus electrical energy produced when tide power is available. There appears to be no reason why small towns on tidal waters should not employ a tide mill, a generator and a battery of accumulators to supply lighting current. On the large scale, however, this method of storage is cumbersome and out of the question with the present type of storage batteries.

Another possible solution presents itself. There must be many places, in the Highlands of Scotland for example, where tide power and fresh water power might be combined, the latter running the plant when the tide is not favourable. Here again complicated constructional difficulties and intricate sluice arrangements would have to be circumvented.

Yet it must not be thought that tide power is merely an inventor's dream, and that it is quite impossible. It was tried out hundreds of years ago and there are traces of derelict tide-mills in South-east England, on Anglesey, in Brittany, and elsewhere. One at least was still working in 1936. This was at Woodbridge in Suffolk, and the mill is shown in our illustration. It was of the simplest type. The rising tide filled a millpond of about 7½ acres area, and when the tide had dropped sufficiently the pond was emptied through another sluice, the water driving a large undershot water-wheel.

In this particular case the wheel was coupled to grain-milling machinery, and the problem of intermittent working was not so acute. The mill had been in operation from about 1700, and probably was not very efficient, but even so it was reputed to develop 50 h.p. for about four hours after each high tide, starting two hours after the tide began to fall. The power developed, expressed in terms of electrical energy, would be 37,300 w. or roughly 150 amp. at the standard lighting voltage of 250. From this some 600 60-watt lamps could be run, but obviously the energy would have to be stored, so as to be available at any time of the day or night as required.

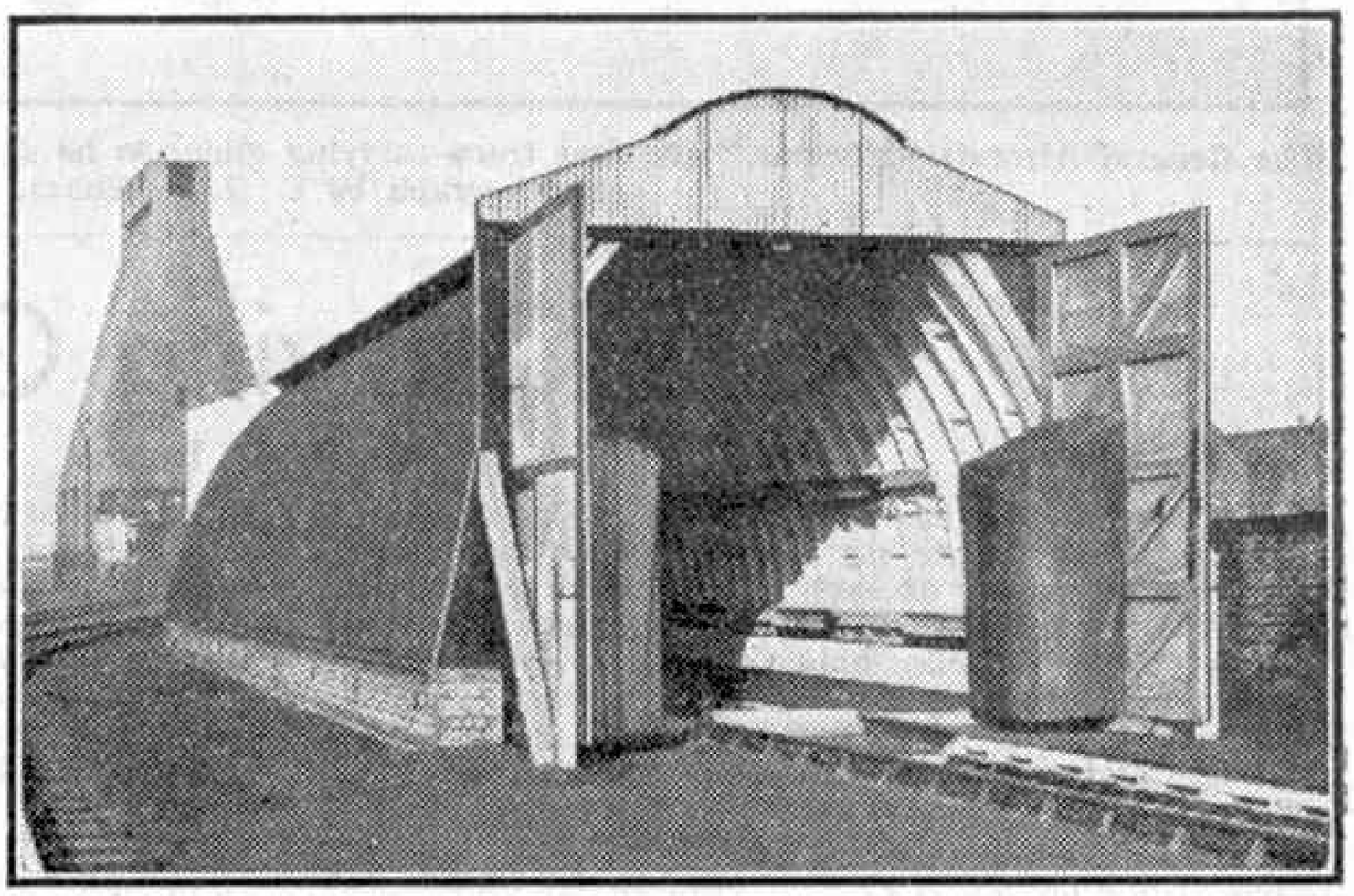
The problem of intermittent working is the real drawback to the whole question of tide power. There is also the disadvantage that the power is inconstant, due to the variation between spring and neap tides. To overcome this it has been suggested that surplus power produced at spring tides could be used to pump sea-water into storage reservoirs, and thus make up the shortage of head of water at neaps. It seems strange that nothing has been attempted along these lines. The only large scheme of the kind that has been discussed in this country concerns the Severn Estuary. Committees have considered the possibility of a great barrage across this, with generators for electric power, but no decisions have yet been made in regard to its construction.

L.N.E.R. Light Tunnel

Examining Locomotives in the Blackout

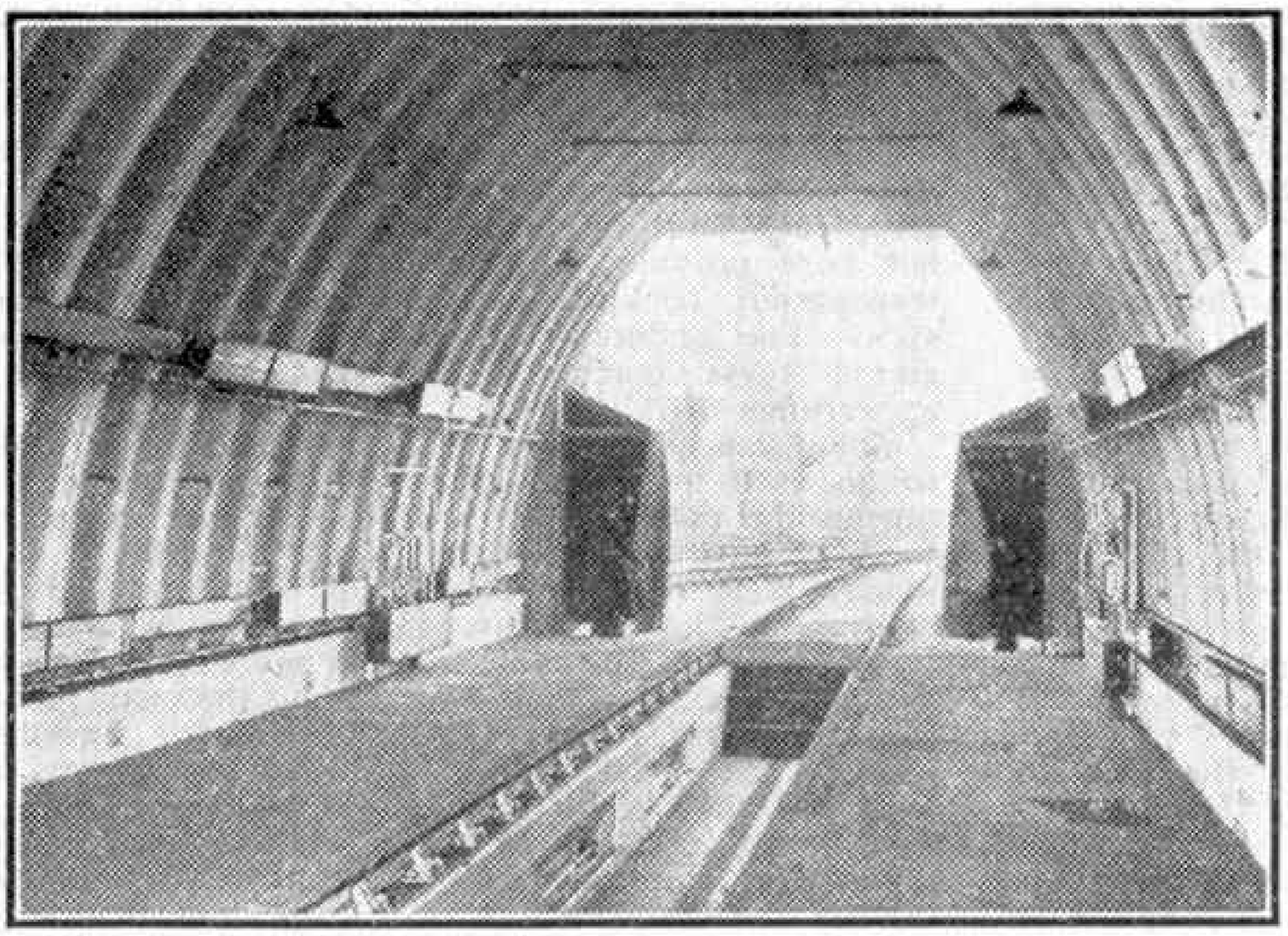
IN wartime conditions locomotives have to work hard. When one arrives at a shed after completing its turn of duty it is sent out again as soon as possible, if it is fit to go. Many of them arrive at depots after dark, and have to go out again before daylight comes. In these cases the complete examination that may be required is very difficult with the limited lighting allowed by blackout conditions, and in order to overcome this trouble the L.N.E.R. have built a light tunnel at one of their main line depots. This is the first of its kind in the country, and it is so arranged that an engine arriving in complete darkness can be moved inside it, and every part examined under brilliant floodlighting.

The tunnel is a modified form of a standard hut of Tarran Industries Ltd., enlarged to a length of 80 ft. It rests on a brickwork foundation, and there are large doors at both ends, with a master switch that cuts out the lighting system as soon as they are opened. Small wicket doors provided with light locks allow drivers, fitters and others to pass through with safety during the blackout while the tunnel is brilliantly lighted.



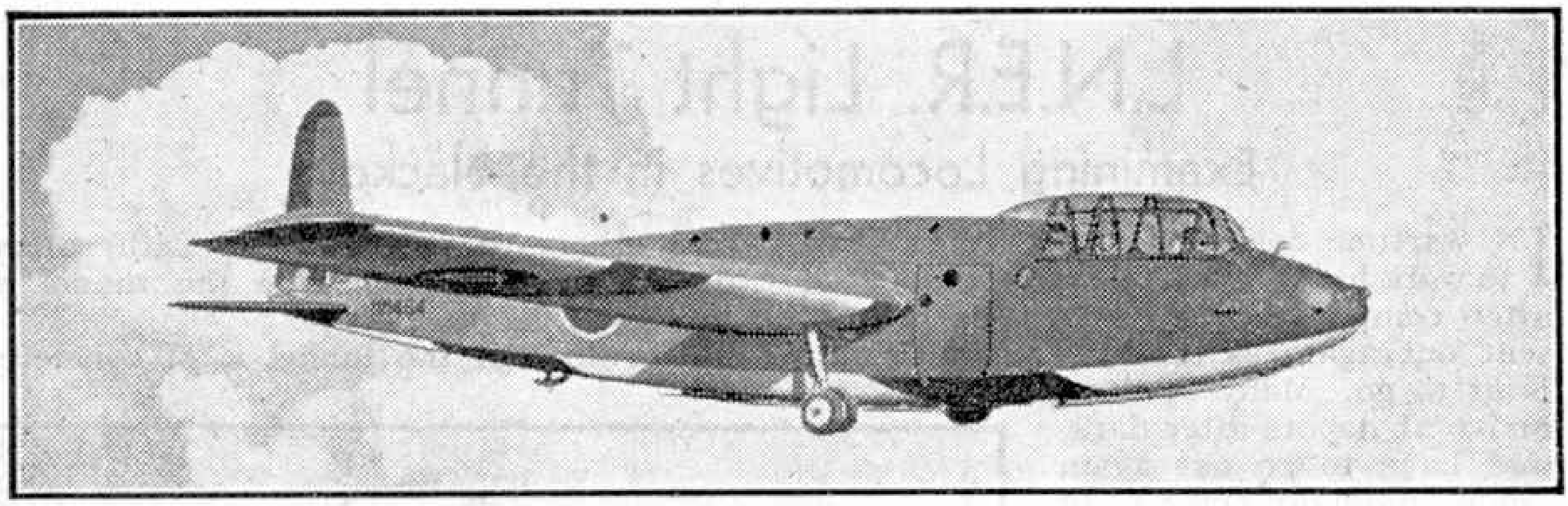
The new L.N.E.R. light tunnel for examining locomotives during blackout. Our illustrations are reproduced by courtesy of the L.N.E.R.

The floor of the tunnel is of concrete, as is that of the pit, which runs the full length of the tunnel between the rails. Floodlighting has been adopted, with fluorescent tubes that have large surfaces and give light free from glare and shadow effect. The walls are whitened in order to provide as much indirect lighting as possible. The units are arranged in two rows at suitable heights along the tunnel walls, and above them there are special lamps that can remain switched on when the doors of the tunnel are opened. Other fluorescent lighting units are fitted in suitable alcoves in the walls of the inspection pit, which are faced with white glazed brick.



Inside the light tunnel, showing the inspection pit and the floodlighting units. The light-locks at the wicket doors also are shown.

Although the light tunnel is a wartime idea it is not without possibilities for peacetime. The complete illumination of locomotives is not easy, and it will be a great advantage to have structures of this kind to which they can be taken for speedy examination in brilliant floodlighting.



The General Aircraft "Hotspur," the first troop-carrying glider to be designed and built in the British Empire. Photograph by C. R. Peckham.

Troop-Carrying Gliders

By John W. R. Taylor

THE present war has proved to be a war of movement. No longer do soldiers sit entrenched in mud, slogging away at each other; the force that can strike with lightning rapidity, seeking out the weak points of the defence, holds every advantage. The element of surprise is the key to success, and surprise can only be achieved by speed in attack.

Two outstanding new forms of offence have been evolved in the present war, both requiring small numbers of highly-trained troops. The British, as usual thinking in terms of sea-power, tested out troop-carrying barges as early as 1936. Germany, on the other hand, fearing rightly that her sea-power would begin and end with the U boat, placed her faith in troop-carrying aircraft to deliver divisions of shock troops at strategic positions. In Holland, Nazi paratroops captured vital airfields and junctions, paralysing the Dutch defences miles ahead of the main army.

But campaigns in Holland, Norway, and Greece proved that the use of Junkers Ju 52 three-motor transports was too extravagant, even with German mass-production methods. A Ju 52, crash-landed, was often completely "written-off" and not worth salvaging. This meant a loss of valuable engines and airframes built in factories that could be making bombers to attack England. What was needed was an aircraft at once light, so that it could be towed off easily by a "tug" aircraft and would not land heavily; strong, to withstand the shock of landings in rough country; cheap, as operational gliders must be regarded as "expendable," and built of non-priority materials so as not to interfere with the production of fighters and bombers.

The answer was obvious to the Nazi High Command. Sailplaning had been a national sport in Germany for many years, and troop-carrying gliders developed from sailplanes would fulfil every requirement. They could be made of wood to provide lightness and strength and save metal, and their low wing-loading and shallow gliding angle lessened the risk of damage in landing. Such machines could be cheaply built in thousands. The result has been only too apparent. Crete fell, to become the first island ever captured entirely by airborne assault.

At once the British War Department saw the immense potential value of glider-borne troops, and specifications were issued for several types of glider. The General Aircraft "Hotspur" was the first to appear, followed shortly afterwards by the Airspeed "Horsa."

The "Hotspur" was designed to carry two pilots and eight soldiers with full equipment, and was turned over to the vital task of training the new army, the larger 22-28 seater "Horsa" being more suitable for operational purposes. Since then many thousands of men have passed through glider-training schools equipped with the "Hotspur," and it has earned for itself a fine reputation.

Built of wood, it has a nicely streamlined appearance, with a well-rounded fuselage and a very high aspect-ratio wing. A pair of small wheels carried beneath each wing may be jettisoned to give glider pilots training in landing under operational conditions, a long skid being provided under the fuselage to cater for this.

The pilot and instructor sit in tandem in the nose of the machine under a large transparent cockpit cover, and the cabin contains seats for eight men with full equipment. The "Hotspur" has not normally a very long service life, but it does the job it is intended to do, and prepares the soldiers for more advanced work on the "Horsa."

American training gliders fall roughly into two classes, neither of them as efficient as the "Hotspur." The need for an airborne army was neglected in America for so long that there was little time for designing new types, and so, first of all, small two-seat gliders of the sailplane type were modified and re-designed to train pilots, but of course were incapable of carrying a load of airborne troops as is the "Hotspur." Notable gliders in this class are the "Schweizer" and "Bowlus" types. The "Schweizer" has a span of 52 ft., and a weight of only 860 lb. fully loaded, and one of them holds the American unofficial height record of 14,960 ft.

The "Aeronca," "Piper," and "Taylorcraft" training gliders are simply conversions of the well-known light aeroplanes built by these firms. An additional seat has been provided in place of the engine, and the transparent cockpit cover extended for improved view. The undercarriage has also been shortened, giving these machines the typical "broody-hen" appearance of all gliders.

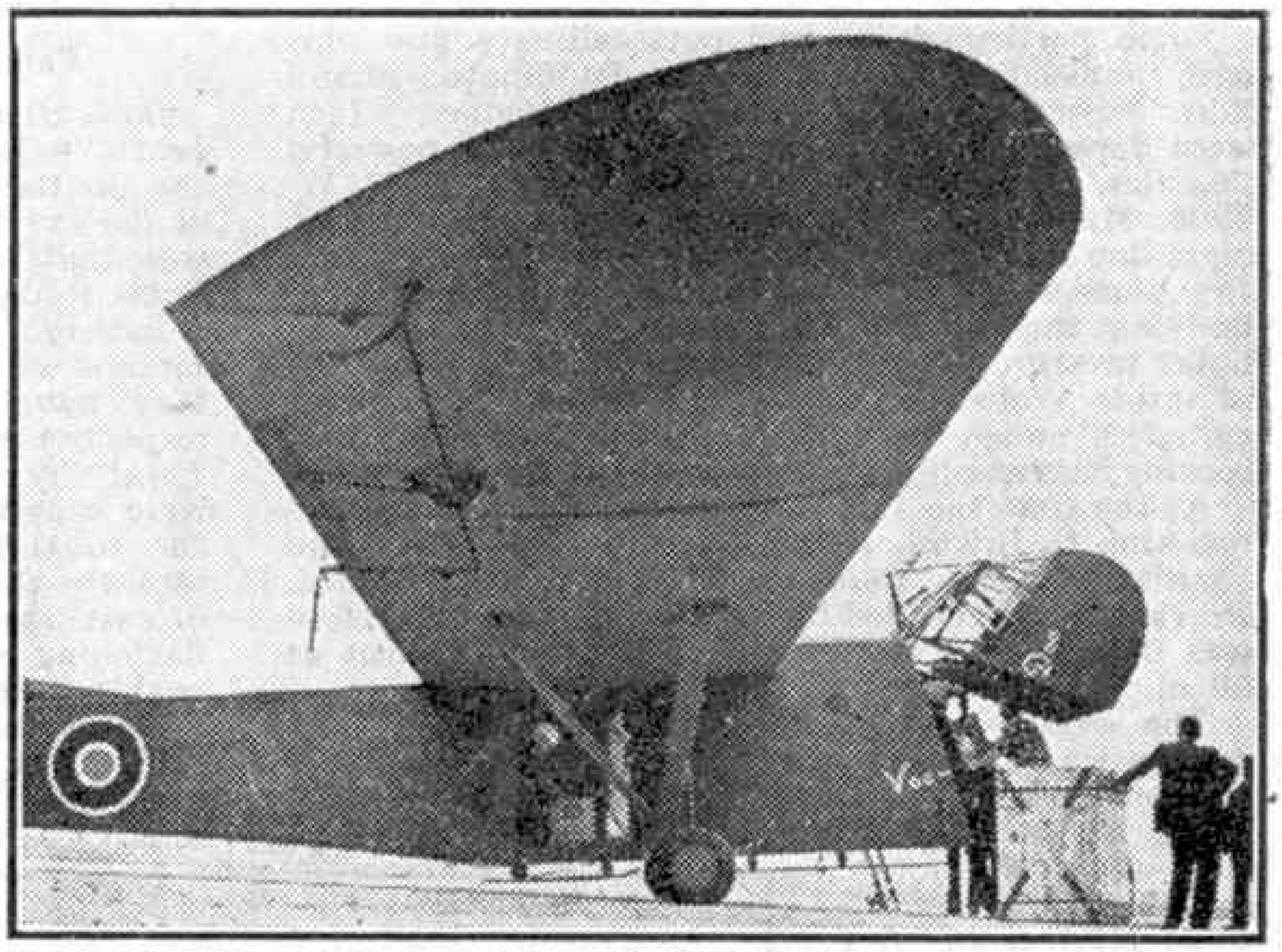
The Airspeed "Horsa" was the first British glider to be used in action, receiving its baptism of fire during the opening stages of the Sicilian campaign, together with the American Waco "Hadrian." It is a high wing monoplane constructed almost entirely of wood. The nicely-rounded fuselage is made in three portions. The nose, housing seats for the pilots, two sets of simple flying controls and the instruments, contains very extensive windows, giving excellent vision. The lower part of the nose is stiffened up with two skids to take the shock of heavy landings. The centre fuselage and tail end are of wooden monocoque construction, the centre portion containing the seats for the troops. A door is situated on the starboard side under the wing. A sprung skid is attached beneath the centre fuselage.

The wing is built up on one main wooden spar

although a little nose spar is also provided. It is covered forward of the spar with plywood and aft of that with fabric. Small air brakes are fitted under each wing, and there are very large flaps to enable the "Horsa" to land safely in confined areas.

The undercarriage is of the tricycle type and may be jettisoned during flight. Four bays are incorporated in each wing to house the containers of arms and ammunition for the troops. There are gunners' hatches above the wing and under the rear fuselage; so that the "Horsa" is by no means defenceless. Instruments in the cockpit comprise altimeter, airspeed indicator, air pressure gauge, artificial horizon, rate-of-climb indicator, turn-and-bank indicator, and compass. Controls include air brake, tow-release control, undercarriage jettison and flap control levers, and elevator trimming wheels.

The Waco "Hadrian" is the largest American glider of which details have yet been released. It normally carries 15 soldiers and has a wing span of 83 ft. 8 in., 5 ft. smaller than the "Horsa." Unlike the latter it has a square section fuselage, and loading is effected by hinging the entire nose upward from behind the windows, as shown in the upper photograph on this page. A jeep can be stowed comfortably within its capacious fuselage, which is constructed of steel tubing covered with fabric. Wings are of the normal wood and fabric type. It has already done well in action in Sicily, proving itself sturdy and efficient; and history was made in July 1943 when the "Hadrian" illustrated here, carrying vital war supplies for Russia, was towed 3,500 miles from Montreal to Great Britain by a Douglas "Dakota," an achievement since repeated many times.



This U.S. Waco "Hadrian" was the first freight-carrying glider to be towed from Canada to Britain. The flight was made in July last year.

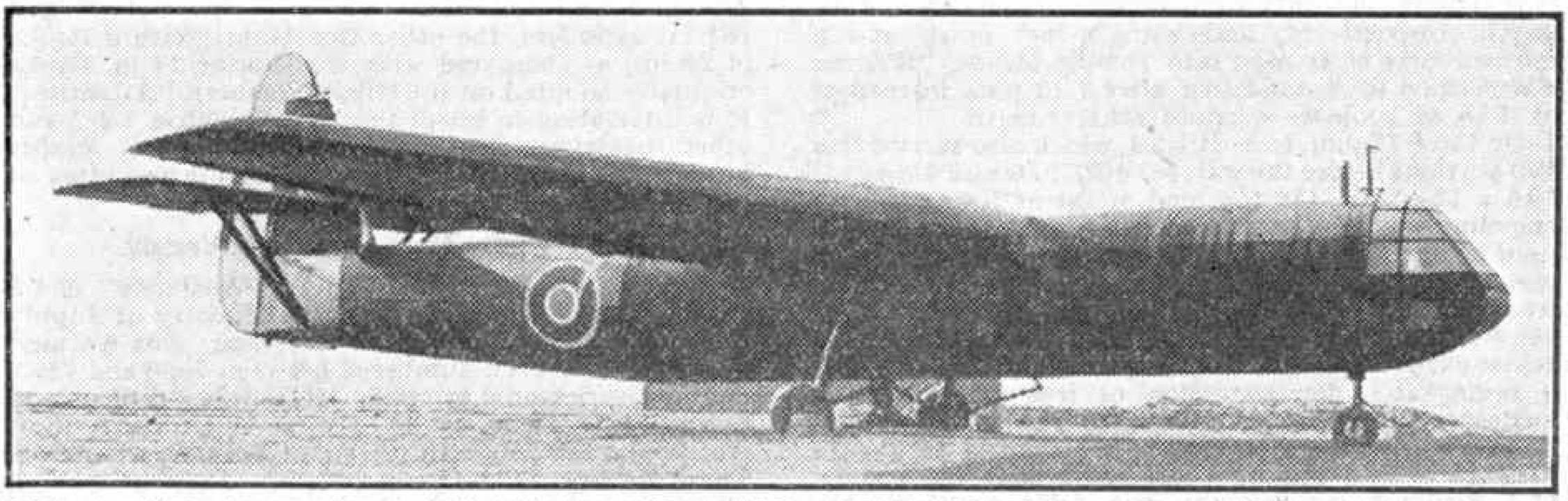
There are four main types of German operational gliders. The D.F.S. 230 A1 and the standard "Gotha" glider are almost identical in all respects. Each carries a pilot and nine troops, and they have a span of 69 ft. 11 in. and 72 ft. respectively. Normally they are towed in pairs behind Junkers Ju 52 troop carriers. Construction is on orthodox lines, the wooden framework being covered with plywood and fabric. Large loading doors are provided aft of the wings. These types were first used in the Battle for Crete, with conspicuous success.

When the Royal Navy, after a bitter struggle, managed to restore its power in the Mediterranean, Rommel's Afrika Korps in North Africa found itself in a perilous state, relying in large part on airborne supplies. For this purpose the Gotha and D.F.S. types were obviously not large enough, and the Gotha 242 and the Messerschmitt 321 appeared on the scene. Both are very unorthodox, the former being the only twin-boomed glider so far built. This arrangement was adopted to permit the loading of large equipment, such as reconnaissance cars or guns, and yet keep the size down to a minimum. The booms are well above ground level and quite large cars can be driven under them and straight into the fuselage, with consequent saving in space, as loading through the side necessitates a much wider fuselage to allow for turning radius on entry. Apparently the practicability of loading through a hinged nose as on the "Hadrian" and Messerschmitt 321 had not then been considered.

The Go 242 has a wing span of 79 ft. and is capable of carrying two pilots and a considerable load of freight or 21 soldiers. Its chief use so far has been to supply high-grade petrol to Rommel in North Africa.

The Me 321 or "Gigant" was not a success and few have been used in action. The capacious steel-tube fuselage structure has a flooring of massive steel beams capable of carrying quite large guns or small tanks. Altogether a total load of some three or four tons may be carried. It has a most unusual appearance, its "pantechnicon" front fuselage being mounted on no less than 10 wheels to spread the weight. Its span of 181 ft. makes it by far the biggest glider ever built.

Its size was against the "Gigant," however; it required a very long take-off run, only a few German planes were capable of towing it, and it was very vulnerable to attack. (*Continued on page 250*)



Not a prehistoric monster, but the Airspeed "Horsa," the first British glider to be used in action. Photograph "The Aeroplane" copyright.

