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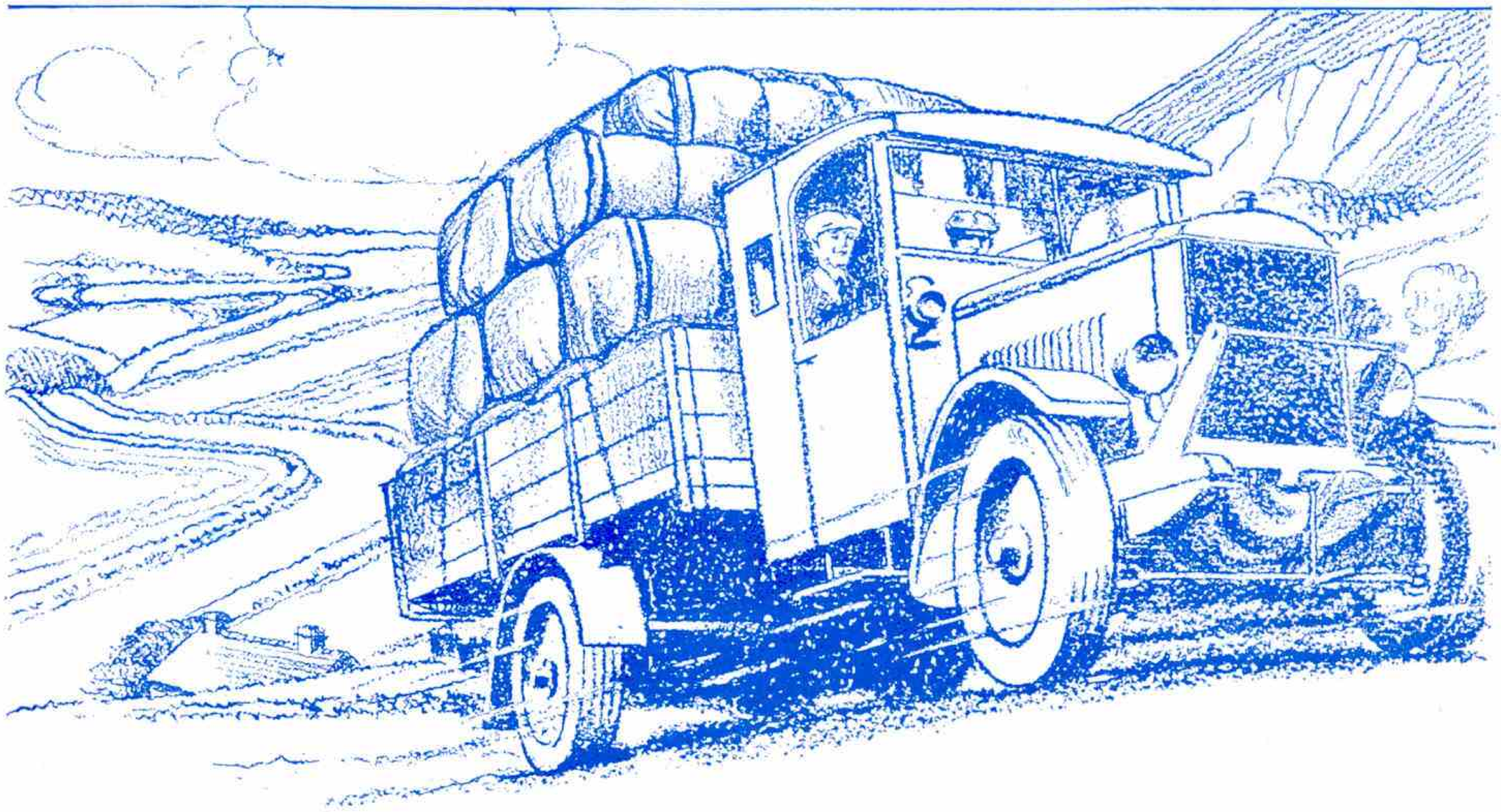
MECCANO MAGAZINE

THE CIERVA "AUTOGIRO"
AN AEROPLANE THAT CANNOT STALL (see page 362)

SECRETS OF ENGINEERING



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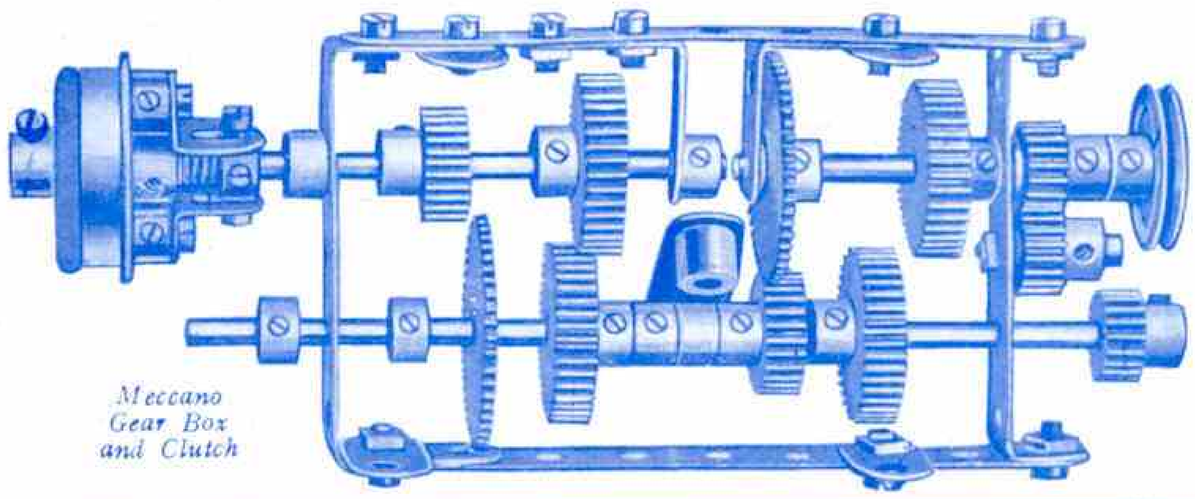

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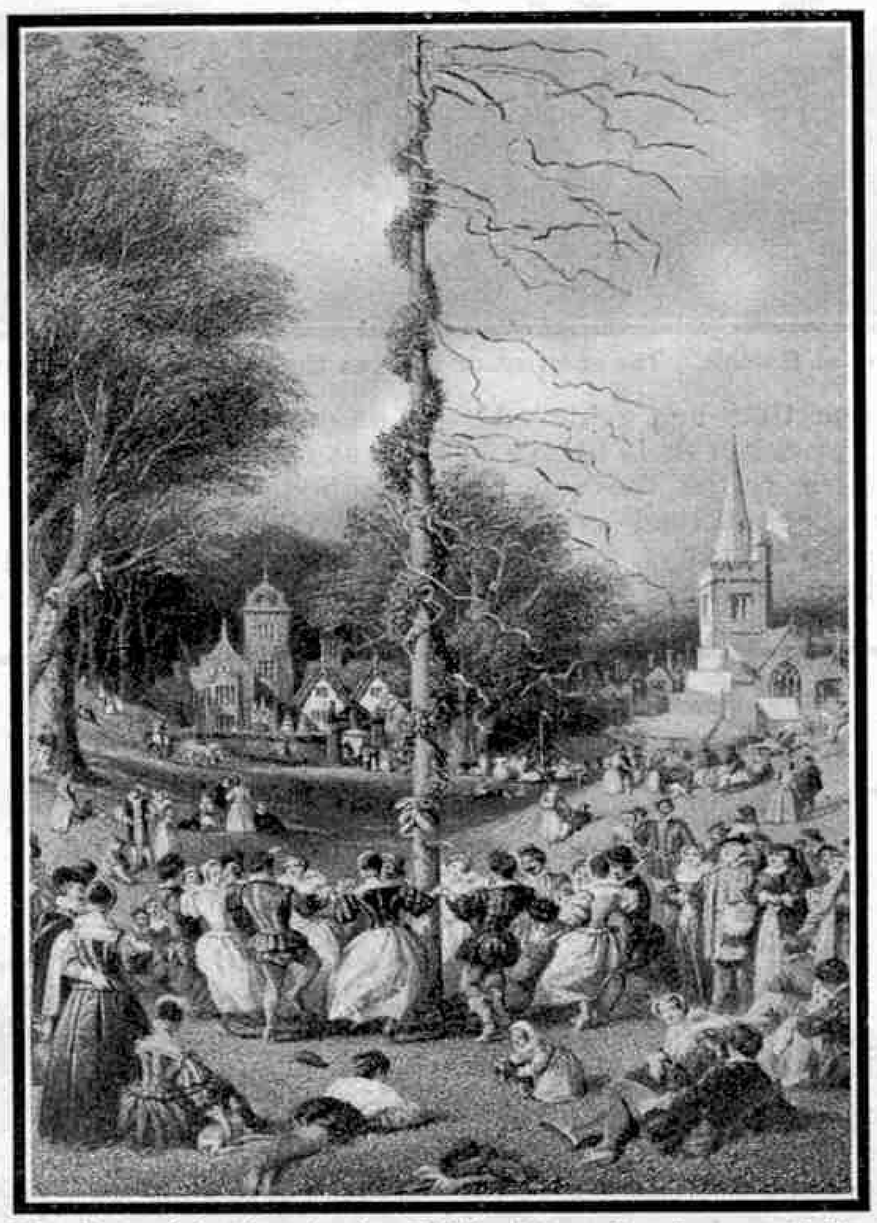
With the Editor

The May Day Festival

The first of May has been kept as a festival from very early times, and the custom is believed to date back to the Roman festival to Flora, Goddess of Flowers. In England, during the Middle Ages, it was customary on the first of May for people of all ranks to rise at dawn and go out "a-Maying" to welcome the coming of Spring. The fairest maid of the village was crowned with flowers and designated "Queen of May." In the Isle of Man two maidens were chosen, one to represent the Queen of May and the other the Queen of Winter. Each queen had a following of young men, who engaged in a mock battle intended to symbolise the last efforts of Winter to reign supreme.

Another aspect of the celebrations was the plaiting of the Maypole. The local inhabitants gathered together on the morning of May Day and, accompanied by the priests, marched to some neighbouring wood where they obtained a sturdy pole and decorated it with suspended leaves and flowers as emblems of Spring. The assembly then returned to the village green, where the pole was set up. Long ribbons of different colours were attached to the top of it, and their free ends were held by dancers who plaited and unplaited the ribbons during a dance.

The newly erected Maypole was often left standing until the following winter, and at some places the poles remained in position for many years, being used for other festivities in addition to those of May Day. Maypoles and May dancers were denounced by the Puritans and forbidden by Parliament, but they came into favour again during the reign of Charles II. The London Maypole demolished during the Commonwealth was replaced during the Restoration by a pole that is variously stated as being 100 ft. and 134 ft. in height. This pole was erected in the Strand close to Somerset House, and remained in position until 1717, when it was removed to Wanstead Park in Essex, and there utilised as part of the support of a large telescope erected by Sir Isaac Newton. It is recorded that on one May Day Henry VIII assembled his Court at Shooter's Hill, and it is known that Queen Elizabeth used to keep May Games at Greenwich.



May Day celebrations in the Middle Ages. Dancing round the Maypole on the village green.

During recent years the Maypole and its accompanying celebrations have fallen into disuse except at a few country places, where they are still carried on in the presence of large crowds of visitors. In many large towns and cities May Day is celebrated by a procession of vehicles drawn by the finest horses of all classes in the locality, beautifully groomed and decorated for the occasion. Prizes are awarded for the best turn-outs, and competition is usually very keen. May Day is also the occasion of great Socialist and Communist demonstrations in almost every country throughout the civilised world.

Another interesting historic celebration takes place on 29th May, the birthday of Charles II in 1630, and also the day in 1660 on which he landed in England at the Restoration. The Royalists celebrated the day by decorating their houses with branches and leaves of the oak tree, in this manner commemorating also the King's escape from capture after the Battle of Worcester by hiding in an oak at Boscobel, near Donington in Shropshire. At the Royal Hospital, Chelsea, Oak Apple Day is still observed as Founder's Day, on which the statue of Charles II is decorated with oak leaves.

Great Britain and Argentina

The visit of the Prince of Wales and Prince George to South America in connection with the great British Empire Trade Exhibition at Buenos Aires will be regarded as one of the outstanding features of 1931. This Exhibition was organised with the special object of bringing British products more prominently before the people of the Argentine Republic, but it has served also as a reminder of the close association that has existed between Great Britain and the Republic for more than 100 years. In a sense the connection is even older, for the second man to visit the country was Sebastian Cabot, the younger of the two famous brothers who sailed from Bristol in the time of Henry VII and discovered Newfoundland and the North American mainland. It was on Cabot's expedition that the name Rio de la Plata, or River of Silver, was given to the broad estuary on which Buenos Aires stands.

Closer contact between the two peoples began in 1806 when British troops captured Buenos Aires, only to be forced out of the city by the gallant defenders of the country. This fighting was not due to enmity between the British and the South Americans who, on the contrary, were quite friendly. The immediate cause of the war was an alliance with Napoleon made by the Spanish monarchy, to which the Argentine then belonged. In 1810 the inhabitants proclaimed their independence, and British warships anchored in the river celebrated the occasion by firing a salute. In the long fight for freedom that followed, the people of the Argentine were greatly helped by the official recognition given to them early in the struggle by the British Government.

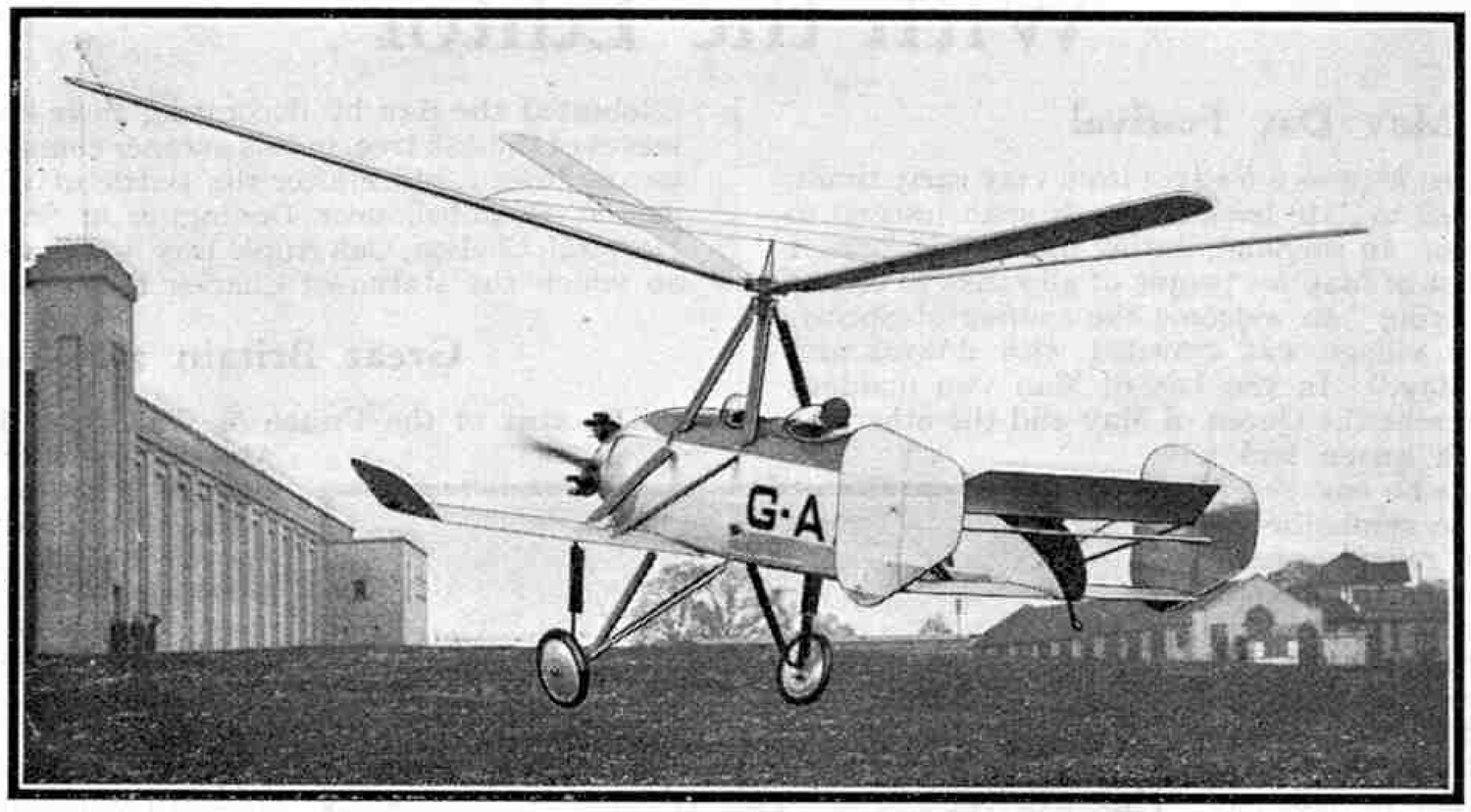
The friendship between the two nations has grown steadily during the past 100 years, and it is interesting to note how largely the Republic has been developed by British enterprise. The people of this country have invested in the Argentine no less than £500,000,000, a large proportion of which is invested in railways. Many readers may be surprised to learn that the Argentine has the fifth largest railway mileage of all countries in the world; the total length of track being nearly 25,000 miles, three-quarters of which is British owned. The chief product of the Republic also is largely British in origin, for the immense herds of cattle that feed on the magnificent pastures of the Pampas have been built up from pedigree stock imported from this country. It has been calculated that there are now 32,000,000 head of cattle in the Argentine, and two-thirds of these are animals of British breeds.

The Cierva "Autogiro"

A Light Aeroplane that Cannot Stall or Spin

THE great majority of aeroplane accidents result from collision with another machine or with some obstacle when an aeroplane is landing or taking off, or from "stalling" or losing flying speed when the machine is near the ground, and consequently has not sufficient room to recover. Both these causes are the result of the necessity for a high speed to be attained before safety and stability can be achieved. In addition the correct use of the controls is essential to maintain this speed, for immediately the stalling point is approached, the controls of the average machine become quite ineffective. Generally speaking, therefore, the fundamental dangers of flight may be summed up as being due to the necessity of maintaining a high forward speed and to the lack of stability and control when this speed is lost.

Many machines have been designed and constructed in the endeavour to eliminate these difficulties, but the only one that has achieved any real success is the "Autogiro," invented by Senor de la Cierva, a Spanish aircraft designer. This is claimed to be the safest aeroplane in existence. The problem has been solved in this machine by ensuring that when it has ceased to move forward there are still forces acting on the wings. These forces are provided by windmill-like blades that keep moving at a high speed, and give such support to the machine that it drops only at a rate that involves no danger. The actual speed at which the machine falls is less than the rate of descent of a parachute. The method in which the rotors are hinged to the rotating shaft also ensures that the machine will be perfectly stable at low speeds, and even if the controls are misused a stall or crash cannot result.



An "Autogiro" landing at Hamble. The short space between the machine and the building should be noticed.

De la Cierva first turned his attention to the "Autogiro" after a machine that he had designed for the Spanish Air Force crashed through stalling. This convinced him that aeroplane flight in which safety depended on speed was by no means ideal. Careful consideration of possible alternative systems of flight led de la Cierva to eliminate in turn not only the conventional type of aeroplane, but also the helicopter, an aeroplane capable of rising and descending vertically, and the ornithopter, a machine that attempts to imitate bird flight by deriving its lift from flapping wings. He became convinced that the solution lay in a machine having wings in the form of blades capable of rotating round a vertical axis.

Courtesy] [*Cierva Autogiro Co. Ltd.*

The latest model of the "Autogiro," the C.19 Mark III.

De la Cierva's first experiments were commenced early in 1920, and many varieties of revolving blades were tested on various aircraft, without any practical result being obtained. In the first type tested the revolving surface consisted of two four-bladed windmills mounted on a vertical axis and driven in opposite directions by the force of the wind; but this did not solve the problem. Shortly afterwards a second type was evolved, in which there was only a single windmill fitted with three cantilever blades. The blades were hinged so that their degree of incidence, that is the angle at which they face the airstream, could be varied at will by the pilot in order to alter the resultant lift to right or to left. The first attempts with this machine were encouraging, but after it had been damaged and modified and reconstructed nine times in the course of experiments it became clear that the solution of the problem had not been found.

The third type of "Autogiro" was fitted with a lifting windmill made up of five rigid blades heavily braced to the axis by steel wires. This machine appeared to be an improvement on the others, but after it had been damaged and repaired four times it was found to be unstable and was therefore put aside in favour of a fourth machine. This type embodied the principle of articulated blades, which eventually proved to be the main solution of de la Cierva's problem. The machine had a single windmill with four blades hinged at the root, so that they could move freely up and down in the vertical plane without any change in their angle to the airstream. Lateral control was provided for by tilting the axis to right or left, but this control proved to be too difficult for the pilot to operate, and many crashes resulted. This machine was reconstructed or modified no less than fifteen times.

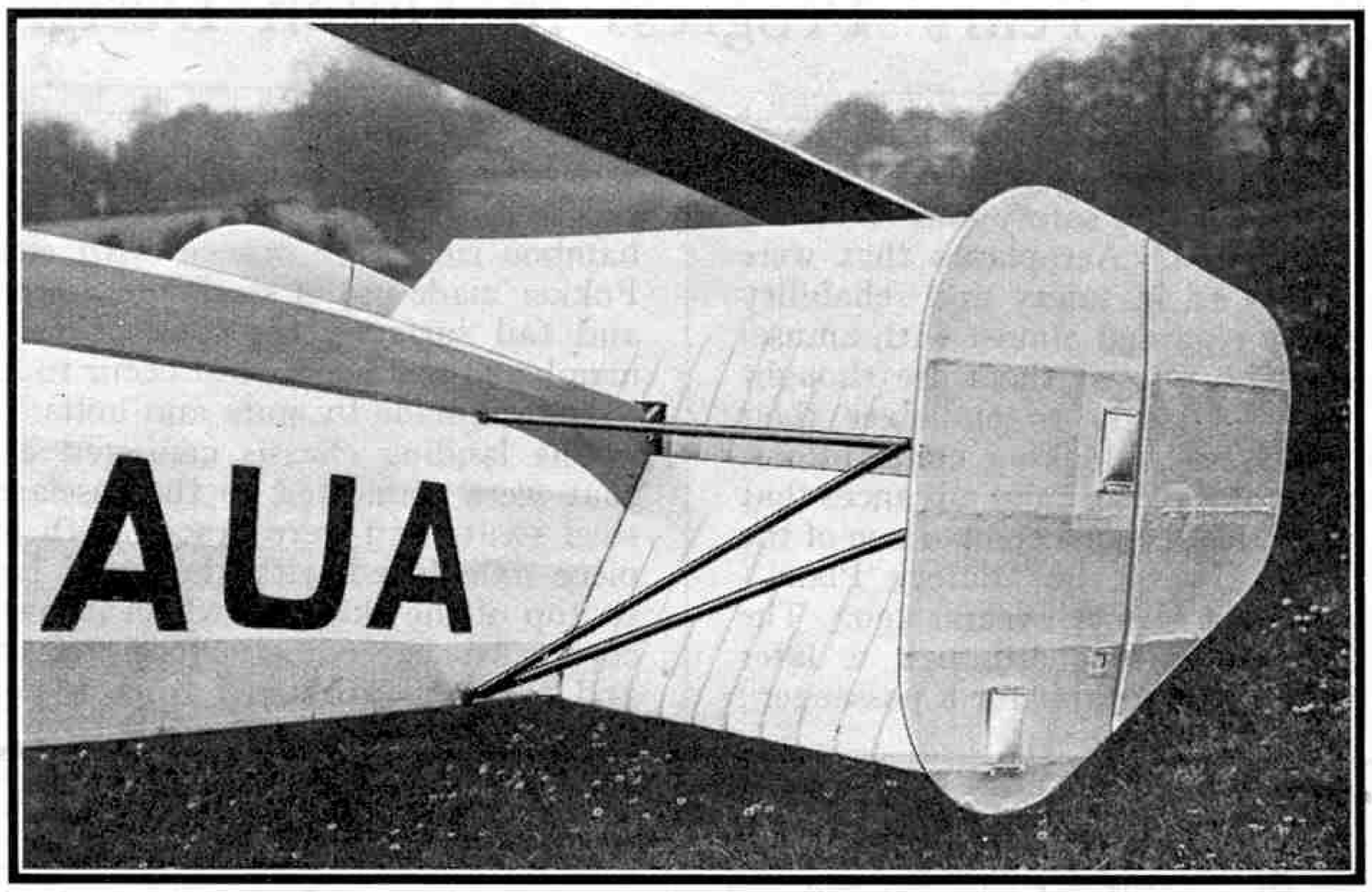
Eventually a better system of lateral control was provided, and in January 1923 a machine was completed that flew across the aerodrome at Getalfe, Spain. This machine subsequently carried out an officially observed and controlled four-minute flight over a closed circuit at the Guatro Vientos Aerodrome, Madrid.

Several other machines were produced after this, assistance being given to de la Cierva by the Spanish Government. One of these machines was demonstrated successfully at Farnborough in England, and at Villacoublay in France, and a similar machine constructed in 1925 by A. V. Roe & Co. Ltd. was demonstrated at the Hendon Air Pageant in 1926. The British Cierva Autogiro Co. Ltd. was formed in this country in that year, and now no less than twenty-one types of "Autogiros" have been constructed.

The modern "Autogiro" has a fuselage similar to that of any normal light aeroplane, but mounted above it on three supports rising over the front cockpit are four blades or rotors. These rotors are of aerofoil section and have a chord of 18.6 in. They are hinged

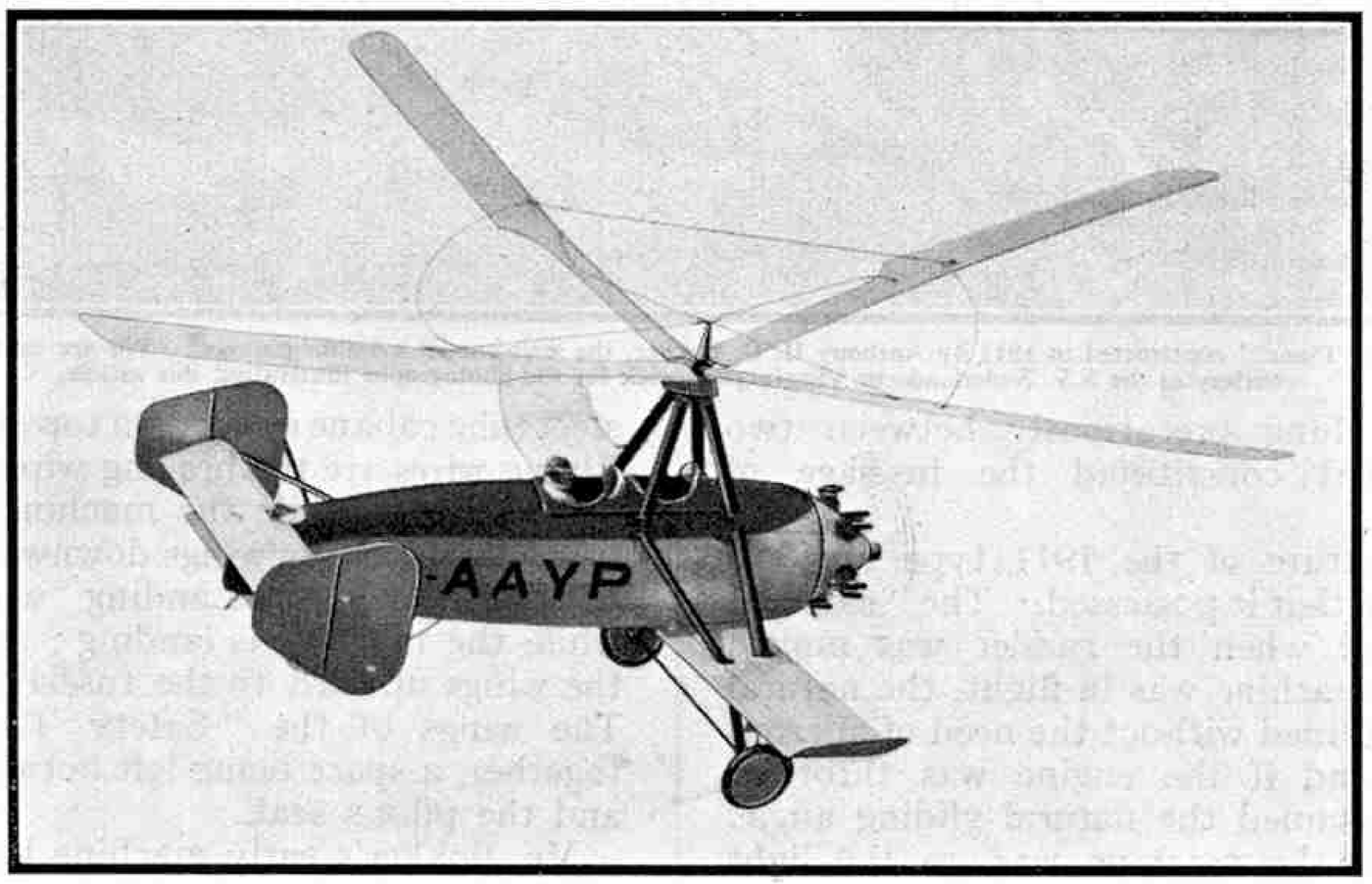
at their attachments to the supporting pylon head to give them full freedom in both the vertical and the horizontal plane, and they provide 80 per cent. of the total lift of the machine when it is travelling at a high forward speed. When the machine is descending vertically this proportion of lift is increased to 100 per cent.