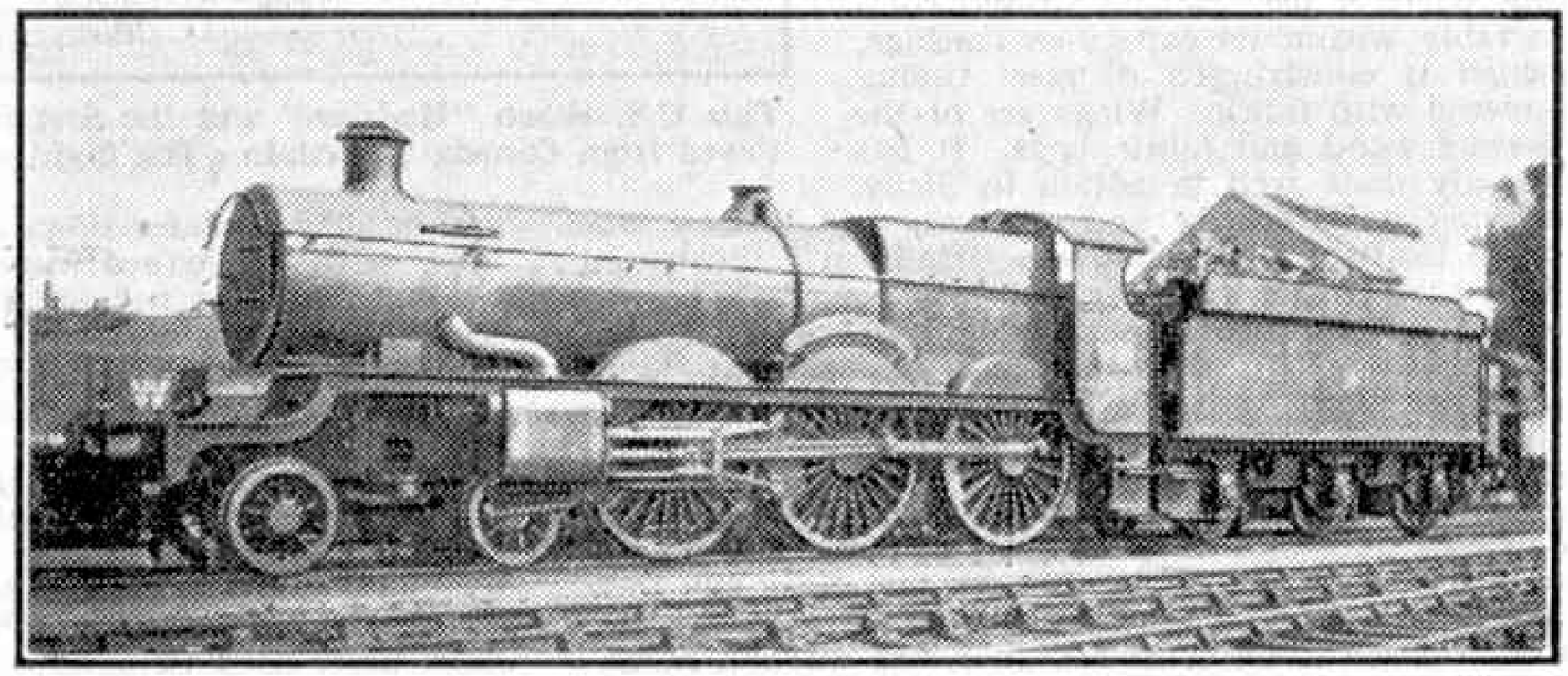
Railway News

Brilliant "Star" Performances G.W.R.

Some particulars of two outstandingly fine runs with unusually heavy loads on Paddington-Bristol 2-hr. expresses behind "Star" class engines, which were deputising for the more modern and powerful "Castles," are available by courtesy of Mr. T. W. Male. Many of the "Stars" are still rendering valuable main line service although 30-35 years old. They were the pioneer 4-cyl. 4-6-0 express locomotives, embodying the notable Churchward features of high boiler pressure, long piston valve travel, and two sets of inside Walschaerts gear, from which the outside cylinders' steam distribution is actuated by means of rocking levers visible at the front end of the valve chests.

At the time the 11.15 a.m. down from London was non-stop to Bristol, 118¼ miles, via Bath, where two coaches labelled "*Bath Spa Express*" were slipped. Previously a well-filled three-coach portion for Oxford was detached as the express approached Didcot at 60 m.p.h.

The engine was No. 4010 "*Western Star*," since withdrawn, with 14 on, weighing 473 tons empty or 500 tons full. After getting into speed with this weighty train, an average of just about 60 m.p.h. was sustained on almost level track over the 47½ miles from Ealing to Didcot, where the load was reduced by "slipping" to 11 coaches, or about 407 tons gross. To passing Didcot the working book allowed only 52 min. for the first 53 miles, which was rather disproportionately "tight" compared with the 68 min. for the remaining 65 miles with reduced load.



G.W.R. "Star" class No. 4057 "Princess Elizabeth" at Bristol. This photograph and the upper one on the opposite page are by A. C. M. Clements.

On this occasion the train was 5¼ min. late at Didcot, yet by covering those last 65 miles in exactly 60 min. Driver Smith secured an arrival 2¾ min. early in his home city of Bristol. Up the faintly rising grades to Swindon speed was mostly above the mile a minute rate. Then after passing the famous junction and works very fast travel ensued, with averages of 74.2 m.p.h. on to Chippenham, and 71.8 over the 29½ miles through to Bath, where the load was reduced to 330 tons. The maxima on the short 1 in 100 Wootten Bassett and Box Tunnel descents were approximately 85 and 80 m.p.h. respectively, and with a fast finish and a miraculously clear road into Temple Meads, "*Western Star*" came to a stand just after 1.12 p.m. instead of at 1.15 as booked—a grand achievement!

On the 5.15 p.m. from Bristol, which also carried two slip portions before the war, No.4023 "*Danish Monarch*" had a 12-coach, 430 ton load as far as Swindon over the more severely graded Badminton route, which was used by the fastest Bristol-London services. The steep rise up to Filton Junction and the South Wales line was rather a tough proposition with this load, while the subsequent 11-mile 1 in 300 rise to Badminton was taken easily, but once over the summit there followed a remarkable demonstration of free steaming and sustained speed as the 100 downhill or level miles on to Paddington were covered in 86¾ min. at an overall average of 69.1 m.p.h. Considering load and engine, this brilliant performance was fully equal to the regular effort required on the "*Bristolian*" and "*Cheltenham Flyer*," which were lighter trains hauled by a "Castle." The maximum before rejoining the old main line at Wootten Bassett was 85 m.p.h., later long stretches were covered after Swindon at 75 or over.

The whole 117¼-mile non-stop run was completed in 3 min. under booked time in 117 min., including a slowing through the platform line at Reading. The gross load after Swindon was 370 tons, reduced to 335 at Reading.

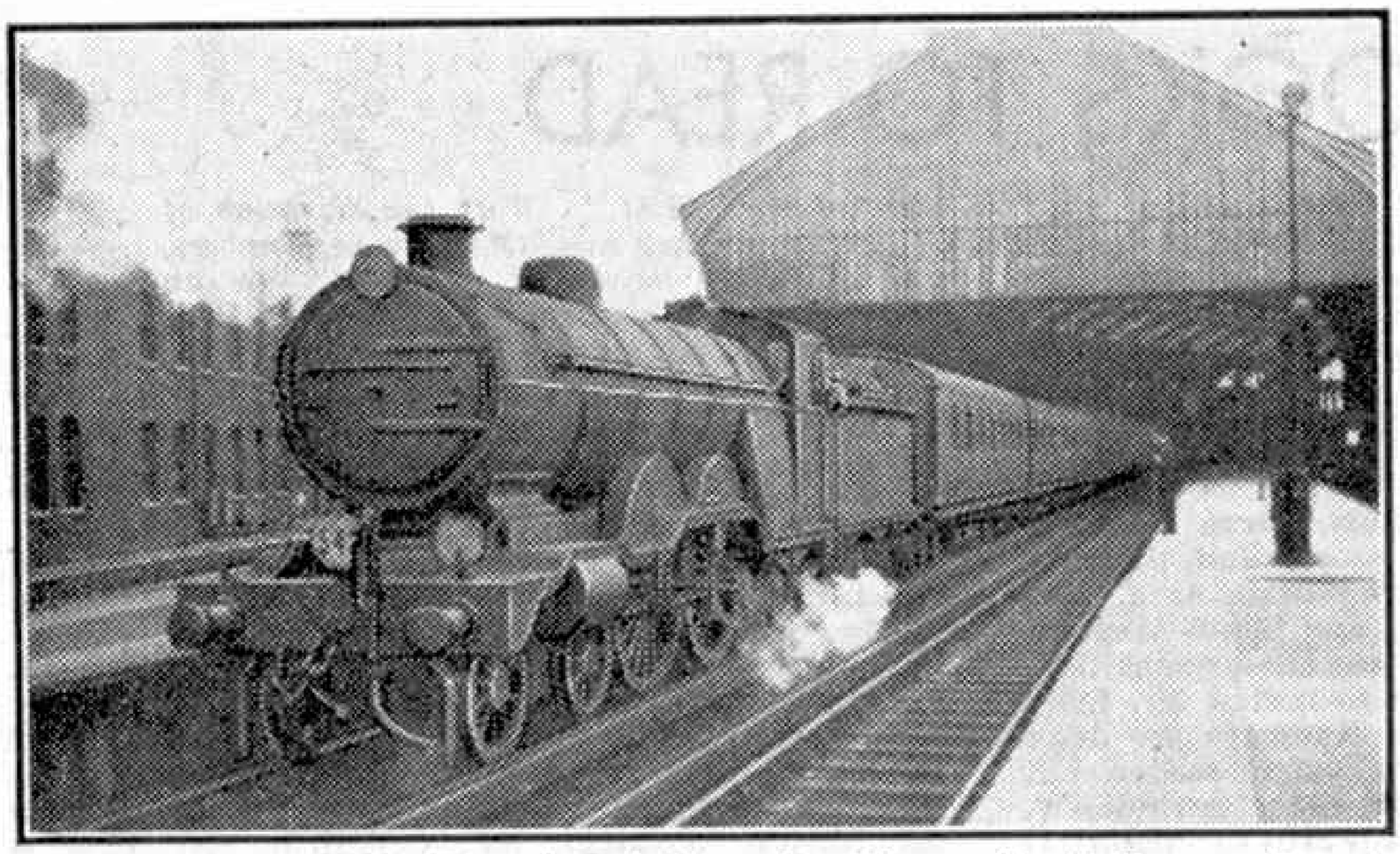
Farewell to Two "Brighton Atlantics"

Soon after the first withdrawal of some of the famous Ivatt "Atlantics" by the L.N.E.R. comes news that the Southern authorities have decided to scrap two of the five "H1" class 4-4-2 express locomotives that were built for the former London, Brighton and South Coast Railway in 1906, modelled on the large-boilered Doncaster type referred to above. The first two victims were originally numbered 40 and 41; recently they have been Nos. 2040-1, having been named respectively "*St. Catherine's Point*" and "*Peveril Point*" by the S.R. in 1925. Shortly afterwards they were superheated, with a consequent adjustment of the tubal heating surface in the big boiler. More recently their appearance was altered by the fitting of cast iron chimneys as on the "U1" 2-6-0s, by the flattening of the dome and by other modifications to enable them to work over a number of routes on all three sections of the Southern system.

The "H1" engines had from the start a boiler pressure of 200 lb. per sq. in., which in conjunction with a large fire-box and a vast boiler made them exceedingly powerful engines for those days. They made notable runs during the heyday of the steam-operated fast passenger services between London, Brighton and other south coast towns, and earned a fine reputation for reliability in conjunction with their "H2" sisters. These were introduced in 1911-2 as superheated "Atlantics" with larger cylinders, 170 lb. per sq. in. boiler pressure, and straight framing in front of the driving wheel splashers. Three of the "H1s" had 18½ in. cylinders, the other two 19 in., with a stroke of 26 in., as compared with the shorter 24 in. stroke originally adopted on the Great Northern "Atlantics." It is interesting to recall that the Brighton 4-4-2 and other passenger locomotives were painted umber brown with straw coloured lining-out for a number of years prior to grouping.

2-8-0 Utility Engines in Great Variety

Hitherto the British wartime "Austerity" 2-8-0 engines that are on loan from the Ministry of Supply to all the main Companies here, and also working overseas, have been numbered between 7000 and 7500, but new series now in traffic are numbered 86xx and 8xx as well. There are 50 of these W.D. utility locomotives on the Southern system at the time of writing. These are Nos. 7422-45 and 7472-97. They are seen on all three sections in the London area, whence they work to marshalling yards on the G.W.R., L.N.E.R. and L.M.S. systems.



S.R. "H1" No. 2041 "Peveril Point" on the "Sunny South Express," ready to leave Brighton for Willesden and the L.M.S. line.

American 2-8-0s are still at work in large numbers in many parts of the British Isles. In addition to these types, interesting examples of other powerful 2-8-0 engines also pass over the same tracks. For example on the Great Western-Great Central joint line to the north between Neasden and High Wycombe, near London, the following were noted within 70 min. on L.N.E.R. or G.W.R. freight trains: Gresley "02" 3-cyl. and G.C. "04" 2-cyl. L.N.E.R. classes; L.M.S. "8F" built at Swindon and loaned to the G.W.R.; G.W. 38xx and 47xx examples; and W.D. 2-8-0 locomotives built in England, Scotland and the U.S.A.

A Busy Main Line Signal Box

We illustrate a large signal box situated not far from King's Cross, at a busy junction station on the East Coast main line from London to the north. It is of typical Great Northern design, built of wood on a brick base and in normal times painted brown and cream. In the older G.N. days the main hue was a more purple shade and a bell fixed outside one of the windows was rung by hand by the signalman to indicate the approach of a stopping train. Electrical warning indications are now, of course, provided.

This particular cabin deals with up traffic only, but as four tracks and a number of points and crossings are involved there is plenty to do, since two or three trains may be passing at once and during morning and evening business hours before the war trains of all kinds were almost continuously in section. Now there is much freight and special traffic to control.

L.N.E.R. Locomotive Notes

New "Antelopes" have made their appearance. These are Nos. 8307, 8308 and 8309, the names of which are "*Black Buck*," "*Klipspringer*" and "*Kudu*" respectively. "Pacific" No. 2577 "*Night Hawk*" is a recent conversion from the "A1" class to class "A3."

A further rebuild of the Robinson "04" Class No. 6595 to the new Class "01" is No. 6244.

The 2-10-0 "Austerities"

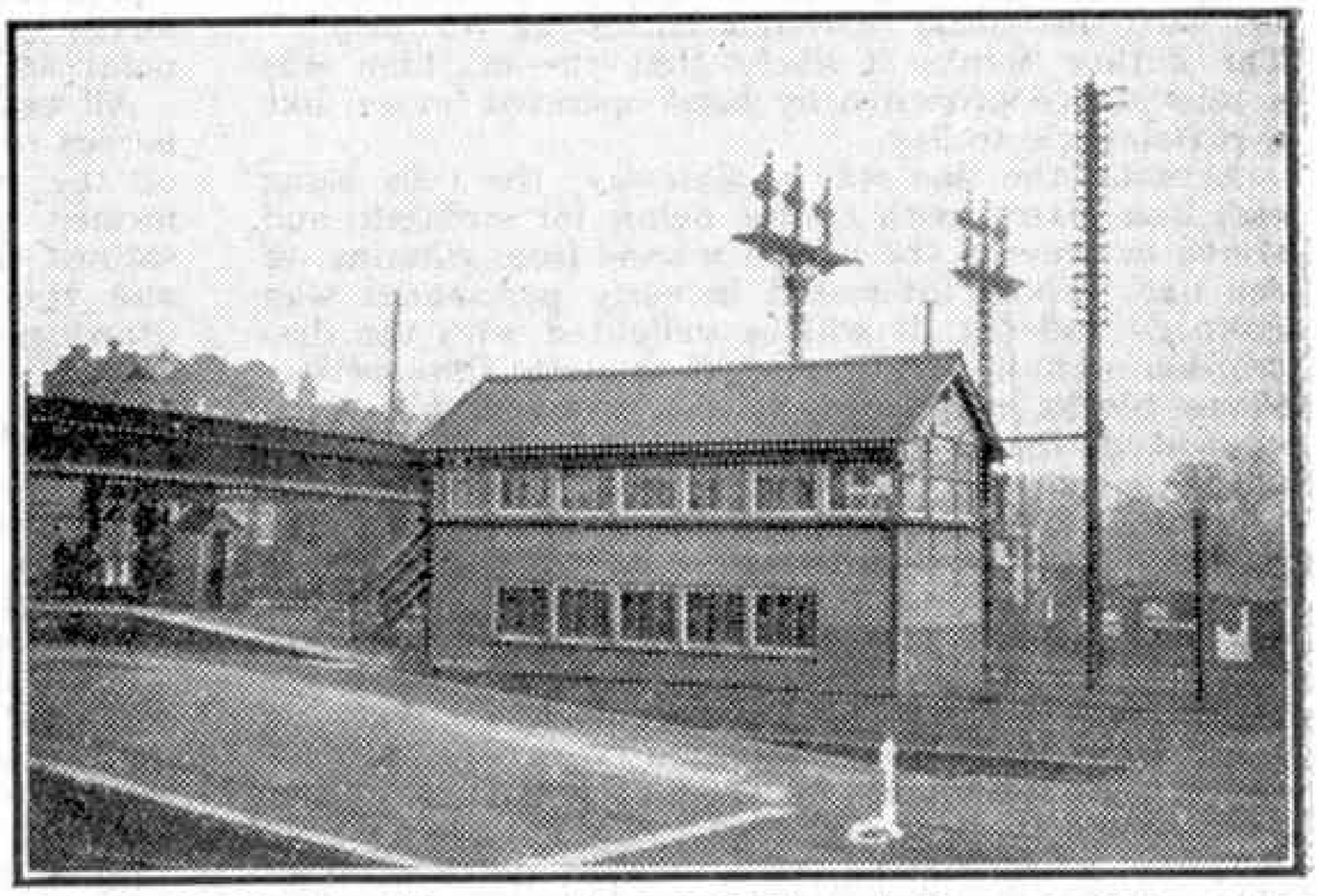
Further details are now available of the 2-10-0 locomotives to which reference was made in the April and May issues of the "*M.M.*" In general the design is of the 2-8-0 "Austerity" type, considerably enlarged. In spite of their great size and power the 2-10-0s are remarkably light, and should be able to work over most British main lines and those of 4 ft. 8½ in. gauge overseas. They will handle trains weighing 1,000 tons at speeds of 40 m.p.h. or so. The engines are noteworthy for the new construction methods employed in order to reduce labour or to conserve material. As far as possible all parts have been kept simple, and many components are built up instead of being made from the heavy steel castings and forgings usually employed. The fire-box is round-topped and the boiler is of the parallel-sided type, so that it is well adapted to quantity production.

There are two cylinders, of 19 in. diameter and 28 in. stroke, and the piston valves working above the cylinders are actuated by Walschaerts gear. The coupled wheels are 4 ft. 8½ in. in diameter, while those of the leading truck have a diameter of 3 ft. 2 in. The coupled wheelbase is 21 ft. The boiler is an ample one, with a generous steam space, and the pressure is 225 lb. per sq. in. There is a grate area of 40 sq. ft. and a total heating surface of 2,374 sq. ft. The tractive effort at 85 per cent. boiler pressure is 34,215 lb.

The engine alone weighs 78½ tons, while the weight of the tender is 55½ tons, making a total of 134 tons. The tender has eight wheels, and its self-trimming coal bunker has a capacity of 9 tons. The tank, which is welded, holds 5,000 gallons of water.

It is interesting to find that the new locomotives have been designed so that they can easily be adapted to special conditions. For instance, the boiler can be converted for oil burning without removing it from the engine. The tender too can be fitted with a water scoop if required.

One of these engines, No. 3698, was observed recently on a coal train at Hooton, Cheshire, on a line where U.S.A. 2-8-0s have been familiar objects for some time.



A typical G.N. signal box on the L.N.E.R. main line. An interesting feature is that it deals only with up traffic.

* * * *

Owing to a typing error the numbers of the S.R. 0-6-0Ts reported last month as working between Waterloo and Clapham Junction were given as 1606 and 1608. These should be 1696 and 1698, and the engines are of Class "R1", not Class "T."

BOOKS TO READ

Here we review books of interest and of use to readers of the "M.M." With the exception of those issued by the Scientific and Children's Book Clubs, which are available only to members, and certain others that will be indicated, these should be ordered through a bookseller. We can supply copies to readers who are unable to place orders in this manner. Order from Book Department, Meccano Ltd., Binns Road, Liverpool 13, adding 6d. for postage.

"EARLY RAILWAYS IN SURREY"

By CHARLES E. LEE ("The Railway Gazette." 2/6)

Just over 100 years ago the Surrey Iron Railway, the first public railway in the world and the first iron railway to enter the Metropolitan Area, was purchased by the former London and South Western Railway, one of the constituents of the present S.R. It is of special interest therefore to review Mr. Lee's book, in which the Surrey Iron Railways are dealt with. This is not a book for the young reader, but it will appeal very strongly to older enthusiasts, especially those who have a bent towards the historical in railway matters.

The name of the author, who has carried out a great deal of patient and painstaking research into the origins of rail transport, is sufficient guarantee of the accuracy of the account and of the very complete evidence that is quoted in support of the various statements. The beginning of the Surrey Iron Railway was to a certain extent due to the menace of Napoleon, and to military events on the Continent that affected British shipping in the Channel. Actually this railway was only part of schemes for linking London and Portsmouth and so improving overland transport between the Capital and the South Coast. It was authorised by Parliament in 1801 and was opened between Wandsworth and Croydon in 1803, when "the Committee went up in wagons drawn by a horse and a gentleman with two companions drove up the railway in a machine of his own invention without horses at 15 m.p.h." The author thinks it likely that the machine was a contrivance propelled by hand-operated levers, like a platelayer's trolley.

Actually the line was a plateway, the rails being cast iron plates, with flanges below for strength, and above to prevent the wagon wheels from running off the line. Those interested in early permanent way methods and details will be delighted with the description and illustrations dealing with this section. Stone blocks embedded in the prepared formation supported the rail joints, and, of course, horses supplied the motive power.

Even before the line had been opened, meetings of those principally interested had been held with the idea of extending it, with the result that a second undertaking was promoted, known as the Croydon, Merstham and Godstone Iron Railway. This was never completed to the extent authorised, but was built from an end-on junction with the original concern to Merstham. In spite of being included in various schemes for connecting the Thames and the Medway with Channel ports, fortune did not favour these plateways. They were scarcely paying concerns, and the coming of steam locomotion and edge rails to the South ultimately resulted in their dissolution.

The book is illustrated by various items of historic interest, including reproductions of share certificates of both the Iron Railway Companies from the author's collection, drawings and several public announcements relating to their system. Traces of the route are still in existence here and there and details of these are given to conclude the account. A useful index completes the book.

Owing to wartime difficulties, it is impossible to guarantee prompt delivery of books ordered as described at the head of this page, but every effort will be made to ensure speedy despatch.

"THE ADVENTURES OF HENRY PENN"

By ISOBEL ST. VINCENT (Harrap. 6/- net)

Our younger readers will enjoy this fantasy, and for that matter, so will most of those who are grown-up. It is a light nonsense story of the fishing village of Little Beakons, which is peopled by as interesting a crowd of penguins as one can imagine, from Porteous Penn, the keeper of a very untidy junk store and bargain shop who is fortunate enough to receive a legacy from his Aunt Emma, to Sergeant Buffer, the village policeman, always alert to blow his whistle, although he does little else that is effective! Then there is the pirate chief, Obadiah Imm, living in disguise to spy out the land. The real hero is Henry Penn, the undersized duffer and daydreamer of whom the other boys at school make perpetual fun; and it is he who finally tracks down the rascally Imm, whose pursuit forms the main part of the story.

The whole thing is gloriously and ridiculously exciting. Porteous Penn's legacy begins it, for with this he buys a yacht, or what he thinks is a yacht, fits it after many misadventures with a ship's binnacle bought years ago to await the day when he could "pick up" a ship for it, and sails away on a pleasure cruise, in the course of which he shows extraordinary command of nautical language. He runs up against Imm and his cutthroats, who prey on the fishermen of the village, and with his comrades' valiant aid vanquishes the miscreants for ever. Henry it is who finally beats the chief villain down, with a sword point at his throat.

All ends well on a beautiful summer day with the heroes of the chase and their friends making merry on the deck of the "*Bouncing Betsy*," while the reformed pirate Obadiah Imm sails by and politely salutes them! There is fun and frolic all the way, and this is reflected in the delightfully humorous drawings that are scattered freely throughout the book.

"AVIATION IN MINIATURE"

Edited by D. A. RUSSELL, M.I.Mech.E.

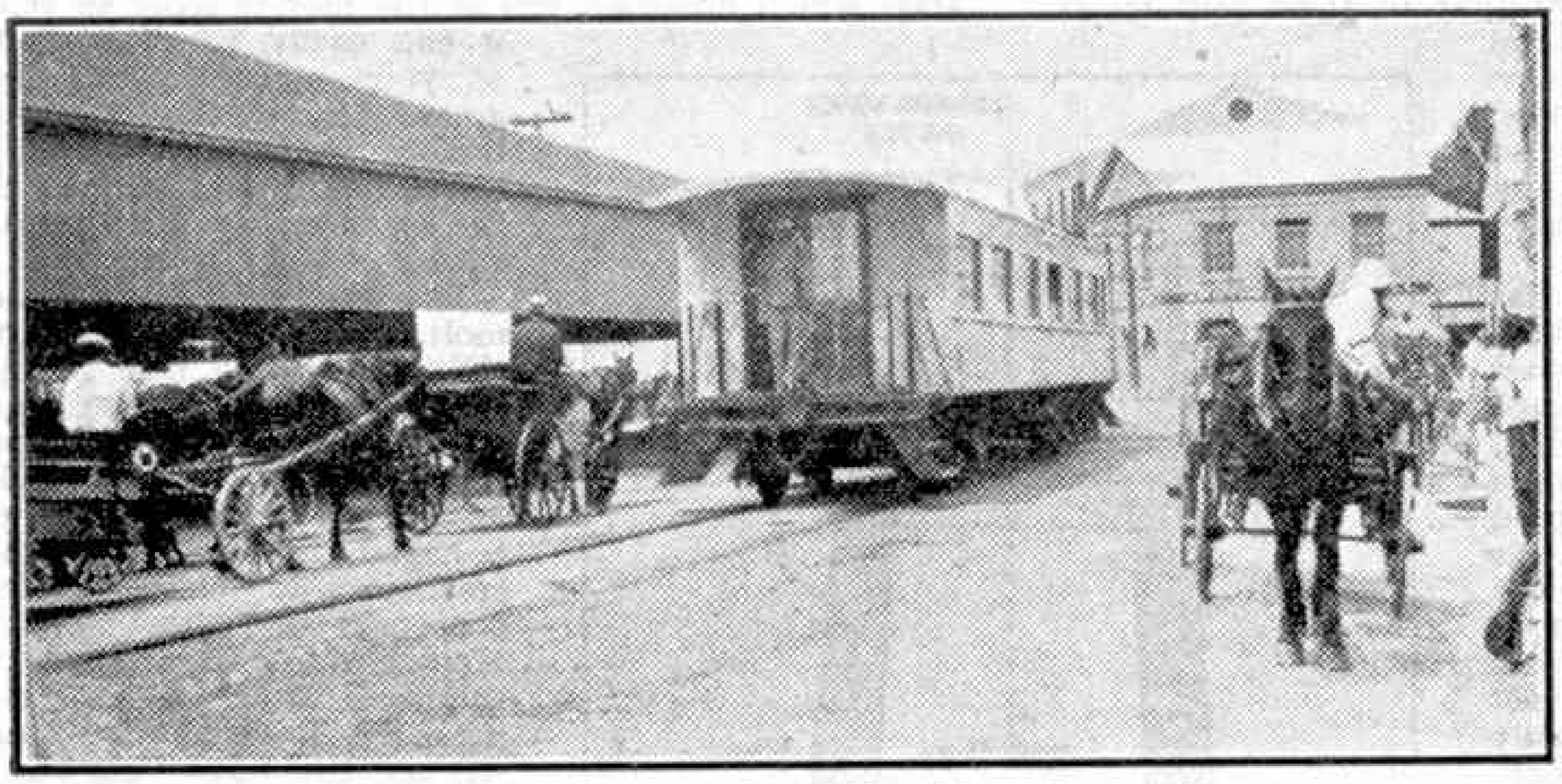
This booklet surveys very briefly various aspects of model aviation. A chapter on designs and jigs contains hints on the care of constructional drawings, and on the completing of a model aeroplane from a kit of partly-shaped components. One on aircraft recognition stresses the great value of scale model aircraft building as an aid to expert identification of the real machines, and other subjects touched upon include the importance of models on various scales in the preliminary work on real aircraft, the now well-known Wakefield Cup Competitions—the high spot of the aeromodeller's yearly programme—insurance and other practical points of model aeroplane flying.

The book is very readable, practically every chapter including some interesting story or anecdote in which modelling played a part, or could have done, and it will be enjoyed by all interested in flying. The book also draws attention to the several ways in which the publishers and associated companies cater for the literary needs of the model aircraft builder. It is published by Aircraft (Technical) Publications Ltd., Allen House Newarke Street, Leicester, price 1/-.

The Bermuda Railway

By Denis Rebbeck, M.A. (Cantab.), A.M.I.Mech.E.

WHEN you first arrive in Bermuda, the most noticeable feature of these interesting semi-tropical islands is the white roofed houses built of limestone. They are just the first of many quaint ideas and customs, many of which, however, are there for a very good reason. You get used to the fact that cars may not be used on the islands' public roads, and to the queer horse-drawn carriages; the bicycles and crowds of visitors become commonplace, but the one thing you won't get used to is the railway. Why? Well, it's hard to say exactly, but it doesn't seem to fit in with the background of these old-fashioned islands which cover an area of only 19¼ square miles, and which have been protected by the English flag since 12th July 1612.



The "main station," Hamilton, Bermuda.