In early types of the machine the rotors were started to revolve by winding a rope round the axis and then setting six or eight men to haul on the rope. Later the rotors were started somewhat in the same manner as a top by means of a mechanical contrivance on the ground; and an attempt was made also to start them by attaching rockets to their tips. Subsequently it was found that the rotors could be started by taxi-ing the machine round and round until they were in operation. In the latest model the empennage or tail unit has been so constructed that the tail plane and the elevator can be brought together to deflect the engine slipstream to the rotors while the machine in held stationary by means of wheel brakes. With larger land machines and with seaplanes a mechanical self-starter is provided. This derives its power direct from the engine crankshaft through a mechanically-operated clutch, and brings the rotors up to speed in less than 30 seconds. When the machine is in flight the clutch is completely disengaged and has no connection whatever with the rotation of the blades, thus eliminating all the torque reaction found in helicopters. A simple braking arrangement similar to the familiar wheel brake stops the movements of the rotors after the "Autogiro" has landed.



This photograph shows how the elevator and the tail plane are brought together to start the rotors by deflecting the slipstream on to them.

The "Autogiro" has also a small fixed wing that is used mainly to provide lateral stability and control in addition to improving the aerodynamic efficiency of the machine. This wing is used also as a base for the wide-track landing gear. It is interesting to note that the fixed wing does not stall even when the machine is descending vertically, as it is always in the downwash from the rotor. This fact has been proved by attaching a series of threads to each part of the wing. When the machine was flown it was found that at all speeds from vertical descent to the maximum possible the threads showed a change in the angle of airflow of only a few degrees, and never approached an angle that would indicate that the fixed wing was in a stalled position.



The Cierva "Autogiro" in flight. For permission to reproduce the photographs on this page and the upper one on the opposite page we are indebted to the courtesy of "Flight."

In early models of the modern "Autogiro" it was found that the high centre of gravity, combined with the low fin area formed by the fuselage and vertical surfaces, rendered the machine laterally unstable at high speeds. This has been corrected in the present machine by setting the fixed wings at a substantial upward angle to the horizontal, and also by providing turned-up wing tips, giving the effect of high fin area.

The landing gear is of the wide-track divided axle type, and long-travel Oleo shock absorbers are used. The gear has been subjected to a great deal of strenuous service and has given complete satisfaction even after innumerable hard landings at the end of vertical descents with heavy loads. It is therefore considered as having been proved that the stresses on the landing gear of an "Autogiro" are less than those with ordinary aeroplanes of the same gross weight. These lower stresses make it possible to design parts of the fuselage and the fixed wing lighter than can be done in a normal aeroplane, with the result of a valuable saving in weight.

The "Autogiro" C.19 Mark III has a span and length of 35 ft., and is 10 ft. in height. The chord of the stabilising plane is 2 ft. 9 in., and it has an area of 42 sq. ft. The rotor blades have a total area of 91.25 sq. ft. The machine has a tare weight of 935 lb., and a loaded weight of 1,400 lb.; its maximum speed is 100 m.p.h. and its rate of climb 750 ft. per minute. It takes off in 30 yd., and there is no landing run or landing speed in still air.

The "Autogiro" is flown in a similar manner to an ordinary aeroplane. In order to take off the necessary revolutions of the rotor blades must first be obtained, and the brakes then released. The machine immediately begins to run forward in the normal manner, but takes off suddenly at a comparatively low horizontal speed, and maintains a fairly rapid climb at a slower forward speed than the conventional type of aeroplane. A notable feature when the machine is in flight is that bumps are hardly felt unless they are exceedingly strong; so that even in the worst weather there is little need to work the controls. When the pilot wishes to make a turn the rudder only need be used. The machine banks automatically unless the turn is very sharp, in which case the machine starts to turn flat before banking, and although the air speed drops there is no lack of lateral control. If the manœuvre has been too sudden, all that happens is the loss of a few feet in turning.

In a normal landing, when the engine is throttled down, the "Autogiro" glides at any speed desired until a height of from 3 ft. to 10 ft. above the ground is reached, and then the "stick" is pulled hard back. The nose rises and the machine stops at once, dropping very slowly to settle gently on the ground. If a forced descent from engine failure or any other cause necessitates a landing in a small field surrounded by high trees or similar obstructions, the machine can be made to drop slowly and vertically, but with perfect stability and still completely under control.

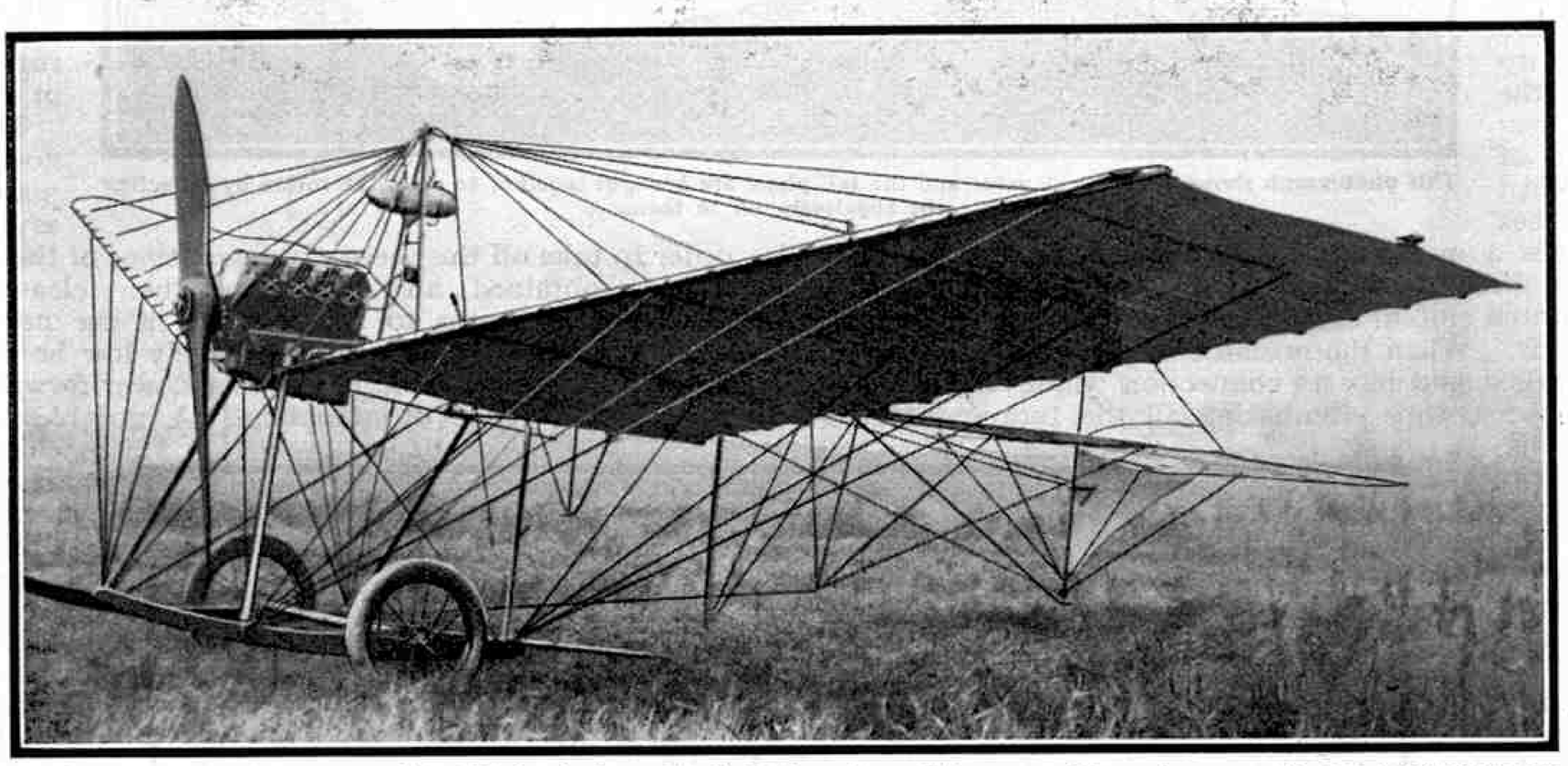
With the "Autogiro" there is no need for the delicate handling that is essential in a normal aeroplane. The machine actually looks after a pilot who, owing to inexperience, or lack of judgment, has mistaken his height when flattening out; and the pilot is free from any anxiety due to thoughts of forced landings or accidents due to engine failure. This makes it (Continued on page 437)

The Fokker "Safety 'Plane" and the F.XII

Twenty Years' Progress in Dutch Design

ONE of the greatest romances of modern times is the rapidity with which the safety and efficiency of aircraft has increased. Aeroplanes that were considered the very last word in safety and reliability only 20 years ago are now regarded almost with amusement, and the pioneers who piloted them are thought of as having been very foolhardy to endanger their lives by going up in such weird-looking contraptions.

An interesting example of the enormous advances that have been made may be gained from a comparison of the latest Fokker machine F.XII, and the "Safety 'Plane" produced in 1911, exactly twenty years ago. The 1911 machine carried one person, although a later model was fitted with an extra cockpit for a passenger; whereas the F.XII has accommodation for 16 passengers and a crew of two. The occupants of the new air liners are carried in a luxuriously appointed saloon, but the pilot of the "Safety 'Plane" was entirely uncovered. His cockpit consisted of a seat slung precariously between two wooden longerons that constituted the fuselage of the machine!



The "Safety 'Plane" constructed in 1911 by Anthony H. G. Fokker, the well-known aviation pioneer. We are indebted to the courtesy of the N.V. Nederlandsche Vliegtuigenfabriek for the photographs illustrating this article.

The outstanding feature of the 1911 type was the great inherent stability that it possessed. The "safety" features provided that when the rudder was moved to one side while the machine was in flight, the natural degree of bank was attained without the need of ailerons or warping wings; and if the engine was throttled down, the machine assumed the natural gliding angle.

The construction of the machine was, in the light of modern practice, exceedingly crude. The fuselage consisted of two wooden longerons that were connected by transverse members. It carried the engine, empennage or tail unit, and the pilot's cockpit. Although the longerons were of wooden construction, the tail surfaces were built of steel tube frames covered with suitable fabric and fitted with bamboo ribs. The rudder was constructed in two parts, mounted one above and one below the fixed tail plane.

The wing construction was very interesting, the framework being of steel tubes covered with suitable fabric, into which were sewn pockets to receive the ends of bamboo ribs. The correct aerofoil section was achieved by inserting the front ends of the bamboo ribs into the ends of curved steel tube pieces. The bamboo ribs were braced with elastic. Although Mr. Fokker made use of steel tube framework for both wing and tail surfaces, the idea of welding the steel tube members together did not occur to him. All joints were therefore made by nuts and bolts.

The landing chassis consisted of two wooden skids that were connected to the fuselage by means of four steel struts and were braced with piano wires. A one-piece axle fitted with the usual landing wheels rested on top of the skids, to which it was sprung with elastic cord. An exceedingly long tail skid was provided, and this was stretched from a point on the fuselage immediately behind the pilot's seat to the rear end of the machine. The two wings were fitted to the undercarriage struts and braced with "flying wires" attached to the skids, and with "landing wires" attached to a steel tube cabane erected on top of the fuselage longerons. Flying wires are the bracing wires that carry the stresses on the wings while the machine is in flight. They go from the tip of the wings downward towards the fuselage or undercarriage. Landing wires take the stresses while the machine is landing; and go from the tips of the wings upward to the fuselage or top of the cabane. The wings of the "Safety 'Plane" were not joined together, a space being left between them for the engine and the pilot's seat.

Mr. Fokker's early machine had a span of 13 metres (42.7 ft.) and a length of 8.4 metres (27.4 ft.). It was 3 metres (9.8 ft.) in height; the total wing area was 26 sq. metres (279.7 sq. ft.), and it was powered with either a 50 h.p. or an 80 to 100 h.p. standard water-cooled engine. It is interesting to note that in the later model of the machine, fitted with an extra seat for a passenger, the seats were covered by a wooden fairing in order to protect the occupants. This later model was known as the "Military Type."

The latest Fokker machine is an 18-seater monoplane produced primarily for service with the K.L.M., or Royal Dutch Air Lines, on the company's air mail service between Amsterdam and Batavia. The machine

is a triple-engined high wing monoplane fitted with three Pratt and Whitney "Wasp" engines each developing 425 h.p. An interesting feature is that, although the machine has been developed from the Fokker F.IX, which is fitted with three lower-powered Bristol "Jupiter" engines, it is considerably smaller and has accommodation for less passengers. This reduction in size and increase in power of the engines has been carried out in order to make the machine capable of maintaining flight with any two engines running, as a long journey across the Mediterranean, from Athens to Sollum by way of Crete, has to be made on the Amsterdam-Batavia route. This oversea flight occupies four hours.

A three-quarter view of the Fokker F.XII. Numbers of these machines have been produced for the Dutch air line companies.

The fuselage of the Fokker F.XII is built up on a framework of welded seamless drawn steel tubes, partially braced with welded steel tubes and partially with steel wire, on the usual modern Fokker method. The bottom of the fuselage is further stiffened by means of floor boards, which are bolted on to the joints in the framework.

The wing is secured to the joints in the top of the fuselage framework over the cabin. Any lateral stresses are conveyed along the top of the fuselage framework and down through the front wall of the cabin, which is braced with tubes in the same way as the framework of the fuselage. The tubes of the undercarriage are secured to the same joints as the lower end of the front wall, and also to the next joints to the rear in the bottom of the fuselage.

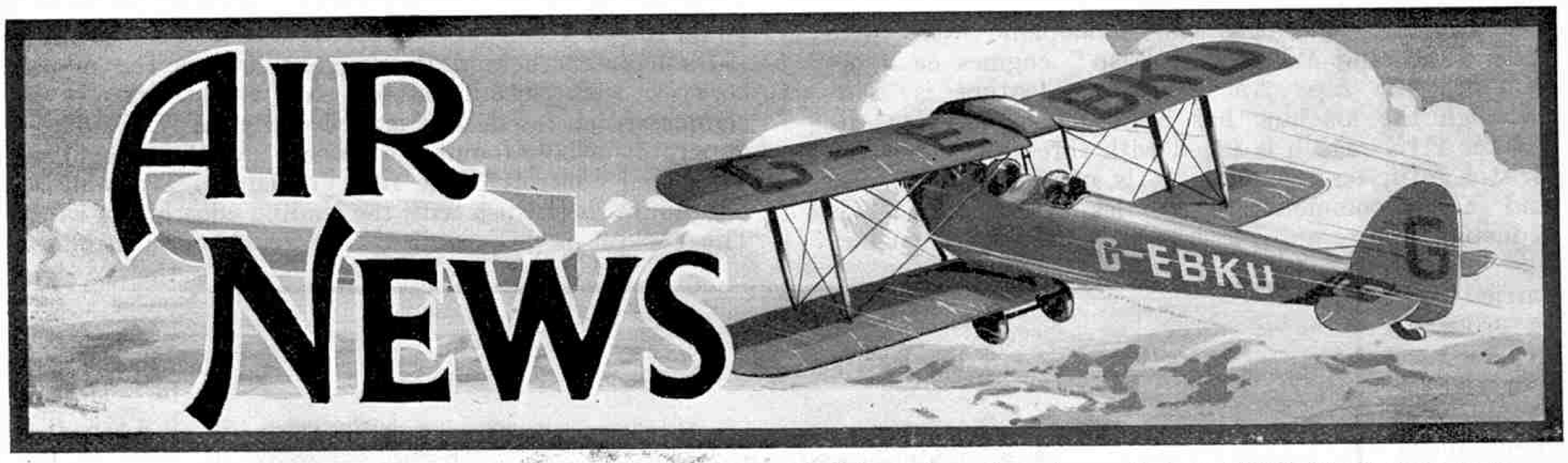
The engine bed is welded on to the front of the fuselage, and this section contains all the usual engine accessories, including the oil tank. An aluminium fire screen separates the engine bed from the forward luggage hold, which covers the entire width of the fuselage and runs back under the cockpit. The placing of the luggage compartment in this position assists to deaden the noise of the engines in the front of the fuselage. The hold is 7 ft. 3 in. in length, 5 ft. 9 in. in width and from 2 ft. to 3 ft. in height. It has a total capacity of 102.5 cu. ft., but of this 71 cu. ft. is partitioned off for the pilot's luggage, and 10.6 cu. ft. for wireless gear.

Immediately behind the luggage hold is the pilots' cockpit, with accommodation for two pilots. It is completely enclosed, and is well equipped with all the apparatus usually found in a modern aeroplane, together with dual controls. The roof consists of a reinforced duralumin sheet flush with the leading edge of the wing. The cockpit is provided with a four-section window, the two outer sections of which may be slipped back in front of the two middle ones, which are fixtures. Sliding windows are also provided in both side walls, and these may be used as emergency exits. Behind the side window and the front spar of the wing another window has been placed, to enable the pilot to obtain a view several degrees to the rear. Access to the cockpit is obtained through double doors in the front of the passengers' cabin.

The passengers' cabin is situated to the rear of the cockpit, and is 16 ft. in length, 6 ft. 7 in. in width, and 6 ft. 3 in. in height. The roof of the forward part slopes down toward the cockpit in order to secure sufficient fall for the petrol conduits over the cabin, and also to ensure that the pilots can obtain a good view of the gauge glasses, which are mounted on one of the spars. The cabin accommodates 16 passengers, and two of these are seated one on each side immediately behind the partition separating the cockpit from the cabin, thereby leaving ample room for passage into and out of the cockpit. Behind the front seats there are four rows of three, two seats in each row being on the right-hand side of the cabin, and the other being on the left. At the after part of the cabin there are only two chairs, so as to provide a free passage to the exit. The cabin windows are of safety glass, and they may be raised or lowered by means of a crank handle according to the wishes of the passengers. They afford an unimpeded view of the country over which the machine is flying. The entrance door to the cabin is at the left-hand side and is at the rear.

Another view of the F.XII. This machine is fitted with three Pratt and Whitney "Wasp" engines.

The after luggage hold has a capacity of 74 cu. ft., measuring 3 ft. 9 in. in length, (Continued on page 446)



Night Air Mail Services in Canada

A regular night air mail service has now been inaugurated between Calgary, Lethbridge, Medicine Hat, Moose Jaw, Regina and Winnipeg. The service covers a distance of 1,000 miles and was previously operated only during the day time. Since its introduction the time taken for letters to travel between Calgary and Winnipeg has been reduced by 22 hours, and letters posted in Calgary in the evening are now delivered in Winnipeg the next morning, a full day before mails carried by train could possibly reach their destination.

Months of preparation were necessary before regular flying by night across the Canadian prairies became possible. This included the erection at Lethbridge of a large rotating beacon that is plainly visible from a distance of 80 miles, and a new Municipal Air Port also has been constructed at that place. Similar work has been carried out at other air ports.

Another new link in the air mail service in Western Canada also was established a short time ago when a service was opened between Winnipeg and St. Paul's, Chicago and Eastern Canada. By means of this service, letters leaving Winnipeg by the morning mail will be delivered next morning at Toronto and other places in Ontario, as well as in Detroit and New York. Through connections also will be made with the air mail services of Western Canada, including the new night service between Calgary and Winnipeg to which we refer above.

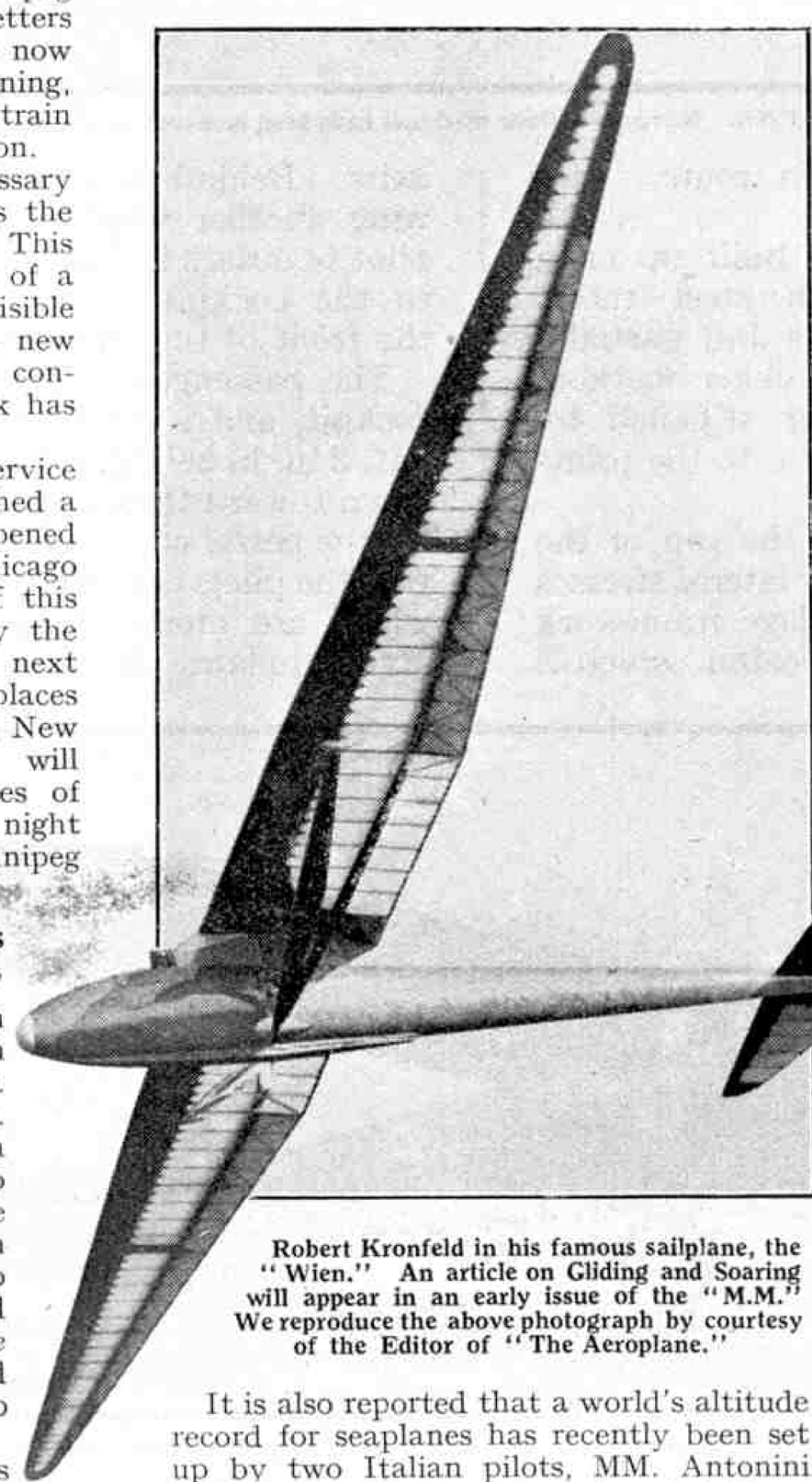
A Flying Tour of the British Isles

Last month a flying "circus" started on a tour of the British Isles in order to give displays at more than 150 aerodromes and landing grounds. The "circus" is led by Captain C. D. Barnard, who is accompanied by a number of well-known pilots and also by Mr. John Tranum, the parachute jumper. The "circus" employs an "Autogiro," an Avro "Avian," two three-seater Spartan machines, and the famous Fokker monoplane "*The Spider*," in which Captain Barnard and the Duchess of Bedford flew to India and South Africa.

In addition to giving actual displays of flying, members of the "circus" will take passengers for short flights, and numbers of school children are to be given flights free of charge. At each town at which a demonstration is staged, the "circus" will pay for one schoolboy to be trained to fly an aeroplane at the nearest flying club. The tour is not expected to be completed until next October, and it is thought that considerable interest and enthusiasm in aviation will be aroused by it.

World's Duration and Distance Records

Two well-known French pilots, MM. Bossoutrot and Rossi, claim to have made a new record for duration and distance flown in a closed circuit. They remained in the air for 75 hours 22 min. and covered a distance of about 5,500 miles. These figures are 8 hours 9 min. and 382 miles respectively greater than the previous best.



Robert Kronfeld in his famous sailplane, the "Wien." An article on Gliding and Soaring will appear in an early issue of the "M.M." We reproduce the above photograph by courtesy of the Editor of "The Aeroplane."

It is also reported that a world's altitude record for seaplanes has recently been set up by two Italian pilots, MM. Antonini and Trevisan, who attained a height of 17,467 ft. in a Caproni 100, equipped with a British "Cirrus Hermes" Mark II engine.

* * * *

The race for the King's Cup is to take place on 25th July. The course to be followed by the machines taking part will be approximately 1,000 miles, the start and finish being at Heston Aerodrome, London. This year machines may only be entered by private owners.

Unique Flying School at Hamble

A new aviation training establishment was opened by Air Service Training Limited at Hamble, Southampton, on the 14th of last month. The object of the school is to promote and develop aviation generally, and to give training in flying and the allied ground subjects on similar lines to those employed in the British Air Forces.

The school has been established on land adjoining Southampton Water in order that training in the control of seaplanes may be included. Armstrong Whitworth "Atlas" and "Siskin" machines are used in tuition and actual flying is supplemented by instruction in navigation, meteorology, wireless, the principles of flight and the theory of aircraft and engine construction.

Distant Reading Compass for Aeroplanes

Owing to the large number of instruments carried on the dashboard of modern aeroplanes, there is often no room to install a reasonable efficient compass within easy reach of the pilot. A new distant reading compass has therefore been introduced by a British firm. This may be placed in any part of the fuselage, room for a small dial only being required on the dashboard of the machine. The instrument must be set to give zero reading on the dial when the course decided upon before the flight commences is being followed. Deviations from this course are shown by movements of the needle to the right or left of the zero mark, and in order to correct these the pilot merely applies corresponding rudder until the pointer returns to its normal position.

Air Service Over Brenner Pass

Proposals have been made for the establishment of an International Air Service between Berlin and Rome. If the service is established, the machines will fly over the Brenner Pass, the most direct route between Germany and Italy, and will pass over German, Austrian and Italian territory.

New Machines for the R.A.F.

By the end of next month one Flight of No. 23 (Fighter) Squadron is to be equipped with Hawker "Hart" two-seater fighters fitted with Rolls-Royce "Kestrel" engines. This will be the first time for many years that two-seater fighting machines have been employed in the Royal Air Force. No. 43 (Fighter) Squadron also is to be re-equipped, Hawker "Fury" single-seater fighters having been decided upon as the standard machine for this Squadron. A photograph of this machine was given on page 873 of our November, 1930, issue.

New Armstrong Whitworth Air Liner

All the large air liners so far employed by Imperial Airways have been of the biplane type, but a high-wing monoplane is now being constructed for the Company by the Sir W. G. Armstrong Whitworth Aircraft Co. Ltd. The general appearance of the new machine is shown in the lower illustration on this page. It will be used on the regular air lines of Imperial Airways, but is intended particularly for employment on certain African sections of the London-Capetown Air Service.

The fuselage of the Armstrong Whitworth monoplane is made throughout of a framework of steel sections formed from steel strips, while the floor and the covering of the cabin are of three-ply wood. The wing also has a covering of three-ply. The landing gear is of the ordinary type, telescopic oil-damped shock absorbers being fitted. An unusual feature is that a tail wheel is used instead of a skid. A machine so fitted is easier to handle, and is less destructive to aerodrome surfaces, than one provided with a skid. It will be remembered that a wheel is also used at the rear of the new Handley Page liners that were described on page 308 of last month's issue.

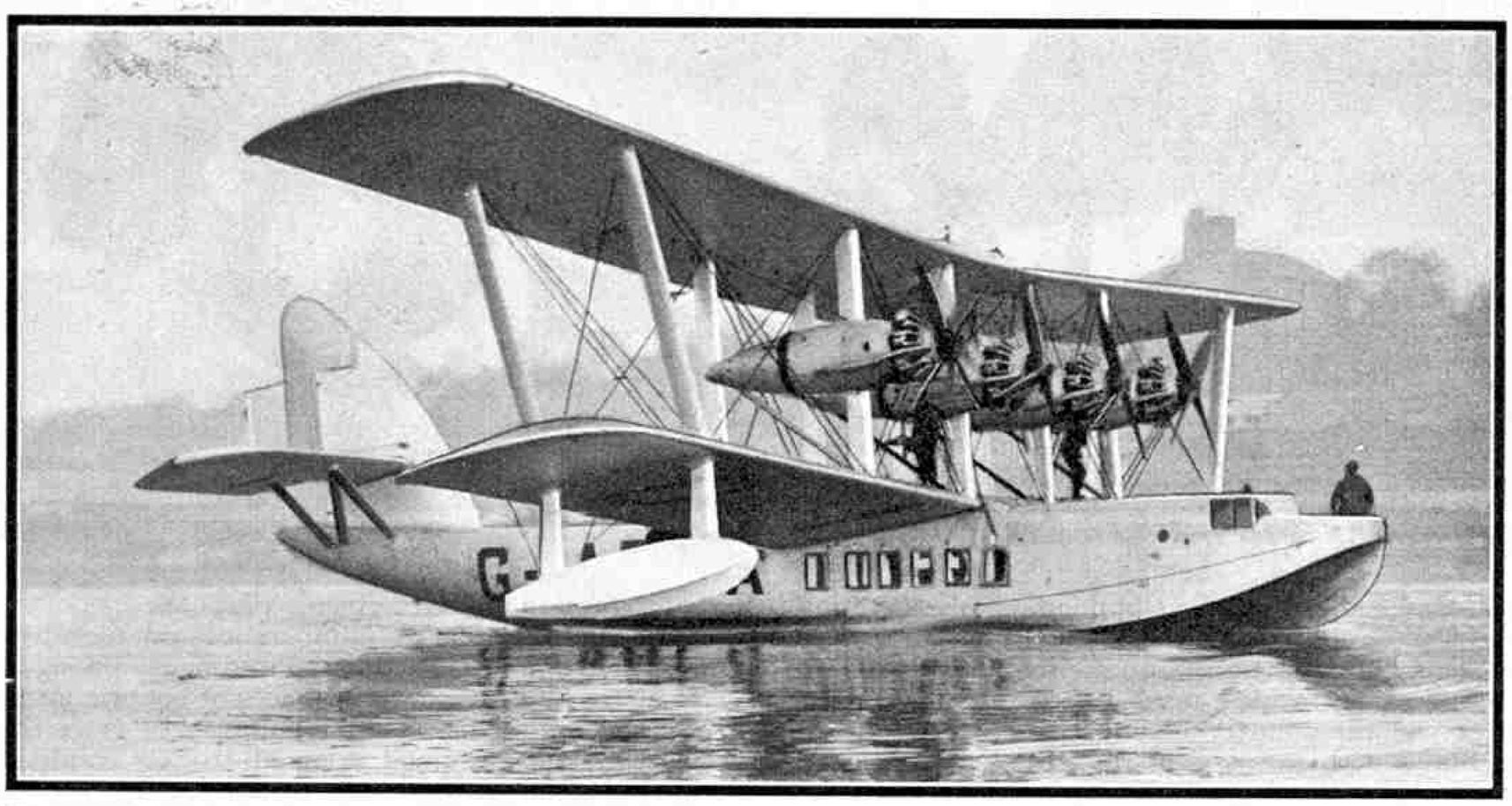
The aeroplane is fitted with wheel brakes, and as the centre of gravity of the machine is very low, a very powerful braking effort may be applied without causing the tail wheel to rise from the ground. On an average aerodrome on a calm day the monoplane may be stopped in less than 200 yards.

The pilots' cockpit is fitted with dual control apparatus so that two pilots may be carried. The passengers' cabin measures 17 ft. 6 in. in length and has an average width of 6 ft. 9 in., while the clear height in the middle is 6 ft. 3 in. There is accommodation for 17 passengers. The steward's pantry and buffet, and the compartment for passengers' luggage, are situated at the aft end of the cabin, the forward end accommodating the main freight and mail compartment. A passage is provided on the starboard side in order to give access to the pilots' cockpit, the wireless compartment, and the cabin.

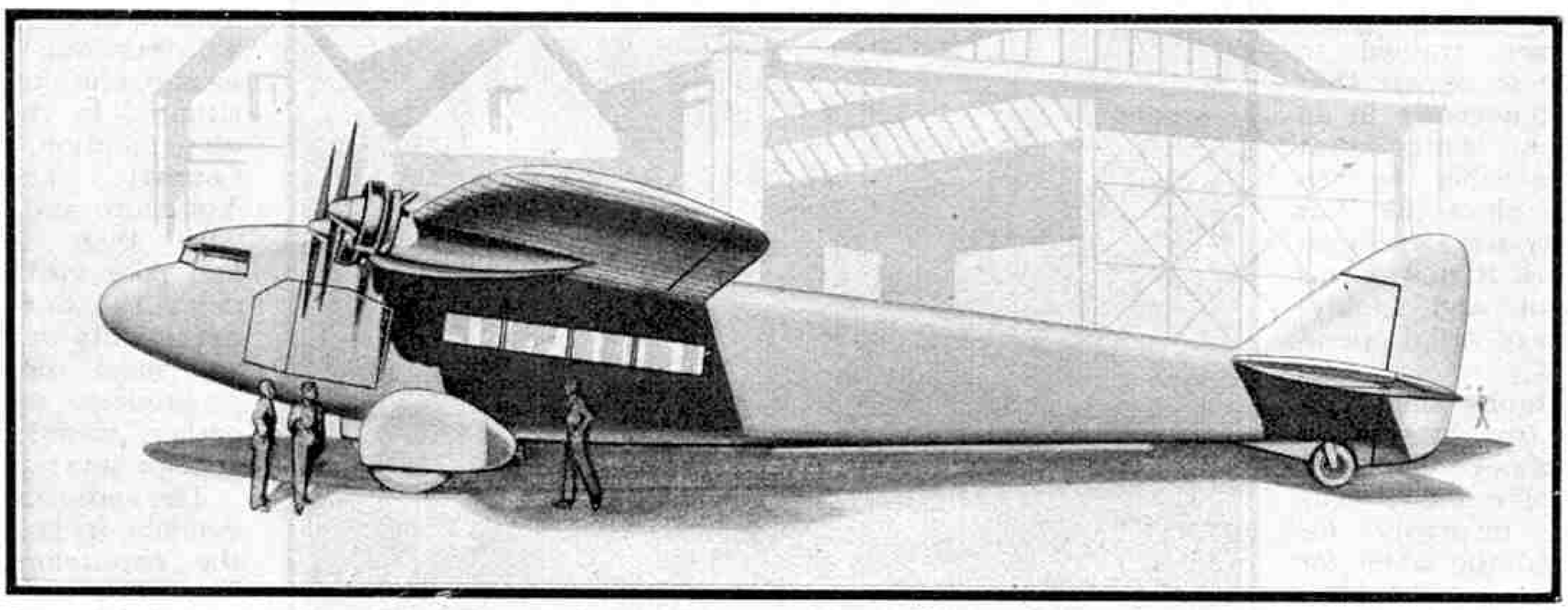
The absence of an engine fixed to the fuselage, and the position of the cabin well aft of the zone of the engines and airscrews, tend to make the passengers' quarters much quieter than those of an ordinary three-engined machine. In addition, the engine exhaust is taken over the top of the plane in order to reduce the noise in the cabin as much as possible.

The monoplane is fitted with four engines, all of which are carried in front of the plane. The power unit chosen is the Armstrong Siddeley "Double Mongoose" ungeared 10-cylinder engine, which develops 340 h.p. at normal speed. The machine will fly on a level course above its operational height with any one engine out of action, and the cruising speed is based on a power output of not more than 60 per cent. of that developed by the engines at ground level. This ensures long life and low maintenance cost and running expenses.

The aeroplane has a span of 90 ft. and an average chord of 14 ft. 9 in. Its height is 15 ft., while its length is 71 ft. 6 in. The maximum all-up weight is 17,500 lb., and the weight allowed for the pay load and the crew is 4,500 lb. It is expected that the landing speed with full load will be less than 60 m.p.h., and that with one engine stopped, a speed of at least 90 m.p.h. will be maintained at any height below 7,000 ft. The fuel consumption at 115 m.p.h. and 7,000 ft. will be 60 gallons per hour.



The "Scipio," the Short "Kent" flying boat referred to in an article on this page. Our illustration is reproduced by courtesy of Short Bros. (Rochester & Bedford) Ltd., the designers and makers of the machine.



An artist's impression of one of the monoplanes now under construction for Imperial Airways Ltd. by the Sir W. G. Armstrong Whitworth Aircraft Co. Ltd., to whom we are indebted for permission to reproduce it.

The Short "Kent" Flying Boat

On page 310 of last month's issue we published a brief description of the new Short four-engined flying boat produced for Imperial Airways Limited. The new type is called the "Kent," and the first of the class has now been delivered. It is called the "*Scipio*," and two other machines that have been constructed are to be named "*Satyrus*" and "*Sylvanus*."

An interesting feature of the "*Scipio*" is that in addition to accommodation for 15 passengers in a large and luxurious saloon, the machine has a large compartment in which there is room for more than 1½ tons of urgent mail. The crew includes a steward, who is in charge of a well-equipped refreshment buffet, and a wireless operator. The wireless apparatus installed has a range of 550 miles while the machine is flying and a telescopic aerial has been fitted in order that messages may be transmitted while the machine is resting on the water.

New Names for Rolls-Royce Engines

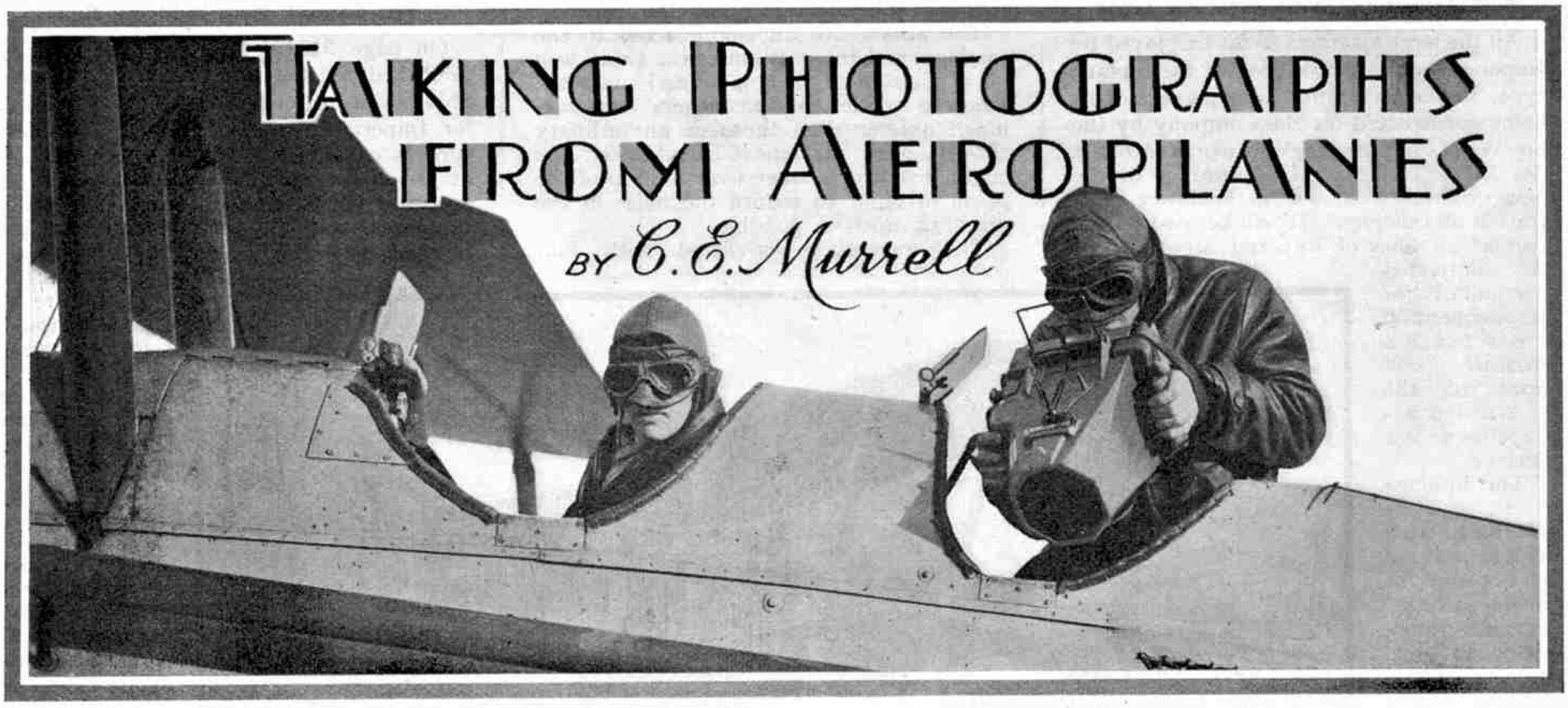
The well-known Rolls-Royce "F" and "H" types of aero engines are in future to be known as the "Kestrels" and the "Buzzards" respectively. The engines formerly described as the F.XI, the F.XII, and the F.XIV, will now be known as the "Kestrel" I, II and III respectively, the Roman numerals signifying the gear ratio with which the engine is fitted. The letters A and B will continue to be used to indicate engines with low and high compression ratios, and the letters M.S. and S. will be employed to denote those fitted with moderate superchargers and full superchargers. Thus, the F.XIB will in future be known as the "Kestrel IB." Similarly the H. XIV M.S. will be known as the "Buzzard III M.S.", the final letters showing that the engine is fitted with a moderate supercharger.

* * * *

The Segrave Trophy for 1931 has been awarded by the Royal Aero Club to Air Commodore Kingsford-Smith.

TAKING PHOTOGRAPHS FROM AEROPLANES

BY C. E. Murrell

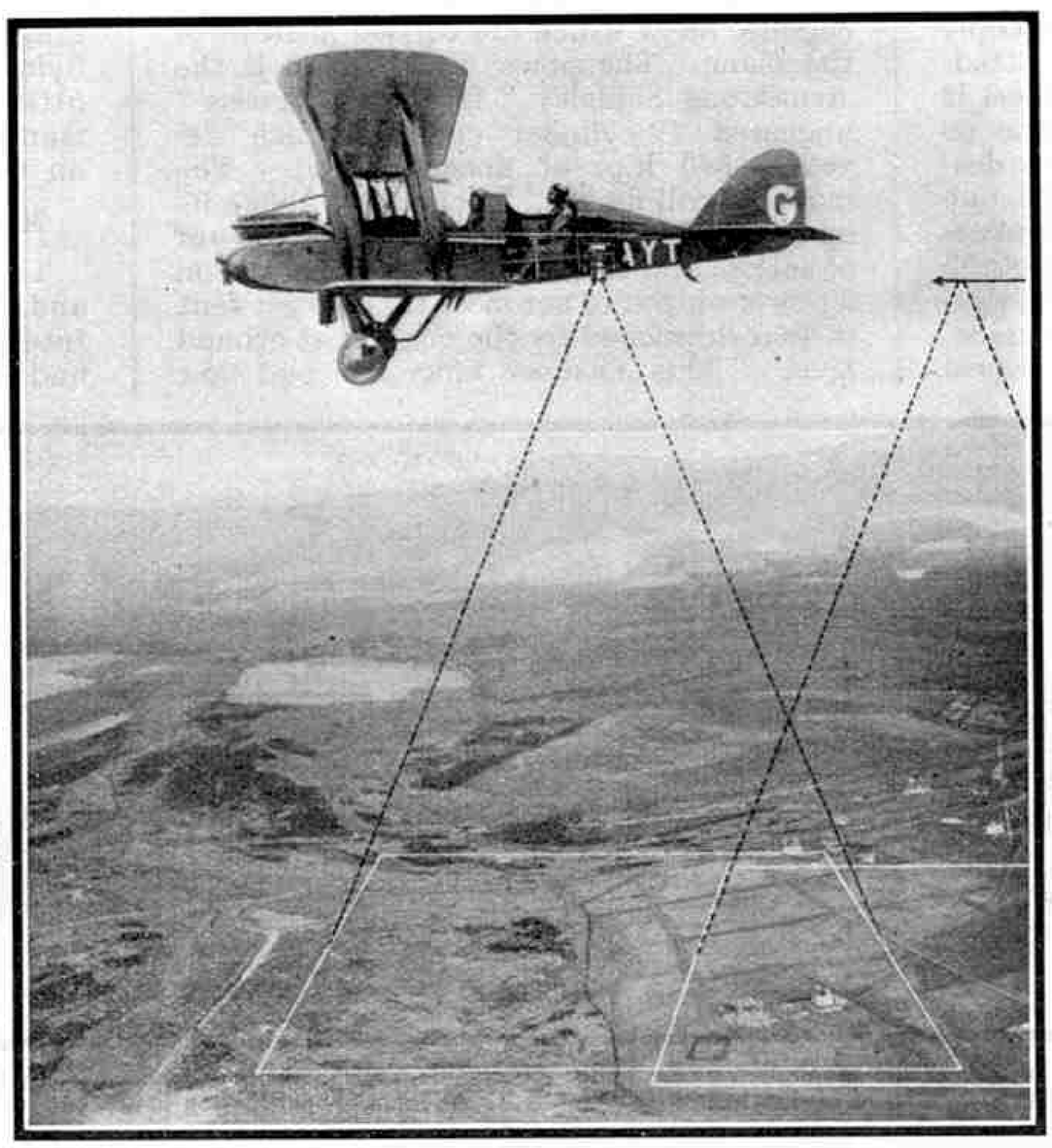


ONE of the most interesting recent developments of photography is that of aerial photography, or the taking of pictures from aeroplanes. This branch of photography originated in the War as the result of the urgent necessity of making records of the enemy's lines and the country behind them. The earliest photographs were taken with cameras of the ordinary type, and were not very successful. By degrees, however, there were developed cameras specially suited for this work, and capable of producing results as perfect as those obtainable by the best cameras of normal type used on the ground. The next problem was that of interpreting the photographs thus taken. The appearance of an aerial photograph is so different from that of one taken on the ground that its indications are apt to be misleading. The urgency of war conditions caused the art of interpreting aerial photographs to be developed with great rapidity, and men trained to the work became so expert that they could see at a glance in an aerial photograph things that were literally invisible to the casual observer. Since the War aerial photography has developed and extended until it now forms a very important and highly-specialised branch of aerial operation.

Aerial photographs may be classified under two headings—the oblique or bird's-eye view, and the vertical or plan view. The former is used primarily for pictorial work, and the latter for survey purposes.

Photographs taken from the air are now playing an important part in the pictorial advertising of the principal manufacturing and industrial concerns throughout the country, and are being extensively used for many other practical purposes. The air picture is acknowledged to be the most effective and convincing means of illustrating the layout and extent of business premises, factories, docks and estates. The popularity of the air picture arises largely from the fact that the aerial camera enables one to visualise the subject under review in a leisurely manner without the necessity of studying plans and numerous ground-level photographs. Every little detail is clearly seen at a glance, and the pictures, being up-to-date and attractive in appearance, are particularly suitable for reproduction for advertising purposes.

In addition, large numbers of air pictures are taken solely for their pictorial value. Prominent among the subjects dealt with are castles and other places of historic interest, health resorts, colleges and schools; and a library of more than 35,000 such air pictures is maintained in an up-to-date condition by retaking the photographs at intervals of two years or less. By means of carefully planned tours, our aeroplane systematically covers the British Isles in the course of twelve months, and during this period the most important towns are visited several times.



The upper illustration shows a photographer taking oblique or "bird's-eye view" photographs from an aeroplane. The lower photograph illustrates the making of a land survey by means of vertical and overlapping pictures. For the illustrations to this article we are indebted to Aerofilms Ltd.

A tour of the country by air is an extremely interesting experience at all times. This is particularly the case during a photographic tour, for then our attention is focussed upon many points of interest that normally might be overlooked. We shall visit a chain of aerodromes and landing grounds, some of which will form our temporary bases for local operations, particularly those situated in the principal centres of population, such as the Black Country. The West Riding of Yorkshire and South Lancashire, with their smoky atmosphere and poor visibility, will probably delay the work, and the general uncertainty of the English climate will most certainly hamper our progress to some extent. Altogether, therefore, our tour may last for several weeks.

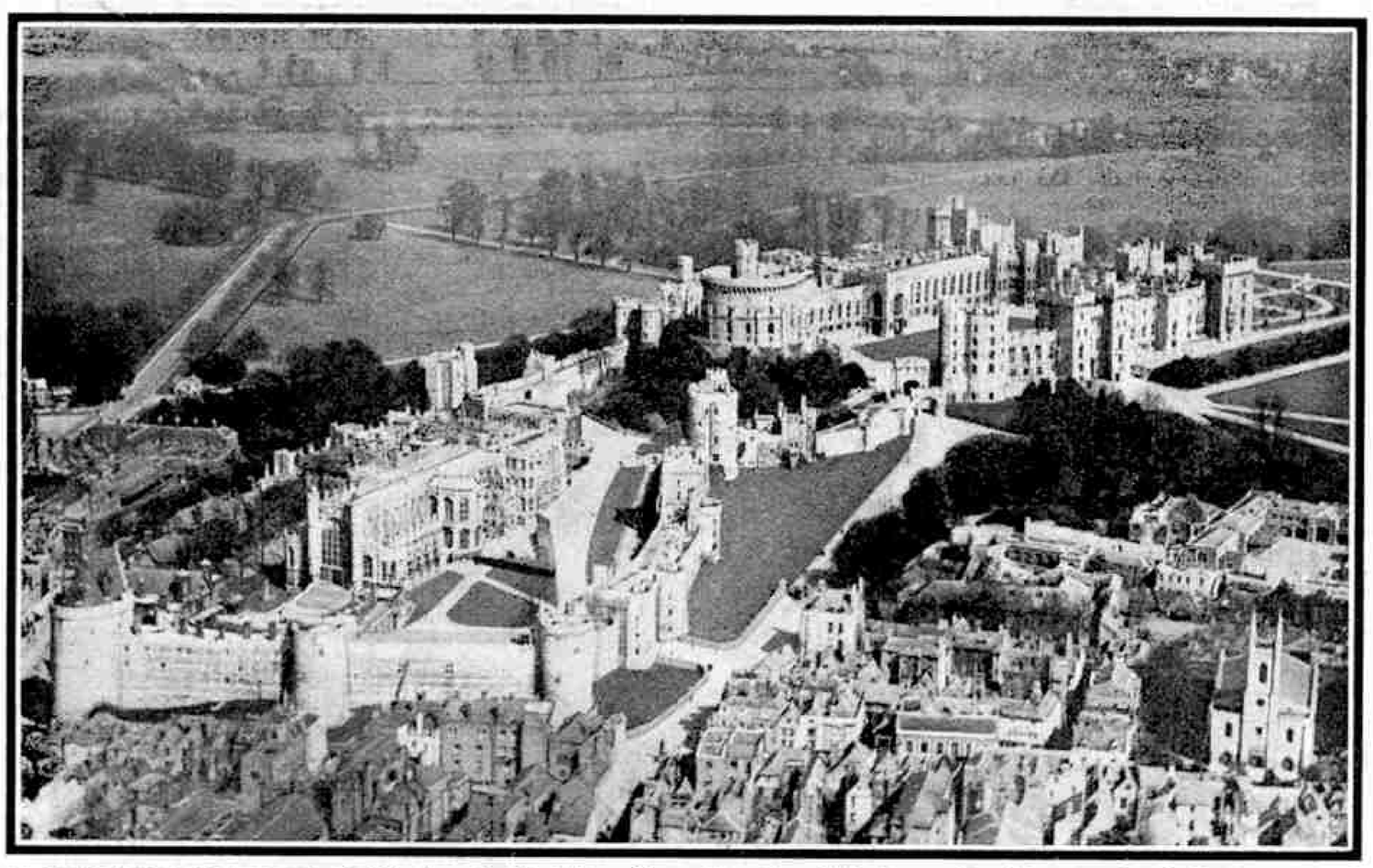
The aeroplane is a de Havilland machine specially adapted to meet the requirements of the work. The pilot and the photographer are chosen for their high proficiency in the art of map reading; and they must also possess at least an elementary knowledge of meteorology, for the various cloud formations and local weather phenomena due to geographical position frequently have to be taken into consideration in the course of the work.

In the flying world the cockpit of an aeroplane is known colloquially as "the office," and this expression is to some extent appropriate, especially during a photographic flying tour. In addition to the necessary supply of plates and film, large numbers of maps are carried; for every place to be photographed must be clearly marked out on the 6 in. to the mile Ordnance sheets, while the ¼ in. to the mile series is used for cross-country flying.

The pilot and the photographer are able to converse throughout the flight by means of telephones sewn into their flying caps, and a convenient speaking tube is close at hand. As each photograph is taken a record is made, and the exposed plates are filed in readiness for despatch to London at the conclusion of each day's work. Additional supplies of plates are collected as required at various places en route.

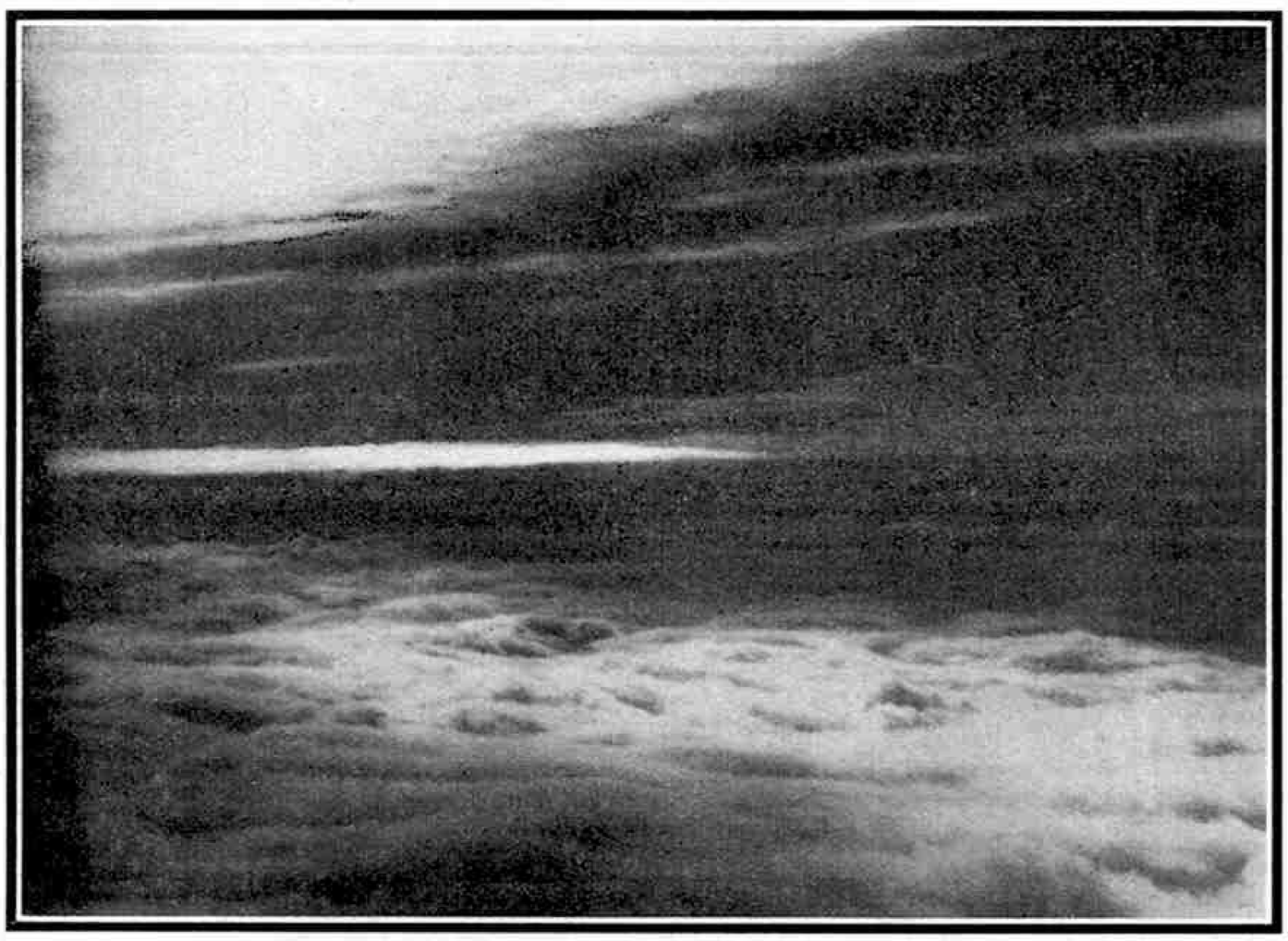
When all is ready, we take off from Heston Air Park or Stag Lane Aerodrome, and London is soon left behind. We climb rapidly to 2,000 or 3,000 ft., and the pilot sets his course for the scene of our first activities. The altitude from which photographs are taken varies considerably according to the area to be included in the picture; and it is governed also by the nature of the ground over which the machine is flying. Considerable scope is afforded in regard to height by the use of lenses of different focal lengths.

The pictures to be taken are many and varied, including housing estates and new developments in course of construction, country houses, perhaps an archæological site, and always a number of factories. As we approach an industrial town it will appear as a hazy blur in the middle distance; but soon we are able to distinguish the forest of chimney stacks that form the most prominent features of our manufacturing cities.