The Bermuda railway commenced operation in 1932, after having had a very mixed reception by the local populace and causing many bitter words in the Bermuda Parliament. Many people didn't want to have trains rattling round their almost private islands. They had banned cars; why should they allow a railway company to operate? However, in spite of much opposition the railway eventually became a reality.

So to-day you can go, for a 25-mile round trip by train and carriage through magnificent scenery, embracing all the points of interest between Hamilton, which is the capital, and St. George's, the town at the easterly end of the islands, or between Hamilton and Somerset, which is the town at the westerly end; and the rail fare is one and a half dollars. Special observation car trains await the arrival of all cruise ships either at Hamilton or at St. George's, and depart immediately after the passengers have entrained from the tender. Between Hamilton and St. George's are to be found attractions such as the Government Aquarium, which has the finest display of fish and live corals in the Western World. Special carriages await the train at Bailey's Bay, and go through some of Bermuda's most beautiful scenery to the caves and back again to the station. Between Bailey's Bay and St. George's the railway passes along the shore of Castle Harbour with a view of the wonderful new Castle Harbour Hotel. The railway offers every facility for quick and comfortable transportation to all the points of interest in these beautiful islands.

The trains themselves are simple three-coach units driven by internal combustion engines, and never go fast enough to spoil the view. Much of the track has been cut through the limestone, but there are bridges and other items of artificial construction. In Hamilton, the railway, which is single line throughout its length, passes down the centre of Front Street, which is the dockside road, and unconcernedly mingles with the horse-drawn traffic, bicycles and pedestrians. Our illustration shows a train in the "main station," Front Street, Hamilton. This photograph has caught exactly the casual air which pervades the whole of Bermuda. Occasionally the railway darts off on its own into the hinterland, but even there the atmosphere of "make-believe" is not left behind. The writer has travelled on a good many railways in different parts of the world, and regards the Bermuda railway as one of the quaintest he has ever seen. Every visitor to these islands will enjoy a trip on this unique line.

The Story of Steel

II—From Iron Ore to Blister Steel

By Eric N. Simons

STEEL begins in the bowels of the earth as iron ore, which has to be torn out by drilling holes in the rock underground, filling these with blasting powder or dynamite, blowing up the explosive, and gathering up the broken rock fragments. These are sorted out at the mine mouth, either by hand or by machinery, into good ore and worthless stuff known as "gangue." A powerful electro-magnet is used to pick out the genuine iron ore from the useless material.

What a steel can be used for depends largely on how pure it is, and right from the start, everything in making steel concentrates on that one thing—purification. The worst impurities are sulphur and phosphorus, two elements that in their own sphere are quite useful, but in steel are bad, because they give rise to serious weakness. Steel has to be strong, and anything that lessens its strength must be ruthlessly eliminated.

After the good ore has been picked out, it is heated to a yellow heat in stoves. This helps to remove some of the unwanted sulphur. It also makes the ore more spongy, which is a good thing, because later on, as you will see, it is necessary to pass gases through it to achieve certain results. Obviously, if water can get through a sponge more easily than through a cannon ball, gas will get through spongy ore more easily than through solid ore.

After the roasting in the stoves, or calcination, as it is called, the ore is stacked up in the open to "weather," which means that the rain and the snow dissolve and wash out more of the sulphur. Sometimes the ore is mechanically washed for the same reason.

After this the ore has to be smelted, or turned into proper iron. This is done in a blast furnace, which looks rather more difficult to understand than it actually is. The ore, you must bear in mind, still contains not only iron but many other things besides, which must all be got rid of. One way of doing this is to find a substance that will combine or join up with these impurities when heated in such a way that they can be easily removed. This is just what the blast furnace is for.

The substance used for this purpose is called a flux, and for iron it is the common stone known as limestone, though other fluxes may be used in those districts where limestone is less easily found. The blast furnace is a huge metal cylinder lined with heat-resisting bricks. The ore is fed in from the top, together with limestone, and charcoal, the fuel. Some blast furnaces are as much as 100 ft. tall, and will produce 500 tons of pig iron a day.

To make the charge in the furnace burn well, a fierce current of air produced by big blowing engines, and comparable in purpose to the ordinary wind bellows, is used, and this is the "blast" that gives the furnace its name. The oxygen in the air blast combines chemically with the carbon of the charge, and hot gases are given off. These are rich in a gas called carbon monoxide gas. The ore is really to a great extent iron oxide, and the carbon monoxide gas combines with this to produce carbon *di*oxide (carbonic acid gas) and pure iron. This iron melts in the great heat developed by the blast, and descends to the bottom of the furnace, being heavier than anything else in it. Meanwhile the impurities in the ore combine with the limestone to form a scum or slag, which floats on top of the molten iron, so that it can easily be drawn off, as your mother skims the grease from the top of boiling soup. Many other interesting things happen in the furnace, but these would take too long to describe.

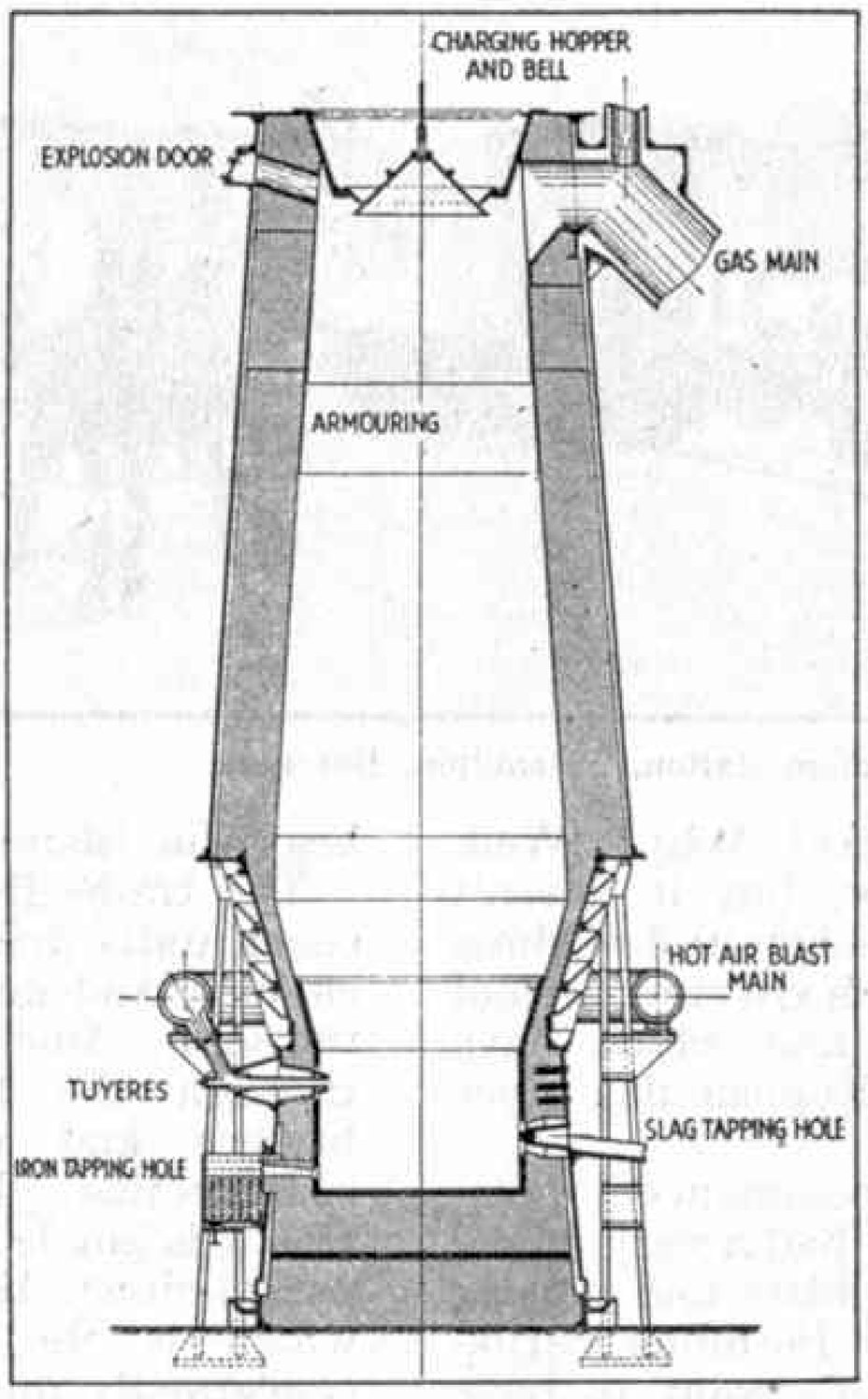


Diagram showing the parts of a modern blast furnace. By courtesy of The Park Gate Iron and Steel Co. Ltd.

Eventually, the white-hot molten iron is drawn off through a small hole at the bottom of the furnace, and runs along a sand channel from which side channels branch off. The main channel is called the "sow," and the smaller side channels are consequently the "pigs." Here the iron is allowed to solidify, after which the pigs are broken off. Thus we get the term "pig-iron" for iron made in the blast furnace.

Now this pig iron is very good for many purposes, but is not nearly good enough for the tool steel maker, because it still contains about 5½ per cent. of impurities. This is far too much, so that the next stage is to reduce this impurity percentage down to something like 0.3 per cent. This can be done in a number of ways. Of these the oldest is the Walloon or Swedish puddling process.

This begins with a rectangular furnace heated by charcoal and having a strong air blast brought in by means of a pipe. On the floor, in front of the furnace, are some wooden rollers, on which are placed long, D-shaped cakes of pig-iron, each weighing about a ton. These long pigs are run forward by levers until their ends reach that point in the furnace where the air blast meets the burning charcoal. There the heat is so intense that the pigs begin to melt and drip like candles, and as they melt they are pushed forward until there is enough pasty, half-molten iron on the furnace floor to make up a spongy lump weighing about 80 lb.

The worker now takes a bar of iron and starts to "puddle" or work up this mass of iron into the region of the blast; it is hot work, and he wears only wooden shoes, a long gown, and thick, woollen stockings. The oxygen in the air blast again combines

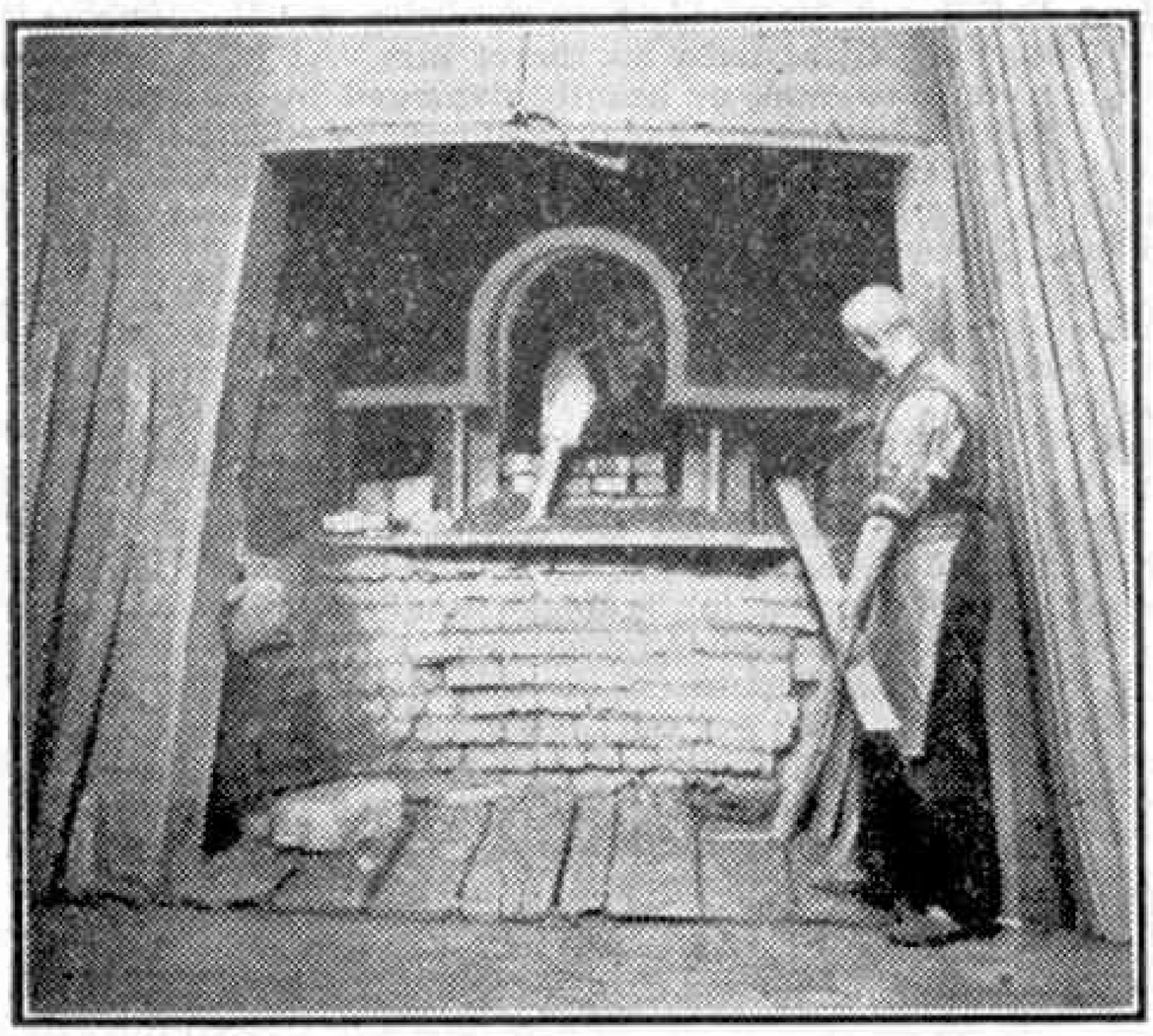
with impurities in the molten iron, and removes them. The worker, by his skill and experience, knows just when the iron has reached the right point. He gets hold of the pasty mass with tongs, breaks it up, and lifts it above the pipe, then withdraws it from the furnace and places it under a power hammer, which shapes it into what is termed a "bloom" or thick length. This bloom is reheated, and forged down under the hammer into a bar about § in. thick by 3 in. wide. The result is that we now have "wrought" (because "worked") iron.

We are now beginning to approach the stage at which the steel maker takes an interest in the proceedings. Wrought or "bar" iron is the basis for the manufacture of the splendid steels that go to make tools, but wrought iron alone is not hard enough, since it does not contain enough carbon, and carbon, as we saw in the previous article, is what makes steel hard. We have therefore to find some way of driving carbon into the iron which, like so many human beings, is perfectly self-satisfied, and has no real desire to be changed.

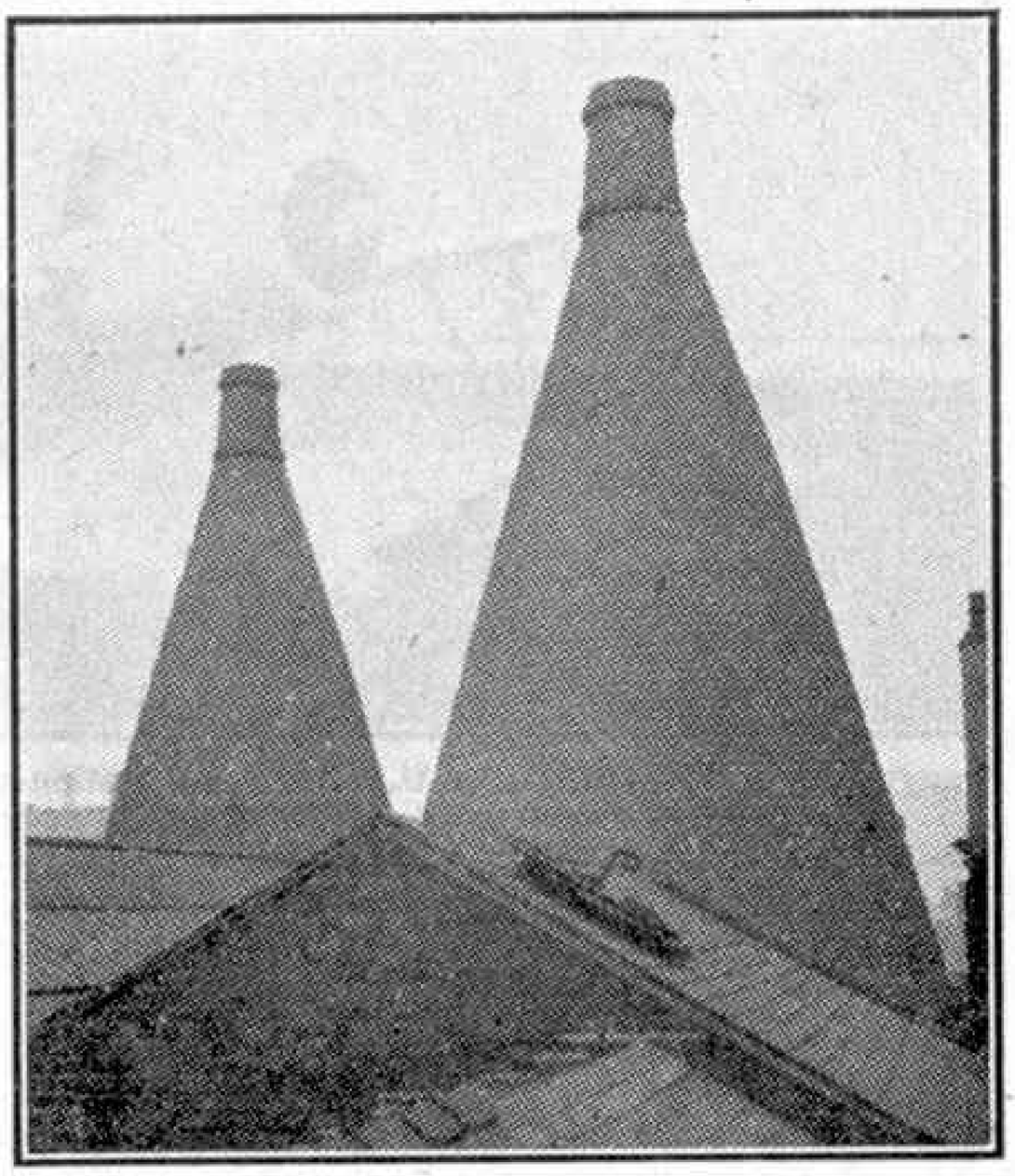
However, by a process known as "cementation," carbon is compelled into the iron. How is this done? First, some large earthenware chests or chambers, called "converting pots," are placed in furnaces, two in each. Layers of wrought iron bars are packed into these chests, and each layer is separated from the next by a bed of charcoal. Air has to be kept out of the chests at all costs, so they are carefully sealed up. The furnace is then heated, and after three or four days it has reached the right temperature. It is kept at that temperature for between 7 and 11 days, according to the type of steel required, and is then allowed to cool down, which takes from 4 to 6 days. The steel maker peeps every now and then through a little spyhole to see how things are going on inside the chests.

When the furnace is cold enough, the bars are taken out, and a man knocks off their ends with a hammer so that he can see what the broken surface is like. His experience enables him to tell at a glance merely from this surface whether the steel has the right amount of carbon in it, and exactly—or so nearly so as to make no matter—how much carbon there is.

The satisfactory material is no longer soft and capable of being bent. It has become hard and brittle, so that a tap with a hammer will break it. Moreover, instead of having a smooth surface, it is covered with small blisters, from which it takes its name of "blister steel." These blisters are usually taken as a sign of good quality in the steel, and for this reason a cunning Yankee merchant once



Interior of a cementation furnace.



Outside view of a cementation furnace.

put down a plant to *roll* blisters on inferior steel, so that he could get a high price for cheap metal. The trick was soon discovered, however.

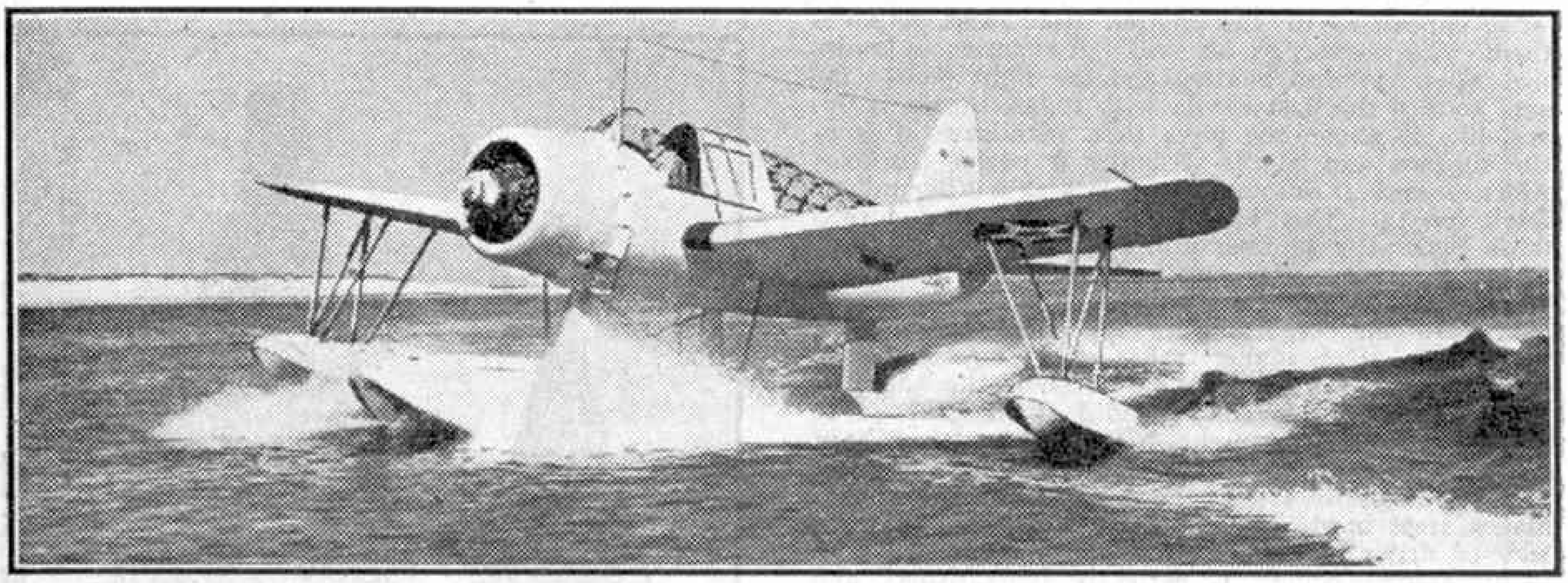
Now how has this iron become steel? Well, when you heat iron hot enough and for a long enough period in the presence of carbon, there is a tendency for the carbon to penetrate into the pores of the metal. It is just as if the heat drove the carbon into whatever dark corners it could find to get away from it. How deep the carbon goes depends on the heat and the length of time the process goes on.

You will probably have begun to wonder what it is that the bar sorter sees, when he breaks the end off a bar of blister steel, that tells him whether the carbon percentage is right or not. The answer is that the carbon penetrates into the steel from the outside inwards, but never quite reaches the very core or centre of the bar, which is therefore still of soft wrought iron. Now this unhardened or uncarbonized iron has a dull, grey appearance, and its surface does not reflect or refract the light to any extent. The carbon-rich or well-carbonized areas nearer the circumference of the bar have, however, a bright staring appearance, the reflection of light from the crystals being greater. The relative proportions of the bright and dull areas indicate clearly to the bar sorter how far the steel is carbonized.

Furthermore, if the steel has been properly carbonized or "cemented," there will only be a gradual shading off of the carbonized portion into the dull soft core. If it has been badly made, there will be a sharp change from bright to dull. The reason why this latter appearance is bad is that the sharp line is, in practice, a line of weakness. There is too great a difference in properties between the two types of structure, and in consequence if a sudden stress or strain is placed upon blister steel thus badly made, there is a distinct danger that it will fail at this point, and the hard outer case will break away or "flake off," as it is called.

But although the blister steel is, if well made, good material, it has not yet reached the stage at which it becomes suitable for the finest tools, such as your pocket knife, your chisel, your plane or hammer. To learn what has to be done next you must read the following article.

Meanwhile, this is an (*Continued on page 250*)



Vought OS2U "Kingfisher," a U.S. Navy observation-scout aircraft used for convoy duty, submarine hunting, and air-sea rescue work. Photograph by courtesy of the United Aircraft Corporation, U.S.A.

Air News

The Vought "Kingfisher"

An aircraft which has been putting in some good service in this war but has received little attention is the Vought OS2U "Kingfisher." It is in production for both the U.S. Navy and the British Fleet Air Arm, and can be fitted with either wheels or floats, but is usually carried on a catapult aboard warships, in the same way as the "Walrus." Its 450 h.p. Pratt and Whitney "Wasp Junior" engine gives it a speed of over 190 m.p.h. at a loaded weight of 4,542 lbs.

The chief duties of the "Kingfisher" are to "spot" for the guns of warships and act as a reconnaissance-scout for convoys, and it has been used also to good effect on anti-submarine patrol with a bomb slung under each wing. Three "Kingfishers" sank one of Japan's submarines in the Pacific, and in the initial attack on Attu "Kingfishers" rained dozens of 335 lb. bombs on to the Jap positions. In addition the type has been extensively employed for air-sea rescue work in the Pacific war zone. J.W.R.T.

Another Transatlantic Record

Another transatlantic flight record has been achieved, this time on the Labrador-Britain route. A Canadian-built D.H. "Mosquito" piloted by Wing-Cdr. J. de L. Wooldridge, D.S.O., was flown from Montreal to Goose Bay, Labrador, in 3½ hrs., and from there non-stop to Great Britain, on the R.A.F. Transport Command's route, in 6 hrs. 46 min., averaging 325 m.p.h. This fast ocean crossing was made in 2 hrs. 10 mins. less time than the previous record for a flight over this route, set up by Capt. W. L. Stewart, of British Overseas Airways, in a Consolidated "Liberator." Wing-Cdr. Wooldridge had been on a duty visit to the United States, and had volunteered to ferry a "Mosquito" to Britain.

Another Canadian "Mosquito" that left Labrador shortly after the first machine and followed the same route completed the coast-to-coast flight in 7 hrs. 10 min.

Rocket Projectiles

On 27th May last it was announced for the first time that the R.A.F. are using aircraft fitted with rocket "guns." Rockets are not a new weapon of war, as Clive used them at Plassy, and in the 1914-18 war "Le Prieur" rockets were fitted to several Allied aircraft. The L.P. rockets were about 18 in. long, mounted on sticks 3 ft. long, and were usually carried in cases of six fixed to the interplane struts; they were fired electrically. One of the few examples on record of their use in action occurred on 15th September 1916, when Capt. Albert Ball, flying a Nieuport, fired them at a German Roland two-seater from 200 yds. range. The rockets just missed their objective, but so startled the enemy pilot that he was "easy meat" for the great British ace, and a burst of fire from Ball's Lewis gun sent the German machine spinning into the ground.

Dr. A. D. Crow, a British scientist, was chiefly responsible for the re-introduction of rocket projectiles—R.P.—on aircraft, and about two years ago the first "Hurricane" fitted with four R.P. rails under each wing took to the air. It proved very successful, and has been followed by rocket-firing "Beaufighters," "Swordfishes," and "Typhoons" in the R.A.F., and Fw 190s, Me210s, and Ju 88s in the Luftwaffe.

Each rocket consists of a warhead carried at the front of a tube filled with cordite, four stabilising fins being fitted at the rear of this tube. It is fired electrically, a fuse then igniting the cordite, and the consequent flow of gas propels the rocket forward at high speed along the guide rails in the sighted direction. The rockets can be fired as a salvo of eight, or in pairs—one from each wing. There is no recoil to upset the stability of the machine, and the continuous explosions cause the projectiles to fly dead straight for their objective instead of in an arc like an ordinary shell.

The first ship to be hit by R.P. was a stranded German merchantman in a Norwegian fjord in June 1943. It was attacked by Wing-Cdr. R. H. McConnell, D.F.C., of Mayfield, Sussex, flying a "Beaufighter," who scored at least six direct hits. At least 66 ships have been sunk or heavily damaged by rockets since then. The weapon has proved equally effective against a variety of other targets, ranging from bridges and lock gates to wireless stations, tanks, and coastal defences.

R.P. is still in its infancy, but there is every reason to believe that it will revolutionise warfare quite as much as the introduction of the tank or jet-propulsion. J.W.R.T.