A remarkable photograph of Windsor Castle taken from the air. This is a splendid example of the amount of detail over a wide area that the aerial photograph makes possible.

We now descend slightly and from our 6 in. map "find" the object to be photographed. It is next necessary to decide upon the various positions from which the photographs are to be taken, and to make sure that they will illustrate the object to the very best advantage. This is a most important point, for our results must be more than mere photographs. Few factories or works are architecturally beautiful, but it is possible to secure an effective picture that will emphasise the extent of the property and make it stand out prominently from its surroundings. The photograph must be taken from just the right viewpoint in order to produce the perfection of detail that is so essential in a picture that may be destined to form the frontispiece of an elaborate and beautifully produced catalogue. When the first photograph has been taken, the pilot banks steeply away from the site. The camera is then prepared for the next exposure, and by the time it is ready the machine again will be placed in a favourable position.



Above the clouds over London at a height of 9,000 ft.

Cinematograph films also are taken from the air. These are required mainly for introduction into photoplays in which aerial scenes are featured, but sporting events, such as the Cup Final, the Derby and the Boat Race are filmed from an aeroplane in order to give picture house patrons a bird's eye view of the scene.

The aerial cinematograph camera is electrically operated, and is fitted with a gyroscope that enables the photographer to hold it perfectly steady while the film is being exposed. Country houses, castles, and seaside resorts offer great scope for artistic results, and the possibility of securing a topical picture of news value is kept in mind during all flights.

A look-out is kept also for strange markings on the ground, as from time to time interesting and valuable photographs of archæological interest have been obtained. Hidden secrets of past ages have been discovered by means of the aerial camera, which has definitely located the position of buried workings that are totally invisible at ground level, but are clearly revealed in air pictures on account of slight difference in the colour of vegetation due to the drainage being affected immediately over the ancient remains. In some cases ridges that are almost imperceptible to the eye on the ground become visible from the air by the shadows thrown when photographs are taken with the sun low on the horizon.

If weather conditions remain favourable, the flight will be of several hours' duration, and a number of towns will be visited in the course of the day before we arrive at the provincial aerodrome for the night. Here the machine is refuelled and inspected in readiness for the following day, and the programme of work is planned out in advance.

Air survey, or the preparation of maps from vertical air photographs, is another branch of Aerofilms work, and one that requires more experience. In this class of work the photographs are taken with the axis of the camera directed immediately downward, and the area to be surveyed is covered by a series of overlapping pictures that afterwards may be mounted together in mosaic form. The Eagle Air Survey camera is used, and this carries a roll of film for 100 exposures. It may be operated electrically, or by a wind-driven airscrew working in the slipstream through a flexible drive to the camera mechanism; or by hand if either of these means should fail. As each exposure is made it is automatically given a serial number; and the North point, the altitude of the machine, and any deviation from the true vertical are photographically recorded on a margin beside the picture. The number of photographs required to survey a given area is calculated from known data; namely, the size of the picture, the focal length of the lens, and the altitude at which the machine will be flown. The photographs are taken at regular intervals by means of a stop-watch, and are timed so that the area of ground covered on each negative overlaps that covered by the previous exposure, usually by a little more than one-third. Parallel lines of flight are made so that the resultant

strips of overlapping photographs will also overlap in a similar manner.

The area of ground is marked out on a 1 in. to the mile ordnance map, and parallel lines at regular and carefully measured intervals are ruled to represent the path of the aircraft, for the use of the pilot and the photographer in the air. In practice these lines should be ruled on a sheet of transparent material, so that it may be placed in any position relative to the map. The machine is flown against the direction of the wind, so that the ground speed is reduced as far as possible, thus lessening the risk of movement in the photographs that might occur if the machine were flown downwind, and consequently at a much higher speed over the ground. Flying across wind will cause drift, but it need not prevent the pilot from keeping the machine on its course. It is sometimes necessary in the case of lineal surveys, and the camera is rotated in its mounting until it is square with the course.

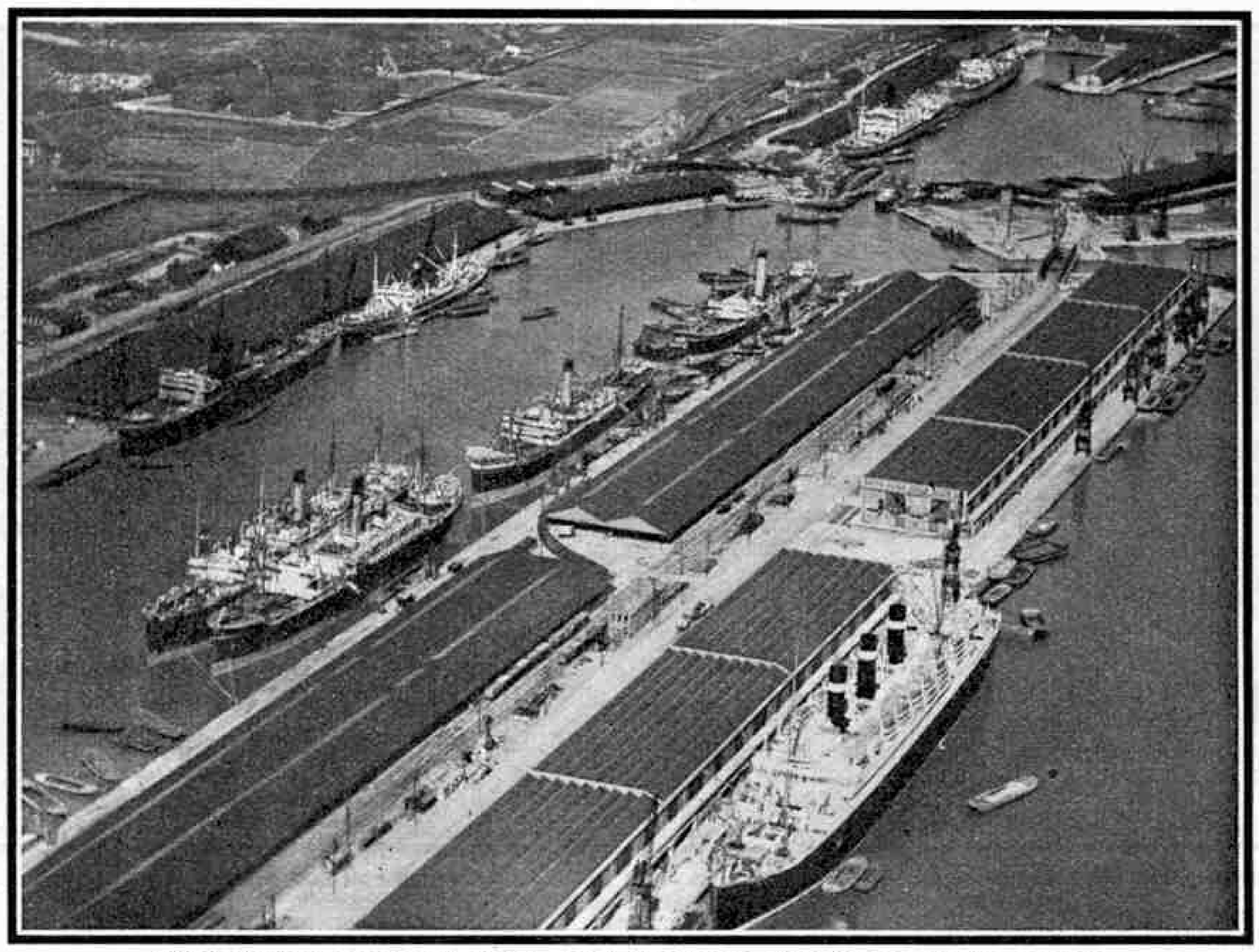
The altitude at which photographs are taken varies considerably. It may be as low as 4,000 ft. or as high as 10,000 ft., according to the amount of detail necessary, and the scale of the finished map. Additional latitude is afforded by the use of lenses of different focal lengths. In cold weather the camera mechanism must be kept working during the climb, or the moving parts may become gummed up on account of the freezing of the oil. With the introduction of the all-enclosed type of aircraft with heated cabins, however, this trouble will disappear.

When the machine has climbed to the required altitude we prepare to take our first line of photographs. Referring to the map, we locate the exact position on the ground over which the first exposures will be made, and the work then commences. The responsibility of keeping the course rests about equally between the pilot and the photographer. As the attention of the pilot is more or less fully occupied in keeping the machine at an even speed on a level keel, he relies to a considerable extent on the assistance of the photographer to see that the machine is passing vertically over the ground indicated by the line on the map.

A frequent source of trouble during flying on air survey is the formation of cloud at or below the level at which the machine is flying. These small detached clouds not only obstruct the view, but also cast dark shadows on the ground beneath. Once such clouds commence to form, they invariably increase in number and size until it becomes necessary to abandon the flight and await a more suitable day.

When the work in the air has been completed the negatives are enlarged and rectified to scale, and are then ready for the preparation of the finished maps, which can be produced in two forms. The scaled prints may be mounted on to the existing Ordnance sheets in mosaic form, which provides a photographic or pictorial map in which all detail is shown exactly as it was seen by the camera; or alternatively the detail in each photograph may be transferred to drawn maps by draughtsmen, who carry out the work by tracing from the individual prints.

In England the work is required for the revision of Ordnance sheets, which are continually becoming out of date through new developments, chiefly on the outskirts of the larger towns. Air surveys have been made also in Central Africa, Canada, South America, and other parts of the world, from which accurate maps have been compiled and have proved of great value in the development of uncharted areas. Excellent work in this direction has been undertaken by the Aircraft Operating Company, who have mapped many thousands of square miles where the cost of ground-level surveys would have been prohibitive, and in any case would have taken many years to complete.

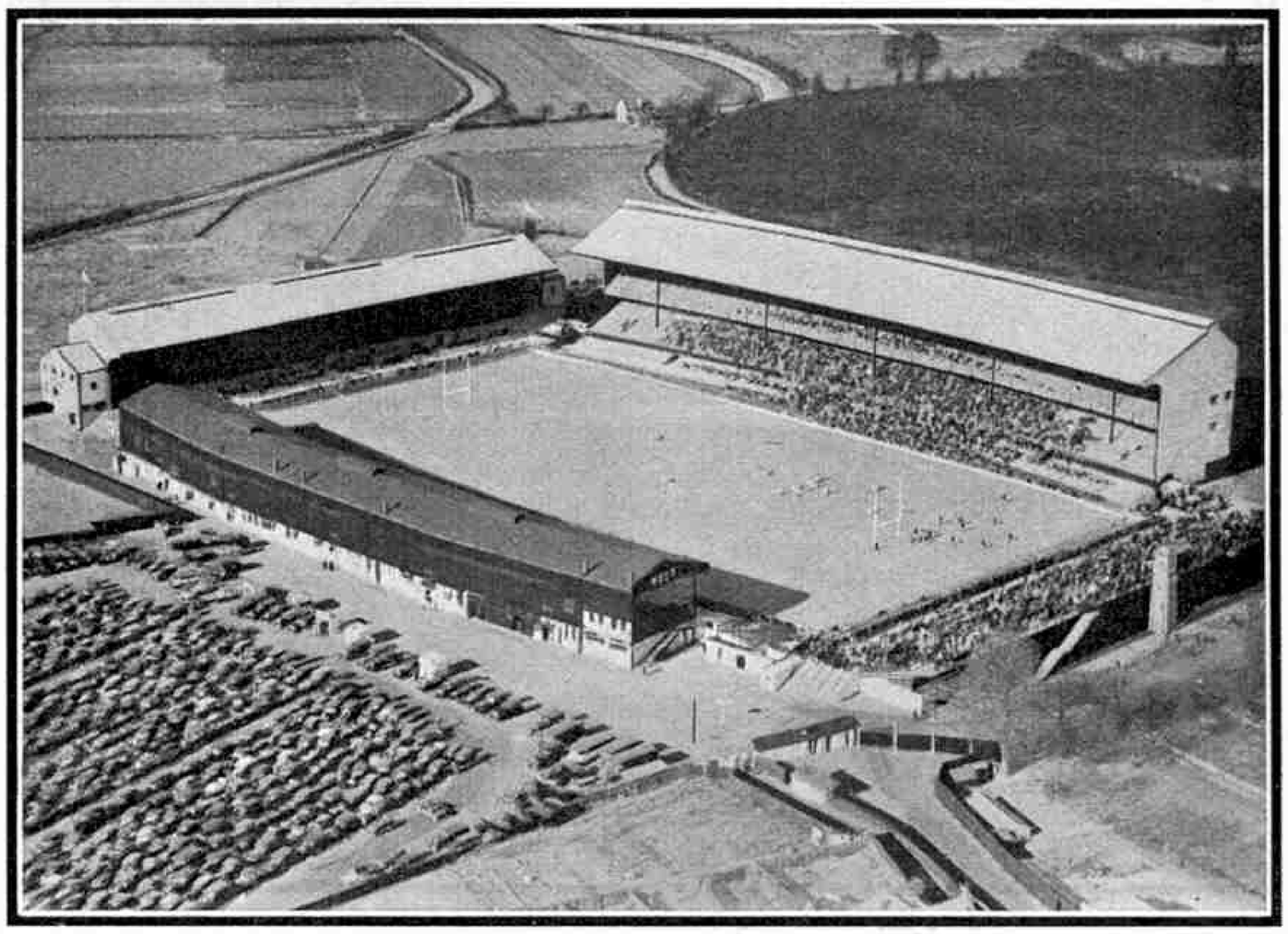


Aerial photograph of part of the Royal Albert and King George Docks, London.

The air survey has many advantages over the drawn map. The topographical detail is shown as it actually exists, instead of being indicated by conventional signs; much valuable detail regarding the vegetation and nature of the ground is clearly seen; and finally there is a very great saving in time and cost.

The making of air surveys is highly specialised work, demanding a considerable degree of technical knowledge and skill. The standard of excellence required in survey photographs is very high, and mistakes are costly. The work is not without its risks, particularly in wild areas of tropical countries. The chief danger arises, of course, from forced landings. These cannot be eliminated entirely, but they have rapidly decreased in frequency as more reliable aircraft have been developed.

Perhaps the most suitable type of machine for this work is one with twin engines of such power that, in the event of either breaking down, the other is capable of taking the machine back to its base of operations. A considerable working range, say 300 miles, is desirable in order to enable a wide area to be surveyed from one base. The larger the area to be dealt with, the greater is the economy in working that can be secured; and this factor has a very important bearing on the cost per square mile.

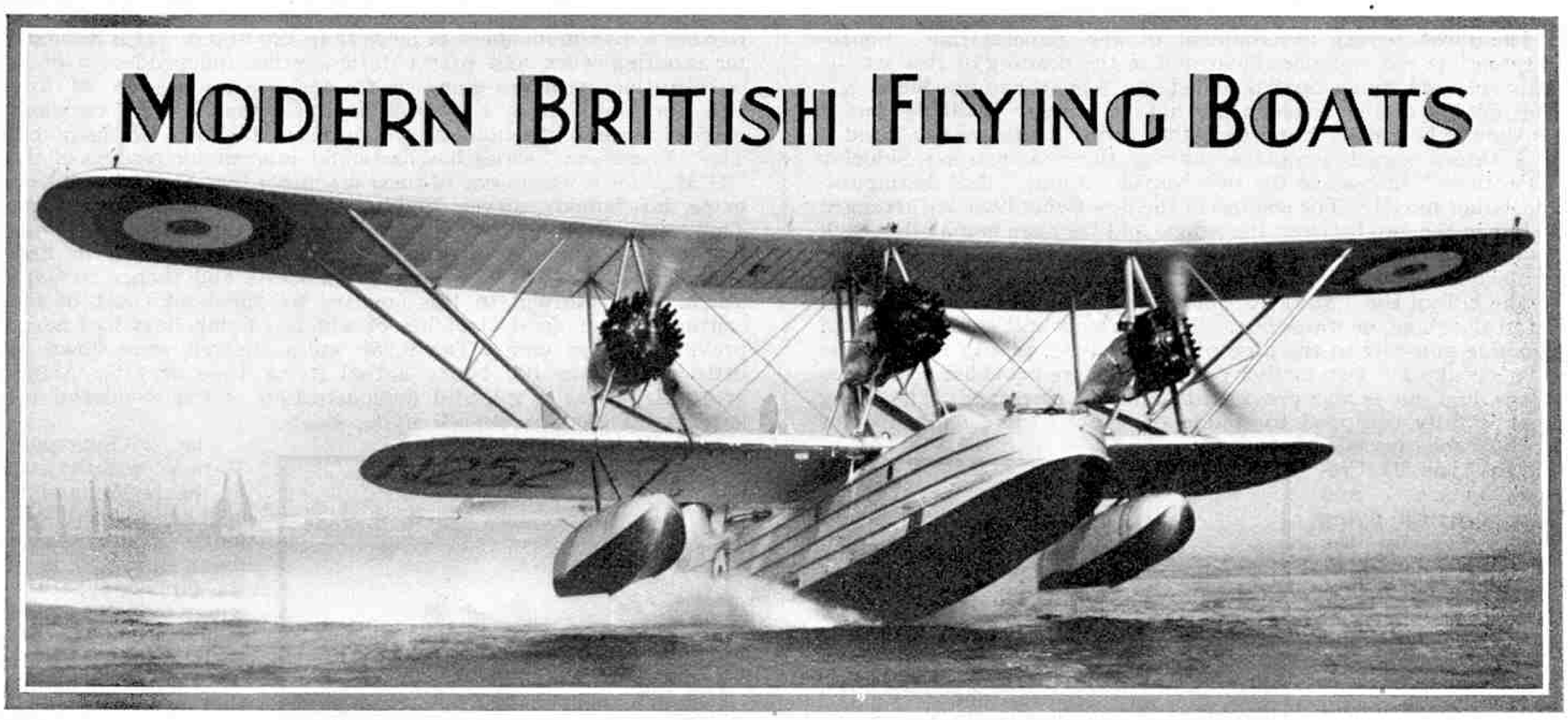


The famous Twickenham football ground as seen from the air. This photograph was taken on the occasion of an Army v. Navy Rugby match.

High speed is not an essential feature in aircraft that are engaged in survey work.

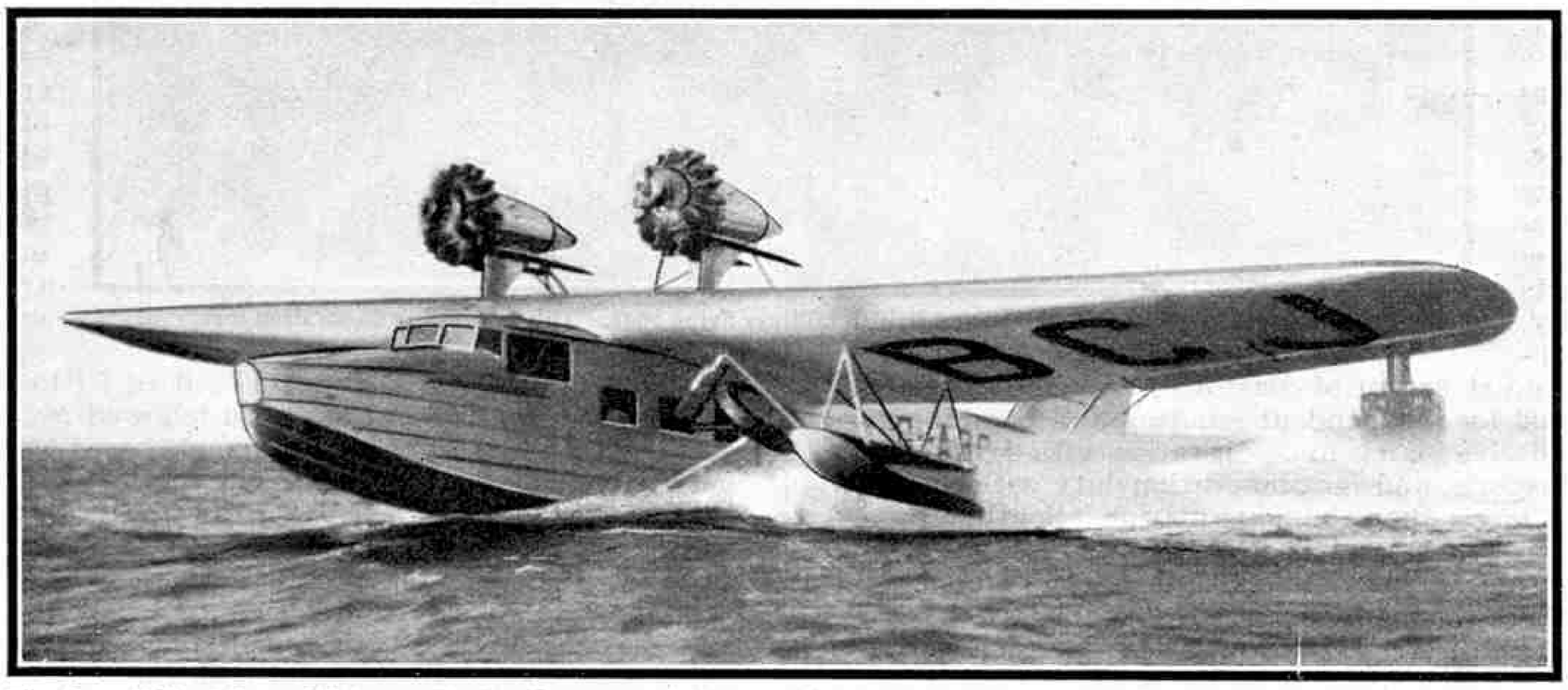
The demand that has arisen for aerial pictures and air surveys may be judged from the fact that Aerofilms Ltd. began operations early in 1919 with a staff of three. To-day there are 25 persons continuously engaged in the production of the work in well-equipped dark rooms, studios and offices at Hendon.

MODERN BRITISH FLYING BOATS



EFFORTS to design aeroplanes that could rise from water and alight on it were begun shortly after the development of the first successful land machines. In view of the close association of the British people with the sea, it is not surprising to find that the pioneer efforts in this direction were chiefly made in this country. An experimental flying boat was produced as early as 1909 by Messrs. Saunders of Cowes, now Saunders-Roe Ltd., and other interesting early flying boats produced by the same firm included an amphibian built in 1912 and the "Bat Boat," a biplane constructed in 1913.

During the war period, a long series of machines were produced by Messrs. Saunders, and other aircraft constructors who entered the field. Interest in flying boats grew steadily, but it was not until the close of the war that aircraft of this type received the attention they deserved. In the last few years wonderful advances have been made in their design. On a large proportion of passenger air lines in all parts of the world it is necessary or advisable to fly over large expanses of water. Many large machines are already in use for this purpose, and there is no doubt that flying boats will not only maintain their present importance, but will become more and more essential as air travel develops. Machines of this type are now being used on certain sections of the London-Capetown air route. More will be needed when the present service to India is extended to the Far East and Australia, and of course, reliable flying boats will be required if the proposals to establish air lines across the Atlantic Ocean lead to practical results.



The Saro "Cloud" amphibian. The landing gear of this machine can be seen raised above the water below the wing. The illustration is published by courtesy of Saunders Roe Ltd., while we are indebted to the Supermarine Aviation Works Ltd. for permission to reproduce the photograph of the Supermarine "Southampton Mark X" at the top of the page.

It is satisfactory to know that British designers and constructors of flying boats have produced machines that are among the safest and most efficient of their type in the world. These include great liners for use on airways, large and powerful machines intended for military purposes and smaller aircraft for the use of private owners and for the carriage of light merchandise or air mails.

Flying boats are distinguished from seaplanes by the presence of a hull, seaplanes being provided with floats only. They may roughly be classed as military and civil. The dividing line between these two classes is not always very distinct, for in certain cases a boat that was produced originally as a military machine has been modified in order to make it suitable for civil purposes. For instance, the design of the Short "Calcutta," a flying boat for commercial use, is based on that of the Short "Singapore," a military machine that has been largely used by the Royal Air Force.

At present three Squadrons in the Home Commands of the Royal Air Force employ flying boats. These are numbered 201, 204, and 209 respectively. No. 201 (Flying Boat) Squadron is equipped with Supermarine "Southamptons" and is stationed at Calshot, while the remaining squadrons have their bases at Mount Batten and make use of Blackburn "Iris" machines.

The Supermarine "Southampton" with which the squadron stationed at Calshot is equipped is a five-seater reconnaissance flying boat fitted with two 470 h.p. Napier "Lion" engines. It is of the biplane type and although the earlier models were constructed throughout of wood, an all-metal one is now available. The boat is fully equipped with wireless apparatus, and hammocks and cooking requisites may also be carried in order that long non-stop flights may be made.

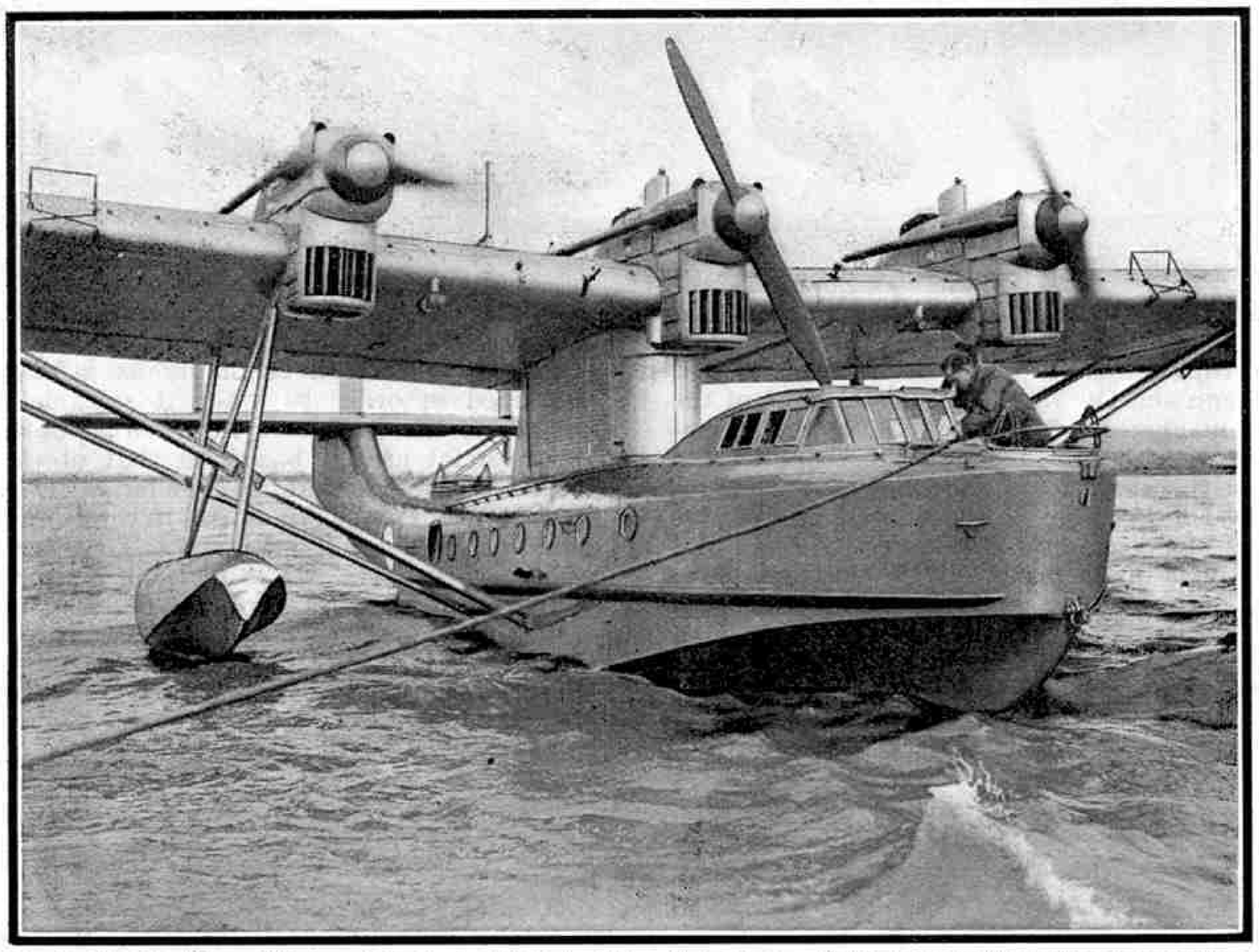
It is interesting to know that a number of long distance flights in formation have been made by squadrons of the R.A.F. equipped with Supermarine "Southamptons." The most famous of these took place in 1929, when an aerial journey of no less than 27,000 miles was undertaken. The squadron concerned flew from England to India and on to Singapore. From that centre an extended flight was made round Australia to Hong Kong and back again to Singapore, the entire flight being carried out without mishap. Last year a flight of "Southamptons" cruised over the Baltic, covering a total distance of 3,300 miles with perfect regularity.

The span of the Supermarine "Southampton" is 75 ft., and it is 49 ft. 8 in. in length, and 18 ft. 7 in. in height. The empty weight of the machine when made of wood is 9,210 lb., and this is reduced to 8,760 lb. when a metal hull is fitted, the fully loaded weight of the second of these models being 14,600 lb. The maximum speed of the machine is 108 m.p.h., its landing speed is 52 m.p.h., and it has a range of action of 800 miles. It is capable of climbing to a height of 5,000 ft. in 10 mins. and its service ceiling is 14,000 ft.

The most recent development of the Supermarine "Southampton" is the machine illustrated in the heading of this article. This splendid flying boat is called the "Southampton Mark X." Full details of the machine are not at present available, but it appears to be a little larger than the early "Southampton," and it is a three-engined aeroplane, having three Armstrong Siddeley "Panthers" instead of the two Napier "Lions" that distinguish the earlier model. The engines of the new flying boat are arranged in line in the gap between the wings, and they are mounted in such a manner that they may be changed while the machine is afloat.

The hull of the "Mark X" model is flanked with stainless steel up to the chine, or water line. There is a cockpit equipped with a machine gun ring in the nose of the machine, just in front of the pilot's cockpit. Two further gun cockpits are provided behind the wings, and one is also provided behind the elevators. The flying boat is fully equipped to enable the crew to live on board for considerable periods.

The "Iris III" reconnaissance and coastal patrol flying boat used by the Squadrons based at Mount Batten is produced by the Blackburn Aeroplane and Motor Co. Ltd. It also is of the biplane type and is fitted with three Rolls-Royce "Condor III" water-cooled engines. The earliest model of the machine was produced in 1926. The "Iris Mark III" retains the chief characteristics of its predecessors but includes many interesting improvements. Of these the two most important are the use of a structure that is constructed entirely of metal, with the exception of fabric wing covering, and the provision of enlarged fuel tanks. Owing to its large fuel capacity, the machine is capable of patrolling a great extent of coast line, and has a very long range when employed for independent scouting and bombing purposes. It is also suitable for use in co-operation with surface craft as an escort for transports, and for observation duty with the fleet.



Mooring the Blackburn "Sydney," the largest British military flying boat. This interesting illustration is reproduced by permission of the Editor of "Flight."

The "Iris III" is larger than the Supermarine "Southampton," its span being 97 ft. and its overall length 67 ft. 4 in. It is 25 ft. 6 in. in height, and its normal tare weight is 19,301 lb. The gross weight of the machine is 29,000 lb. and it carries a military load of 2,800 lb.

The maximum speed of the "Iris III" at sea level is 105 knots (120 m.p.h.) and at a flying speed of 80 knots (92 m.p.h.) it has a range of 992 sea miles (1,140 geographical miles). Its landing speed is 60 m.p.h. By ascending to a height of 5,000 ft. the range of flight may be increased to 1,070 nautical miles (1,232 geographical miles). The initial rate of climb of the machine is 630 ft. per min. and it is capable of reaching a height of 10,000 ft. in 31½ mins.

It has already been pointed out that progress in flying boat design has been very rapid in recent years, and now the "Iris III" has been surpassed in performance by the "Sydney" a larger flying boat that also is manufactured by the Blackburn Aeroplane and Motor Co. Ltd. This is of the monoplane type and is the largest military flying boat of this type in the country. It is constructed entirely of metal, with the exception of fabric covering on the wings and tail unit, and the hull has a deep forefront and is well flared in order to keep down the spray. Above the water line its sides are nearly perpendicular, thus giving a roomier interior than that of the "Iris III," in which the sides slope inward toward the deck at a noticeable angle. The machine has two steps and from the second the lines sweep upward to the stern, where the tail defence machine gun station is provided behind the tail plane. An unusual feature of the machine is that there are no fins at the rear.

The formation of the wings gives the Blackburn "Sydney" in flight the appearance of a giant gull, for the centre plane has a dihedral angle and the outer planes taper to the tips. Details of its performance may not yet be published, but the machine is thought to have a maximum speed of more than 120 m.p.h. It is designed for scouting work and patrol duties, either independently or in co-operation with sea-going craft, and carries a crew of five.

A very interesting British flying boat that has an excellent record for reliability under all conditions is the Short "Singapore." The "Singapore" series has particular interest for readers of the "*M.M.*," for it was in one of these machines that Sir Alan Cobham made his famous survey flight round Africa three years ago. The course followed by Sir Alan on his outward journey was by the Nile Valley to British East Africa, after which he flew above the chain of great lakes to Rhodesia and thence to Cape Town. He returned to this country by the west coast of the continent, over great stretches of which a flying boat had never previously been seen. The 9,950 miles covered were flown in little more than 100 hours' actual flying time, and Sir Alan's great flight was a splendid demonstration of the wonderful reliability of modern British flying boats.

The "Singapore Mark I" was the first of the series, and is a twin-engined all-metal long distance flying boat. It is of the biplane type, the wings being unequal in span, and is fitted with two Rolls-Royce "Buzzard" engines that give it a maximum speed of 128 m.p.h. at cruising speed. The "Singapore Mark I" has a range of 900 miles. It takes ten seconds only to rise from the water and is capable of climbing to a height of 10,000 ft. in 13 minutes. When empty it weighs 12,955 lb., and for service use carries a crew of five, two of whom are pilots and there are three gunners' cockpits, of which one is in the nose and the other two behind the wings. The loaded weight of the machine is 20,000 lb., giving a disposal load of 7,045 lb.

The "Mark I" model has been followed by a Short "Singapore Mark II", in which the improvements based on the wide experience gained on machines of the original type have been incorporated. The new machine is believed to be the fastest flying boat in the world. It has four Rolls-Royce "Kestrel II" engines mounted in tandem pairs in the gap between the wings. It is interesting to find that no struts are used to brace the interplane engine struts to the boat hull, the weights of the engines being taken by thick wing roots built integral with the hull. As is the case with other flying boats recently introduced for military purposes, details of the performance of the "Singapore Mark II" cannot yet be divulged.

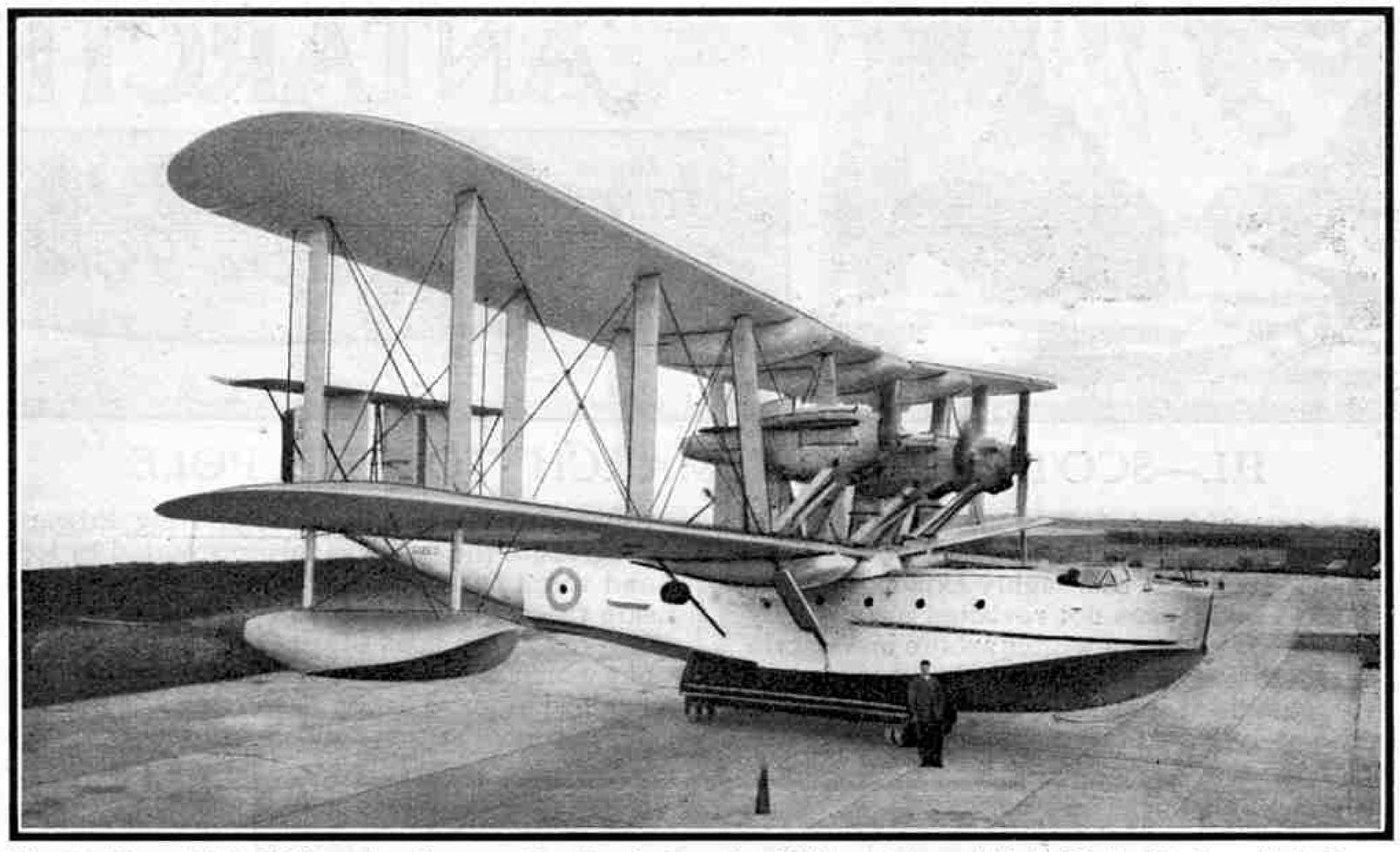
The only small civilian flying boats constructed in this country are the interesting range of machines of this type made by the well-known firm of Saunders-Roe & Co. Ltd. They are the "Cutty Sark," the "Windhover" and the "Cloud." These resemble each other in general design, the chief variations being in size, the layout of the cabins and the engines installed. They are of the high wing monoplane type and have graceful lines and well streamlined hulls. In each machine the engines are carried in nacelles mounted on struts some distance above the wing, where they are clear of spray thrown up when taxi-ing or landing. In each case a choice of engines is available. For instance, the "Cutty Sark" may be equipped with any engine or engines with a total output of about 200 h.p., while the "Windhover" and the "Cloud" may be equipped with one, two or three engines developing a total of approximately 300 to 350 h.p., and 600 to 650 h.p. respectively. The machines may be obtained as ordinary flying boats or as amphibians.

The smallest of the Saro machines is the "Cutty Sark," which is a small four-seater cabin boat. With a span of 45 ft. and an overall length of 34 ft. 4 in., it weighs 2,430 lb. when empty and has a loaded weight of 3,700 lb. The machine may be used for

various purposes, including pioneer work on new air routes in districts where land-locked harbours and navigable rivers exist, aerial photography and survey, fire fighting and also passenger or mail carrying.

The engines with which the "Cutty Sark" is usually equipped are two "Cirrus Hermes" or two of the "Gipsy II" type, giving a total horse power of 210, or one Armstrong Siddeley geared "Lynx" developing 215 h.p. The amphibian type has a maximum speed of 100 m.p.h., when fitted with two "Gipsy II" engines and cruises at 85 m.p.h. It climbs at the rate of 500 ft. per minute and has a ceiling of 9,000 ft.

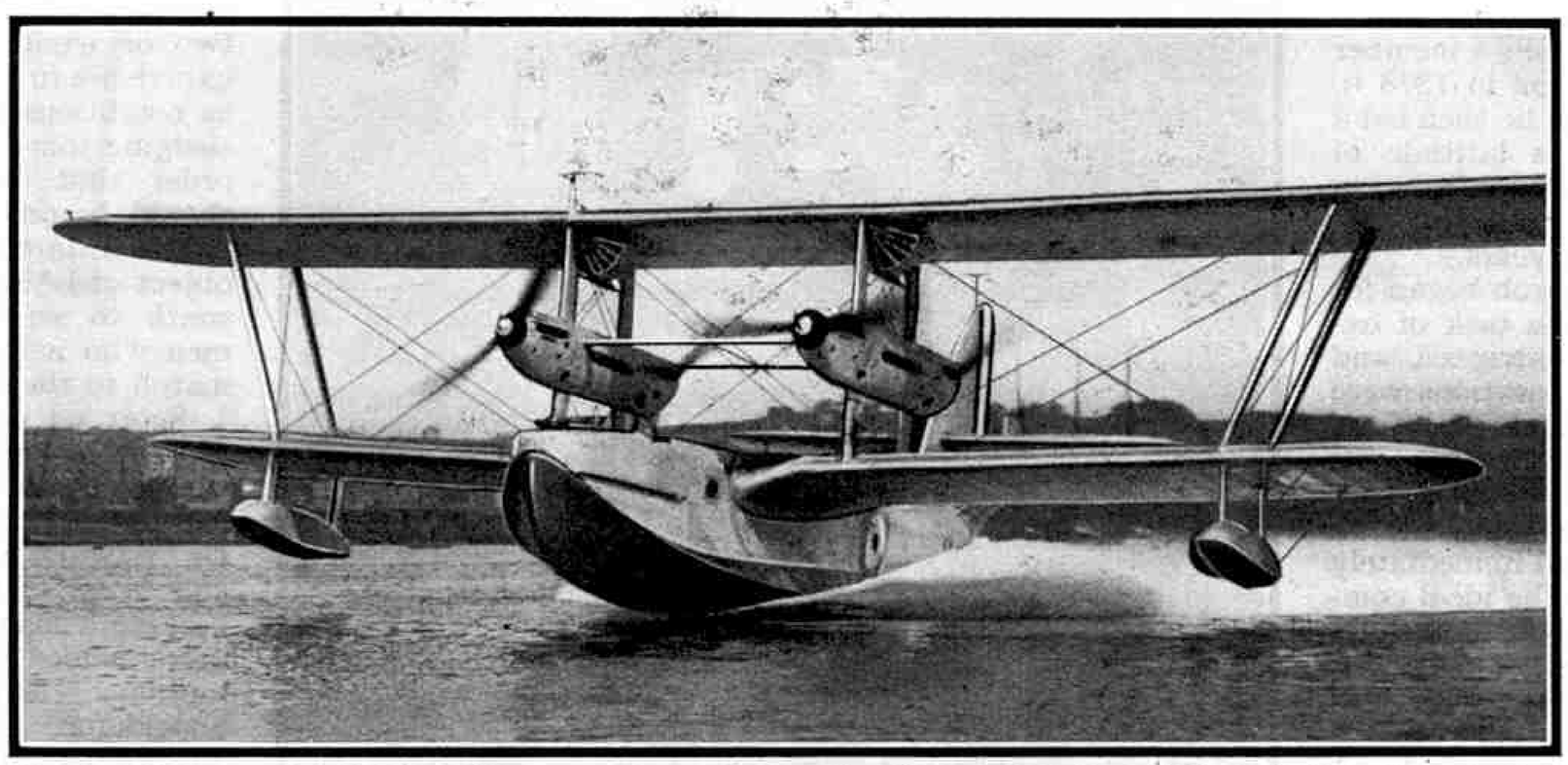
The next largest boat is the "Windhover," which is a six-seater. This is usually fitted with two Armstrong Siddeley "Mongoose" engines, which give it a maximum speed of about 103 m.p.h., a cruising speed of about 88 m.p.h. and an endurance of 4 hours. The boat is 41 ft. 4 in. in overall length and has a wing span of 54 ft. 4 in. The weight empty is 3,682 lb. and the total weight is 5,270 lb. The disposable load is 1,588 lb.



The Blackburn "Iris III" on the slipway. For the photograph of this machine, which is fitted with three Rolls-Royce "Condor" engines, we are indebted to the courtesy of the Blackburn Aeroplane and Motor Co. Ltd.

After the "Windhover" comes the Saro "Cloud," seating from eight to ten persons. The chief features of this machine closely resemble those of the smaller boats, except that experimental features are minimised and that full advantage has been taken of experience gained on the smaller machines. This vessel is usually fitted with two Armstrong Siddeley "Double-Mongoose" engines or two Wright "Whirlwinds," but if a triple-engined machine is required Armstrong Siddeley "Lynx" engines may be used.

The wing span of the "Cloud" is 64 ft. and the overall length 49.75 ft. The overall height is 13.3 ft. and when the landing wheels are employed the wheel track is 14 ft. The amphibian machine, when fitted with "Double-Mongoose" engines, has a tare weight of 6,150 lb., the useful and pay loads being 3,350 lb. and 1,850 lb. respectively, and the all-up weight 9,500 lb. The maximum speed of the machine is 117 m.p.h. and it cruises at 100 miles an hour. Its climbing rate is 850 ft. per minute, and the service ceiling 11,000 ft. Fuel and oil tanks giving an endurance of four hours are standard, but extra ones to enable the machine to remain in the air for six hours can be provided if desired.



The Short "Singapore Mark II" taxi-ing preparatory to taking off. The four Rolls-Royce "Kestrel II" engines mounted in tandem are clearly shown. This illustration is published by courtesy of Short Bros. (Rochester & Bedford) Ltd.

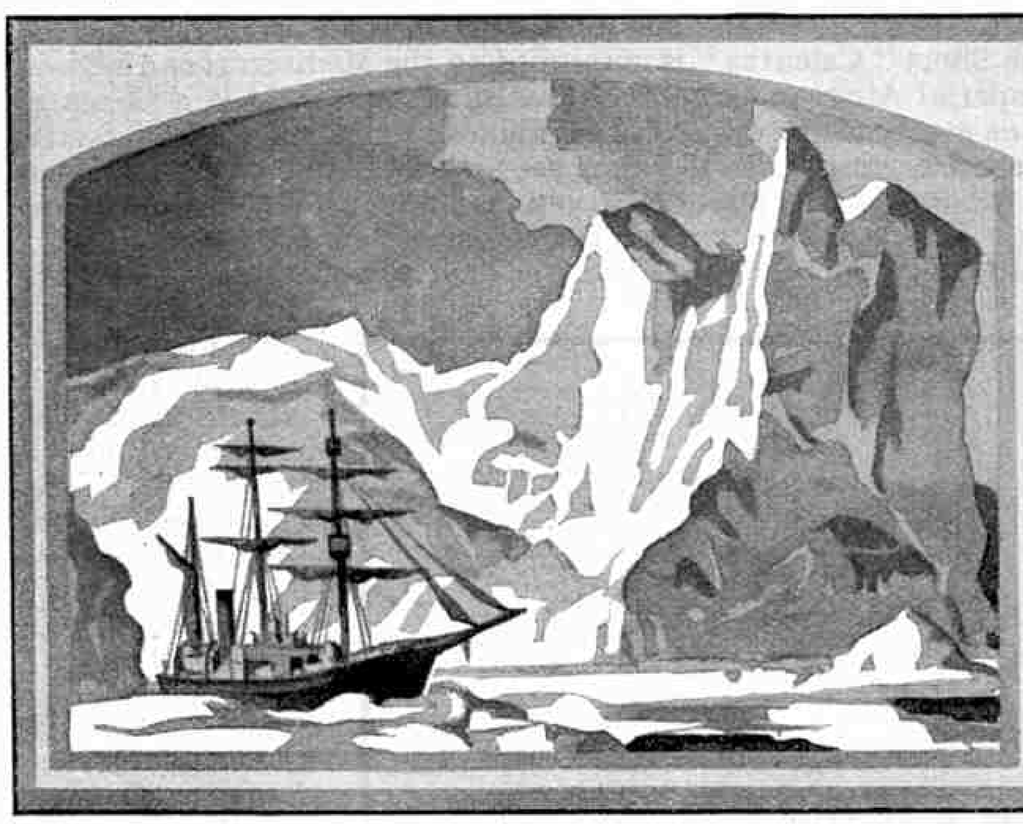
The only other commercial flying boats at present in production in this country are the Short "Calcutta" and the Short "Kent." The Short "Calcutta" was the first British all-metal commercial flying boat to be produced. It was modelled on the lines of the military "Singapore" flying boat constructed by the same firm, and in designing it advantage was taken of the experience gained during Sir Alan Cobham's flight round Africa in a flying boat of that type, to which reference has already been made.

The Short "Calcutta" is employed on the Mediterranean section of Imperial Airways, London-Karachi air route. It is a 14-seater biplane machine fitted with three engines carried in nacelles mounted between the wings. Both wings are above the hull of the boat and thus the passengers are able to obtain an excellent view from the cabin. The machine has a cruising speed of 100 m.p.h. and a normal range of 6½ hours. The pay load plus the crew is 4,860 lb. and a feature of the machine is that no petrol is carried inside the hull, thus diminishing the risk of fire. The three engines employed are Bristol "Jupiters."

The latest British commercial flying boat to be completed is the Short "Kent," which also has been produced for Imperial Airways. A brief description of this machine was given on page 310 of the "*M.M.*" for April, and a photograph of the machine appears on page 367 in the "Air News" of this issue. The "Kent" has been developed from the "Calcutta" flying boat. It is considerably larger than the earlier machine, the span of the upper wing of the "Calcutta" being approximately the same as that of the lower one of the new flying boat. The engines are carried similarly to those of the "Calcutta", but there are four instead of three, and they are supported on struts in the gap between the wings. The "Kent" accommodates 16 passengers and their luggage in addition to a crew of four made up of a pilot, a pilot-mechanic, a wireless-operator-navigator, and a steward. A striking feature of the new machine is that the planing bottom of the hull is planked with stainless steel up to a little above the waterline. This makes its initial cost heavier but it is expected that the cost of operation of the machine will be reduced because of the greatest durability attained.

The "Kent" has an estimated maximum speed of 132 m.p.h. at a height of 5,000 ft. and it is expected to cruise at about 100 m.p.h. The landing speed will be 60 m.p.h. Its initial rate of climb is put at 760 ft. per minute, and the time required to reach a height of 10,000 ft. will be 14 minutes. The boat has been designed to operate at a service ceiling of 19,000 ft. and to take off with a full load in a calm sea in 18 seconds. Its endurance when fitted with standard petrol tanks should be five hours, but by the use of additional tanks this can be increased to eight hours, during which 800 miles could be covered.

British firms specially interested in the construction of flying boats are unsparing in their efforts to improve them, and new types are continually being produced in which good use is made of experience gained with existing machines. Interesting new civilian boats now under construction include (*Continued on page 437*)



EXPLORING THE ANTARCTIC

Famous Attempts to reach the South Pole.

III.—SCOTT'S GREAT MARCH TO THE POLE

LAST month we told the story of the discovery in 1841 of Victoria Land and the great Ice Barrier by James Clark Ross. The section of the Antarctic then first thoroughly explored is now known as the Ross Quadrant and it was not revisited until nearly 60 years later, when Borchgrevink spent a winter ashore in Victoria Land. Borchgrevink's expedition was followed by a series of efforts that made the Ross Quadrant by far the best known portion of the Antarctic, and ultimately led to the discovery of the South Pole itself. The leader of the first of these expeditions was Captain Robert Falcon Scott, the most famous of all Antarctic explorers, who eventually reached the Pole, only to die in tragic circumstances on his return march.

Although the Scott expedition did not sail until 1900, preparations for it had been made well in advance. The impulse that once more turned the attention of British explorers to the icy regions around the South Pole came from Admiral Markham, a veteran of Arctic discovery. He had been a member of the Nares expedition in 1878 to North Greenland, and he then led a party that reached a latitude of 83° 20′ North, thus achieving a Polar record that remained unchallenged for seven years.

Long before the search began for the men to whom the task of exploration should be entrusted, and even before any preparations were contemplated, Admiral Markham had met Scott, who was then a midshipman in the Royal Navy. He was greatly impressed by Scott's energy and ability and immediately realised that he was the ideal commander for a British Antarctic expedition. This was in 1887 and it was not until 1899 that Scott heard of the proposition and applied successfully for the command. A year later his appointment became public, and on 31st July, 1901, the expedition sailed from the Thames in the "*Discovery*," a stout whaling vessel that was specially adapted for the task of resisting the pressure of the ice when passing through sea covered with pack. The last call made by the vessel was at Dunedin, in the South Island of New Zealand. There the necessary stores were taken on board, and the vessel was completely refitted.

Captain Robert Falcon Scott, R.N.

The "*Discovery*" sailed along the coast of Victoria Land and then turned eastward to the Great Ice Barrier. On this a landing was made, and several members of the expedition made ascents in a balloon in order to get glimpses of the way to the Pole. Sailing eastward along the face of the Barrier, Scott discovered new land, to which he gave the name of King Edward VII Land. Further progress to the east was then prevented by icebergs and heavy pack, and the "*Discovery*" turned back to Victoria Land in search of a safe place in which to pass the winter. Eventually one was discovered at the head of what had been thought by Ross to be a bay, but which actually was a sound separating Victoria Land from the small island now called Ross Island. The stretch of water separating it from the mainland is known as McMurdo Sound.

Soon after the vessel was taken into its winter quarters the Antarctic night fell; and throughout the long dark months great preparations were made in anticipation of the work of the following summer. It was Scott's intention to make a dash southward in the hope of reaching the South Pole, in addition to carrying out general exploration and scientific work in the interesting and previously unvisited land surrounding his winter home. The work was new to practically every member of the expedition, only two of whom had had previous experience in Polar regions. As soon as conditions permitted, therefore, sledging journeys began, partly in order that both dogs and men should become accustomed to life in the Antarctic, and also with the object of laying food depots to the south to serve the needs of the men who were to make the great march to the Pole.

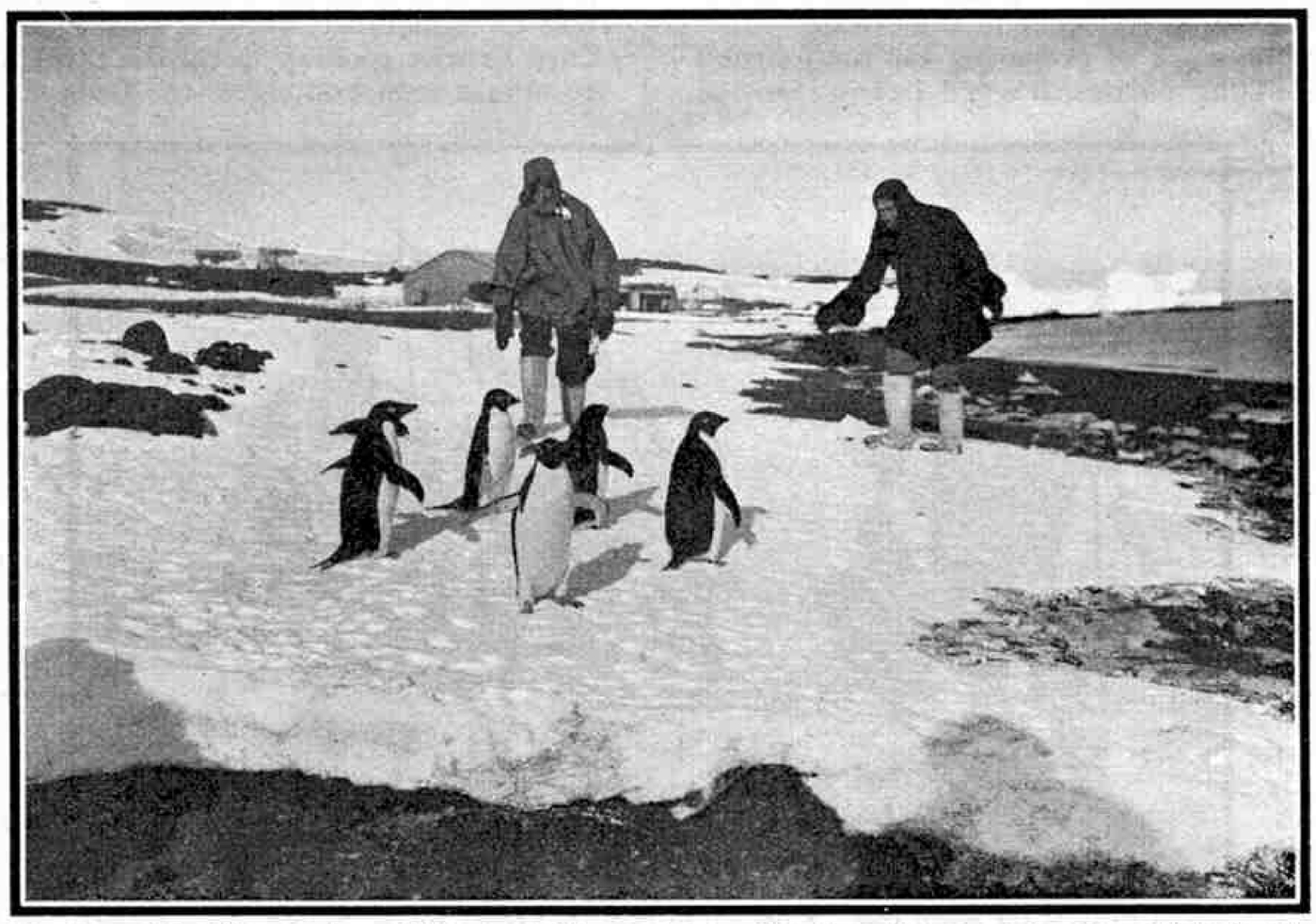
Scott set out on 1st November, 1902, accompanied by two men whose names became famous in Antarctic exploration. One was Dr. Edward Wilson, the zoologist and artist of the expedition, who became a firm friend of Scott and accompanied him on his last tragic journey. The other was Sir Ernest Shackleton, then Lieutenant Shackleton, and this was the first opportunity that remarkable explorer had of showing his great powers of endurance and leadership.