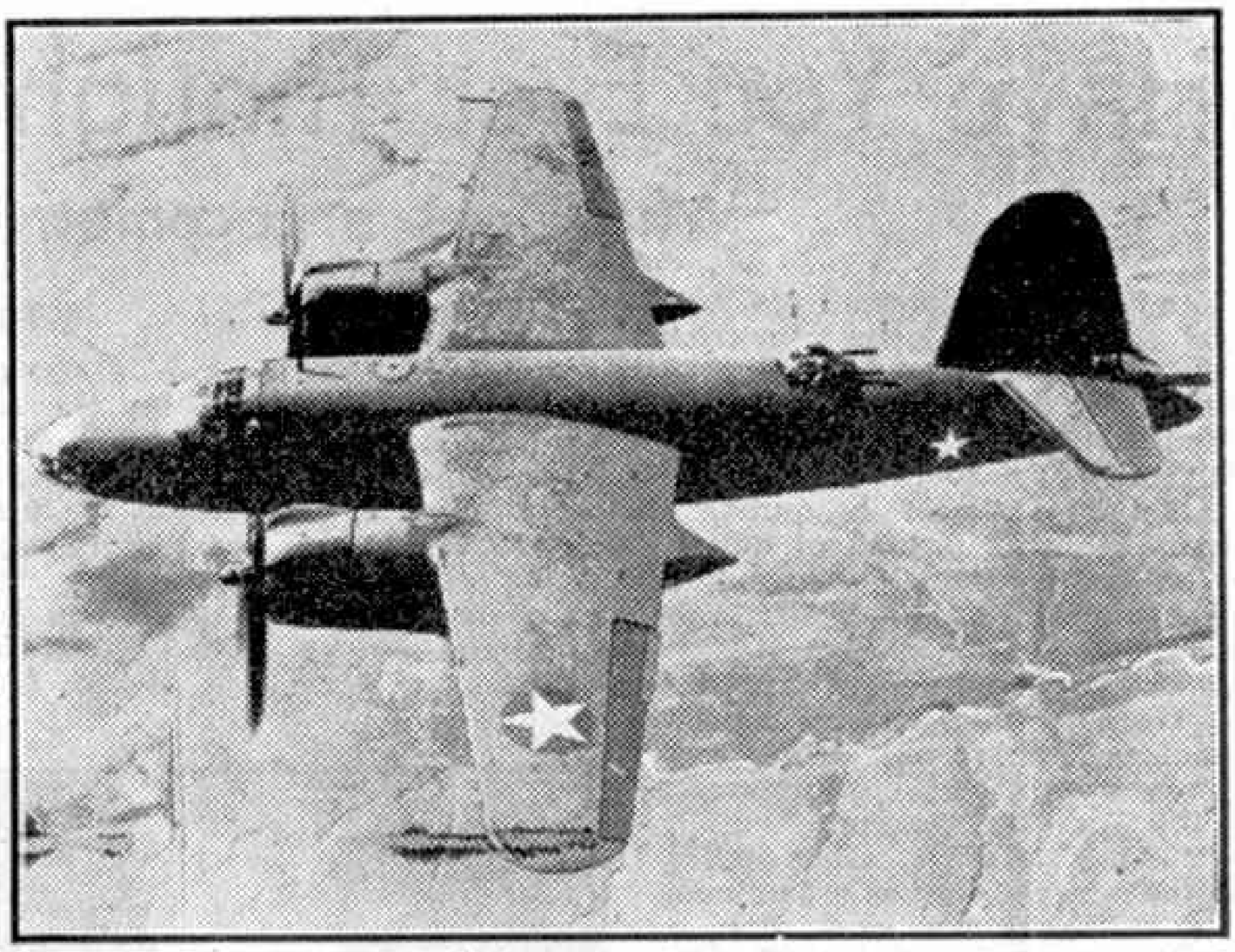
Record Production of "Flying Fortresses"

During March last the Seattle plant of the Boeing Aircraft Company, U.S.A., achieved what is claimed as a world record for a single month's production and delivery of completed 4-engined bombers. The output of "Flying Fortresses" at this factory in that month was almost 25 per cent. higher than in February, the previous "best," and more than double the output of January 1943. The production rate at the Seattle factory has been increased more than 400 per cent. in the past two years, with the same number of direct factory workers to-day as at the start of the period. This great increase has been achieved by constant improvement in production methods, and maximum efficiency in use of machinery and available man-power.

The Martin "Marauder"

It was stated recently by U.S.A.A.F. Headquarters that at one time the Martin "Marauder" was banned because of its bad flying qualities and very high landing speed. A group of American Service airmen had so much faith in it, however, that they started intensive training on the type, suggesting modifications to improve controllability. Their confidence was not misplaced, and to-day the "Marauder" is very highly regarded, both in the R.A.F. and the U.S.A.A.F.

Large numbers of these aircraft operate almost every day from bases in this country and in the Mediterranean theatre, with excellent results. Perhaps the greatest tribute is that the percentage loss in action among "Marauder" formations is lower than that for any other bomber type—less than one per cent. This is due partly to its high top speed of over 300 m.p.h. and partly to its heavy armament of twelve ·50 in. machine-guns. J.W.R.T.

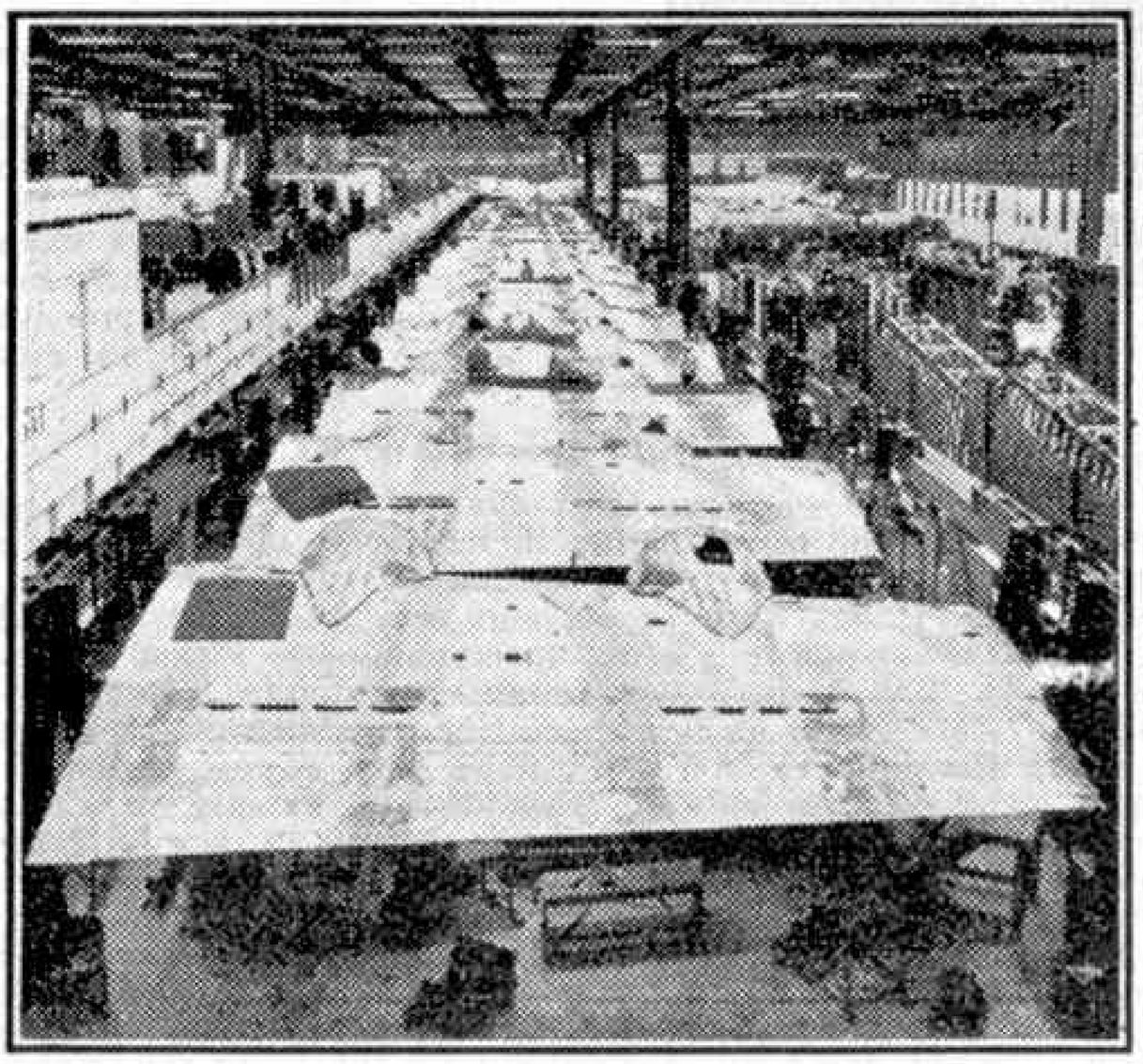


Martin B-26 "Marauder" bomber. U.S.A.A.F. aircraft of this type are among the very many machines engaged daily in attacking targets in France

Success of K.L.M. Lisbon Service

Royal Dutch Airlines, more familiarly known as K.L.M., have completed 1,000 return flights on their U.K.-Lisbon air service, which they operate under charter to British Overseas Airways. The service was inaugurated in July 1940, less than three months after the destruction or capture of the greater part of the K.L.M. fleet and organisation by the Germans when they invaded the Netherlands. It is operated with a small fleet of Douglas DC-3 air liners, with Dutch crews. The many thousands of passengers carried on this service have included statesmen, diplomats, officials, refugees, evacuee children, and escaped prisoners of war. Many tons of mail and of urgent freight, including drugs, medicines and comforts for British prisoners of war in German hands, also have been carried.

Full details of this "Lisbon Story" cannot be told until after the war, but these 1,000 return flights, carried out under difficult conditions that at times became hazardous when the aircraft had to run the gauntlet of German fighters, have represented a great service to the Allied war effort.



"Flying Fortress" production at a Lockheed factory. Inner wing sections on a huge conveyor that carries them, with work on them continuing, to the final assembly area where they are attached to the fuselages. Photograph by courtesy of the Lockheed Aircraft Corporation, U.S.A.

A Stainless Steel Aircraft

A twin-engined high wing transport aircraft built of stainless steel is in production by the E. G. Budd Manufacturing Co., Philadelphia, U.S.A. It is called the Budd "Conestoga," and has a top speed of 165 m.p.h. and an operating range of 1,700 miles. When used as a freight transport it can carry two "Jeeps," which enter the fuselage through its underside by way of a ramp. The machine can be adapted for use as an air ambulance, and when equipped for this purpose it can accommodate 24 stretcher cases. The "Conestoga" has been accepted by the U.S. Navy, and the first of these machines is being used by the U.S. Naval Air Transport Service.

"Flying Scotsman" Joins the Navy

"*Flying Scotsman*," one of two "Spitfires" subscribed for in 1940 by all grades of L.N.E.R. staff, has been converted into a "Seafire" and is being used for training Fleet Air Arm pilots. During its early days "*Flying Scotsman*" was attached to the Natal squadron and piloted by the squadron commander. It completed many operational trips, which included sweeps, escorts, interception and convoy patrols, the shooting-up of enemy minesweepers, and air-sea rescue work, and it was successful in destroying a Focke-Wulf Fw 190. Now it is attached to an R.N.A.S. base. Pilots who have already gained "advanced" experience from it include many who put their learning to the test in the Salerno landings.

The other "Spitfire" was named "*West Riding*," also after a famous L.N.E.R. express. This machine, piloted by a Dutch flight lieutenant, made many flights over enemy territory, and eventually was shot down while escorting bombers.

* * * *

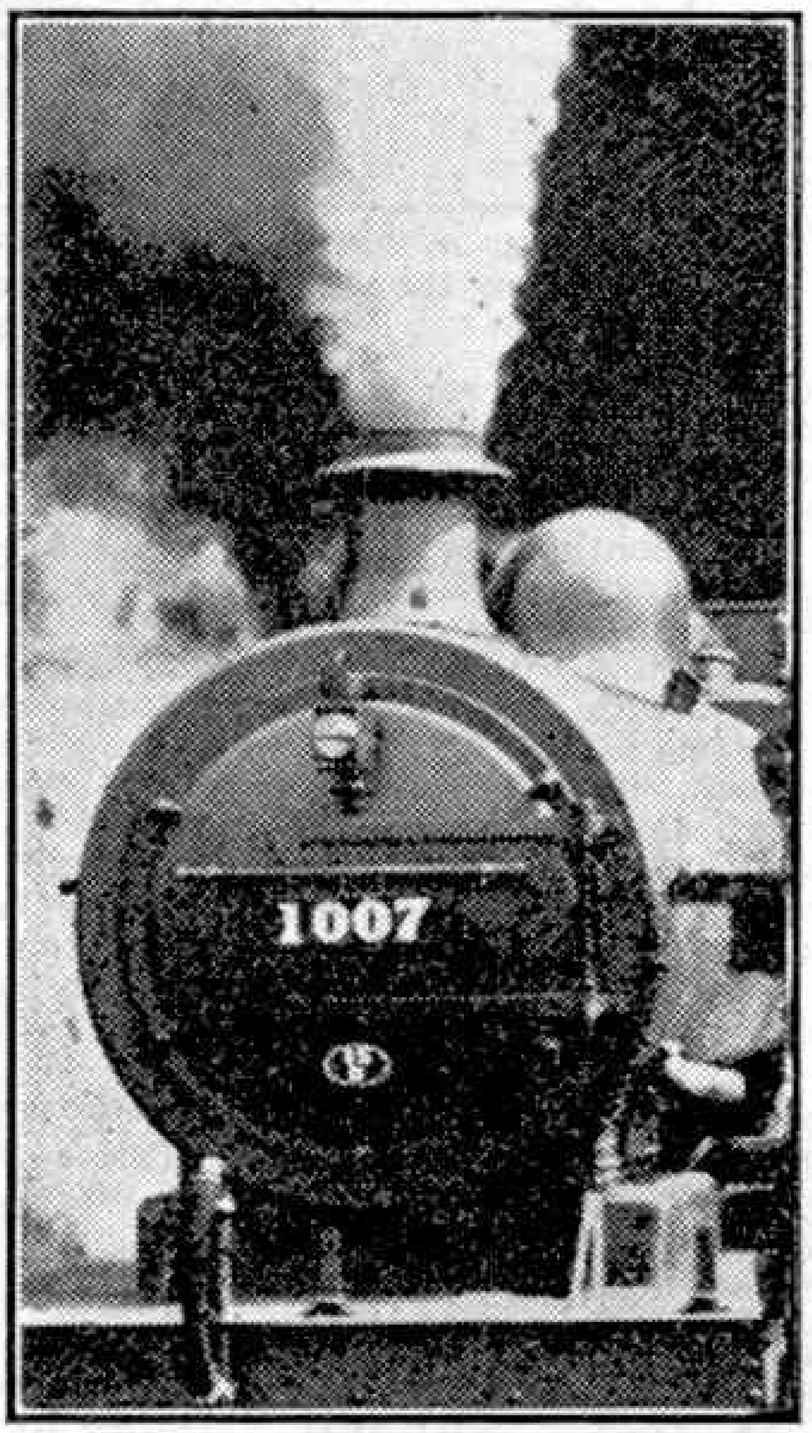
The National War Museum of Australia is to be enriched by the addition of two scale model aircraft, one of a Handley Page "Hampden" and the other of a "Halifax" II. Sir Frederick Handley Page has presented the models to Mr. S. M. Bruce, High Commissioner for Australia, to be sent to the Museum.

Have You Ever Thought About This?

Why Does a Locomotive Puff?

EVER since locomotives began running up and down railway lines they have been "puffers" to the only persons who always really say what they mean, that is to small boys. They are probably "puffers" to most older railway enthusiasts also, although to avoid being looked upon as childish these may talk of locomotive engines and speak of exhaust beats instead of puffs. Long names do not alter facts, although they may hide them sometimes. The important thing is that a locomotive has to puff, and the music and rhythm of its puffing are its most characteristic outward features.

We all admire modern named engines, but are not always well pleased with the choice of names. Why call an engine, and a "Bulldog" at that, after such a spindle-legged bird as a flamingo, for instance? Or even after a nightingale for that matter? The songs just cannot be compared. There is a little more sense in "*Thunderer*" or "*Colossus*," but to my mind the only engine that was ever rightly named was Hedley's "*Puffing Billy*." This puffed to such good purpose that it used to blow out most of its fire and scatter red-hot cinders over the countryside; and although the puffing is better controlled nowadays, the name this engine won for itself has come to stand for any locomotive.



ENGINE TALK

In order to find out why an engine puffs we must obviously see what it does. When we look at one waiting to start from a terminal station, it is a lifeless mass of painted steel, but the giant even then gives us some hint of the life within it, by the hiss of escaping steam or perhaps by a subdued, far off rumble suggesting that it is liable to eruption at any moment. Then comes the signal for departure. The driver moves the handle that lets steam into the cylinders—when we grow older we say that he opens the regulator valve—and the monster moves off, with one mighty puff shooting upward at high speed from the chimney that unmistakably is a shout of joy at being allowed to leave the gloomy interior of the station. Immediately afterwards comes another puff and as speed is gained the puffs follow in more rapid succession.

From that moment the engine is all puffs. As it settles down to a steady run on the level the puffs come easily and regularly, but on an incline the monster perhaps becomes short of breath. At any rate its puffs slow down and become sharper as more and more is demanded from it, but you too would pant and puff in a laboured fashion if you were hauling a huge load up a hill. "*I think I can, I think I can*" is the meaning of the slow hard puffs, each clearly expressive of the great effort with which the top of the rise is approached, but when hard work and determination have carried the load over the summit the puffs come more rapidly and take on a higher and triumphant note, as if they were saying "*I thought I could, I thought I could.*"

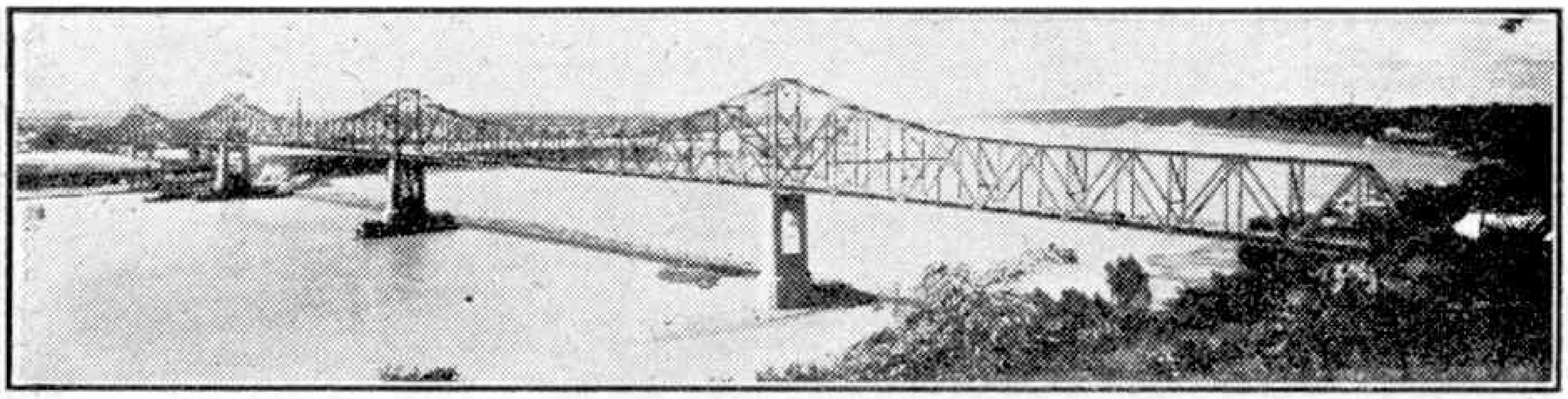
WHERE THE PUFFS COME FROM

Now the puffs tell the story of what is happening inside the engine, to which they are the breath of life. We only hear the end of them, for it is in the cylinders that they do their chief work, whether these are plainly seen at the front of the engine or are of the inside type, hidden under the smoke-box, with the "works" between the wheels. In each the steam is breathed in from the boiler, to push the piston backward and forward, valves directing it first to one side and then to the other. As each puff or breath comes in the one that has just done its share of the work, on the opposite side of the piston, has to be breathed out so that the return movement of the piston is not hindered. The valves are responsible for this too, opening up a passage through which the steam can escape and closing it again when this has been pushed out by the returning piston.

It is this escaping steam that does the puffing that we hear. From the cylinders it passes through the valves and exhaust pipes to the blast pipe in the smoke-box, which is directly under the chimney and in line with it. The exhaust steam comes in pulses each consisting of a mass of steam that has just pushed the piston along the cylinder, and each is shot out in one sharp blast. With an engine running at a steady speed, which means that the piston too is careering backward and forward at a constant rate, the puffs come regularly, packet after packet of steam being whirled into the cylinders and then shot out of the blast pipe and up the chimney. When collar work is called for the driver gives the cylinders more steam, and then the puffs become noisier, more expressive and almost explosive. In fact they become real snorts.

PUFFING TRICKERY

Those who love the puffing of a locomotive will be delighted to recall that there is more in it than meets the ear. Every puff indeed has a double mission, for it has work to do, and very important work at that, while it is being unceremoniously kicked out as well as on its way through the cylinders. In its upward career at high speed from the blast pipe through the chimney above it carries with it part of the air in the smoke-box. This doesn't exactly create a vacuum, but it goes near enough to alarm Dame Nature, who is said to abhor such a thing, and she promptly rushes air in to fill up the space again. Thereby she falls into a trap, for the locomotive engineer has cunningly arranged that this air must enter through the fire-box and the tubes through which the fumes and gases from this reach the smoke-box. This is just what the fire wants to make it burn more brightly, so that in its headlong flight from the cylinders every puff helps to raise more steam to carry on with the good work—and of course to provide more puffs!



The Natchez-Vidalia road bridge, which stretches more than a mile and a half over the waterway and banks of the Mississippi River. The steelwork of the bridge, 8,240 tons in all, was erected in the record time of less than six months. Photography by courtesy of the Bethlehem Steel Co., Pittsburgh, U.S.A.

Engineering News

Pumping a Lake Dry

In "*Engineering News*" in the June 1943 issue of the "*M.M.*" plans to work immense deposits of high grade iron ore in the bed of a lake in Ontario, Canada, were reported. These plans have now been put into operation. The first idea was to sink shafts on the shore and to drive tunnels under the bed of the lake to reach the ore. We learn from the "*Compressed Air Magazine*" that this scheme was abandoned in favour of simply removing the lake, after which it will be possible to dig up the iron ore.

The scene of this gigantic scheme is Steep Rock Lake, which is about 130 miles west of Lake Superior. It is in a country of lakes and rivers, and the first step was to divert the water of the Seine River, which formerly flowed through the lake. This was done by the erection of dams at various points, and by cutting a channel leading from a larger lake in the course of the river above Steep Rock Lake to another one about half a mile away. This channel is in two sections 1,000 ft. and 1,600 ft. long respectively, which are separated by a smaller lake, and both are 100 ft. wide at the bottom, with sheer walls up to 70 ft. in height. They were cut chiefly in solid rock. Until all was ready for the water to be diverted rock plugs were left at the ends of the channel, and each was finally blown away in a gigantic blasting operation. The larger block contained 7,000 cu. yds. of rock, and in this about 5 miles of drill holes were made and loaded with 15 tons of dynamite. The blasting itself was very spectacular. The man who closed the electrical contacts that fired the charges was only about 400 ft. away, crouching inside the steel bucket of a power shovel and watching the result through a rivet hole. Fragments of rock were showered over the whole countryside, and a wall of water 25 ft. in height rushed into the channel.

The lake into which the Seine River was diverted was originally 35 ft. higher than the one from which the water was tapped. Because of this it was necessary to lower its level before the diversion could be made, and this was done by means of a tunnel leading into another waterway, which is now broadened out into a long narrow lake. Now the Seine completely bypasses Steep Rock Lake, except for a portion that has been shut off by a dam.

The ore deposits are in the isolated part of Steep Rock Lake, which covers an area of more than 4 sq. m. and has a maximum depth of 300 ft., and the water in this is now being pumped out. This work is on an immense scale. Seven barges are anchored near the shore of the Lake. Each of these carries two pumps, electrically driven, and between them the 14 pumps in use reduce the amount of water in the lake by more than two million tons a day.

When the water level has been sufficiently reduced the mud and earth over the ore will be removed by a section dredge and mechanical shovels, and an attack will then be made on the ore itself. There are three deposits, which are believed to amount to at least 32,000,000 tons. In the meantime a branch line is being built from the C.N.R. main line 3½ miles away and cars are being constructed in which to haul the ore to Port Arthur, on Lake Superior, where an ore loading dock is under construction.

The Giant South African Graving Dock

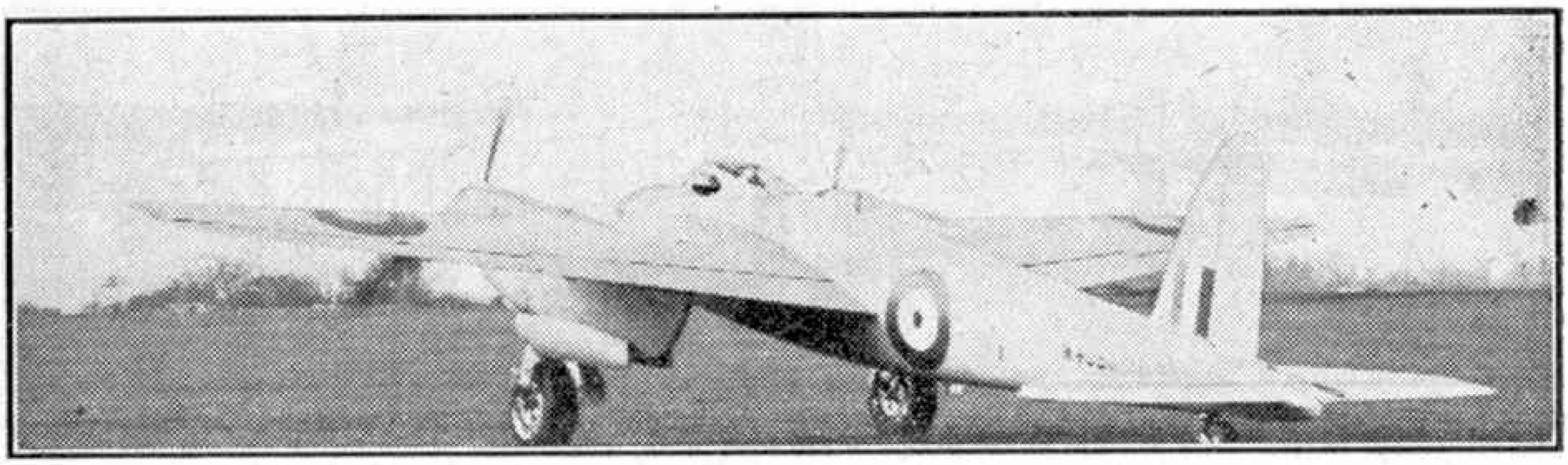
Splendid progress has been made with the construction of the giant graving dock at Cape Town, to which reference has been made on several occasions in these notes, and it is now expected that within two years the largest battleships and liners in service will be able to make use of the dock for underwater repairs and overhauls. Work is proceeding night and day, powerful flood-lights being employed in darkness, and the construction time will create a record for a dock project of this magnitude.

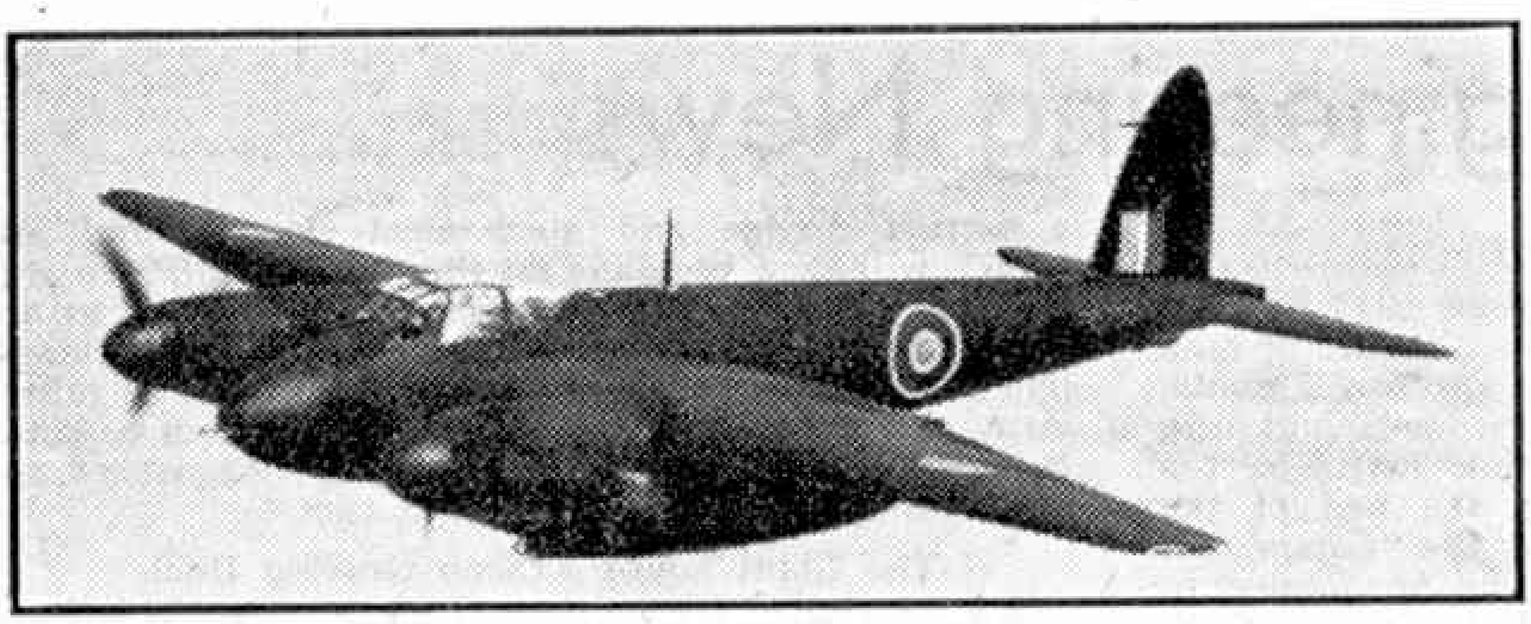
It is only 16 months since pile driving for the construction of a cofferdam to enclose the site was begun. On its completion the area was pumped dry and scoops then removed the mud at the rate of hundreds of tons a day. The laying of concrete for the walls, at the shore end, began in December last. As soon as the floor at the shore end of the dock has been laid down work will begin on the assembly of two caissons, one to close the entrance to the dock and the other to divide it into two portions of different lengths when required. Steel for the caissons is already being made in Scotland.

It has been finally decided that the dock is to be 1,248 ft. long, with an entrance width of 148 ft. It will therefore be larger than the King George V dock at Southampton, which has an extreme length of 1,200 ft. and an entrance width of 135 ft. The erection of new quays and sheds, the deepening of an existing basin, and the re-claiming of a large area of new land are other important parts of the scheme, which will give Cape Town one of the finest harbours in the World. In addition a great new railway station is to be built and a new civic centre is planned, so that the city will become an imposing gateway to the Union.

New York's 85-Mile Aqueduct

Immense quantities of water are required by a city of the size of New York. The previous supply sources for this city furnished about 1,000 million gallons of water a day, and a new system just been brought into use will add 540 million gallons daily when further storage reservoirs now under construction are completed. The outstanding feature of the scheme is an aqueduct 85 miles in length tunnelled underground at depths varying from 310 ft. to 1,550 ft. according to the height of the ground above it. The aqueduct varies in diameter from 13 ft. 6 in. to 19 ft. 6 in., and is lined with concrete.

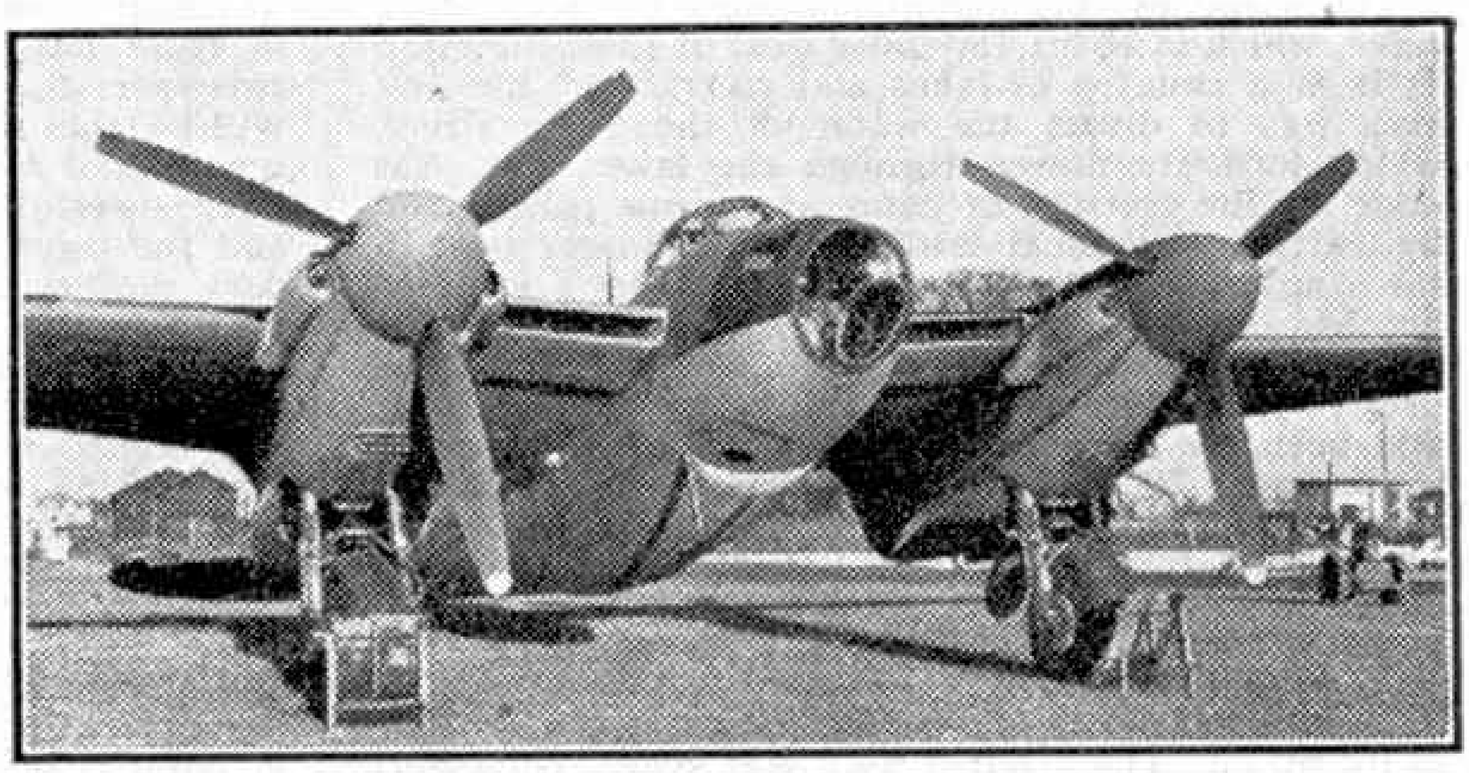




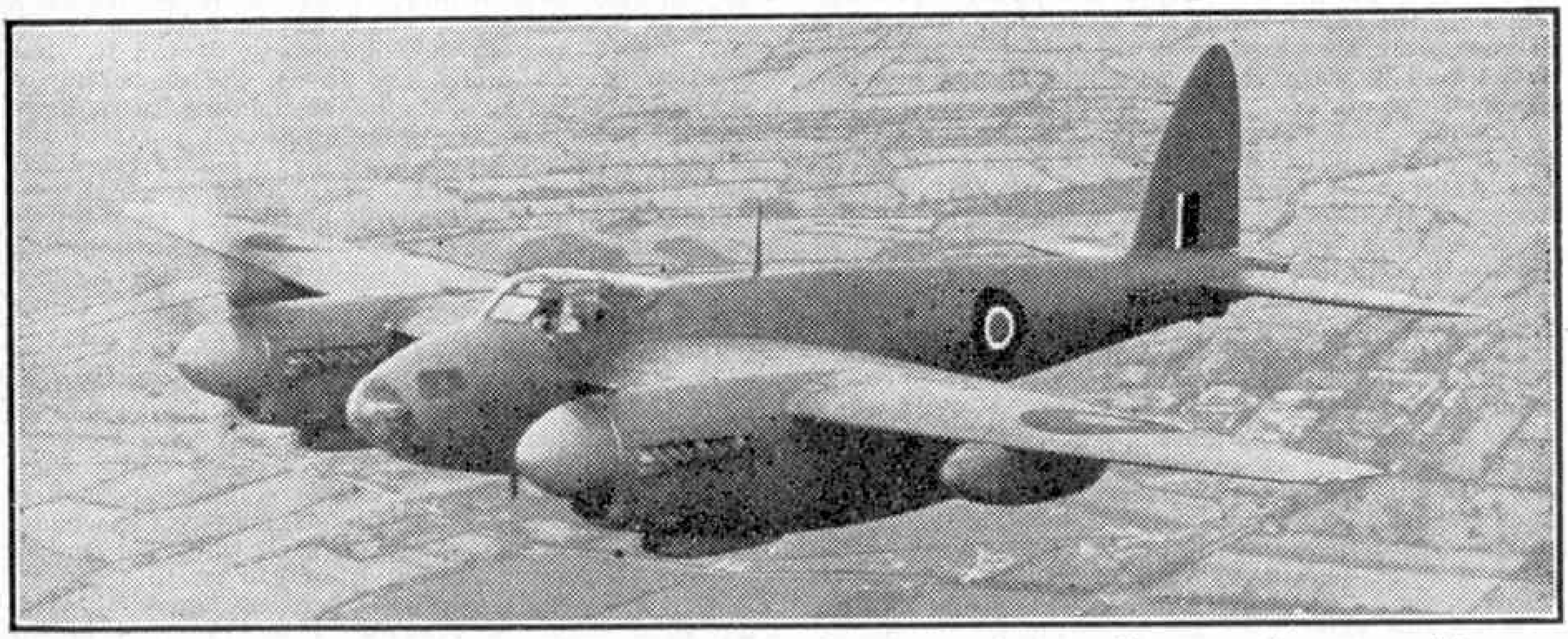
(Above) The first "Mosquito," designed to carry four 250 lb. bombs. (Left) D.H. "Mosquito" Mk II fighter, armed with four cannons and four machine-guns.

The "Mosquito" Develops

Some stages in the life of this famous de Havilland aircraft.



The latest "Mosquito" bomber, which carries a 4,000 lb. bomb.



Another version. The "Mosquito" as a high-altitude long-range photographic reconnaissance machine.

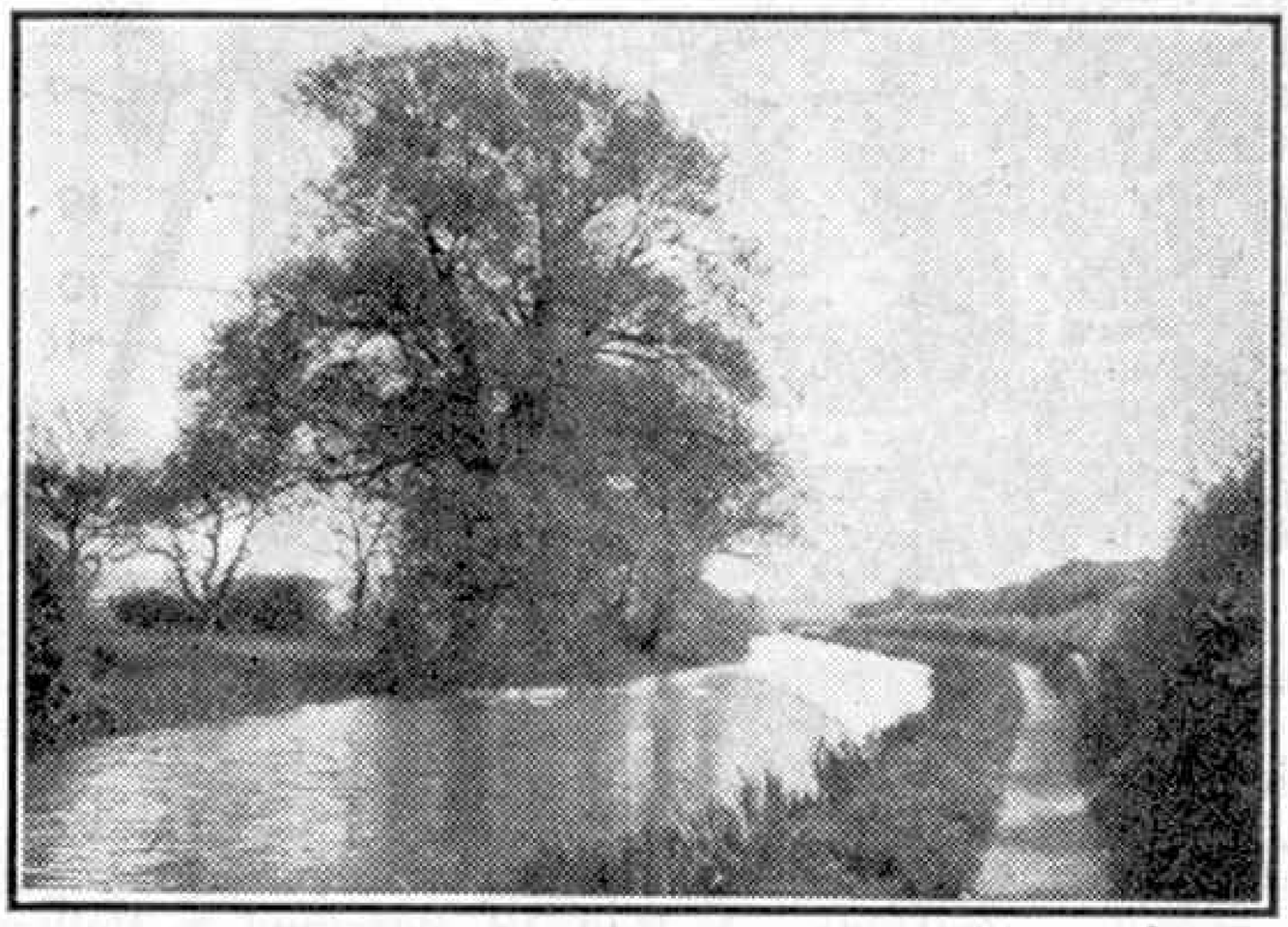
Photography

Colour and Distance

By A.R.P.S.

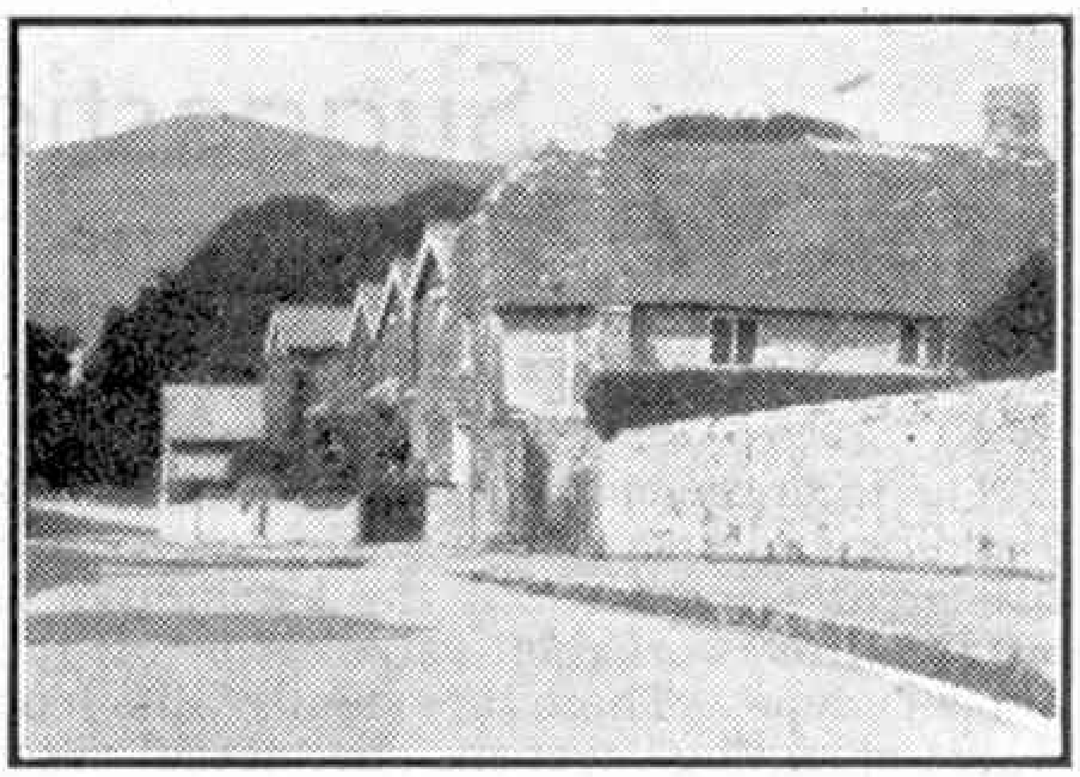
THIS month I want to draw attention to two very common mistakes made by amateur photographers. These mistakes result in many failures, which are often particularly disappointing because the photographer expected the picture to turn out specially well.

The first mistake is due to colour. Nature paints our countryside in a great variety of beautiful colours, and it is only natural that we should want to reproduce colourful scenes that specially attract our attention. The question to ask ourselves before we photograph such a scene is whether this includes some features of interest in the foreground or middle distance. If it does, the colour will help to give tone values and gradation, and the result probably will be a successful picture. But if the scene does not include such features, and depends for its interest entirely on a mass of colour, pass it by, because a black-and-white version will be quite worthless.



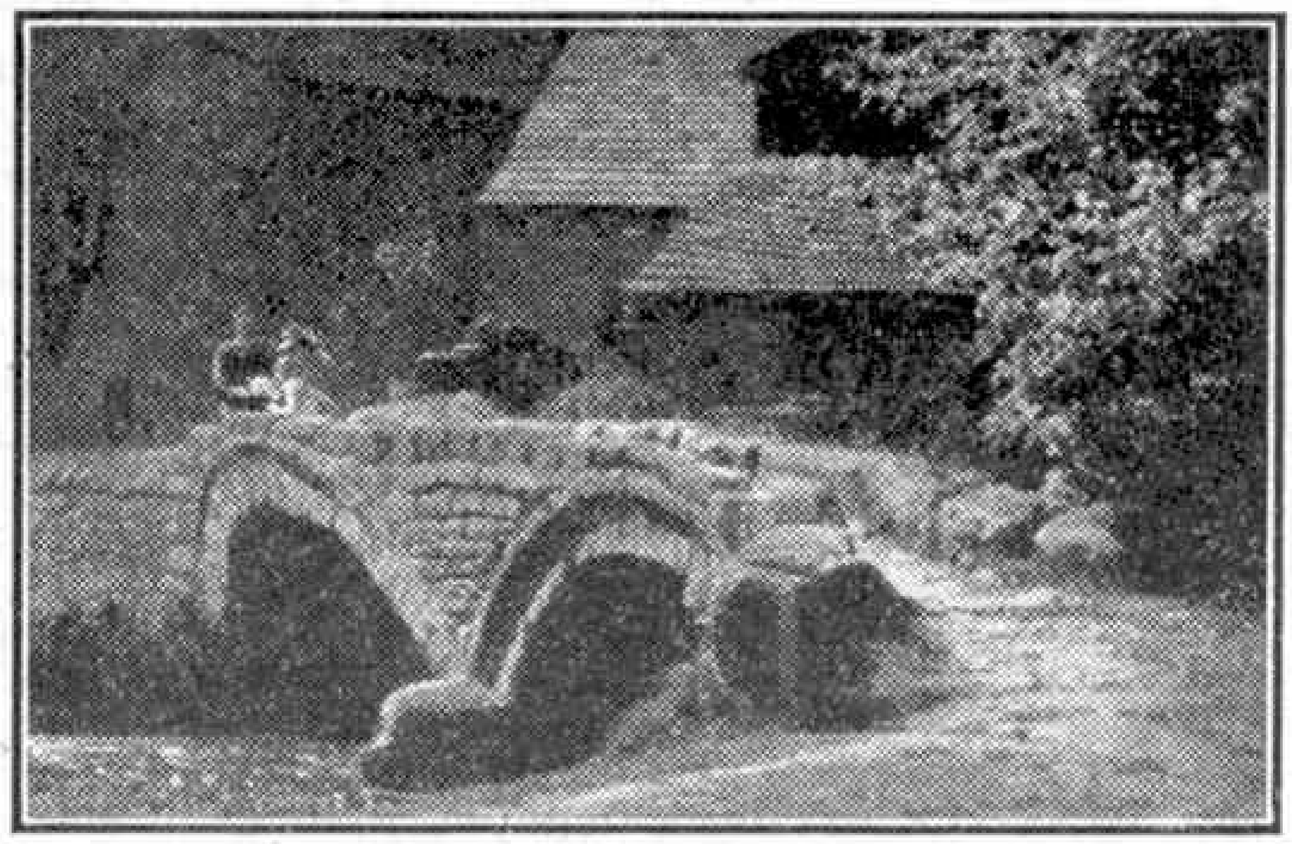
"Quiet Waters." Photograph by P. R. Wickham, Leicester.

A few years ago I was staying in the West of Scotland. One evening there was the most gorgeous sunset I have ever seen. In our party there happened to be a good number of cameras, and I calculate that at least three dozen exposures were made of that sunset; yet not one of them was any good. The sunset depended for its beauty entirely on colour, and when this was taken away there was nothing left.



A Sussex village. Photograph by O. Keef, British Columbia, Canada.

The second mistake is due to distance. How often have I stood on a hill top and heard the cameras clicking in the attempt to make pictures of a scene extending over miles and miles of open country, with no points of interest in either foreground or middle distance. Such an attempt is hopeless. The attractiveness of a scene of this kind lies almost entirely in the distance that the eye can cover, and the ordinary camera lens simply cannot reproduce the effect. The eye adjusts its focus to different distances in a marvellous way, but the lens cannot do this. We feel quite excited at seeing clearly some object that we know is miles away across country; but think how this object will appear when we try to squeeze all these miles into 3¼ in. by 2¼ in.!



The Old Bridge. Photograph by G. Gemmill, Burnley.

Suggestions Section

By "Spanner"

(645) Stephenson's Link Motion for Locomotives

The interest and pleasure obtained from building and operating a model locomotive are greatly increased if the locomotive is fitted with workable valve gear of the proper type. There are many different valve-operating systems in actual use, and one of the oldest is that known as Stephenson's link motion, of which a reproduction in Meccano is shown in Fig. 645 on this page.

A construction known as the expansion link is built up from two 2½" radius Curved Strips secured and spaced apart at the top and bottom by nuts placed on the shanks of ⅜" Bolts. At the centre of these Bolts, loosely mounted between the two inner spacing nuts, are the eccentric rods 13 and 14. These are bolted at their other ends to the Eccentrics 10 and 11, which are secured to the main driving axle 12 by the bosses nearest their centres, giving a ½" throw to each Eccentric. The Eccentrics work in opposite positions in order to rock the expansion link about its centre.

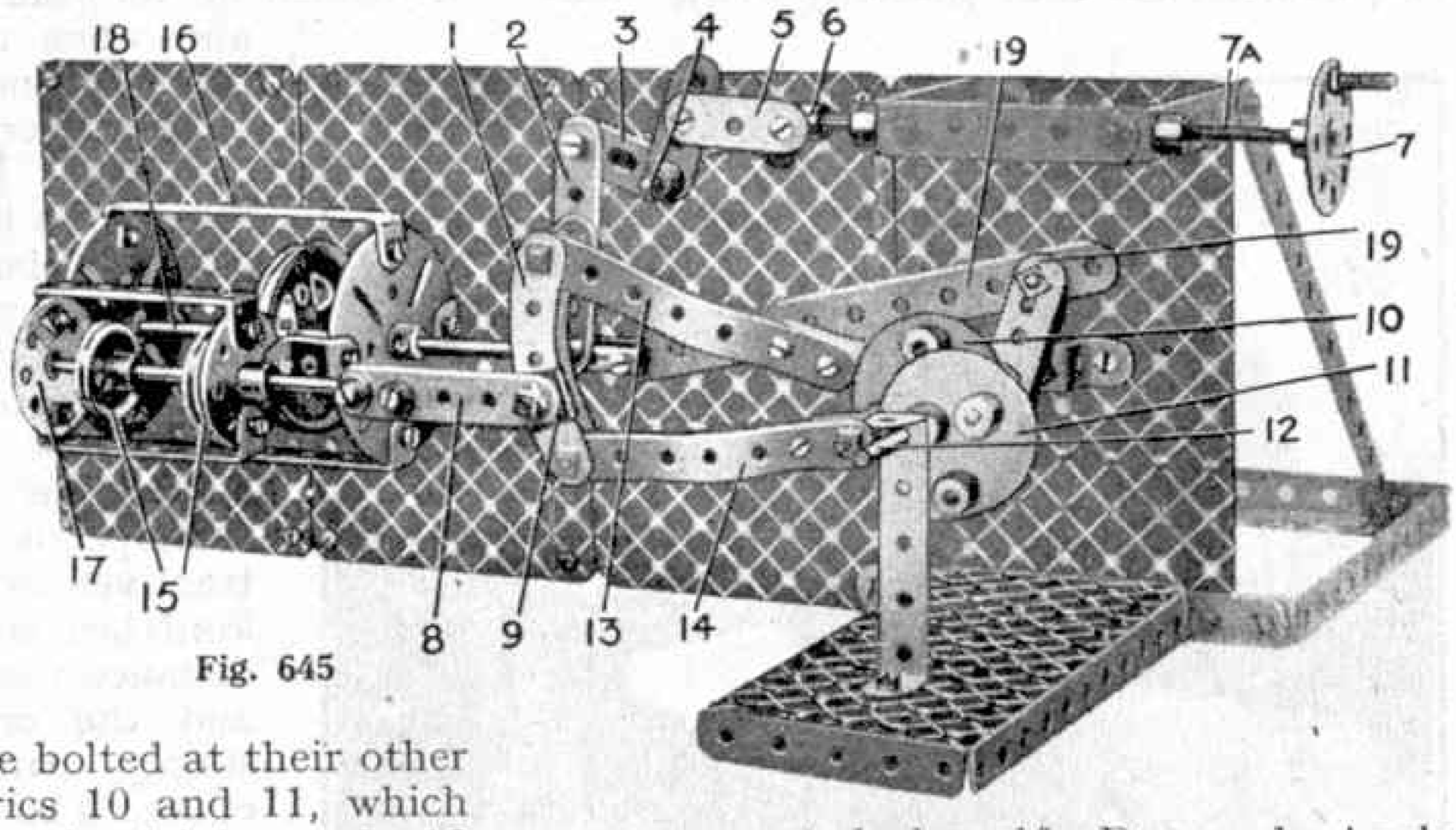


Fig. 645

A Pivot Bolt passes through the centre hole of the rear 2½" Curved Strip in the expansion link, and is secured in the boss of a Crank bolted to the 2" Strip 2 forming a suspension link, which is attached pivotally by means of a bolt and lock-nuts to one arm of the Boss Bell Crank 3. This is secured to the shank of another Pivot Bolt 4 journalled through the outer end of a 2½" × ½" Double Angle Strip, the other end of which is bolted to the rear framework. One end of a 1½" Strip 5 is rigidly bolted to the Threaded Boss 6, Washers being placed on the Bolt to make sure that it does not touch the Threaded Rod on which the Boss moves; the other end of the Strip is loosely connected by bolts and lock-nuts to the elongated hole in the upper arm of the Bell Crank. By operation of the hand-wheel 7 the Threaded Boss 6 is made to travel to and fro along the Threaded Rod 7a, thus rocking the Bell Crank 3 about its pivot 4. In the case of a model locomotive the handwheel is placed in a convenient position in the driver's cab.

The piston valves, represented by 1" Pulley Wheels 15, are connected by means of the 2½" Strip 8 to an Eye Piece 9 that fulfils the functions of the die and slides on the outer Curved Strip of the link.

The cylinders 16 and steam chest 17 are connected by ½" Reversed Angle Brackets. A Rod 18, carrying a Pulley Wheel representing the piston, is attached by a Strip Coupling to the connecting rod 19, which is mounted on a ½" Bolt secured in the ends of two Cranks forming part of the main axle 12.

(646) Examples of Meccano Gear Ratios

The most positive method of transmitting the drive from one shaft to another is by means of gears, and of these parts the Meccano system has a most complete and varied range. Many remarkable gear reductions are possible with the aid of these gears. One of special interest is a gear-train formed entirely of Worms and ½" Pinions that gives the enormous reduction ratio of 2½ million to one, yet the size of the entire gear-box is only 2½" by 2½" by 1½".

A reduction ratio of this extent is of no practical use in Meccano model-building, but all the ratios normally required can readily be obtained from various arrangements of the different gears in the range.

A few useful examples are described here for the benefit of readers who may not be very familiar with the use and arrangement of gearing.

Contrate wheels are available in two sizes, 1½" and ¾", the first size having 50 teeth and the second 25 teeth. By meshing these with ¾" Pinions it is possible to produce ratios of 2 to 1 and 1 to 1, the driving shafts in both instances being set at 90 deg. to the driven shaft. Examples of these arrangements are shown on the left-hand side of illustration Fig. 646. In the centre of this illustration is seen an arrangement consisting of a Worm meshed with a 57-teeth Gear. This is suitable in cases where a right-angle drive is required between two shafts not in the same plane, or where a very low reduction gear is required. Although non-reversing, this gear arrangement has a very wide application and its units can be meshed with all the spur gears and pinions in the Meccano range. In the example shown the reduction ratio is 57 to 1.

In place of Contrate Gears, Bevel Gears can be used, and these are available in three sizes, giving two different reductions. Two ⅞" Bevels meshed together will produce a 1 to 1 ratio, while a 1½" and a ½" Bevel used together will give a 3 to 1 gear ratio, both shown on the right-hand side of Fig. 646. These Bevels are not interchangeable.