The three men had with them 19 dogs, but the surface of the Great Ice Barrier over which they travelled was so heavy that the work was terribly hard, and for a whole month they were compelled to drag their load in relays. Every mile was covered three times, and they advanced at a snail's pace. To add to their troubles, sickness broke out among the dogs. Very soon their number was considerably reduced, and the remaining animals were expected to give out any day and thus throw the three explorers on their own resources. But the men were by no means dismayed, and pressed steadily forward into the unknown regions between Ross Island and the Pole.

On Christmas Day the explorers had two square meals, the first for many weeks, and the last they were to have until they reached the headquarters of the expedition once more. All three were almost worn out with the constant toil of dragging their sledges, but they were greatly cheered by the new and wonderful mountain scenery that was continually revealed. They were travelling on the Great Ice Barrier itself, a sea of ice and snow that clearly was fed by enormous glaciers lying still further to the south; but apparently they had been travelling parallel with the true coast line of a mountainous section of the great Antarctic Continent.

On the last day of the year they finally abandoned their efforts to penetrate southward, when they were still 500 miles from the Pole. They had reached a latitude of 82° 16′ 33″S, however, and thus had advanced 200 miles nearer their goal than any previous explorer had done. In the circumstances this was a really remarkable achievement.

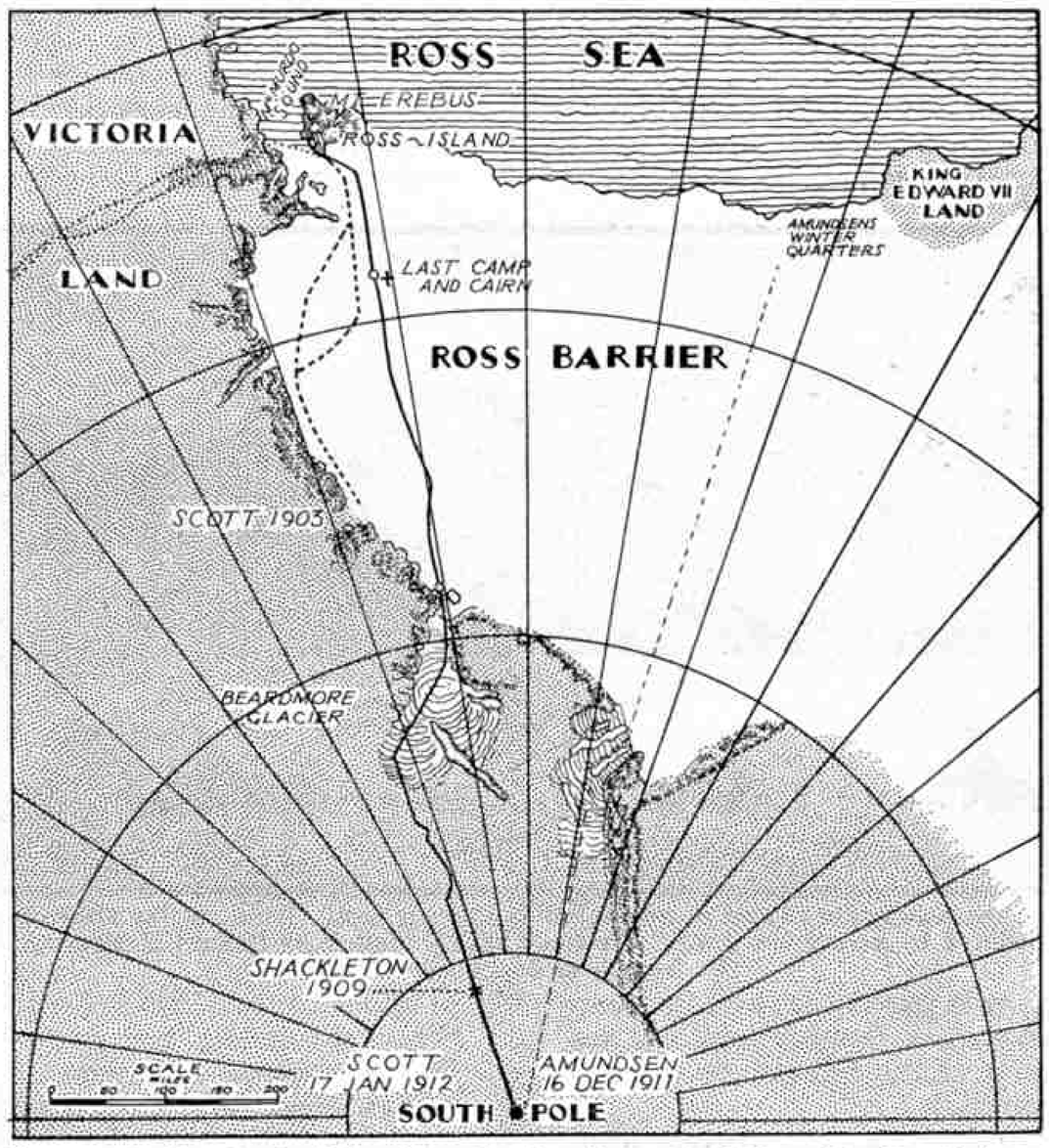
The run home was made under threatening conditions. A few days later the remaining dogs practically ceased work, and on the 11th January only two were left. Food was running desperately short, and success in reaching Ross Island depended on finding the tiny depot they had established in the wilderness of ice and snow. To make matters worse, Shackleton was severely stricken with scurvy. He had suffered from this for many days, but now it became so acute that he could not help to drag the heavy sledge.



Members of Scott's second expedition greeted by penguins. Reproduced by permission from "The Great White South" by Herbert G. Ponting, F.R.G.S. (Duckworth & Co., London, 7/6).

Day after day the indomitable explorers struggled on. A sail mounted on the sledge helped them considerably, and to their great relief at last they reached their main depot. This assured them of food in plenty, but unfortunately Shackleton's condition did not improve. The result was that when the three eventually reached the "*Discovery*" they were in a terribly exhausted condition, and Shackleton was invalided home in the "*Morning*," a relief ship that arrived during the summer with stores and provisions.

Scott remained a second year in the Antarctic, and in the following summer made a sledge journey that in many respects was more arduous than the one toward the Pole. This time he forced his way up a tremendous glacier to the interior of Victoria Land. For days he then travelled over the great plateau, and did not turn back until he had covered a distance of 300 miles. When Scott reached the "*Discovery*" once more—happily enough on Christmas Eve, 1903—he and the two seamen, Evans and Lashly, who had accompanied him, had covered 725 miles in 50 days of actual travel. Thus their average distance was 14½ miles per day, a wonderful record for men dragging a sledge heavily laden with food and camping gear over terribly difficult snow-covered surfaces.



The way to the South Pole. Map showing the routes followed by Shackleton, Scott and Amundsen.

It was now time to consider the return of the expedition. Unfortunately the ice of McMurdo Sound had not broken away sufficiently to free the vessel from the quarters in which she had been frozen for two years, and when Scott returned from his western journey he found that the majority of the crew were trying to saw a passage through ice six or seven feet in thickness in order to make a way of escape for the "*Discovery*." Their puny efforts were unavailing, and Scott decided that the only plan was for them to wait until the vessel was released by the melting of the ice. Before that happy event took place two ships appeared in the Sound—relief vessels sent out to the rescue of the expedition. Scott and his men were well able to look after themselves, however, and in the end the ice broke up sufficiently to allow the "*Discovery*" to pass through, charges of dynamite being exploded in the pack in order to expedite matters. The fleet then sailed northward to New Zealand, and finally the "*Discovery*" reached Spithead, a little more than three years after she had set out.

On returning from the Antarctic, Scott resumed his career in the Navy, in which he rose to the rank of Captain, with command of H.M.S. "*Bulwark*," a battleship of the Channel Fleet. He always kept before him the possibility of extending the work that he had begun so splendidly ten years earlier, however, and in September, 1909, he made public his plans for a second expedition to the Ross Sea quadrant. He received support from many quarters, the Government subscribing £20,000 and granting him leave of absence on full pay. On 28th November, 1910, he sailed southward from New Zealand at the head of the largest and best equipped expedition that had ever ventured into the Antarctic. In addition to the naval officers and seamen who were to be chiefly concerned with the actual work of exploration and the dash for the Pole—one of Scott's principal objects, of course—several scientists also were included; and Mr. H. G. Ponting, the most famous of field photographers, went south in order to secure a permanent record of the wonderful scenery.

A number of Siberian ponies and dogs formed an important part of the Expedition. Scott intended to rely on these, in addition to the strength of his men, for pulling the sledges on which the necessary supplies and equipment were to be carried; but motor sledges were taken in the hope that they would enable large loads to be carried expeditiously over the surface of the Barrier. These sledges did useful work in the early stages, but the severe conditions eventually proved too much for their engines. These were air-cooled and they alternately became overheated and too cold to be restarted without extraordinary efforts on the part of the mechanics.

The members of the expedition sailed in the "*Terra Nova*," an old Dundee whaler of about 700 tons. The vessel was heavily overladen, and unfortunately she ran into a terrific gale soon after leaving New Zealand. The pumps became blocked up with coal dust, causing the vessel to settle deeply in the water and to be in great danger of foundering altogether. Continuous hard work on the part of every member of the expedition brought her safely

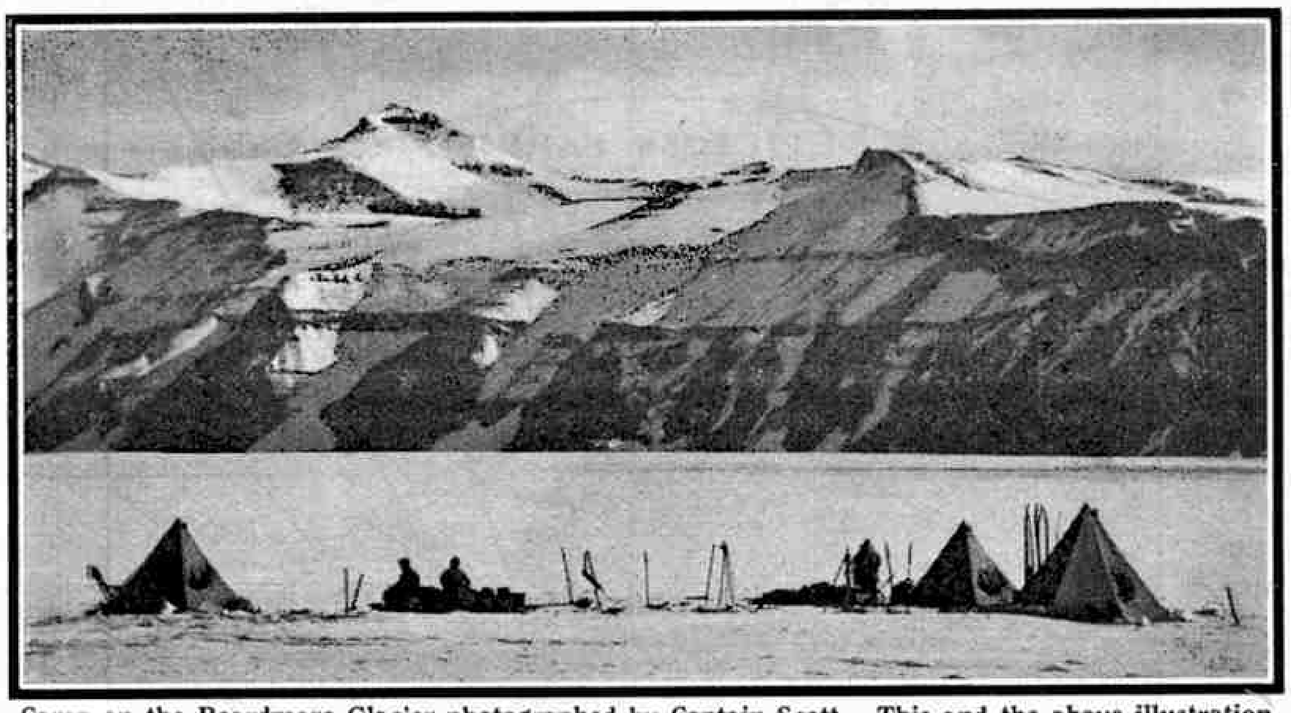
through, however, and eventually she entered McMurdo Sound, on the shores of which Scott had made his headquarters on the previous expedition. This time the Sound was partly frozen over, and he was unable to reach the winter quarters occupied by the "*Discovery*." Instead he landed at Cape Evans on Ross Island, and there a hut was erected that was to be the winter home of the members of the expedition who remained in the South. The "*Terra Nova*" returned to New Zealand, from where she was to return in the following year in order to pick up the members of the party who were unable to stay a second year in the South.

Immediately on landing, the work of preparing for the journey to the Pole was begun. Sledging parties dragged heavy loads of provisions and fuel across the ice of McMurdo Sound and up on to the Barrier surface, where depots were established to serve the needs of the exploring parties of the following summer. Many difficulties were encountered in this work, and it was not without danger. On one occasion two members of the expedition and their ponies were travelling over the frozen surface of McMurdo Sound when a sudden break-up and northward movement of the ice flows carried them seaward. They managed to scramble back to the shore after a very anxious period, but their ponies were lost. These and other mishaps sadly reduced the number of ponies, and the loss of the animals undoubtedly handicapped Scott when making his great journey southward in the following summer.

Scott's party at the South Pole. From left to right the figures are Dr. Wilson, Lieut. Bowers, P. O. Evans, Capt. Scott, and Capt. Oates. The photograph was taken by Lieut. Bowers.

The dark winter days passed quickly. The men were employed chiefly in the preparation of clothing and food rations, while the scientists were busily engaged in recording weather conditions and in examining the seals and penguins and other creatures that abounded on the shores of McMurdo Sound. The penguins were a special attraction to all the members of the expedition, those who had no special scientific interest in these primitive birds being greatly amused by their strange behaviour. The species that chiefly makes its home on Ross Island is the Adelie penguin. This quaint creature is distinguished by a white breast, and as it waddles forward on its short legs it bears an absurd resemblance to a small man in a dress suit. Its manners are as humorous as its appearance. On land it is absolutely fearless, for except the skua gull, which steals its eggs and kills its chicks, it has no natural enemies. It marches boldly up to human beings, or even dogs, uttering queer squawks of welcome; and when these are unanswered it stops to investigate the strangers more closely, and even calls other penguins into consultation!

The Adelie penguin is a wonderfully expert swimmer, and a crowd of the birds about to take to the water presents a very curious sight. First one and then another leans over the ice edge to gaze into the sea, and with loud squawks draws back again. After considerable hesitation one of the birds finally falls into the water, or is pushed in, and immediately the rest follow. It is probable that fear of lurking sea leopards and other enemies is the cause of the reluctance of each penguin to be the first to enter the water.



Camp on the Beardmore Glacier photographed by Captain Scott. This and the above illustration are reproduced by permission from "The Great White South" by Herbert G. Ponting, F.R.G.S. (Duckworth & Co., London. 7/6).

The penguins live on the snow and ice near the water, from which they obtain their food; and in their cheerless homes they build crude nests of small stones. The number of stones available is limited, and the scarcity compels practically every penguin to become an expert thief. Most of the stones in a rookery apparently change ownership more than once during the nesting season. The birds display great cunning in this occupation, stealing up behind a nest and waiting until some incident distracts the owner before snatching up a stone. If detected in the act they immediately drop their booty and assume a remarkable air of innocence that never carries conviction with it.

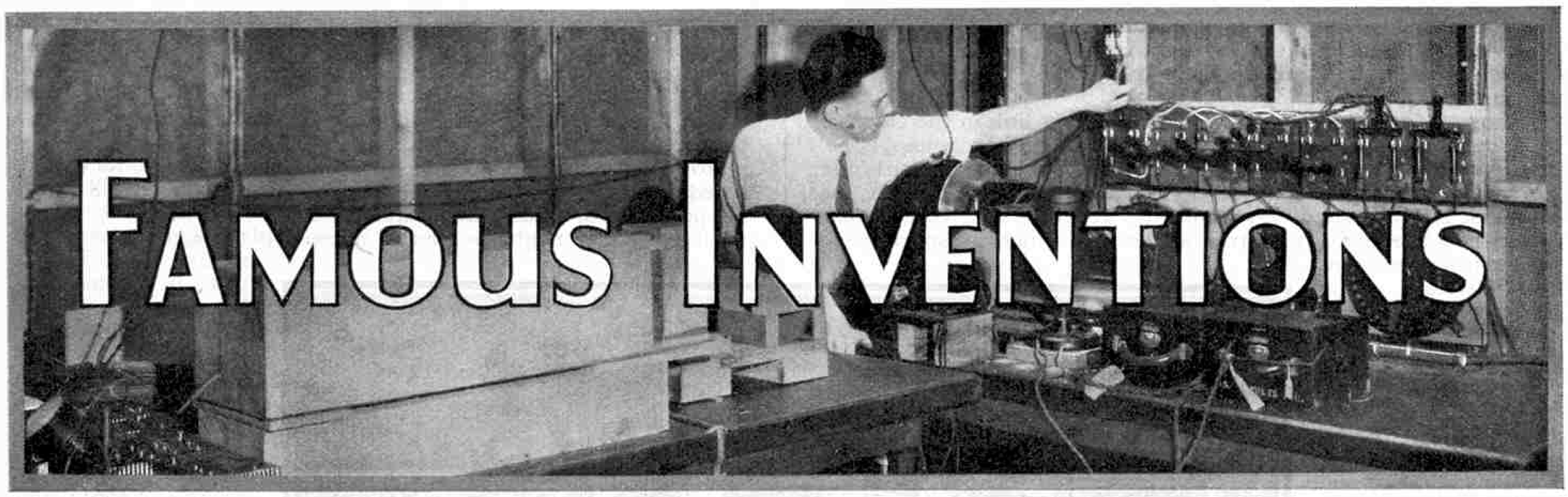
In addition to Adelie penguins, larger birds known as Emperor penguins are occasionally met with in McMurdo Sound. The chief rookery of these birds is at Cape Crozier, on the east of the island, near the point where the Great Ice Barrier begins. The nesting season of the Emperor penguin is during the late winter, and three members of Scott's party actually made a journey to the Cape Crozier rookery in the depth of the Antarctic winter in order to obtain eggs and study the behaviour of the birds in that part.

During their journey the three experienced violent blizzards, with temperatures as low as -77° F., or 109° F. below freezing point. One terrific storm blew their tent cloth away, but by great fortune they discovered this in a crevice in the rocks some distance away. If they had not done so, they could scarcely have survived the severe conditions, for they could not operate their Primus stove without shelter, and would have been deprived of the hot food that is so necessary in Polar regions. They returned triumphantly with three fresh Emperor penguin eggs, the only specimens that have ever been obtained.

As soon as conditions permitted, Scott commenced his great march to the Pole. This was splendidly organised, the members composing the party being divided into groups for the purpose of supporting the chosen few who were actually to try to reach the Pole itself. One by one the supporting parties returned when their work was done, until finally Captain Scott and four companions only were left. The members of the party had then travelled about 420 miles over the Great Ice Barrier, and up the Beardmore Glacier, the gigantic river of ice, 126 miles in length, that had been discovered in 1908 by Shackleton. The last supporting party had actually accompanied the Polar party over the blizzard-swept monotonous plateau at the head of the Glacier until they were only 150 miles from the Pole itself. The work had been arduous, for the ponies had become worn out before reaching the foot of the Beardmore Glacier, and from that point the sledges had been dragged entirely by the men themselves. All had done splendidly, however, and there was every prospect that the Pole would be reached.

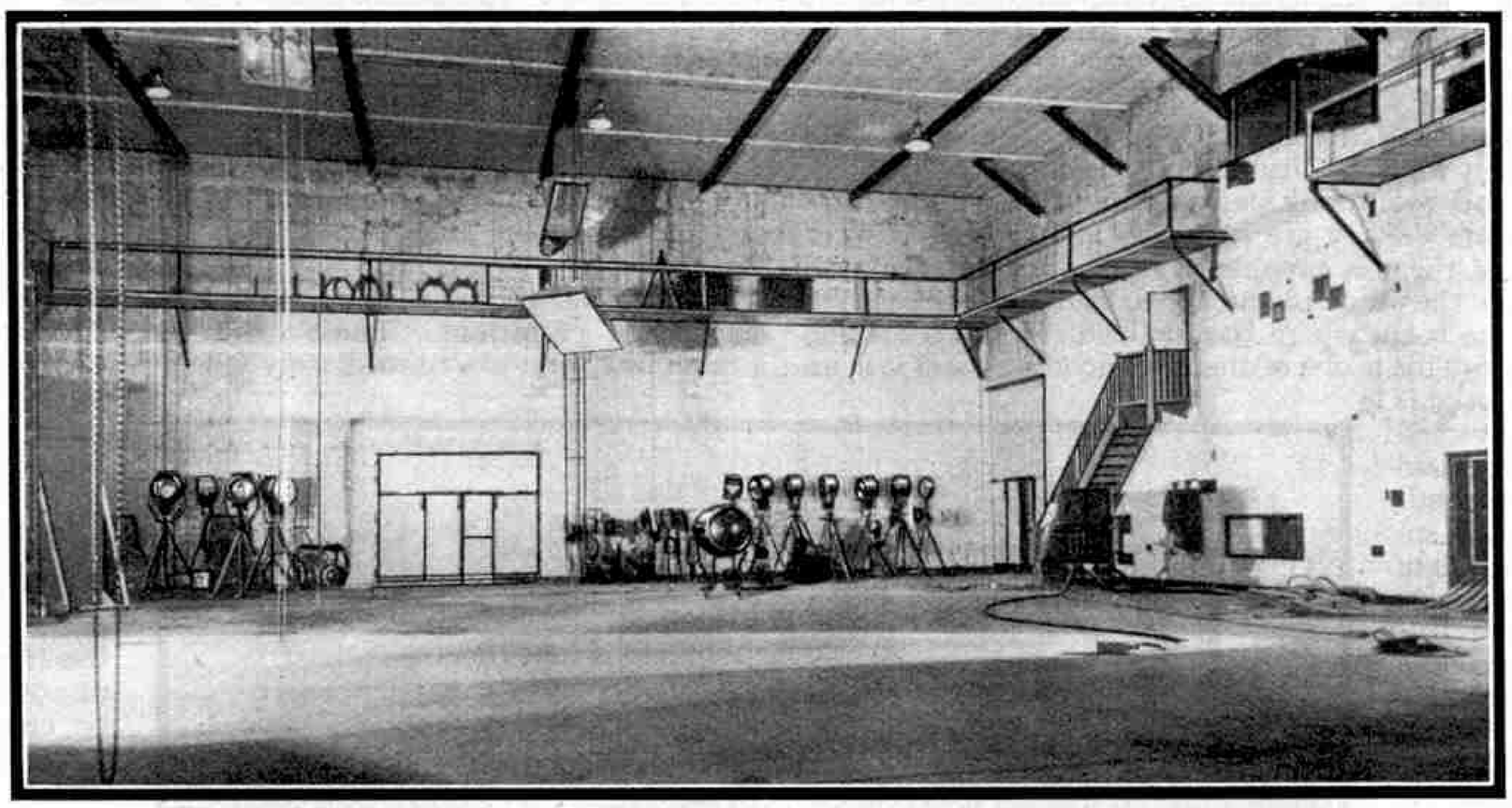
Scott's four companions were Dr. Wilson, his old comrade of the "*Discovery*" days, Lieutenant Bowers, Captain Oates and Petty-Officer Evans, a burly seaman who also had been with Scott on his previous expedition. They had every confidence in their ability to reach the Pole, and the only disquieting circumstance was that Amundsen, the Norwegian explorer, was also at work in the Antarctic. They had a fear that they would find themselves forestalled, but Scott refused to make a race of his Polar journey. His plans had been made long before Amundsen had decided to attempt to reach the South Pole. The Norwegian's change of plan had not been announced until Scott's expedition had actually sailed, and during his preparations everybody had been led to believe that he was intent on an expedition to the Arctic.

Over the blizzard-swept plains Scott and his comrades advanced steadily day by day, and at length it became evident that a few days march would bring them to the Pole itself. Then they came across sledge tracks, and realised at once that their hope of being the first to reach the Pole had (*Continued on page 448*)



XXII.—TALKING PICTURES—(2)

LAST month we outlined the general principles on which the talking film is based, and described the two chief methods employed to record sound photographically in the form of a narrow continuous track 1/10 in. in width at the side of the film, the remainder of the film being occupied by the picture. The first is the "variable width" method, in which the sound track is of constant density, but varying width, the width corresponding to the intensity of the sound at any moment. The second is known as the "variable density" method, and in this the track is of constant width, but of varying density. In this article we shall deal with the latter method as developed and perfected by the Western Electric Company. In this process the record appears as a series of horizontal lines. A marked difference between the density of the lines and the clearness of the spaces between them indicates a loud sound. If the lines appear so faint that they can scarcely be seen by the naked eye, a very soft sound is indicated. The spacing of the lines controls the pitch of the sound, the closer the spacing the higher being the pitch.



A Talking Picture Studio, or Sound Stage, showing the specially padded walls for absorbing sound. High up on the right is seen the bay window of the Monitor Room. The illustrations to this article are reproduced by courtesy of the Western Electric Company Ltd.

In order to maintain the correct pitch of the music a gramophone record has to be run at some definite and constant speed. Similarly, a photographic record of sound has to be run during reproduction at precisely the same speed as that at which it was recorded. Variations, or sudden changes of speed of the film during either recording or reproduction must be carefully avoided, or there will be changes in the pitch of the sound that will completely destroy the quality of the speech or music.

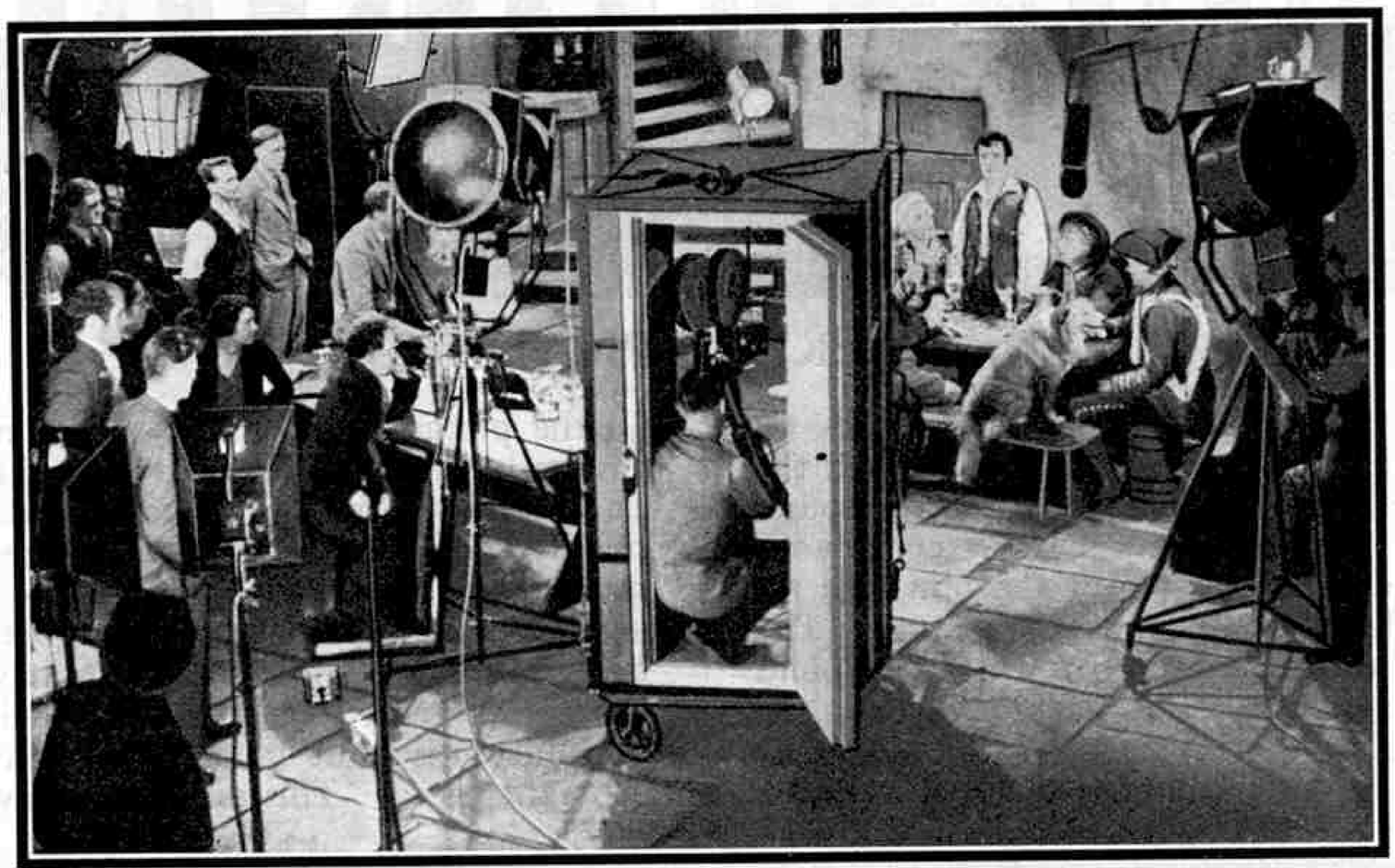
A film that is being shown on a screen is made up of a large number of individual pictures, each having been taken in sequence at the rate of 24 pictures per second. In the picture projector itself the film is not run continuously through, but each individual picture is flashed on to the screen, and remains stationary for approximately 1/24 sec. The eye merges this rapid intermittent sequence of pictures into a continuous and smooth motion, the intervals between the pictures being absolutely imperceptible. It will be realised that the sound record on the other hand must not move intermittently, but must move continuously and at a constant speed. This difficulty is overcome by printing the sound record ahead of the picture. Thus the sound that has to be reproduced for a given individual picture must be picked up from the film ahead of that picture, and where the film is running smoothly. Synchronisation of sound and picture is therefore always obtained.

Many processes and many pieces of complicated apparatus go to the making of a talking film, and the best method of learning how it is done will be to make a tour of a studio.

The accompanying photograph shows one of the studios, or sound stages as they are now called. Everything is quiet, and one's voice sounds as if one was speaking in the open air. The walls are all heavily padded, with the object of absorbing all the sound, and producing the effect of open air conditions. It is thus possible to take open air scenes inside the studio, where there is the enormous advantage of having both the lighting and the weather under complete control at all times. The heavy padding of the sound stage renders the ventilation very poor, and the unfavourable atmospheric condition is greatly worsened when picture-making operations are in progress. Then the high intensity illumination necessary to light up the scene, or "set"

as it is called, causes the temperature to rise rapidly. Against the wall of the studio will be seen a number of the big lamps, which are used to illuminate the scenery while a picture is being taken.

Hanging from the end of a boom is the first link in the chain of apparatus used for sound recording. This is the microphone, the instrument that picks up the sound in the studio and faithfully translates it into electrical energy. This little instrument is the result of many years of development. It works in a very similar manner to the microphone transmitter into which we speak when we are using an ordinary telephone. The average energy of the speech of a human being, if measured electrically, is only of the order of ten millionths of a watt; it is interesting to compare this with the energy of an ordinary 60-watt lamp. The microphone is capable of picking up this minute sound energy and converting it without distortion into corresponding electrical energy.



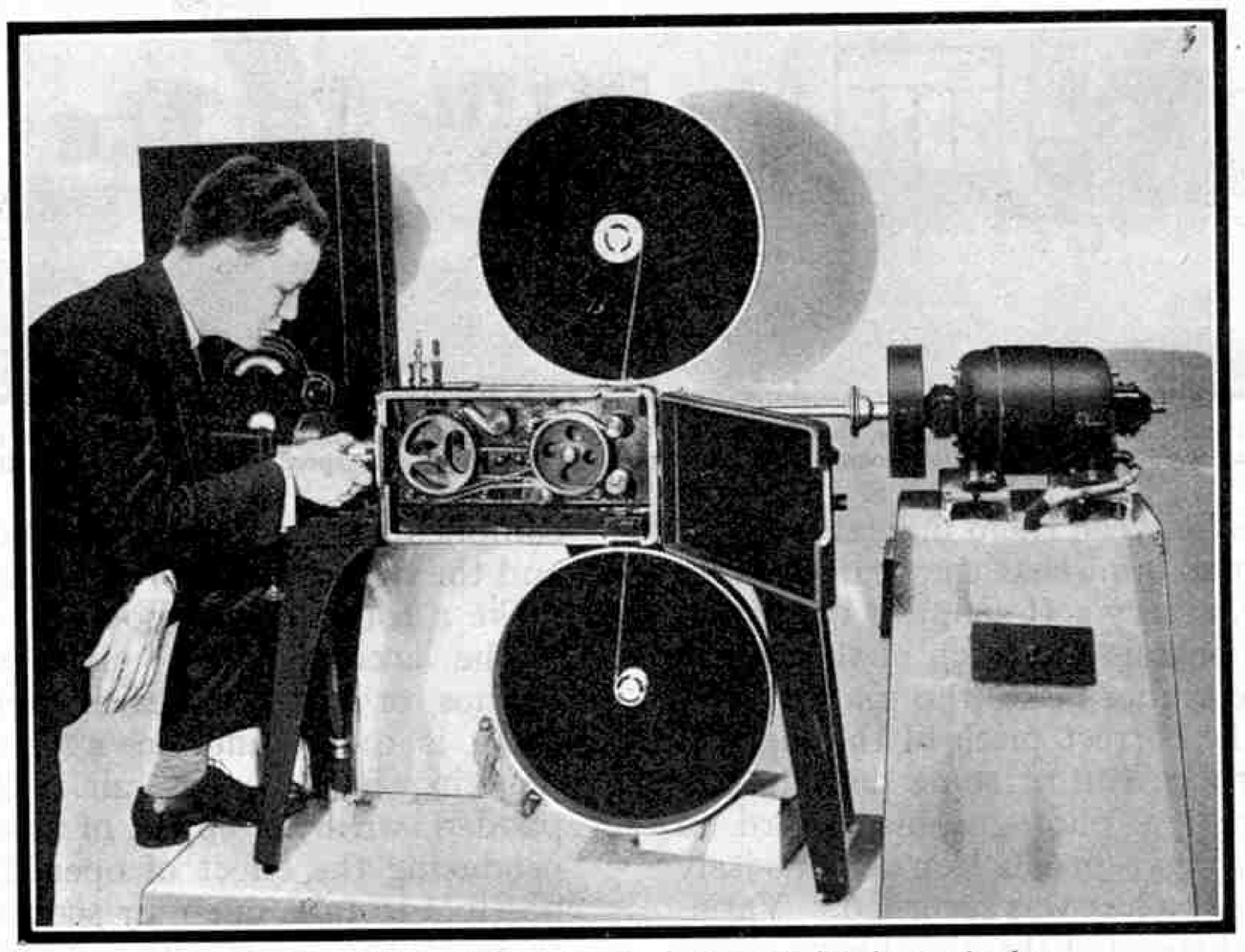
Rehearsing a scene for a talking picture. In the centre is the sound-proof booth in which are the camera and cameraman; and on the right are microphones suspended from booms. On the left are the director, members of his staff, and a few players not taking part in this particular set.

In a small cylinder above the microphone itself is a valve amplifier. This little instrument works on the same principle as the low-frequency amplifier portion of a broadcast receiver, and contains two valves. The output from this amplifier is still extremely small, and it is led out of the studio into the main amplifiers, to see which we must visit the amplifier room.

The amplifiers in this room look very different from those that are used in wireless sets. They are mounted in imposing rows of racks, and each one of them is capable of increasing the electrical energy obtained from the microphone by a hundred millionfold.

We now come to the room where the final link in the recording apparatus is situated. This is one of the film recorders, and it is an instrument that translates the electrical energy fed from the output of the main amplifiers into corresponding variations of light intensity. These variations of intensity are used for exposing a photographic negative film. The roll of unexposed film, which is probably 2,000 ft. in length, is kept in a light-proof spool box at the top of the machine. It is fed from the machine at a constant speed of 90 ft. per minute, being driven by an electric motor mounted on a pedestal at the right.

At the left-hand end of the machine is a small but very brilliant electric lamp, which is used to illuminate the light valve. This valve is the device that changes into light variations the varying electrical energy obtained from the amplifiers. It consists of a simple magnet system, with two duralumin strips stretched between the pole pieces of the magnet. These strips are six thousandths of an inch in width, and three thousandths of an inch in thickness, and are stretched in such a manner as to leave between them a narrow slit one thousandth of an inch in width.



The sound recording machine, opened to show the interior mechanism.

The effect of passing through these two strips the electric speech currents from the output of the main amplifiers, is to open and close the strips in sympathy with the applied voltage. The strips thus form a variable optical slit, and alternately diminish and increase the amount of light passing through them amd falling on the film. The exposure on the film is thus in the form of a series of lines running across the sound track.

The film is moved past the image of the light valve strips by a large sprocket some 5 in. in diameter. In spite of the fact that the motor driving the mechanism of this recorder is held to its correct speed within plus or minus one-tenth of one degree, it still might be possible for small instantaneous speed variations to occur. Such variations might be due to microscopic irregularities in the cutting of the gear teeth in the mechanism. A heavy flywheel is therefore mounted on the sprocket shaft and driven through a series of springs. This method of driving effectively damps out any momentary changes of speed, and gives a continuous and smooth rotation of the sprocket.

The making of a film is a very costly process, and it is essential in every stage of production to take precautions against faults developing in the system. A very ingenious device is employed for actually listening to the sound as it is being recorded on the film. Inside the large sprocket that drags the film past the image of the light valve a photo-electric cell is held stationary. This cell is a little instrument that is capable of transforming light energy into electrical energy. Some of the alternately diminishing and increasing amount of light falling on to the film actually passes through the film, and this light is collected into the stationary photo-electric cell that transforms the light variations into electrical energy variations. These variations of electrical energy are very minute, and are immediately led into a valve amplifier, where the energy is raised to such a value that the sound can be listened to on a pair of headphones. Thus the man who is controlling the recording apparatus can actually listen to the sound as it is being recorded on the film, and so a continuous check on the quality can be maintained.

We will now go into the studio where preparations are being made to take a picture. We see that the camera and the cameraman are housed in a small sound-proof booth. This avoids the possibility of the microphone picking up any noise from the camera. The task of making a film studio soundproof is a very difficult one, and often, in spite of the heavy padding of doors, walls, ceiling and camera booth, some unexpected sound, either from an outside source or within the studio, may intrude with disastrous results. In a British talking picture studio recently a "set" in course of being "shot," or recorded and filmed, was completely spoiled by an aeroplane passing over the studio. A cough or a sneeze at the wrong time by some unfortunate member of the cast or studio staff has proved a costly affair, while in certain American film studios men are employed solely in keeping flies away from the "sets." In spite of the efforts of these defenders

the buzzing of flies is estimated to cost a studio sometimes more than £1,000 a day in wasted film and time. Even silken dresses are an evil on account of the peculiar rustling effect they produce.

In the days of "silent" films, the producer instructed the actors and cameramen by means of a megaphone, from a position outside the range of the cameras, but this is not now possible, and a "set" has to be rehearsed again and again until the producer is satisfied that everything is perfect. He then gives the necessary brief instructions to the cameramen and others by means of different coloured signal lights, and the scene is then "shot."

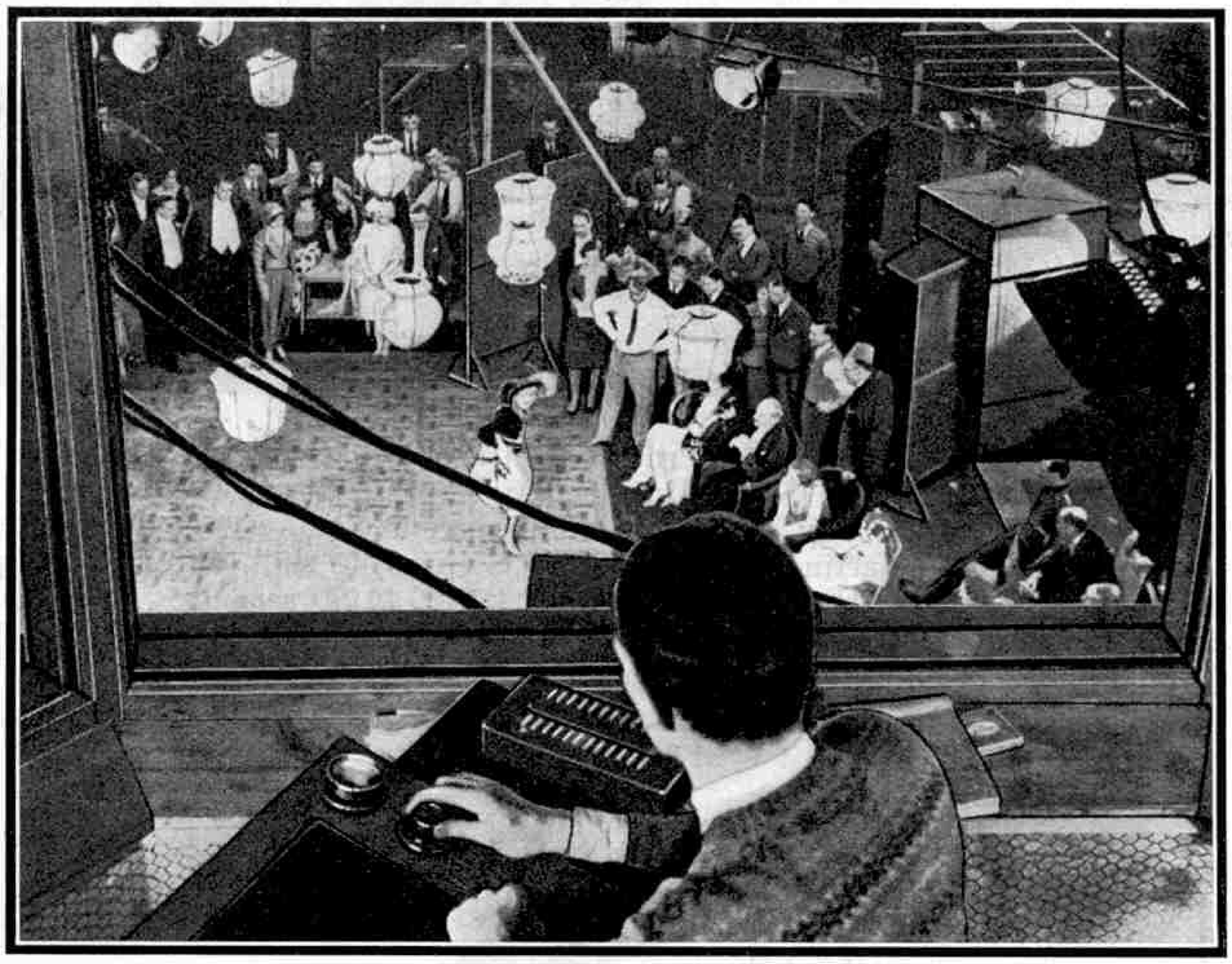
The sound and the picture are photographed on two separate negative films. These two films are finally printed on to a single positive film. As the picture and the sound are photographed separately, it is essential that the camera and the sound recorder machine should run at exactly the same speed. The cameraman no longer has to turn a handle, but his camera is driven by a small electric motor similar in construction to the motor that drives the recorder. Both these motors are fed from a single electric generator, the speed of which is very carefully controlled.

The control of the recording system is carried out from the monitor room, a large chamber adjacent to the studio, with a bay window overlooking it. This room is designed so that its acoustics or sound properties are as nearly as possible those of the average talking picture theatre, and it is carefully insulated, so that it is impossible for any sound to penetrate from the studio. The occupant of this room is termed the "monitor man," and when work is in progress in the studio below he sits at a desk and manipulates numerous controls in front of him. He can not only control the output of a particular microphone, but can combine the outputs of as many as nine of these instruments and at the same time control the volume of each one until the required acoustic balance is obtained. Without this adjustment the recorded sounds would not have the correct relative proportions.

A large loudspeaker is placed at the back of the room, and this reproduces every sound that the microphone picks up. It is possible, therefore, to hear the sound that is being recorded, and a second continuous check on the quality of the recording is thus obtained. In this manner any defective sound recording is detected immediately.

Next we will pass into an operating box and see the projector that will reproduce both the sound and the scene that have just been recorded. This projector is of the type used in school lecture halls, and is somewhat simpler than those that are used in a theatre for entertainment purposes. Its principle, however, is exactly the same.

The film is contained in a circular spool box at the top of the machine. It is threaded first through the picture projector and then through the sound projector situated immediately underneath; and so into the take-up spool box at the bottom of the machine. The illumination for the picture is obtained from a 1,000-watt incandescent lamp. Complex mechanism inside the picture projector moves the film intermittently, showing each individual picture stationary on the screen for approximately 1/24 sec. By the time the film is passing through the mechanism of the sound projector it is running smoothly and at a constant speed. Here again, in order to avoid minute momentary variations of speed, a flywheel is mounted on the shaft of the sprocket in the sound mechanism, and is driven through rubber pads.



Looking down on the Sound Stage from the Monitor Room during the rehearsing of a set. The operator, or monitor man, is controlling the volume of sound passing from the stage to the sound recording room.

This mechanism runs very smoothly, and a motor of only 1/10 h.p. is necessary to drive it. This motor is of the "universal" type, capable of working from any direct current or alternating current voltage normally experienced. It is just as essential in reproducing as in recording to maintain a constant speed, and for this purpose the motor is fitted with a small but very efficient governor.

Inside the sound projector is a small but very brilliant electric lamp, and a simple optical system, which this time contains a fixed optical slit only 1/1,000 in. across. The first lens of the optical system forms an image of the lamp filament on the slit, and the second lens forms an image of this slit on the film itself. The film is therefore illuminated on the sound track by an extremely bright line of light, 1/1,000 in. in width and 80/1,000 in. in length. As the film passes by it is traversed by this bright line of light; and the amount of light passing through the film depends entirely on the density of the lines of the sound record, and therefore on the original exposure of the film.

If all the processes have been carried out correctly the amount of light that passes through the film is exactly the same amount that fell upon the negative in the film recorder. We are therefore repeating our original process, and have reached the stage at which we have turned our film record into light variations. These light variations are allowed to fall on a photo-electric cell that is contained in the right-hand side of the sound projector. This device changes the light variations back again into electric current variations.

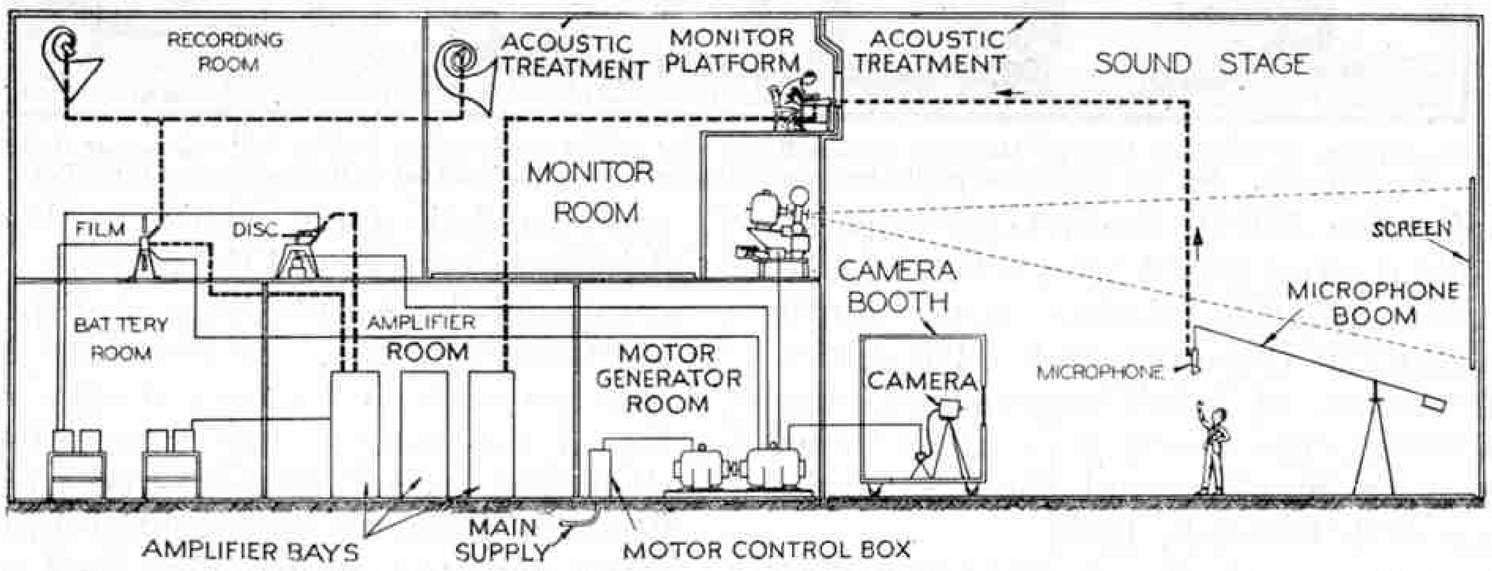


Diagram showing the layout of a typical Western Electric sound-film recording studio. This shows clearly how the sound and the picture are recorded simultaneously and how the sound volume is controlled.

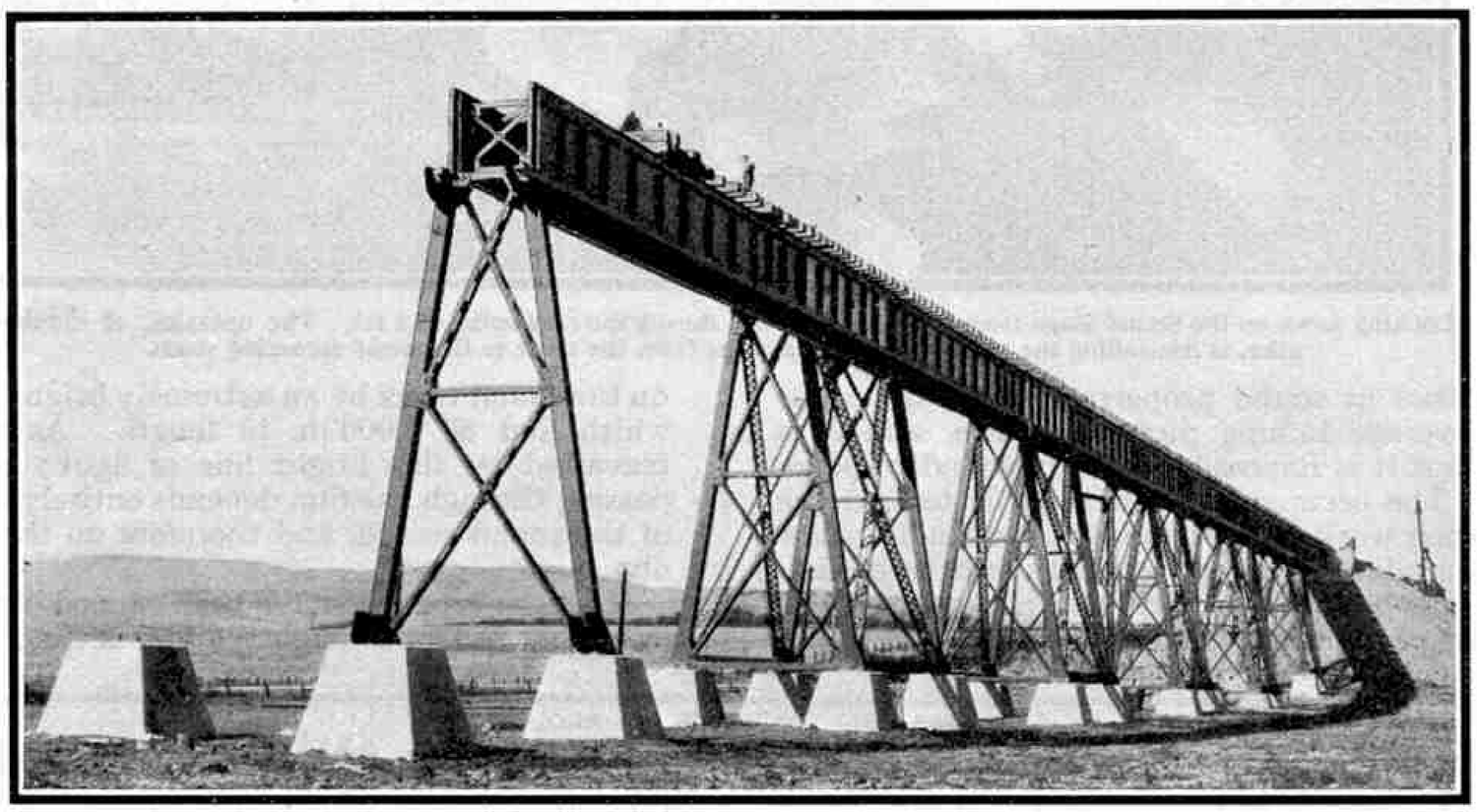
The minute electric speech currents that are obtained from the photo-electric cell are exceedingly small, and it is necessary to feed them into an amplifier contained in a compartment at the bottom of the projector, and from there into the main amplifier of the system. This amplifier is capable of multiplying the energy received from the projector one hundred million times, and is so designed that all speech currents are magnified equally.

At the end of the hall is the final link in the chain, namely, the loudspeaker and the picture screen. In order to secure the illusion that the voice is coming from the figure on the screen, it is desirable that the loudspeaker should be placed actually behind the screen.

BRIDGING SAN FRANCISCO BAY

THE famous train ferry service of the Southern Pacific Railroad across the Carquinez Straits in the upper reaches of San Francisco Bay has been superseded by the opening of the Martinez-Benicia Bridge across Suisun Bay. Since 1879 the "*Solano*" and the "*Contra Costa,*" the largest ferry boats in the world, have carried freight and passengers, and have served the splendid Overland and Shasta route expresses. The new bridge makes possible faster and more convenient handling of passengers and freight, and its opening marks the completion of a great 1929-30 construction scheme.

The Martinez-Benicia Bridge is the longest and heaviest two-track bridge west of the Mississippi. Its total length is 5,603 ft., made up of seven 526-ft. through truss spans, two deck spans of 264 ft. and 504 ft. respectively, one 328-ft. vertical lift span, a 560-ft. viaduct at the south end, and a 220-ft. viaduct at the north end. The entire bridge, including six miles of track approaches, cost $12,000,000 (£2,400,000). The work was carried out in the record time of 18 months, and the first train crossed the bridge on 15th October, 1930.



Erecting one of the viaducts of the Martinez-Benicia Bridge that carries the Southern Pacific Railroad across Suisun Bay, America. For this and the other illustrations to this article we are indebted to the courtesy of the S.P.R.

The steel superstructure includes 25,000,000 lb. of silicon steel and 5,500,000 lb. of heat-treated eye-bars, the remainder being carbon steel.

The main piers and 22 pedestal piers required 105,000 cu. yd. of concrete and 1,500 tons of reinforcing steel. The largest pier is 207 ft. from bed-rock to bridge seat, or the height of a 20-storey building, and it has a base measuring 40 ft. by 60 ft. More concrete was poured into any one of the ten main piers than was used in constructing the largest skyscraper in San Francisco.

A clearance of 70 ft. above water is provided, which will enable 95 per cent. of the ships now using Suisun Bay to pass beneath the bridge. The 1,580-ton vertical lift span erected over the deep water channel is a marvel of engineering skill, and can be opened to a clearance of 135 ft. in 90 seconds. It is operated by electricity, and there is also a petrol engine for auxiliary or emergency use.

The construction of the bridge presented many serious engineering problems. The difficulties arose from the depth of the water, a maximum tidal fluctuation of about 10 ft., the swiftness of the current during winter floods and at rip tide, and softness of the underlying bay deposits.

Finally a unique method of constructing the piers was decided upon. This method involved first the driving of piles round the pier site, and the erection of an octagonal-shaped platform on top of the piles. On this platform were then erected eight steel towers containing winches with cables over sheave wheels situated at the top of the frames. By means of this apparatus a steel shell that might be compared to a bottomless oil tank 81 ft. in diameter was erected and lowered through the water into the mud. This shell penetrated to a depth of from 15 ft. to 50 ft. depending on the compactness of the mud. The shell was built up of circular sections 10 ft. in height, each section being bolted to the top of the shell as it was gradually sunk into the water. When the shell touched bottom it was filled with sand dredged from the surrounding waters. The island of sand thus formed inside the shell permitted the exact staking out and fabrication of the steel cutting edge of the caisson that was to be sunk to rock.

Portable steel forms were erected above the caisson cutting edge, and reinforcing steel was placed in them.

Concrete was then poured in in successive lifts of 10 ft. in height. All this work was done above water, which enabled the working crews to pour tested concrete of the required quality and strength. It also allowed them to centre and position the concrete mass exactly as it settled toward the bed-rock. The caisson was so designed that it contained six wells, by means of which sand could be removed from the bottom of the caisson. As the sand was removed by means of excavators, the caisson gradually settled to the underlying strata.