A very useful Gear Wheel in the Meccano range is the 2½" Gear, by means of which it is possible to arrive at any gear ratio having a common multiple of five, such as

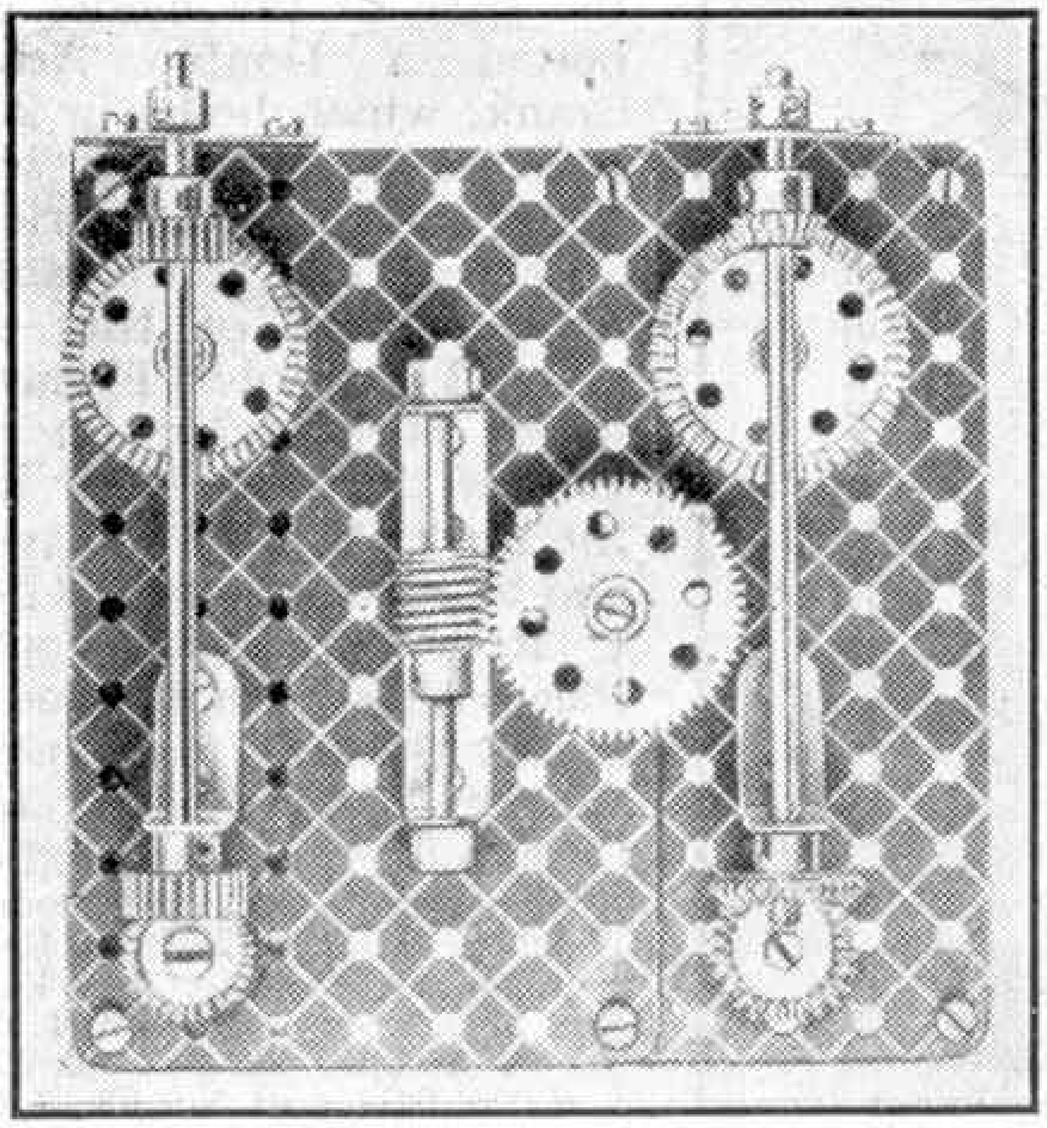


Fig. 646

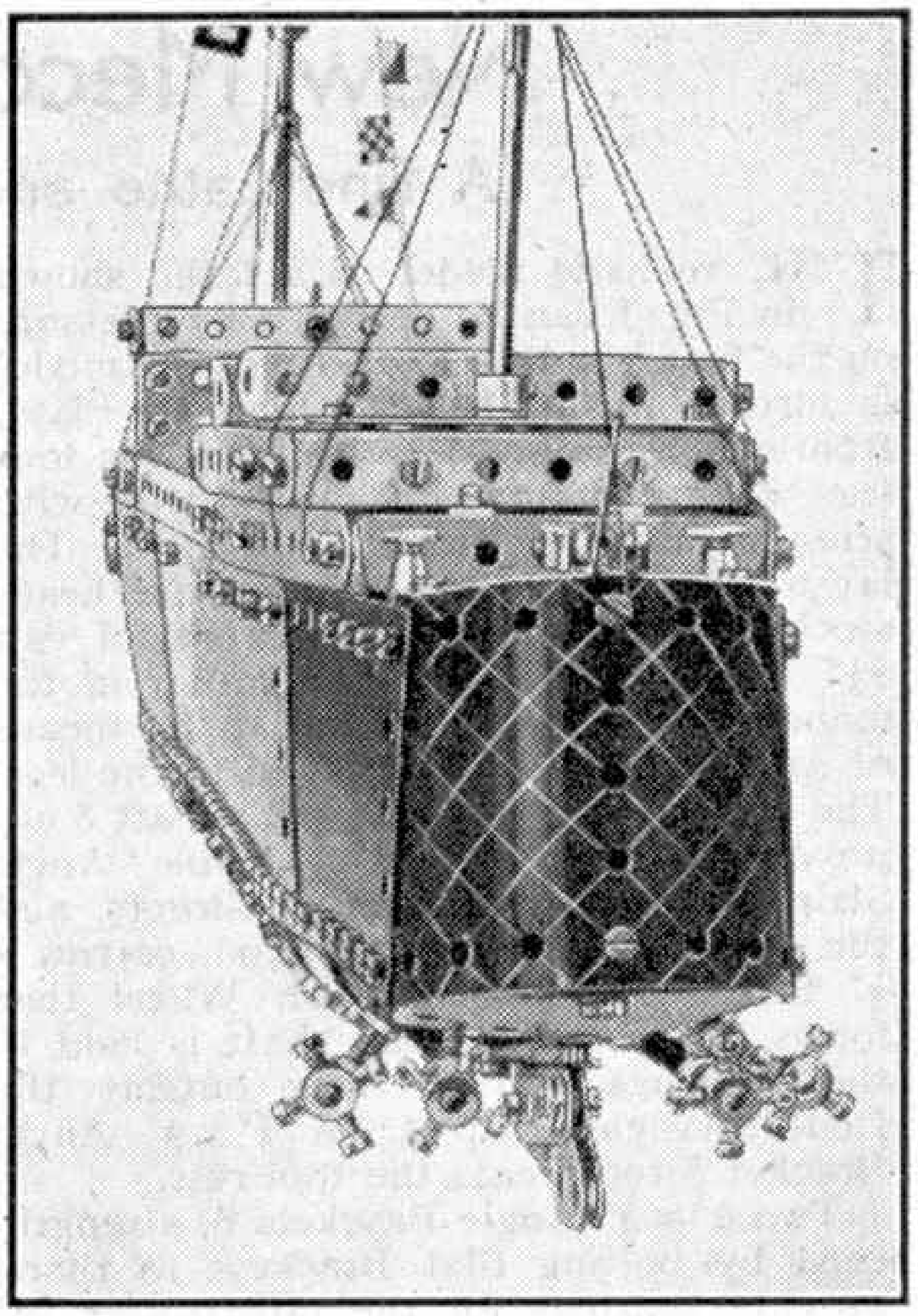


Fig. 647

25 to 1, 50 to 1 and 100 to 1. For example, when meshed with a ½" Pinion it gives a 5 to 1 ratio, while if a 1" Gear is used in place of the ½" Pinion the result is a ratio of 2½ to 1.

(647) Propellers for Small Model Ships

Most model-builders who try to reproduce ships make their models of the waterline type, but those who have a good supply of Plates and Strips will find it even greater fun to construct a complete hull and fit it with propellers and a driving motor. Fig. 647 shows a stern view of a fine model liner built in this manner and fitted with four miniature working propellers. Each propeller consists of a spider from a Swivel Bearing, in the tapped bosses of which four Bolts are inserted to represent the blades. These Bolts also grip the propeller shaft, the bearings for which are provided by the stern framework and a Collar secured to the framework by Bolts of suitable length.

An advantage of constructing propellers as in this model is that the scale can be varied simply by using longer or shorter Bolts as necessary. Alternatively, a very neat effect can be obtained by using Threaded Pins instead of Bolts, and if desired these can be fitted with Collars.

New Meccano Models

A Fine Lathe and a Simple Balance

THE realistic model of a lathe shown in Fig. 1 can be operated by pressure on the foot treadle. The base of the model is formed by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, from which the bed 1 is supported on four legs, each consisting of a $5\frac{1}{2}''$ Strip, with strengthening $1\frac{1}{2}''$ Strips 2 as shown. The lathe bed itself, which carries the headstock and the tailstock, consists of two $5\frac{1}{2}''$ Angle Girders bolted together in the manner indicated and attached by means of Angle Brackets at each end to the legs. The bearings for the headstock shaft 3 are provided by a $2\frac{1}{2}'' \times 1''$ Double Angle Strip 4 bolted to the Angle Girders, and the shaft itself, a 3" Axle Rod, carries a $\frac{1}{2}''$ fast Pulley and a Bush Wheel that forms a face plate. The shaft is held in the bearings by a Collar outside the Double Angle Strip 4. A $1'' \times \frac{1}{2}''$ Angle Bracket 5 represents the tool rest.

Two $1'' \times \frac{1}{2}''$ Angle Brackets 6, strengthened by bolting Flat Brackets to them, provide bearings for the tailstock, a $2\frac{1}{2}''$ Screwed Rod 7, and this is screwed through the central threaded bore of a Threaded Boss held between the $1'' \times \frac{1}{2}''$ Angle Brackets 6. The handwheel is a 1" Sprocket Wheel fixed to the Screwed Rod.

The foot treadle and its supports are constructed as follows. To the left-hand $1\frac{1}{2}''$ Strip bolted across the legs a Double Bent Strip 8 is fixed, and a 2" Rod is passed through the middle holes of the Strip and the Double Bent Strip. The Rod carries a Flywheel and a 3" Pulley, and a 2" Strip 9 is held by means of a Spring Clip on a $\frac{3}{4}''$ Bolt in one of the holes in the 3" Pulley as shown in Fig. 1, the Strip being spaced from the Pulley by four or five Washers. A $2\frac{1}{2}''$ Strip 10 is pivotally connected to the 2" Strip by a lock-nutted Bolt 11, and at its lower end is pivotally attached to an Angle Bracket bolted to the Flanged Plate, the Bolt 12 also being lock-nutted.

Parts required to build model Lathe: 4 of No. 2; 1 of No. 5; 1 of No. 6; 1 of No. 6a; 2 of No. 9; 2 of No. 11; 1 of No. 12; 1 of No. 12b; 1 of No. 15b; 1 of No. 16b; 1 of No. 19b; 1 of No. 23a; 1 of No. 24; 26 of No. 37a; 24 of No. 37b;

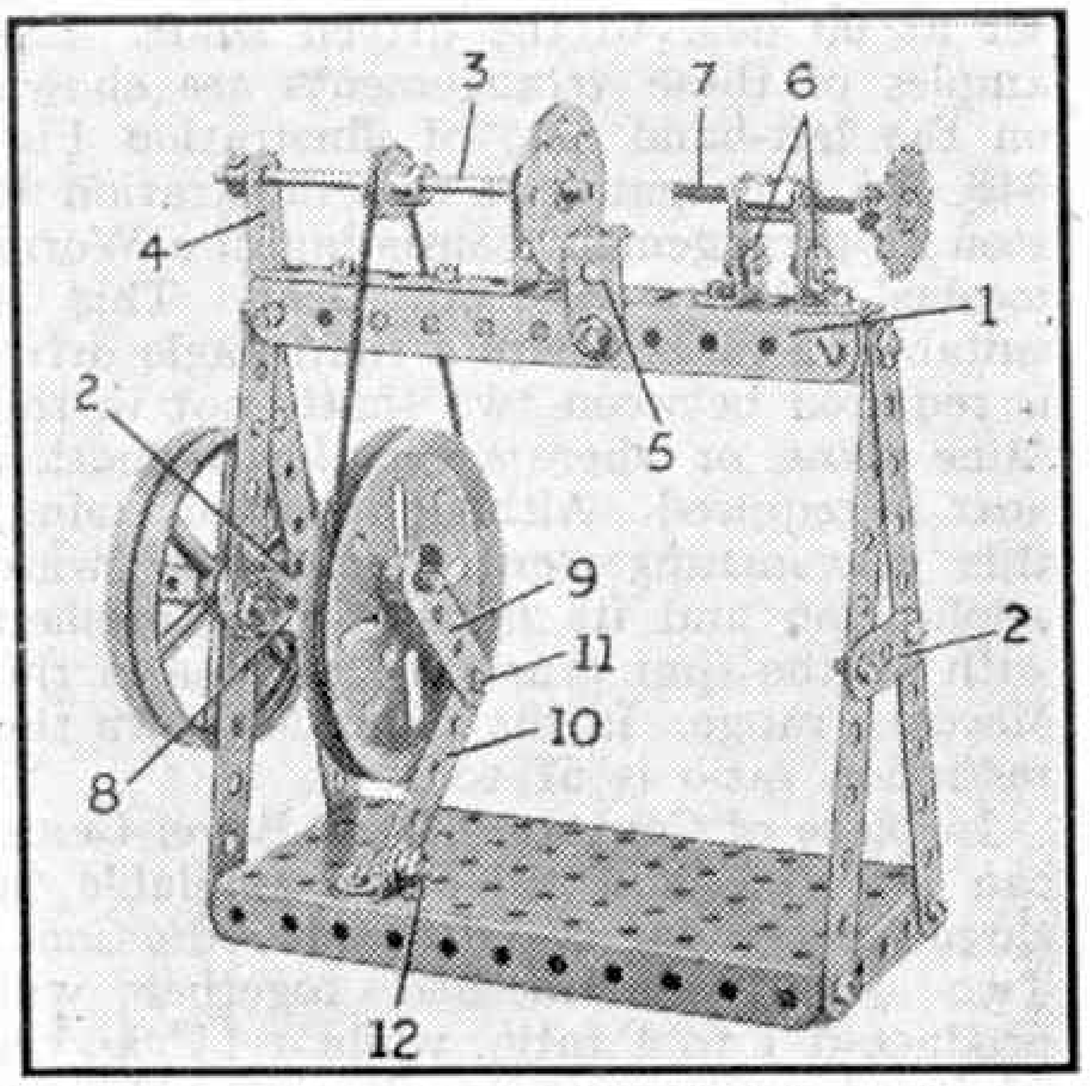


Fig. 1. A model lathe that is realistic in construction and operation.

1 of No. 45; 1 of No. 46; 1 of No. 52; 2 of No. 59; 1 of No. 64; 1 of No. 81; 1 of No. 96; 1 of No. 132; 1 of No. 186a.

Our second model is a simple balance that can be used to weigh small objects. It is shown in Fig. 2. To the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate that forms the base of the model is bolted a Double Arm Crank, which holds in its boss an 8" Rod. At its upper end this Rod carries a Large Fork Piece 1, and in the arms of this is pivoted a Girder Frame, which is mounted on a 1" Rod held in place in the Fork Piece by Collars, and at its end supports on 1" Rods two Large Fork Pieces fitted with $6\frac{1}{2}''$ Rods 2 and 3. The pans are Wheel Discs bolted to Cranks fixed on the Rods.

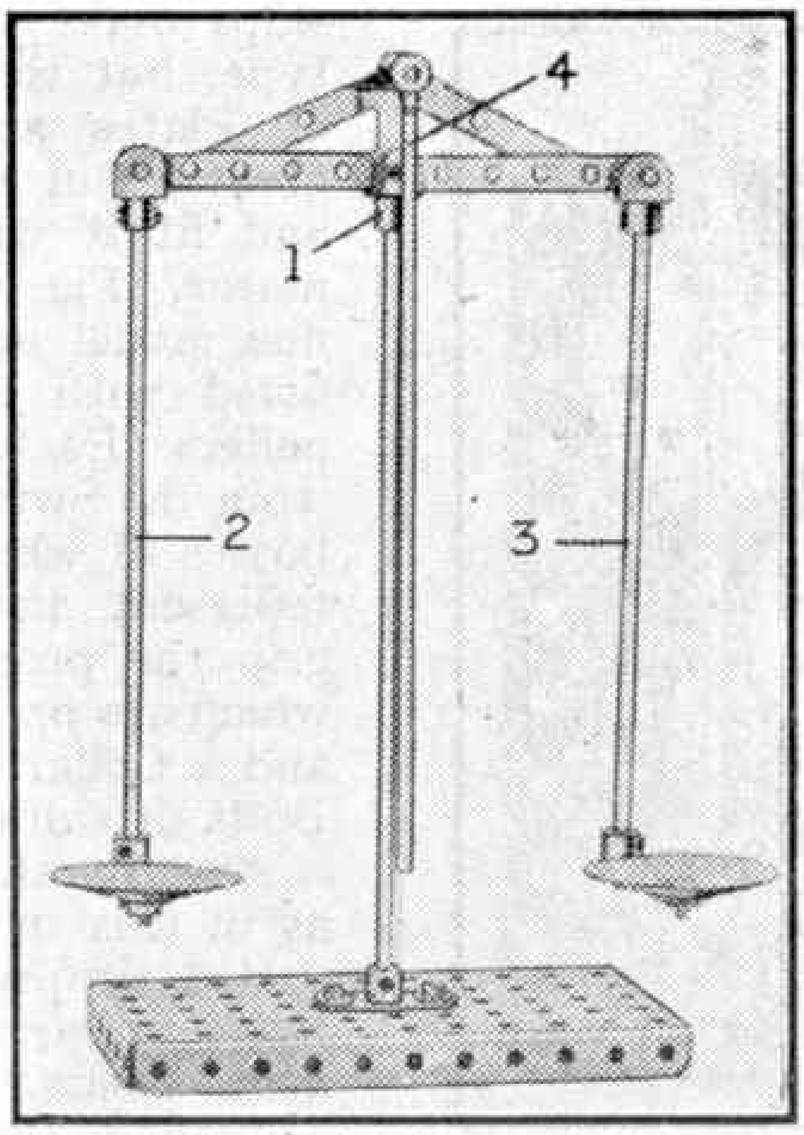


Fig. 2. This simple Meccano balance can be used for actual weighing.

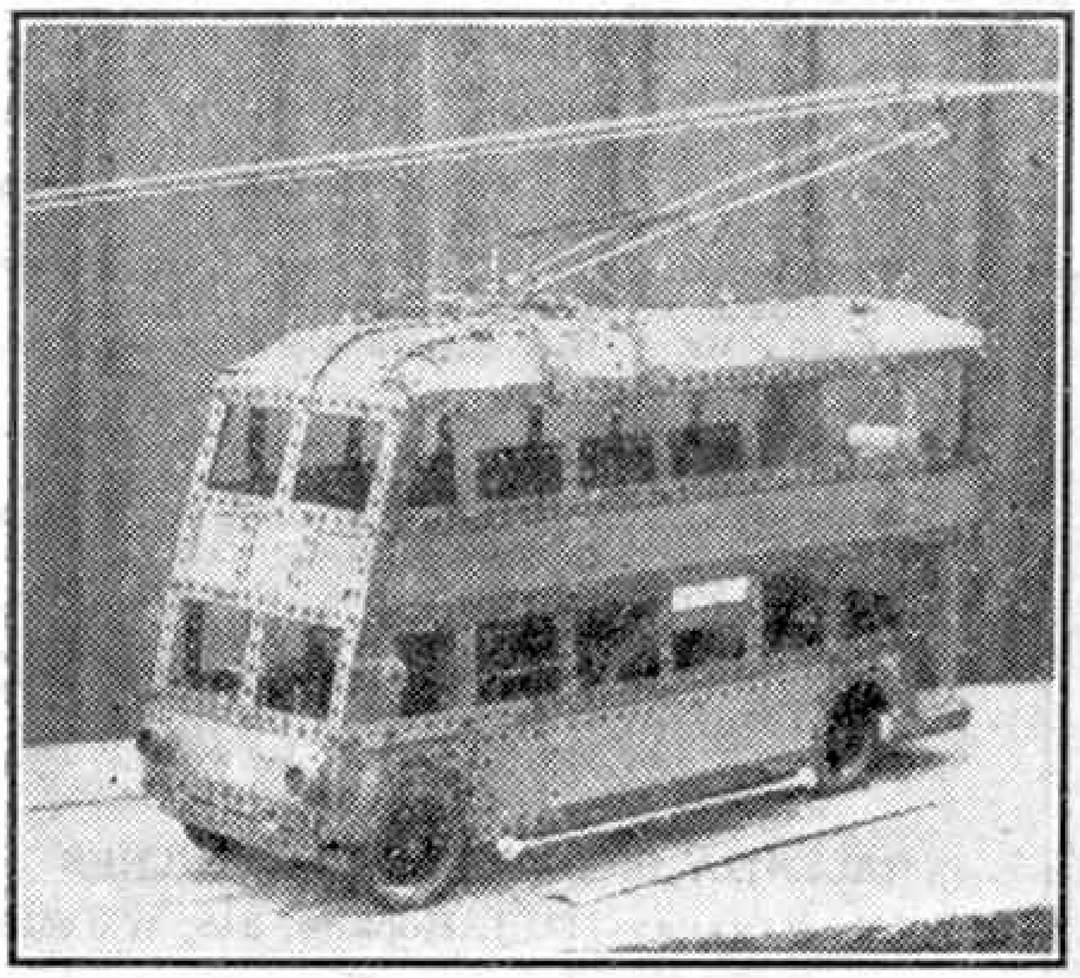
Parts required to build model Weighing Balance: 2 of No. 13a; 2 of No. 14; 3 of No. 18b; 4 of No. 37a; 4 of No. 37b; 1 of No. 52; 5 of No. 59; 2 of No. 62; 1 of No. 62b; 1 of No. 63; 1 of No. 111; 1 of No. 113; 3 of No. 116; 2 of No. 219.

Meccano Model-Building Competitions

By "Spanner"

Summer "Simplicity" Contest

This attractive competition, in which handsome prizes await successful entries, is open for yet another month, so that model-builders have plenty of time to build models and prepare entries. The opportunity is particularly good for those whose stock of parts



J. E. Meggitt, Ipswich, was awarded Second Prize in Section B, New Year Model-building Contest, for his model trolley bus.

is limited, for the simplest models may win the prizes, and also for those who cannot obtain films with which to photograph their entries, since "Simplicity" models are easy to draw. So start now and see that your entries are in good time.

The first step in the preparation of an entry is to choose a subject that can be represented realistically by a small number of parts. It is a good plan to examine the result very carefully to see if certain parts can be missed out, or replaced by others, fewer in number perhaps, that will give an even better effect. The prizes will go to those whose models show the best uses for the least number of parts, so that there will be plenty of scope for model-builders to exercise their ingenuity in simplifying. More than one model may be entered by any competitor, but no competitor can win more than one prize.

When the model is ready the competitor should have it photographed or make drawings showing its general appearance and construction, and these should be forwarded, together with any necessary notes, to *"1944 Simplicity Model-Building Contest, Meccano Limited, Binns Road, Liverpool 13."* The competitor's age, name and full address must be written on each entry.

Entries will be divided into two sections, A for competitors of 15 years of age and over, and B for those under 15. In each prizes of £2/2/–, £1/1/– and 10/6 respectively will be awarded to the best entries in order of merit, with consolation prizes of 5/– each. The closing date is 31st July.

1944 "New Year" Contest Results

The standards of design and construction of the models submitted in this popular contest were very high, and competitors also were particularly successful in finding original subjects. The complete list of prize-winners is as follows:

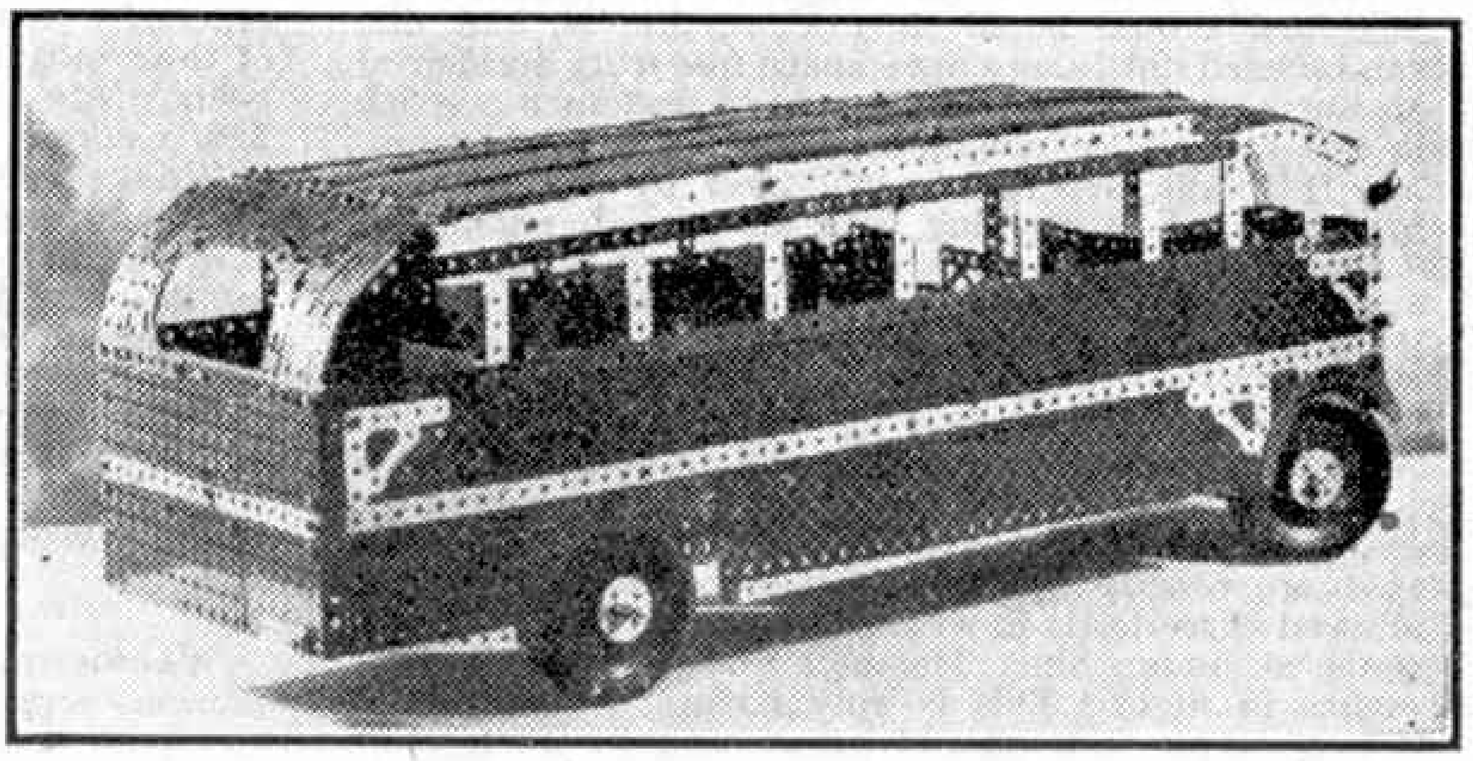
1st Prizes, Cheques for £2/2/–, Section A: A. Short, Birmingham 17; Section B: J. Waite, Wakefield. 2nd Prizes, Cheques for £1/1/–, Section A: J. Matthews, Fillongley; Section B: J. E. Meggitt, Ipswich. 3rd Prizes, Postal Orders for 10/6, Section A: R. A. Picken, Gainsborough; Section B: P. T. R. Brown, Oldbury. Consolation Prizes of 5/– each, Section A: R. Coar, Blackburn; G. Wilkinson, Stockport; B. Hampshire, Wimbledon; C. E. Wrayford, Bovey Tracey; W. S. Roberts, Sowerby Bridge; Section B: G. R. Allcock, Kirkham; J. White, Leek; J. C. Cutler, Petersfield; R. L. Herrick, Watton-under-Edge; K. G. Eyre, Mansfield.

First Prize in Section A went to a 14 year old competitor, A. Short, and his success is highly creditable in view of the fact that he had in this Section opponents two or three times older, and more experienced in Meccano Construction than himself. The award was made for two excellent models, one of which is a splendid reproduction of an articulated omnibus, while the other represents one of the Leyland buses in the service in Birmingham.

J. Matthews, winner of Second Prize in Section A, entered a fine model of a 600 h.p. 6-cylinder Diesel engine. Matthews put very neat and careful work into his model, which is one of the best of its kind that I have seen for some time. R. A. Picken, won his award of Third Prize in Section A with an attractive model of a single-decker bus, which is driven by a Klaxon Motor. The illustration of the model on this page shows well its handsome realistic appearance.

Coming now to Section B, I must say that many of the prize-winning efforts in this Section would have done credit to much older competitors.

First Prize in this Section was earned by a really good working model of a giant dragline excavator, built by J. Waite, but unfortunately the photograph submitted with the entry is unsuitable for reproduction. The illustration of the trolley bus built by J. E. Meggitt, however, which appears on this page will give readers an idea of the very high standard of work done by the young prize-winners in this Section. Meggitt was awarded Second Prize, and the Third Prize went to P. T. Brown, for a very fine model of a 30 cwt. motor lorry.



This finely proportioned model of a single-decker bus won Third Prize in Section A of the New Year Model-building Contest for R. A. Picken, Gainsborough.

Club and Branch News

WITH THE SECRETARY

MODEL AEROPLANE MEETINGS

I am very pleased to see that Clubs continue their interest in making and flying model aeroplanes. This is always good fun, even when the flying is restricted to indoors, as in the pole flying method that I have previously described; but it becomes much more fascinating when models can be tested in the open air, as they can at this time of the year. Models can range from simple ones on thin card to more elaborate structures with longerons and spars of wood strip and plane covering of suitable fabric, and of course there are many excellent kits for assembling that can be purchased. Whatever the origin of the designs, the final test should be of their airworthiness, and this can be tried out in any open space free from accidental air currents. It may not be easy to find such a space in the immediate neighbourhood of the Club room, but this difficulty can be got over by combining a model aeroplane meeting with an outdoor excursion.

A group of members of the Long Itchington (Rugby) Branch, No. 448, Chairman, Mr. G. W. Herbert; Secretary, H. Windsor. This Branch was incorporated in May of last year, and a Meccano Club has been formed in association with it. The Branch has an excellent layout, with a covered terminal station, and colour light signalling has been introduced. An interesting model theatre has been built.

Competitions should be arranged in which members can try out against each other the models that they have constructed. The exact details of the contests will depend on the kinds of models built. There should be separate competitions for "kit" models, and to encourage members to do the job thoroughly it is a good idea to include others for models that they have designed and constructed throughout from materials that are readily available. Each entrant should be allowed three trials in which to show the stability and range of his machine. Members like to see their aeroplanes in flight. This is only natural, and for this reason ample time should be allowed for each competition.

* * * *

Whenever members have occasion to send stamps with letters or application forms these should not be gummed down, but should be pinned or clipped to the sheet. When they are gummed down, it is difficult to detach them in good condition, and sending them loosely attached will save a considerable amount of time and worry for the overworked staffs of the Guild and the H.R.C.

PROPOSED CLUBS

NEWCASTLE—Mr. C. Bagnall, 1, Alwinton Terrace, Gosforth, Newcastle 3.

LEICESTER—Mr. G. E. Bardo, "Millbrook," March Drive, Kibworth Het, Leicester.

WHITWICK—Mr. J. Radford, Grace Dieu Manor House, Whitwick, Leicestershire.

READING—Mr. A. B. Wells, 43, Berkeley Avenue, Reading.

PROPOSED BRANCHES

CARDIFF—Mr. G. Francis, Lynwood, 94, Ninian Road, Roath Park, Cardiff.

ANDOVER—Mr. P. Davenport, 6, Newron Villas, Kaberstown, Ludgershall, Andover.

LONDON—Mr. M. J. Gilbert, 439, Lordship Lane, Wood Green, London, N.22.

SLOUGH—Mr. A. W. Gillard, "Sherwood," 306, Stoke Poges Lane, Slough, Bucks.

RECENTLY INCORPORATED BRANCHES

B.461. BANBURY—D. J. Hopkins, 348, Warwick Road, Banbury.

B.462. LOCKWOOD—Joan M. Lee, 1, Alexandra Road, Paddock, Huddersfield.

B.463. SHAWE-HALL—V. Chatburn, 11, Porlock Road, Flixton, Manchester.

B.464. MASONIC MINIATURE RAILWAY—S. Jones, "A" House, Royal Masonic (Senior) School, Bushey, Herts.

CLUB NOTES

GRASMERE M.C.—Model making continues to be the chief interest, and an excellent display was made at an Exhibition. Competitions also have been held, with increased prizes in view of the excellent efforts of members. A Morse Section has been started. Cricket is played regularly. Operations have commenced on outdoor Hornby and Hornby-Dublo tracks. Club roll: 33. *Secretary:* I. H. Hardman, "Greenburn," Wansfell Road, Ambleside, E. Lakes.

TYNECASTLE M.C.—Excellent progress is being made, especially with model-building. Members build models of their own design or choice. A set of chessmen has been made. Club roll: 20. *Secretary:* A. Forrest, 228, Georgie Road, Edinburgh 11.

WORCESTER COLLEGE FOR THE BLIND M.C.—This Club was formed in November 1941, under the leadership of Mr. R. D. Follett, and has now received affiliation. Meetings are held weekly, and model-building is varied with the reading of extracts from the "*M.M.*" Individual models were first built, and later competitions were introduced, members being allowed only a certain number of parts. Combined building of large models also is carried on. *Leader:* Mr. R. D. Follett, Worcester College for the Blind, Worcester.

BRANCH NEWS

WARNHAM—A new track has been laid down, with sections representing lines in town and country, and excellent farm scenery has been introduced in the country section. Rambles in the fields and model boat sailing have been enjoyed. *Secretary:* S. Delves Broughton, Home Farm, Pondtail Road, Horsham, Sussex.

From Our Readers

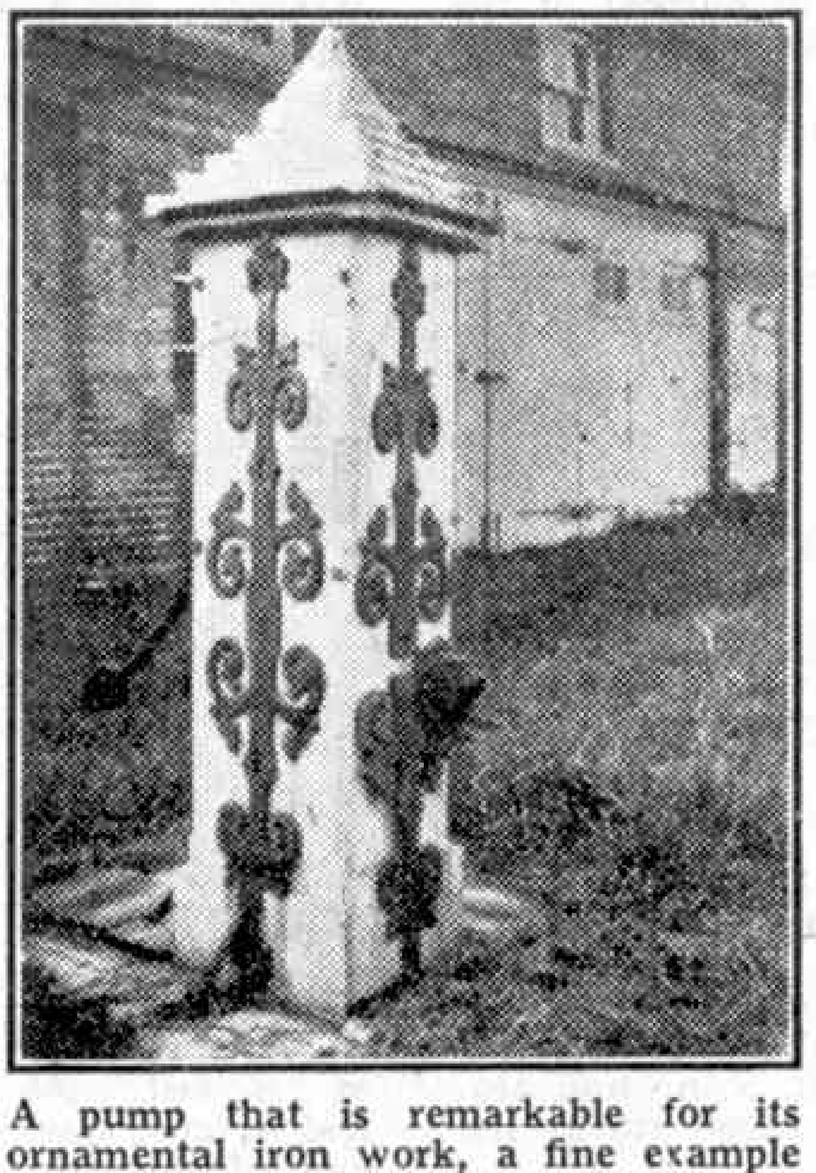
This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

WHY A LADDER WAS LOST

The wrought iron work seen in the accompanying photograph may be of interest to readers because of its fine execution. It is certainly excellent workmanship, especially the head of the dog that acts as the exit through which the water is pumped. The structure dates back a great number of years and is to be seen on an estate in Hampshire.

Some years ago previous to my living in the district, a little trouble developed with the working of the pump, necessitating an examination. Expert workmen came with their customary tools and long ladder to descend the well. The covering stone was removed, the ladder, of 40 rungs, was placed in position, and a workman began descending. As he was doing so he had a feeling the ladder too was moving, and on being told by the mechanic at the head of the well that the ladder had lowered he scrambled back to the top. He was just in time. The ladder was being sucked down by shifting sands or a powerful spring of water. It sank lower and lower and was never regained. Perhaps its disappearance was partly due to the close proximity of the estate to a creek or tidal wash of the sea. Anyway, no examination has ever been made.

C. TURNER (Brockenhurst).



A pump that is remarkable for its ornamental iron work, a fine example of the smith's art. Photograph by C. Turner, Brockenhurst.

A GREAT PIONEER MOTORIST AND AIRMAN

At the spacious ancestral home of the Rolls family, "*The Hendre*" near Monmouth, evacuated schoolchildren from the South-East Coast play in the grounds. How many stop to think that 60 years ago on the same lawns there played a lad by name Charles Stewart Rolls, who was destined to be one of the earliest of British motorists and airmen, and whose importance in the history of modern mechanical transport is not yet properly understood.

Rolls went to Cambridge University to study engineering. His spare time however was given up to the study of motor cars and aeronautics, then regarded as novelties, and in 1895 he shocked the natives in Cambridge by introducing a top-heavy looking Peugeot car, the fourth to be brought into this country. It was driven up from London to Cambridge, and by law a man with a red flag had to go in front of it. This trip took 11¾ hours and to-day would be completed in a modern car in less than an hour and a half, going quite slow.

This French car gave Rolls ideas. Most cars were then made on the Continent, and he asked why better and faster cars could not be made in this country. Claude Johnson, the first Secretary of the Royal Automobile Club, and Mr. Royce, the head of a well-known engineering firm, thought the same. So in 1904 the Company which was to give the Rolls-Royce car an international reputation came into being. Within a few years their designs had produced a car capable of standing up to a 15,000 mile road test, and in 1908 a Rolls-Royce car won the Bombay Kholapur trial, travelling 320 miles and climbing hills 9,000 ft. in height.

Motor cars were only one of Rolls's interests. When quite a boy he had gone in for ballooning and before his death he had won the Gold Medal for spending the longest period of time in the air in the Gordon Bennett International Balloon Race. Wilbur Wright and his brother, the first men to fly in a power driven machine, were friends of his. Rolls made several flights with them, and in 1910 he gained the distinction of being the first Englishman to cross and recross the Channel in one flight. It seems strange to realise that he had to wait for a favourable wind before he set out.

Rolls was not satisfied with the early aeroplane engines and probably would have gone in for producing machines on a large scale himself had he lived. But in July 1910, shortly after his cross-Channel flight, he was killed at Bournemouth while taking part in a flight tournament. His machine went into a steep dive, the tail plane of the machine collapsed, and the aeroplane crashed. He was a true pioneer, who paid the penalty that all adventurers must risk.

Statues at Monmouth and Dover commemorate him, but the Rolls-Royce engines that carry motorists and airmen all over the world at speeds Rolls would have marvelled at, made possible through his vision and enterprise, are his real memorials.

R. D. WOODALL (Monmouth).

Statue of Charles Rolls, the famous motor car and aeroplane pioneer.

A Hornby L.M.S. (N.C.C.) System

THE accompanying diagram shows a miniature railway that represents a section of the great L.M.S. organisation that is rarely modelled. This is known as the "N.C.C." section, these initials standing for "Northern Counties Committee," the name of the managing body. It is a sort of outpost of the main L.M.S. system, because it is situated in Northern Ireland, and thus has no rail connection with the parent concern. Even if it had, the N.C.C. is laid to the Irish standard gauge of 5 ft. 3 in., and also it has a fair mileage of narrow gauge track, the dimensions here being 3 ft.

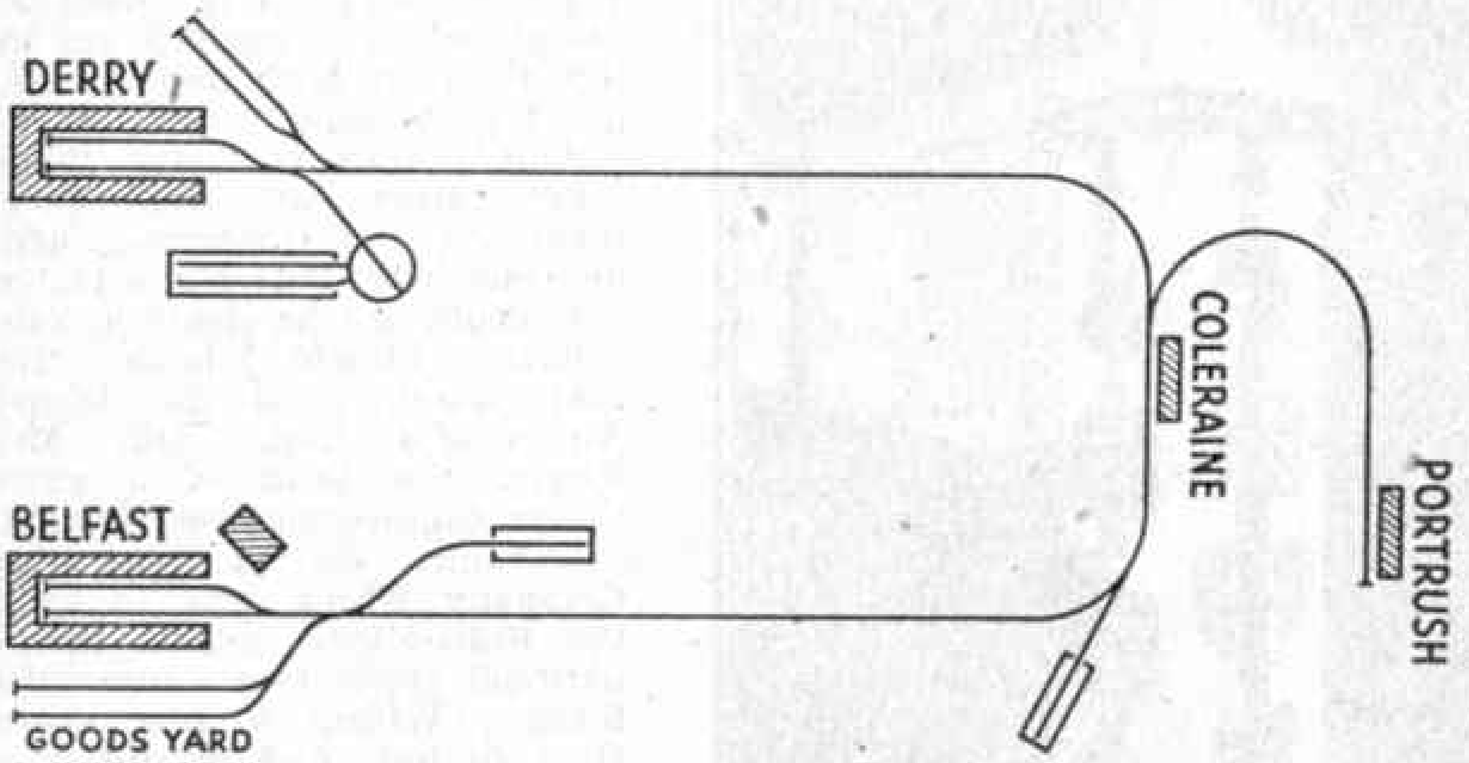


Diagram of the N.C.C. layout described on this page.

This miniature N.C.C. layout is owned and operated by two keen "*M.M.*" readers, Derek Lemon, of Londonderry, and his friend, J. Cook, of Eglinton, using standard Hornby Gauge 0 track and material to represent the Irish 5 ft. 3 in. equipment. This is quite a reasonable step in miniature as the size in general of the N.C.C. stock is not a great deal different from the usual English standards, while the difference in the real track gauge is a matter of inches and not sufficient to worry about for general purposes. The layout is situated in a loft where the space has made it possible to develop quite a long non-continuous system, the ideal for timetable working with clockwork engines.

As the diagram shows, the main part of the railway takes the form of an elongated U laid on its side, with various offshoots leading to sidings near the terminal stations and intermediately a branch line. The line stretches from "*Belfast*," the headquarters of the system, to "*Derry*," the Larne branch of real life not being included. "*Coleraine*" is situated roughly half way between the terminals, and from this point the branch line previously referred to diverges to "*Portrush*."

Belfast (York Road) is represented by a station of wooden construction made at home, and the station representing Coleraine is also of wood. Two Hornby No. 3 Stations are used together at Derry. In addition to these principal points and the branch terminus at Portrush, other stopping places represent Ballymena and Limavady junction. For these and for Portrush the handy little "M" Series Stations are used.

The track, buildings and so on are permanently installed, the rails being screwed down. Owing to the absence at school of the owners, the rolling stock and locomotives are kept packed up during term time, but the railway is in full operation in the holidays. All locomotives and stock are overhauled at regular intervals, and matters are arranged so that sufficient equipment is always available in the pink of condition to operate the various services in a reliable manner.

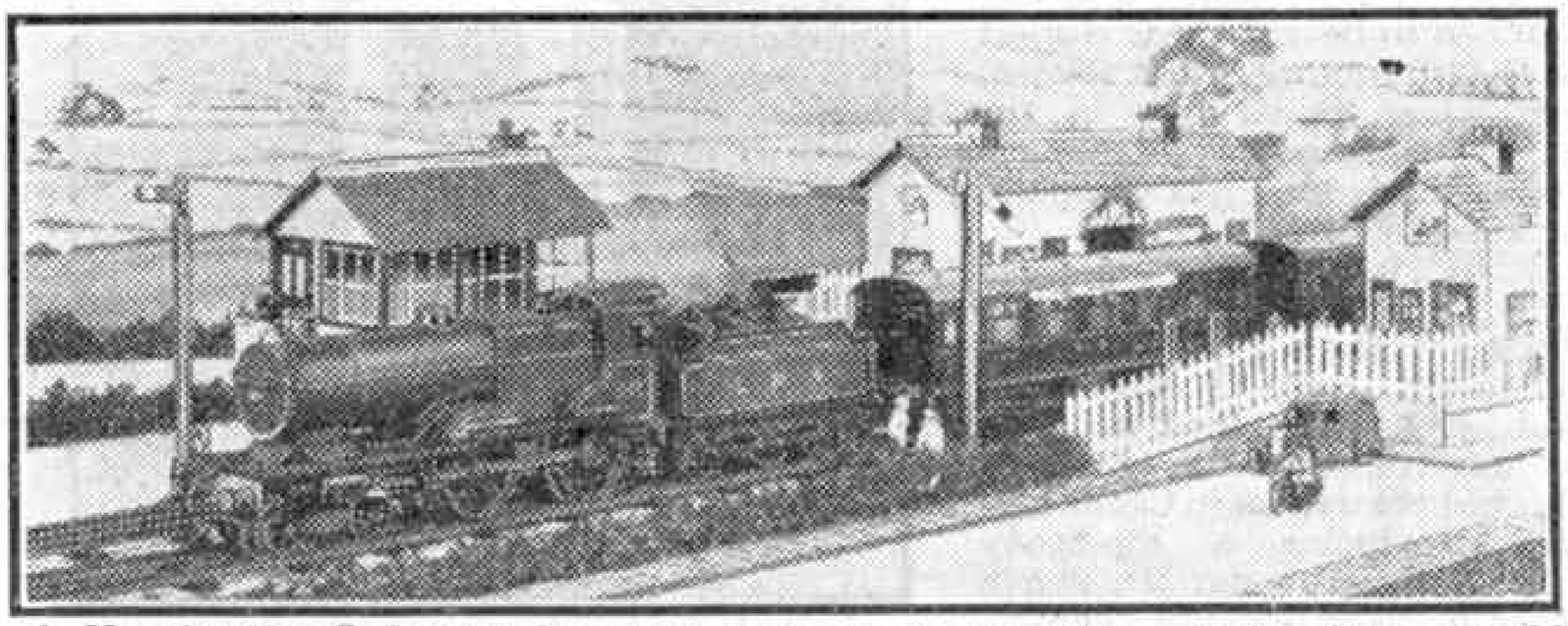
Contrary to the practice on many layouts, the policy has been followed of using a number of the smaller engines of the Hornby range, there being a total of 11 in regular traffic. The same principle has been applied also to rolling stock, there being 10 of the smaller four-wheeled Pullmans in use for passenger trains. This scheme is a good one where traffic operation generally forms the principal interest of the railway. A fair variety of goods stock is in use, including one of the bogie High Capacity Wagons. This is reserved specially for traffic between "*Derry*" and "*Coleraine.*"

Locomotive sheds are provided at various points, the buildings being of wood, and the different engines are allocated permanently. There are four engines at "*Derry*" four at "*Coleraine*," and three at "*Belfast.*" All have been given N.C.C. numbers, and in most cases names as well, these being printed on cardboard "plates" attached to the engines. Various classes are represented, including the "Heavy Compounds" such as "*Jubilee*" and "*Parkmount*," the "Mountain" series such as "*Slieve Gallion*" and the sprightly Moguls such as "*The Maine.*"

The more recent locomotives and stock of the N.C.C. closely follow in their general style the practice of the present L.M.S., and so the management of the miniature N.C.C. system hope to add to their stock a Hornby L.M.S. Standard Compound.

In addition to the 11 engines in regular traffic, there is an old tank locomotive in use, the dark green colour of which makes it suitable for representing one of the original Belfast and Northern Counties engines, these having been at one time finished in what was known as "invisible green," a dark shade that looked almost black. There is also another 0–4–0 tank locomotive that unfortunately has no "works." This is handy for helping to make a crowd at the sheds!

Each running period or episode includes one express in each direction, five stopping passenger trains and two express goods trains each way. This is quite a good show for an end-to-end layout with just two operators to do all that is required.

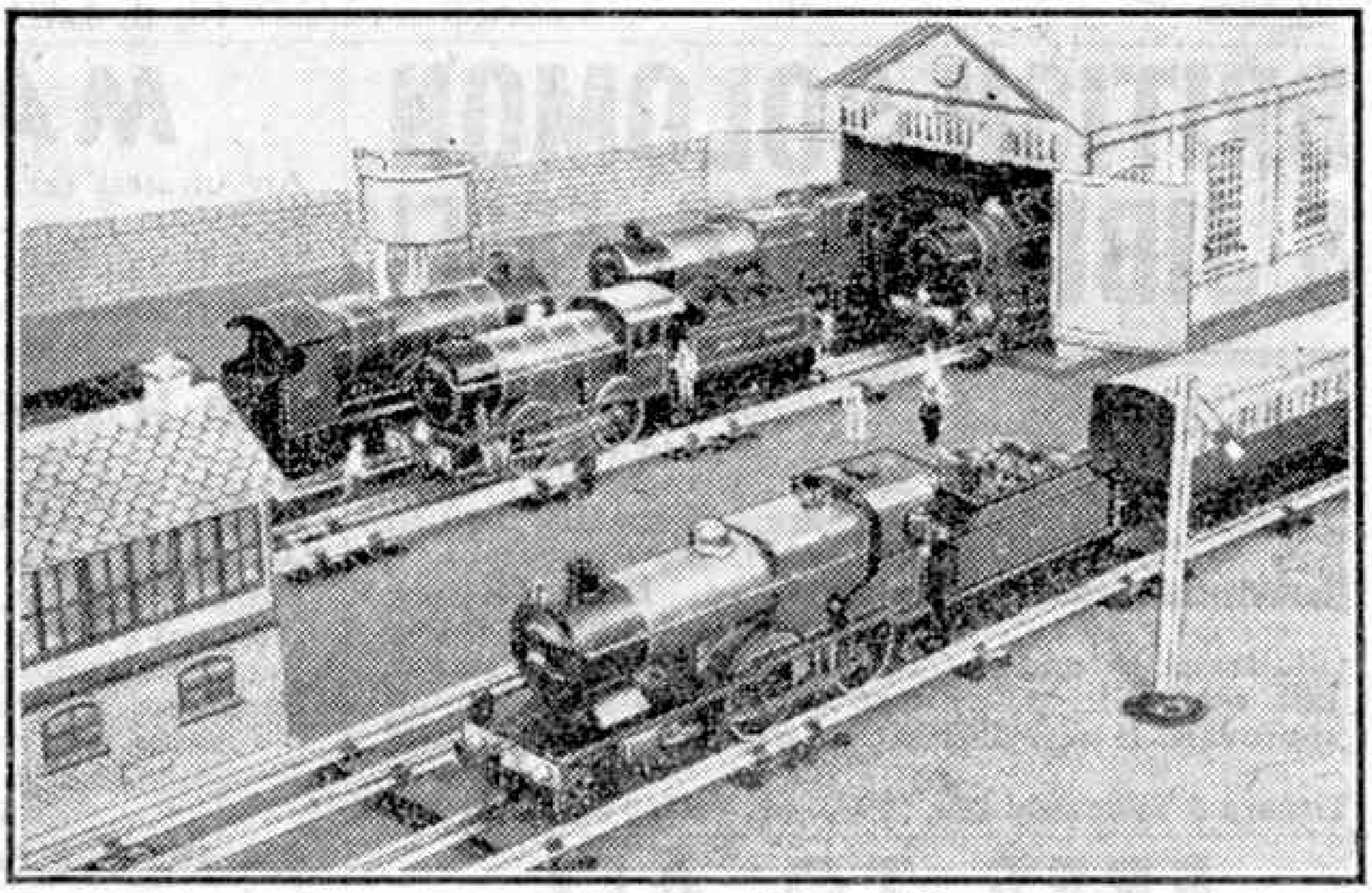


A Hornby No. 2 Special Standard Compound and train. These items could be used for miniature N.C.C. services.

The "Loco Department" on a Hornby Railway

THE object of an engine shed is of course primarily to provide accommodation for locomotives when they are not at work. In miniature this is quite as true as in full-size practice, for the engines can be laid up in the shed, and while out of the way of dust they are ready on the track when operations are next carried out. This applies particularly to permanent model railways.

Our engine shed, whether it is a standard Hornby product or whether we have made it at home from wood or cardboard or both, should not be the only evidence on the layout of the existence of the "Locomotive Department" on our line. It should be part of the effects of this branch of the activities of our railway, the other items including Water Tanks, a Turntable, and maybe even a coal stage. Apart from these specialised pieces of equipment the shed itself can always have near to it one or two buildings to serve as offices, stores and so on. These can be simple structures that would serve well as examples of buildings on which the beginner in accessory construction can try his hand. Exactly where they are placed will depend largely on the layout arrangements and the disposition of the tracks, but they should as far as possible be close to the shed itself.



Hornby locomotives at home. The disposition of the various engines and of the shed staff represented by the miniature figures is very realistic.

Probably there is no ideal layout for the locomotive yard premises; these are bound to vary almost as much as station layouts do in miniature. If we have a shed of the "through type," that is with doors at each end as in the case of most of the Hornby Engine Sheds, it is desirable if possible to make it a rule that engines come in at one end and pass out to work again at the other end. This ensures that incoming and outgoing locomotives do not get in each other's way, but a fair amount of space is necessary and two connections with the main line are required. With a double track main line, too, cross-over points will probably be necessary. Still, on railways where there are fairly large "families" of engines there is normally a fair amount of space, and equipment generally is on a generous scale.

There are of course many layouts where it is only possible to provide one connection with the main line, and then a "dead-end" locomotive yard is practically the only possible arrangement. The tracks may pass through the shed, but they will be terminated by buffer stops a short distance beyond it. Where this scheme is adopted it is not a bad plan, if possible, to place the shed so that about an engine length of track projects beyond the shed. Here we can stand engines that are not required immediately for traffic, and they can be cleaned and oiled here out of the way of the general movements in the yard itself. When turntable operation is the rule there will be many instances of engines "popping in" to the yard in between runs, and these probably will not enter the shed at all. They may be scheduled to call in for turning, or merely for "coal and water"; not that Hornby Locomotives need either really, but a little "make believe" adds considerably to the fun!

Water is provided from a storage tank or by means of a "water crane" or standpipe in real practice. The Hornby Water Tank is a good example of the average type of circular tank placed on top of a column from which thirsty engines can draw supplies. If we have not one of these accessories we must exercise our skill in making one. A round tin will do for the tank, a length of round wood for the column, a piece of flat wood for the base, and so on. We may even have an old signal ladder we can use too, while the other details are not really difficult to fix up. An ordinary water column is perhaps simpler to make and needs no ladder, but a tank is more imposing. Whichever type we use, near to the head of the yard is the best place for it. Visiting engines can then call in for "water" only and will not need to disturb any of the other engines that are perhaps standing on the shed tracks waiting to go in or out.

Coaling arrangements are various, ranging from the modern mechanical plant to the simple but laborious method of throwing the coal from wagons into the tenders or bunkers of engines drawn up alongside. In miniature some splendid mechanical plants have been made in Meccano and are most interesting and realistic. Owing to their height, however, they tend to dwarf the rest of the railway. A coal siding on which loaded wagons stand is easily provided and need not take up much room, but it is difficult to suggest "life" about it without some figures with shovels to stand on the wagons. A simple stage, roofed or otherwise, on which the coal can be placed in skips or tubs from the wagons on one side and then tipped into tenders on the other side, is quite effective. Standard miniature figures can then be used, and for the tubs small pill boxes or even a few sewing thimbles will do. You will have to flatten slightly what is normally the top of the thimbles so that they can stand upside down. It is wise to buy your own thimbles for this purpose! If these tubs can be placed on a miniature barrow or trolley for moving across the stage, so much the better.

Another scheme which we have seen worked successfully is to fix up a bracket attachment for the standard Platform Crane and use this to transfer the "fuel" from wagon to tender.

A final thought occurs to us. With portable layouts, if the engine shed is used to house engines between operations, take care to apply the brakes and fasten the shed doors. Otherwise a disastrous "runout" may happen while the shed is being placed on its shelf or in the cupboard.

For other Stamp Advertisements see pages 248 and viii.

Stamp Collecting

British Somaliland

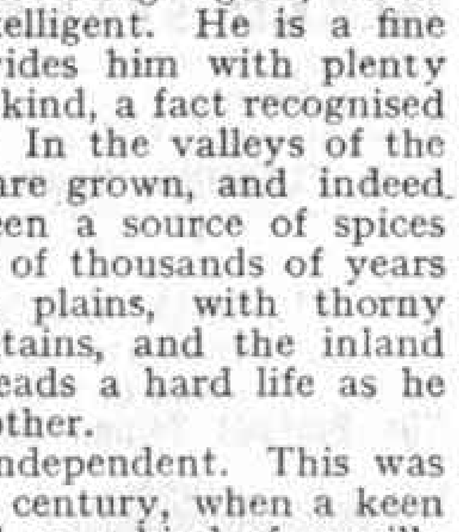
By F. Riley, B.Sc

CONTINUING our stamp tour of the Empire from Aden, our last port of call, we have not far to go to reach British Somaliland, our next territory, for this is just across the Gulf of Aden from the south coast of Arabia. It came into prominence in 1940, when Italian invasion from the neighbouring state of Abyssinia made it necessary to abandon the country to the enemy. The lightning campaigns of the following year destroyed Italian domination in East Africa, however, so that once again Somaliland came into British hands.

The country was originally occupied to safeguard the road to India and the East on its southern flank, and a Protectorate was declared over it in 1884. It is large, although looked upon as a minor portion of the Empire, for in it there are 10,000 more square miles than there are in England and Wales together. Yet it has only about half a million people, Somalis, all Mohammedans, and its capital Berbera has a population of only 30,000 which sinks to half that number in the hot season. The Somali is an interesting figure, taller than many Europeans and intelligent. He is a fine hunter, and the country provides him with plenty of opportunity for sport of this kind, a fact recognised on its stamps, as we shall see. In the valleys of the coast myrrh and frankincense are grown, and indeed the country seems to have been a source of spices of this kind for the Egyptians of thousands of years ago. Behind the valleys are plains, with thorny scrub and mimosa, and mountains, and the inland Somali is a camel man, who leads a hard life as he wanders from one camp to another.

The Somali is warlike and independent. This was discovered early in the present century, when a keen and ambitious leader embarked on a kind of guerilla warfare that earned for him the name of the Mad Mullah. He proved to be a very elusive enemy and it was not until 1920 that he was defeated, the R.A.F. playing a prominent part in bringing his career to an end. Now the country is peaceful and no doubt will share in the developments that are sure to take place in this corner of Africa.

The stamps of British Somaliland have not been very popular in the general sense, yet they are of great interest, and collectors looking for a "small" country might well turn to it. The first stamps that came to British Somaliland were Egyptian, for Egyptian postal agencies were set up in the country as far back as 1874. When the British Protectorate was proclaimed Somaliland was attached to India, as was Aden, and the result was that here also the stamps of India were brought into use, in this case with the words "*British Somaliland*" printed over them. One of these is illustrated here.



It is interesting to find that the country got its own stamps more than 30 years earlier than Aden, the first appearing in 1904. These stamps showed the

heads of first Edward VII, and then George V, and an example of the latter is illustrated on this page. The use of Indian currency was continued, so that we find the Somaliland stamps in anna and rupee values. Of the new issues there were two sizes, the one we illustrate being the smaller, but in each case the oval surrounding the head of the King was surmounted by a crown and flanked by wreaths, as seen in our example. The lower values of these stamps are comparatively reasonable in price, although they are not too plentiful. This is not surprising. The Somalis are comparatively few in number and not many of them are letter writers. Most of the stamps available come from India and surrounding countries, with which the trade of British Somaliland is chiefly carried on.

These stamps continued in use until Silver Jubilee year, which was celebrated by a special issue, as in other British dominions. The design of this was the usual Windsor Castle view, with the head of George V and the dates 1910–1935, and the stamps have shared in the advance in prices that has been the lot of Jubilee issues in general. It was followed in 1937 by the well-known Coronation set, and then in the following year came the Protectorate's first pictorial issue, a very fine and interesting set that makes a splendid show in the album.

There are only three designs in this set, although there are 12 values, and two of them, covering all the anna values, are illustrated on this page. Both show characteristic examples of Somaliland animal life. The four lowest values, from ½ a. to 3 a., feature the black-headed sheep, seen in typical Somaliland country in the 2 a. value reproduced at the head of this column. This is described as a variety of the Abyssinian fat-tailed sheep, which stores up food in its tail in readiness for the time when pasture is poor.

The animal chosen for the next four values, from 4 a. to 12 a., is an antelope, the kudu, the splendid spiral horns of which seem to support the oval containing the King's head. Apparently there are two kudus. One of these is the lesser kudu, which is found only in Somaliland and neighbouring countries, but the one shown on the stamp is usually described as the greater kudu, a handsome antelope that lives in woodlands in South and West Africa as well as in the north-eastern part of the continent. This creature lives alone, or in pairs, instead of gathering in herds, and its most striking feature is the immense pair of spiral horns of the male, which may be 4 ft. or even more in length. It is not surprising that these have been chosen for representation on Somaliland's stamps, and in their different colours the stamps make a very handsome show.

For the four rupee values, from 1 r. to 5 r. in different colours, a design to represent the whole country was found in an excellent map, one of the best examples of this type of stamp yet issued. This not only shows the extent of the country itself, but also illustrates its relation to Arabia, part of the South Coast of which, with Aden, is included in the design. The map stamps are somewhat highly priced, but the collector who goes to the expense and trouble of including them, so making his set complete, will be amply repaid.

For other Stamp Advertisements see pages 246 and viii.

Stamp Gossip

and Notes on New Issues

By F. E. Metcalfe

THE overprinted stamps for the Falkland Dependencies overshadowed all other new issues last month and they had to be given full attention. Collectors are anxious to obtain used copies and already a few covers have arrived, even from Graham Land, where there is said to be not even an established post office. Most collectors will have to be satisfied with mint copies, however, and here is a word of consolation for those who have not yet obtained a set, since many dealers did not get anything like their full supply. The Crown Agents advise that there will be a further overprinting, and this should mean enough for everybody. Of course there is always the possibility that the second supply will differ from the first, so it is safer to buy now, if sets can be located.

Egypt has been in the philatelic news lately. Recently the balance of the Princess Ferial Child Welfare stamp, which was issued in May 1940, has been overprinted. There was the usual scramble in Cairo to obtain copies. These stamps are now being offered in England from 15/- to £1 a copy, but buyers deserve to lose their money if they pay anything like such a price.

Now another Egyptian commemorative has appeared, a King Fuad memorial stamp, and we illustrate a copy. King Fuad died on 28th April 1936. The colour of the stamp is plum and it will be seen that the design is rather attractive. In spite of an initial printing of 860,000 copies they were all cleared out of the post office in no time, to the accompaniment of disgraceful scenes. A further printing is said to be in preparation and readers should ultimately obtain a copy for a few pence, but what one cannot understand is why Egypt cannot emit a stamp in a decent orderly manner. The remedy is simple enough—the printing of enough to go round, with prior notice that there will be plenty. That would stop the ramp.

A contrast to all this is the way the Free French authorities in London handle their stamp issues. A case in point is the recent release in London of the "Cross of Lorraine" overprints of Indian Settlements, one of which is illustrated on this page. A full set of 43 values is selling at from £4 to £5, and quite well the "de Gaulle" organization would know this. Yet all supplies received were handed over to the stamp trade at face value, which is about 25/-. A full set of these stamps is beyond the pocket of most young collectors, but fortunately there is also a set available of 15 values; this is quite representative and can be obtained for about 4/-.

As usual the Free French authorities did not make a penny of a very handsome sum which was theirs for the asking, had they cared to charge what the stamps were actually worth, instead of the bare face value.

Holland has joined the group of Free Countries that have emitted sets of stamps in London, for use on their ships. By the time these words appear the stamps will be on sale and should be available for about 3/6, a full set of nine values. We hope to illustrate at least one of them next month. These London Free Government issues form a nice compact group. All are obtainable at a reasonable price, even used, and as they are of historic interest they are well worth having.

United States have dug up another couple of overrun countries to add to their set of flag stamps. The latest two to be "honoured" are Corea and Philippines. Well, well.

Perhaps one of the most handsome sets in the colonial section of the catalogue is that issued by Zanzibar in 1936 to commemorate the Silver Jubilee of the present Sultan. This is illustrated here. Now there is news of a further commemorative set to mark the bi-centenary of the ruling Al Busaid dynasty. The stamps are to be the same size as those issued for the Jubilee, and of the denominations 10 c., 20 c., 50 c. and 1/-. As the design will include a map of East Africa and Arabia as well as a representation of a native dhow, the stamps should prove very popular. Readers who want a set of the Jubilee stamps had better buy one with as little delay as possible, for, as always happens, the appearance of the new set will make the price of the old set rise quickly.

We have previously mentioned that a new value for Sierra Leone was to be issued, of a face value of 1/3. News is now available that this stamp will be issued on 1st July and is for use on air letters of half an ounce in weight from the colony to Great Britain. Now in every sense this is an air stamp: its life may be quite short, for such a high postal tariff is hardly likely to endure, as the pre-war rate was only 1½d.

A new stamp from Cuba, is illustrated here; it is one of three values issued to help the Postal Employees' Retirement Fund.

Direct news has been received from the Postmaster at Bahrain that no more mint stamps will be exported; only current stamps cancelled to order will be sent. Readers are warned against buying these.

Troop-Carrying Gliders—(*Continued from page 225*)

Consequently it became the first "powered-glider" under the designation Me 323, when six Gnôme Rhône engines of 965 h.p. each were fitted. It is thus no longer a true glider, but it can, according to German reports, carry up to 10 tons of freight or 150 soldiers. The Me 323 has suffered cruelly at the hands of Allied fighters, no less than 32 being shot down in one engagement with "Kittyhawks" and "Beaufighters," without loss to the latter.

It is extremely unlikely that such large gliders will prove capable of much development and, indeed, it is difficult to foretell any possible trend of glider development. One thing is certain—that in view of the vulnerability of such aircraft and the fact that their approach can be detected by radio-location while they are many miles away, gliders in their present form will be of no use operationally for much longer. Even powered gliders such as the Me 323 and the new Franklin-powered "Hadrian" are still slow and cumbersome.

Amphibious gliders are being built in America, but their uses are very few, except perhaps for landing on lakes in countries such as Norway.

But there should be a future for the glider as an aerial freight car. The "Hadrian" has already pointed the way in its transatlantic flights. For compact, valuable or perishable goods, gliders towed behind freight-carrying aeroplanes may prove quite useful. On the other hand, wooden low-powered transport aeroplanes might be more efficient. It must not be forgotten, however, that gliders have achieved much in this war, and may have an even bigger part to play in future operations.

Our "Town" Class Cruisers—

(*Continued from page 221*)

an early casualty, being damaged shortly after hostilities commenced. However, she was repaired in due course, and sailing as the flagship of Vice-Admiral R. L. Burnett, she took part in the action that resulted in the sinking of the German battleship "*Scharnhorst*," the pride of the German Navy, on 26th December 1943.

The ships which took part in this historic action, in addition to the "*Belfast*," were H.M.S. "*Duke of York*," "*Jamaica*," "*Norfolk*," and "*Sheffield*," as well as destroyers of the "S" class, the "*Matchless*," "*Opportune*," etc. Within the space of a few hours these ships trapped, brought to bay and destroyed this fast modern 26,000-ton German battleship. Mr. A. V. Alexander, First Lord of the Admiralty, when speaking at a luncheon in Belfast earlier this year, described the sinking of the "*Scharnhorst*" as "one of the most important sea actions of the war."

The Story of Steel—(*Continued from page 231*)

appropriate moment to tell you something about steel that you must know or before we go further. Steel is not one thing, one substance; it is many different substances. Some steels are specially designed for one set of purposes, and some for another. It is not possible to make all these steels with such different properties in one and the same way. Hence, there are several widely different and extremely ingenious ways of making steel. In the next article I shall explain how blister steel becomes shear steel, and then I shall describe some of the varied and wonderful processes by which different sorts of steel, or sometimes the same sort, are made.

The thing to bear in mind is that there is no magic and nothing impossible to understand in these various clever processes. They are all founded on common-sense and observation, and at any time if you do not quite understand a point in these articles, write to me, c/o the Editor, and I will do my best to answer your questions.

COMPETITION RESULTS

HOME

February "Knight's Tour" Contest.—Readers were quick to make sense of this puzzle, and so large a proportion of entrants gave an all correct solution that the judges found it necessary to decide on the neatness and enterprise of the actual entries. The complete passage read as follows: "The new jet aircraft will be very speedy and indeed able to move with a speed greater than that of sound, and with it flights can be made at great heights where the engines of an aircraft of the usual type could not get air to burn their fuel except by special means. At these heights the air is free from bumps and cloud."

1. A. S. Poole, Basford; 2. C. Young, Glasgow; 3. R. L. Pellatt, Manchester. Consolation Prizes: E. A. Fisher, London; P. Bulkeley, Surbiton; F. Linton, Mirfield.

Loading a 2,700 lb. boiler, destined for a cobalt mine in Ontario, into the fuselage of a Canadian Pacific Air Lines freight transport machine. Canadian Pacific photograph.

December "Railway Errors" Contest.—1. D. Watson, Glasgow; 2. D. A. Berry, Peterculter; 3. W. P. Stubbs, Rochester. Consolation Prizes: J. F. K. Hinde, Harrow; J. L. Makin, Allestree, Derby; A. W. Richmond, Kirkmichael, Isle of Man.

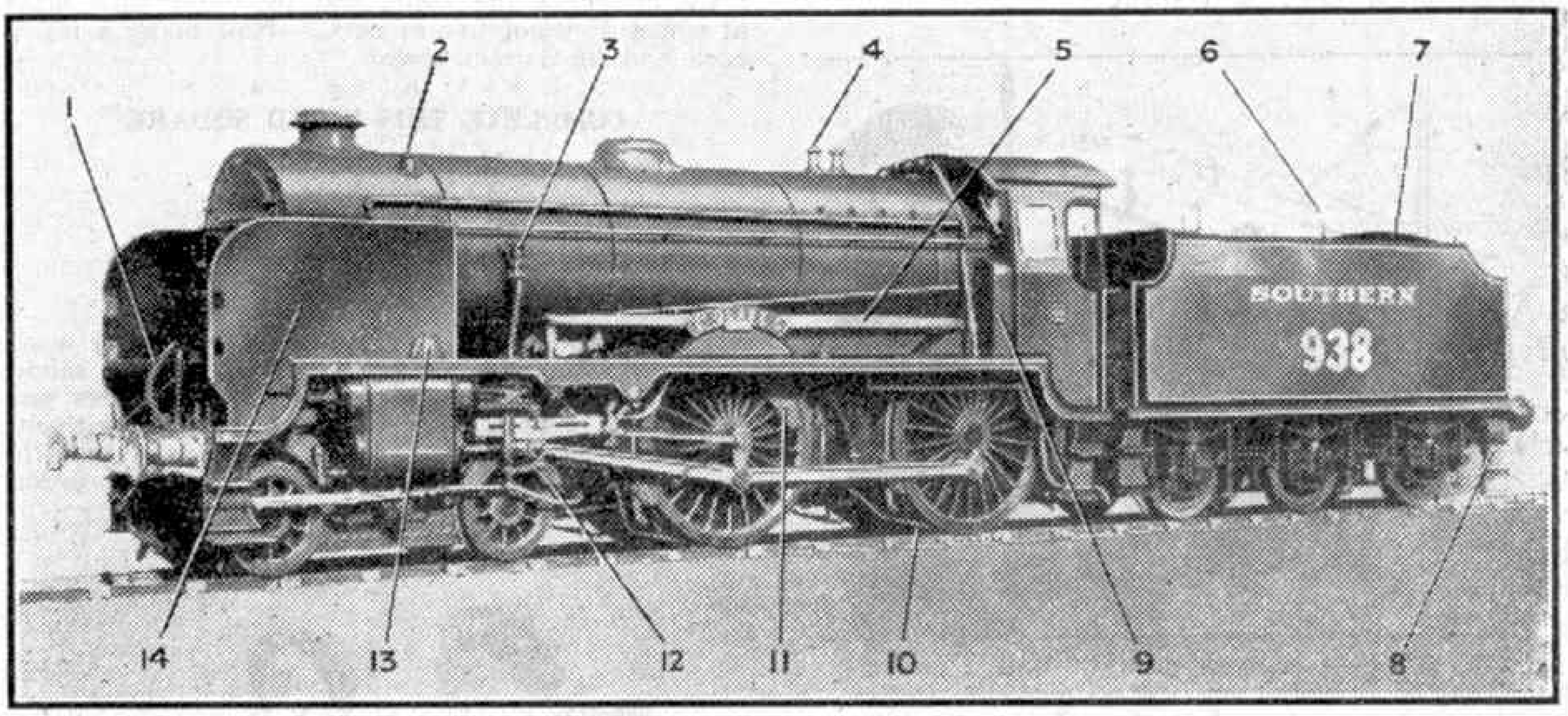
January "Railway Quiz" Contest.—1. F. Mills, Kearsley, Nr. Bolton; 2. C. E. Wrayford, Bovey Tracey; 3. J. L. Makin, Allestree, Derby. Consolation Prizes: F. Linton, Mirfield; M. G. Roberts, Chester; P. Pearson, Peterborough; G. Simpson, Leeds.

February Photographic Contest.—1st Prizes, Section A: T. Jones, Neath; Section B: J. Nichol, Dingwall. 2nd Prizes, Section A: D. Traviss, Scunthorpe; Section B: P. Dyer, Southend. Consolation Prizes: H. W. Jones, Cardiff; R. Atkins, Eccles.

March "Photographic" Contest.—1st Prizes, Section A: C. A. Reader, Guildford; Section B: H. W. Jones, Cardiff. 2nd Prizes, Section A: J. A. Fraser, Portsmouth; Section B: K. Davies, Dursley. Consolation Prizes: P. Milne, Whyteleafe; R. Atkins, Eccles; R. A. Fraser, Portsmouth.

Competitions! Open To All Readers

What Are These Locomotive Parts?



The locomotive has grown and has been developed to a wonderful extent since the pioneer days of "*Puffing Billy*" and the "*Rocket*," and many devices have been added that have increased its power or speed and made it easier to run and to control. Our competition this month is concerned with the many parts that can be seen on a modern locomotive such as S.R. No. 938 "*St. Olave's*," of the "Schools" class. This is shown in the illustration on this page, on which certain carefully selected parts have been marked by numbers. These parts are all essential for efficient working, and entrants in the contest are asked to name them and explain what they do. The number and name of each part should first be given, and in each case these should be followed by an account of its purpose that should be brief, but should make clear exactly what it is included in the make-up of a locomotive for.

There will be the usual two sections in this contest, for Home and Overseas readers respectively, and in each prizes of 21/–, 15/– and 10/6 will be awarded to the three best solutions in order of merit. There also will be several consolation prizes, and in the event of a tie the judges will take into consideration the neatness and novelty of the entries concerned.

Entries in the competition should be addressed "*July Locomotive Parts Contest, Meccano Magazine, Binns Road, Liverpool 13.*" The closing dates are 31st August in the Home Section, and 28th February 1945, in the Overseas Section. Every sheet of the entry must bear the name and address of the competitor.

A Holiday Drawing Contest

It is a long time since "*M.M.*" readers were given the opportunity of entering a drawing contest, and in view of this, and of the approaching school holiday period, we have decided on one of these competitions this month. As competitors will have until the end of August to send in their entries, they will have plenty of time in which to find suitable subjects, and to complete their drawings entirely to their own satisfaction.

What am I to draw? This will be the first question readers will ask. The answer is, whatever can be done best. Those who are familiar with locomotives, ships, motor cars, bridges and similar subjects will turn naturally to them, but there is no restriction whatever, and drawings of people and animals, landscapes, sea and river scenes will have just as much chance as those selecting engineering subjects. The only point to bear in mind is that the subject of each entry must be clearly stated. Thus if it shows a locomotive the number and name, if it has one, must be given, if some scene is reproduced its position must be stated, and so on. Drawings may be in colour, but it is on the skill in drawing that the prizes will be awarded.

As usual in "*M.M.*" contests, there will be two sections, for Home and Overseas readers respectively. In each there will be prizes of 21/–, 15/– and 10/6 for the three best entries, in order of merit, and other good efforts will be awarded consolation prizes.

Entries must be addressed "*1944 Holiday Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13.*" The closing dates are 31st August in the Home Section, and 28th February 1945 in the Overseas Section.

July Photographic Contest

This month's contest is the 7th in our 1944 series, and in it, as usual, prizes are offered for the best photographs of any kind submitted. There are two conditions: 1, that the photographs must have been taken by the competitor; and 2, that on the back of each print must be stated exactly what the photograph represents. A fancy title may be added if desired, but entries on which the conditions stated above are not observed will be disqualified.

Entries will be divided into two sections, A for readers aged 16 and over, and B for those under 16, and all entries must be clearly marked with the section letter. They should be addressed: "*July Photographic Contest, Meccano Magazine, Binns Road, Liverpool 13.*" There will be separate sections for Overseas readers, and in each prizes of 15/– and 7/6 will be awarded. Closing dates: Home Section, 31st July; Overseas Section, 31st January 1945.

Fireside Fun

"I haven't run my car for three years."
"Why grumble about that? You always said you wanted a car light on petrol."

* * * *

"Are all these your children, or is it a picnic?"
"They're all mine, and it's no picnic."

* * * *

"You look bothered to-day. What's the trouble?"
"I've just been told by my uncle that he's cut me out of his will again. That's three times in the last year."
"Dear me. He's a regular fresh-heir fiend."

* * * *

"And they don't let you out in the blackout, Uncle?"
"Why, yes. Nobody tries to stop me."
"But Father said you were one of the shining lights of the district."

* * * *

Recruit: "What's on the menu to-night, cook?"
Cook: "Oh, hundreds of things."
Recruit: "Yes, but what are they?"
Cook: "Beans, friend."

* * * *

Caller: "Is Mr. Jones in, please?"
Mrs. Jones: "No sir, he's gone drillin'."
Caller: "That's fine. In the Home Guard, I suppose."
Mrs. Jones: "No, sir, turnips."

* * * *

"Did that electrician tell you where all the No. 8 batteries have got to?"
"No, he said he was in the dark himself."

* * * *

Farm labourer: "Can I no hae a holiday, sir?"
Scottish Farmer: "Holiday, ye say. Nae, nae. It's nae that lang sin ye had the twa meenute's silence."

* * * *

THIS MONTH'S HOWLER

Coal is delivered a la carte or cul de sac.

* * * *

BRAIN TEASERS

DO YOU KNOW?

How long is a cricket pitch? What is the full size of an Association football field? Is this the same size as that of a Rugby football field? What is the height of a badminton net, and how deep is it?

* * * *

LEFT OUT

Judging by the number of those who write to the Editor instantly when they discover a misprint, readers are very keen of eye and scrutinise their "*M.M.*s" very closely. To give them a chance a letter has been missed out of a word on this page. What is the word that has been wrongly spelled?

A ROUNDABOUT TALE

Farmer Giles was pleased with his food-producing efforts. "Yes," he said to his wife, "I've ploughed and sown 200 acres of corn this year." "How much of that is barley?" asked his wife, knowing that he took a special pride in the quality of this that he grew. "Oh, I've only got two acres of barley for every three of wheat this year, and for every nine acres of wheat I've got five of oats." How many acres of each had the farmer sown?

* * * *

COMPLETE THIS WORD SQUARE

X X X X X X
X X X X X X
X X X X X X
X X X X X X
X X X X X X
X X X X X X

Each of the above lines represents a six-letter word, clues to which are as follows: 1. Get away safely; 2. For cooking or heating; 3. Place that gives protection; 4. Tree-lined approach; 5. Read attentively; 6. Regard with respect. A further guide is that the six words are repeated downward in the same order.

* * * *

"Aren't you going to walk with me to the bus?"
"Oh no! We're having tea as soon as you've gone!"

* * * *

SOLUTIONS TO LAST MONTH'S PUZZLES

The motor cars that the various people named in our first puzzle would naturally run are a Fiat, a Hillman, a Hotchkiss, a Morris, a Rover, a Singer, an SS Jaguar, and a Squire.

I wonder how many found the price at which the farmer's six sons in our second puzzle sold their apples to give the same yield, although they sold greatly differing numbers. It was 2d. for each complete dozen, and 1d. each for those left over, and each brought 10d. back. For instance, the fourth son, who had 40 apples, sold three dozen, at 2d. per dozen, bringing in 6d., and then had four aples left over, which at 1d. each yielded 4d.; thus the total return was 10d. Readers will agree that this method of selling was no way to get rich.

In our third puzzle it is easy to work out that John is now two years old, since in two years time he will be four and this is four times his age of a year ago. Two years ago his age was nothing. Thus in nine years he will be infinitely older, and in fact this will apply to him throughout life.

In our fourth puzzle the biggest word according to the conditions is not necessarily the longest, for the short word "zoo" gives a total of 56, and the much longer word "algebra" gives only 46. What is wanted is the longest word with the largest proportion of letters that come late in the alphabet, and this is found in "substituted," which was included in the wording of this puzzle. Its letters give numbers that add up to 160.

STAMP ADVERTISEMENTS

(See also pages 246 and 248)

READERS' SALES AND WANTS

SALES

64 "Champions"; 36 "Hotspurs"; 14 "Dixon Hawke"; price the lot, including postage, 30/-. "The Concise Universal Encyclopædia," by Hammerton, 1,500 pages, 2,000 illustrations; what offers?—Ward, 191, Baker Street, Enfield, Middlesex.

No. 6 Meccano, 15/-; also T20 Transformer (new) and E120 Electric Motor (20 volts); Spare Parts; Nuts and Bolts; Gears, etc.; offers (stamp reply).—12, Calder Street, Lochwinnoch, Renfrewshire.

"Meccano Magazines," April 1930 to December 1942, complete, £1/12/6; also "Modern Wonders," November 1937 to March 1941, complete, 15/-.—H. G. Davies, 7, Highfield Road, Purley, Surrey.

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Readers' advertisements are published as soon as possible; inclusion in the first issue after receiving them cannot be guaranteed.

Small Advertisements. 1/8 per line (average seven words to the line), or 20/- 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.

Bargains: Wilson-Wolfe 110 volt D.C. Dynamo, 16/6 C.P.; Large Red-Green Meccano Set, complete; No. 1A Clockwork Motor, as new, many Gears; New Ball-race Turntable to carry 56 lb., fits above set; 3 volt Permanent Magnet Motor, as new. All guaranteed good condition, about £8 worth, £6/10/-, C.P.—Simpson, Boatmere, Gedney Marsh, Spalding, Lincs.

Large Meccano, mostly Blue-Gold; many new parts; Two Electric Motors, One Clockwork; current price over £30; accept £20. Not for sale in separate lots. Stamp for list to—M. Lane, White House Farm, Foulridge, Nr. Colne, Lancs.

Five Lens Telescope, £3/10/-, or will exchange for .177 Air Pistol.—Murray, 56, Pierce Avenue, Olton, Birmingham.

Ideal for Beginner: Stamp Album, including 300 Stamps, £1/5/-.—L. Dalling, Whiteside Farm, Bathgate, Scotland.

WANTS

Reversing Meccano Electric Motor and Transformer, A.C. 230 v.; good condition.—Francis, 43, Torland Road, Hartley, Plymouth.

In as good a condition as possible, any "M.M.'s" issued before August 1943; postage paid.—R. Silcock, Bowkers Green, Aughton, Nr. Ormskirk, Lancs.

"Meccano Magazines," 1929-1932 inclusive; good condition; Also "Living Things," "More Living Things," "Moving Things" and "Everyday Things for Lively Youngsters"; all by Rowland and Smith.—Ferguson, Broadway, Exmouth (Devon).

No. 1 Special Tank Loco. and Rolling Stock, Gauge "0" and Signals; and volumes "Boy's Own Paper"; in good condition.—Brown, Little Somerford, Wilts.

Urgently: "Locos. L.N.E.R., 1923-37"; 5/- offered for copy in good condition.—C. Gillett, 29, Mount Pleasant, Harefield, Uxbridge, Middlesex.

Books about Railways and Model Railways, also Railway Postcards; good prices.—Ward, 13, Forfield Place, Leamington Spa.

In good condition, Four Meccano 2 in. Pulleys with Tyres; state price to—E. Allen, 2, Hickory Street, Blackburn, Lancs.

Hornby-Dublo Electric Passenger Train Set, "Duchess of Athol," with extra Straight Rails, Points, and Coaches; also "Dolly Varden" Doll's House, complete with Furniture. Good condition essential. State price.—Knockton, 4, Hartley Grove, Toll Bar, St. Helens, Lancs.

2-3·5 c.c. Model Aeroplane Petrol Engine; Two Sets Meccano Helical Gears.—McKay, Milnthorpe Drive, Winchester, Hants.

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