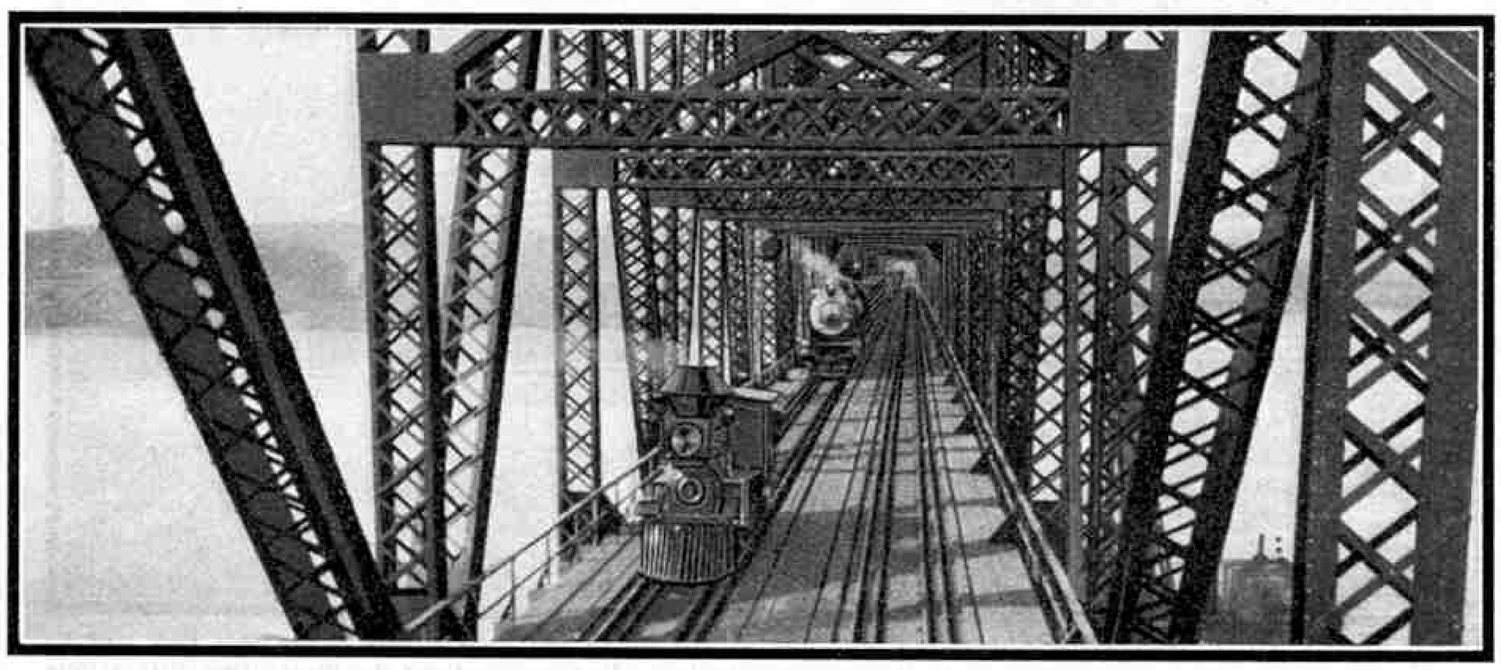
When the caisson had been landed at or near bed-rock, and after the greater part of the material immediately above bed-rock had been removed by hydraulic jetting and excavating, a deep-water diver was sent down to explore the bottom. While down below he telephoned to the surface the conditions existing inside and under the caisson, and gave accurate information as to the penetration of the cutting edge of the caisson into the foundation rock. On each inspection he brought to the surface samples of the rock encountered, and these provided very useful information. This is believed to be the first instance of a deep-water diver being employed in the construction of bridge piers sunk to such great depth of water. The diver's inspection enabled the engineers to verify the pier drill borings, and to determine definitely the nature of the bed-rock formation. In addition the engineers were able to assure themselves that the bridge piers were actually resting on bed-rock, that the full bearing had been secured, and that an interlocked connection had been established between the concrete and steel cutting edge and the bed-rock.

The "Solano," one of the two boats that maintained the Carquinez Straits ferry service, the largest in the world, which has been superseded by the opening of the bridge.

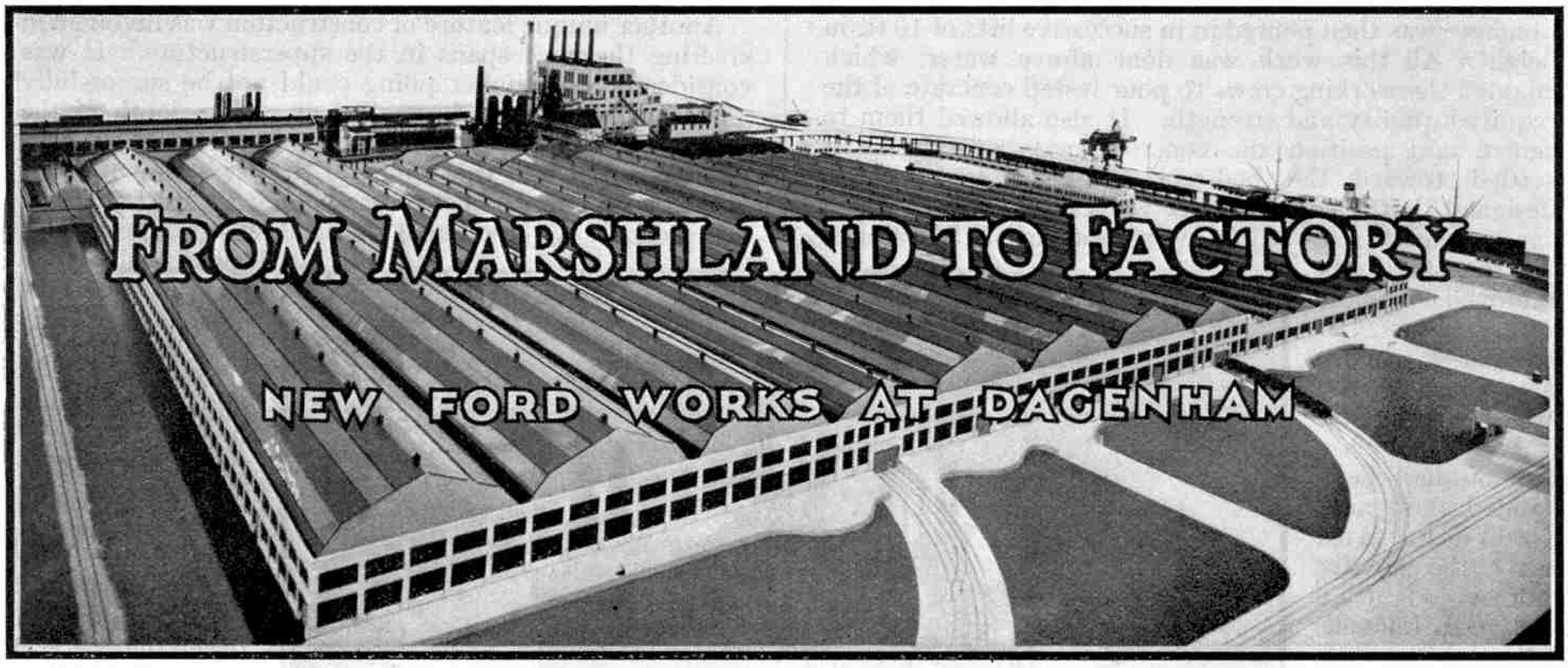
The bridge is, of course, situated in a region of earthquakes, and all the piers are therefore designed to withstand earthquake vibrations of twice the intensity of the one that accompanied the San Francisco disaster of 1906. The concrete used in the piers has a compression strength of 2,500 lb. per sq. in., and a tensile strength of 400 lb. at the end of 28 days after pouring. The piers have 30 lb. of steel reinforcement per cu. ft.

Another unique feature of construction was involved in erecting the steel spans in the superstructure. It was considered that timber piling could not be successfully and economically used on account of the depth of the water, the softness of the underlying mud, the strength of the current and the height of the piers above water. It was therefore decided to use one of the steel spans as falsework for the erection of all the other steel spans. This span finally took its place as the most northerly span in the bridge. It was erected on piling sunk in the shallow waters at the south end of the bridge, and when complete it was floated by two steel barges to a position between the first two deep-water piers at the south end. The span was rested on shoulders provided in the construction of the concrete piers. When in position the top of the falsework span was below the level of the permanent span to be constructed over it, and gave temporary foundation on which to erect the permanent span. When the permanent span was completed the falsework span was again floated on steel barges into a new position between the succeeding piers.

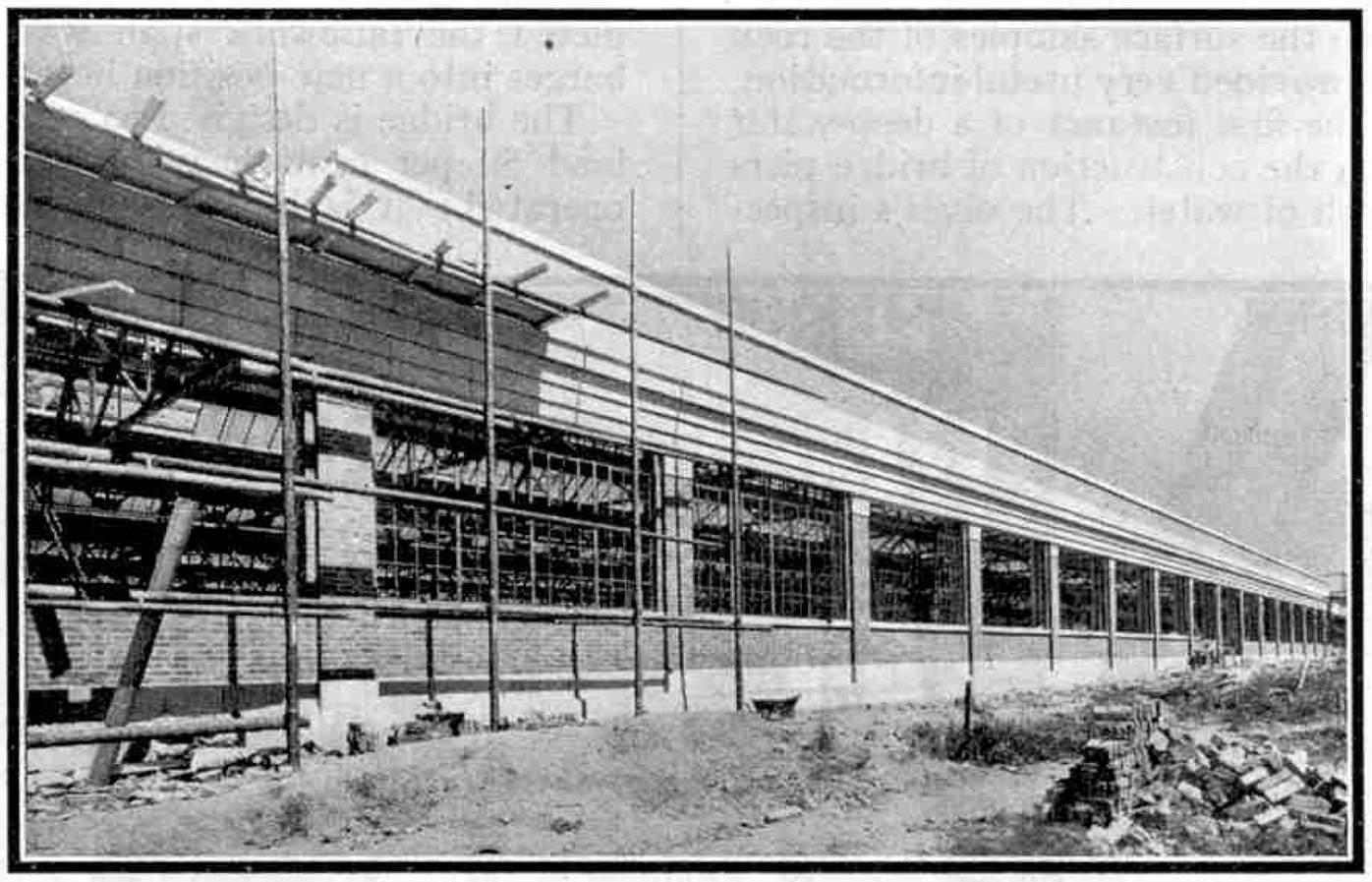
The bridge is designed to carry along its full length a load 50 per cent. heavier than the trains now being operated; it is indeed not exceeded in load-carrying capacity by any bridge in the country. Lighting codes for land, sea and air are installed on the bridge. In addition to the usual maritime lighting system and the railway signals, the bridge is topped by a series of red lights, and a giant 24 in. signal beacon of 2,000,000 candle-power, which flashes its signal light to aviators at intervals of 30 seconds.


View through the bridge. The locomotive in the foreground is the historic "C.P. Huntington," the Southern Pacific Company's earliest engine, which was given the honour of being first across the bridge.

The first railway line to San Francisco Bay was built from Sacramento by way of Stockton and Niles Canyon in 1869. The heavy gradients of the Altamont Pass made this roundabout route unsatisfactory, and in 1879 there was completed the more direct low-level route through Port Costa and across Carquinez Straits to Benicia and Suisun, where connection was made with the line into Sacramento, which was built originally by the old California Pacific Company. (Continued on page 401)



TWO years ago the waste swamp lands flanking the Thames at Dagenham in Essex presented a wild and desolate aspect. The marshes supported only a few cattle, and the monotony of the sky-line was only relieved by farm buildings, and the unsavoury mass of the great South Hornchurch rubbish dump, consisting of the accumulated house refuse of London. Most people would have regarded this depressing scene as the very last place to provide a suitable site for the erection of a huge factory. The Ford organisation deliberately selected it, however, and the building scheme was put into operation with such tremendous energy that almost incredible progress has been made during the past eighteen months. Thousands of British workmen have been working night and day, with the assistance of the most up-to-date building machinery, striving to complete the great factory in record time. It is anticipated that the Dagenham Works will be in production in less than a year, and when working to its output capacity of 200,000 motor vehicles per year, will provide regular employment for 20,000 British workmen. It will constitute the largest motor factory in Europe, and will place Great Britain in a class, as a producer of cars, comparable only with America.



A view of the new Ford factory, showing the south facade facing the river. This is the side that will be seen by ships sailing up the Thames to the Port of London. For the photographs illustrating this article we are indebted to the courtesy of the Ford Motor Co. Ltd.

From an engineering point of view the new works will present many novel features. It will possess a power house of unique design, operating at a pressure of 1,200 lb. per sq. in., a pressure hitherto unknown in this country. In the power house will be three high-pressure boilers and accommodation for a fourth, with an evaporation capacity of 200,000 lb. of steam per hour each, designed to burn refuse, blast furnace gas, coke oven gas, or pulverised fuel. In addition, two low-pressure boilers, working at 200 lb. per sq. in., will be utilised for process work generally.

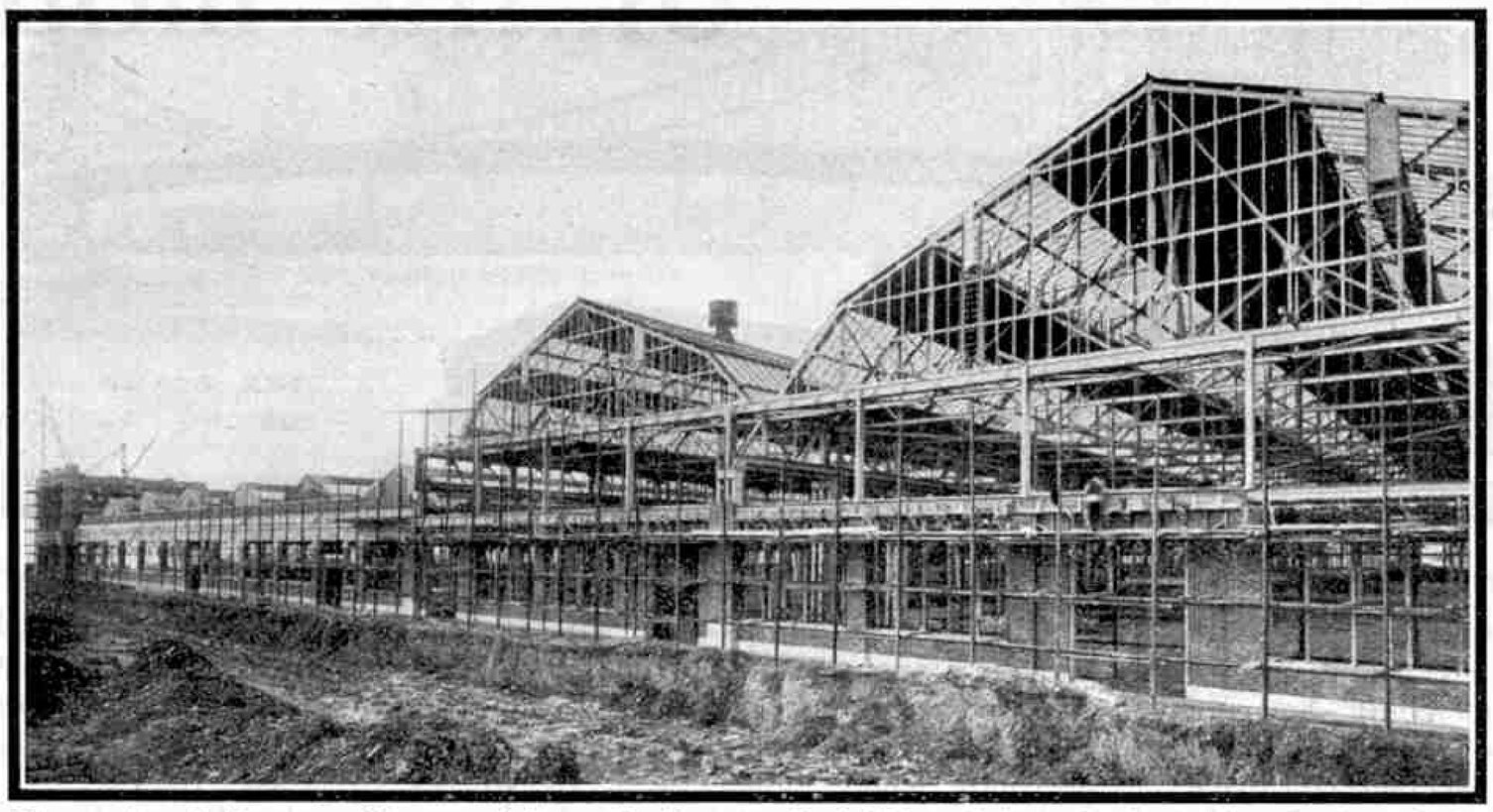
At the eastern end of the power house a refuse preparation house is being constructed, capable of treating 1,000 tons of refuse per day, separating the material according to size and quality, including the removal of iron, steel and tin. Two 30,000 kilowatt generating sets will be employed, running at a speed of 3,000 revolutions per minute; while the engine room will include a house service set and two blowers for the blast furnace. The south elevation of the power house will incorporate a switch-gear house and offices for the power house executives.

The blast furnace, which is the largest in the country and the only one in the South of England, will have a production capacity of 500 tons of pig iron per day. To feed this voracious furnace nearly 10,000 tons of coal ore and limestone will be transported to the works every week. The ore yard from which the furnace will be supplied, entirely by electrical means, will hold 34,000 tons of coal, 122,000 tons of ore, and 11,500 tons of limestone.

The coke oven block, consisting of a battery of 45 ovens, has been designed to carbonise 800 tons of coal every 24 hours, and has adjacent to it a coke handling plant for the purpose of grading the various sizes of coke produced. This latter plant must be considered one of the finest in the world, incorporating automatic operation practically throughout. In a by-products plant close by, the liquid residues produced in the coke

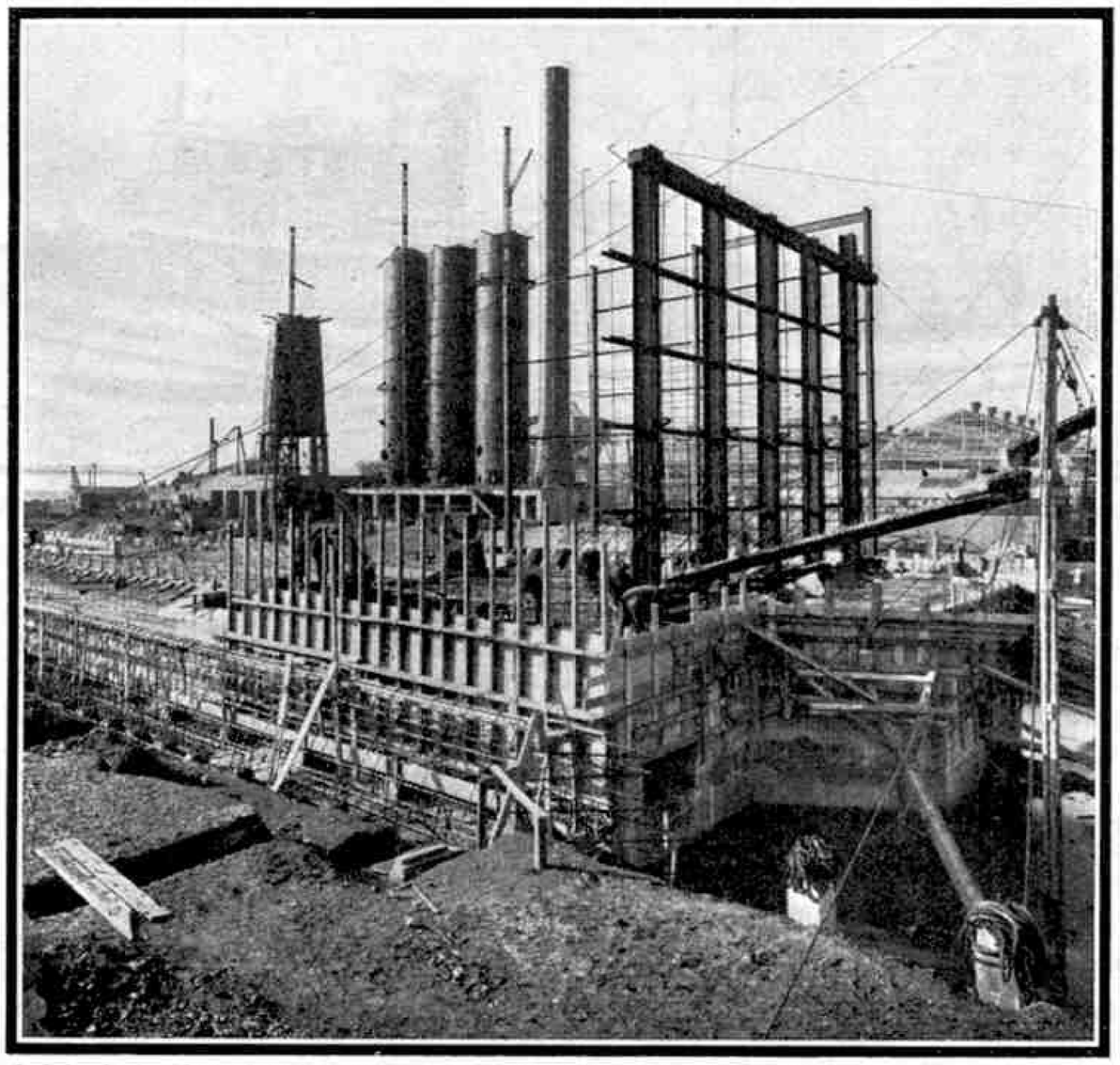
ovens will be treated. Many substances will be extracted, but the chief derivative will be benzol, ultimately intended as fuel by which cars will be driven from the factory.

Amazing strides have been made in the general constructional work. Already the enormous manufacturing, foundry and assembly shops have been erected, and a striking illustration of their immensity lies in the fact that the smallest is as big as the Horse Guards Parade! The factory actually occupies an area of 1,000,000 sq. ft., and the whole of this area is covered by a thick concrete slab reinforced with steel mesh. In all, 92,000 tons of concrete were necessary for this work, and the total length of steel in the reinforcing mesh is about 2,224 miles. The concrete floors of the assembly and manufacturing shops are covered with wood blocks, some 8,000,000 of which have been required. Great steel skeletons indicate the progress that is being made with other buildings, and it is an interesting feature to note that nearly 15,000 tons of British steel were ordered for this work.



The spacious halls approaching completion. In the assembly building all is ready for the introduction of the machinery.

In the main shops, which are now practically completed, it is apparent that every attention has been given to the health and comfort of the workers. Splendid natural lighting is obtained in every corner of every shop by the use of 600,000 sq. ft., or nearly 14 acres, of roofing glass; while those parts of the roof that are not glazed are of a specially-protected metal, coated on the inside with aluminium. This tremendous expanse of glass will call for the permanent employment of a gang of window cleaners, for whom six miles of roof gangways have been provided, with combined water pipe and handrail.



A labyrinth of steelwork dominated by the giant blast furnaces. This shows a year's progress in the building of Europe's greatest motor car factory.

In order to ensure perfect ventilation, warm air will be injected during the winter and cool air in the summer. Nearly 250 ventilators, ranging from 3 ft. to 4 ft. in diameter, will extract the impure air; and six miles of glass roof, 3 ft. 9 in. in width, can be controlled by a series of electric switches, one switch operating eight tons of windows.

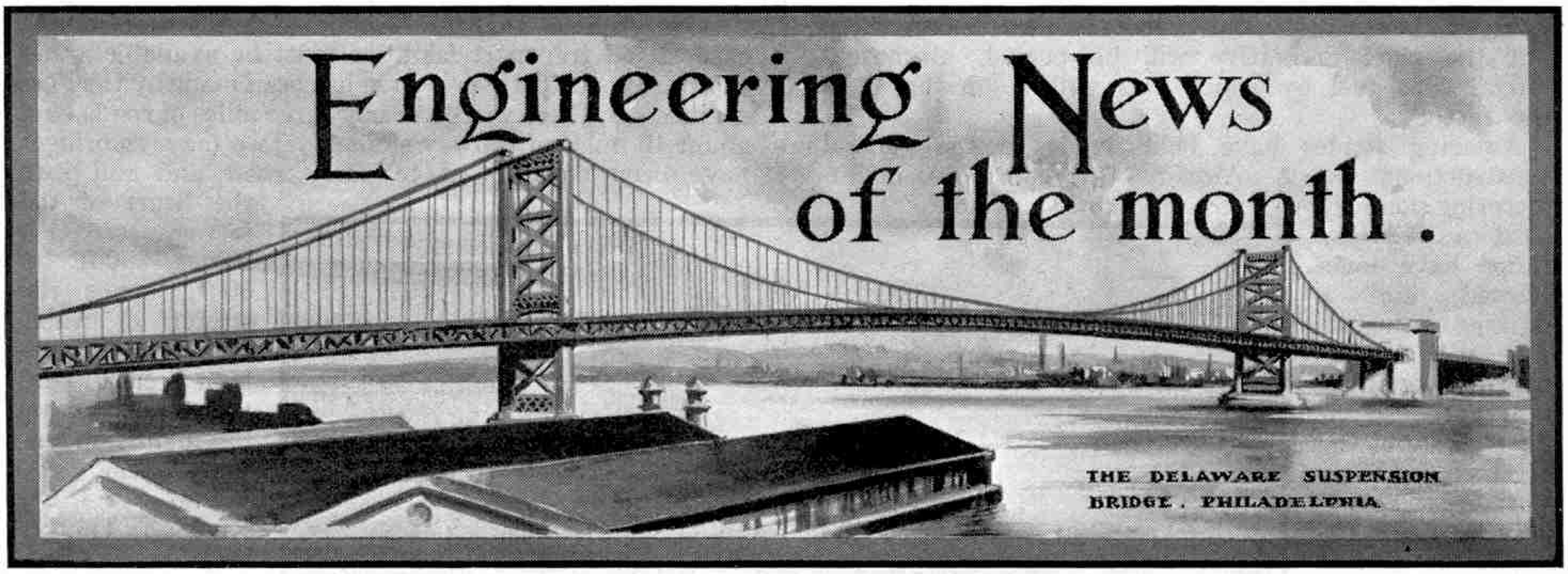
It is obvious that for such a gigantic undertaking exceptional transport facilities must be available; and thoroughly adequate provision has been made by the Ford engineers. There will be nearly three miles of roads, and about 10 miles of railway sidings. Two massive bridges have been constructed to carry road and rail into the heart of the factory. One bridge, 360 ft. by 60 ft., spans the stretch of water known as Dagenham Breach; and the other crosses the main London-Tilbury line.

Out in the River Thames huge steel cylinders are being sunk into the mud and then filled, under pressure, with concrete to form the piers for the jetty. The gigantic task of constructing this jetty which, when completed, will be 1,800 ft. in length and 51 ft. in width, will entail an expenditure of a third of a million pounds. In order to enable passengers to be handled at any time of the day, and at any state of the tide, a floating pontoon is being built at the western end.

The part of the jetty immediately adjacent to the pontoon is intended for the outward shipment of goods, and is designed to accommodate two 6,000-ton ships with an average draught of 20 ft. The central portion of about 600 ft. will receive vessels bringing coal ore and limestone for the blast furnace, and has been dredged to a depth of 30 ft. to accommodate ships of 12,000 tons. The steel superstructure extending to the Thames bank from this portion of the jetty is estimated to weigh about 12,000 tons, and will carry two British-built unloaders with the enormous output of 300 tons per hour each.

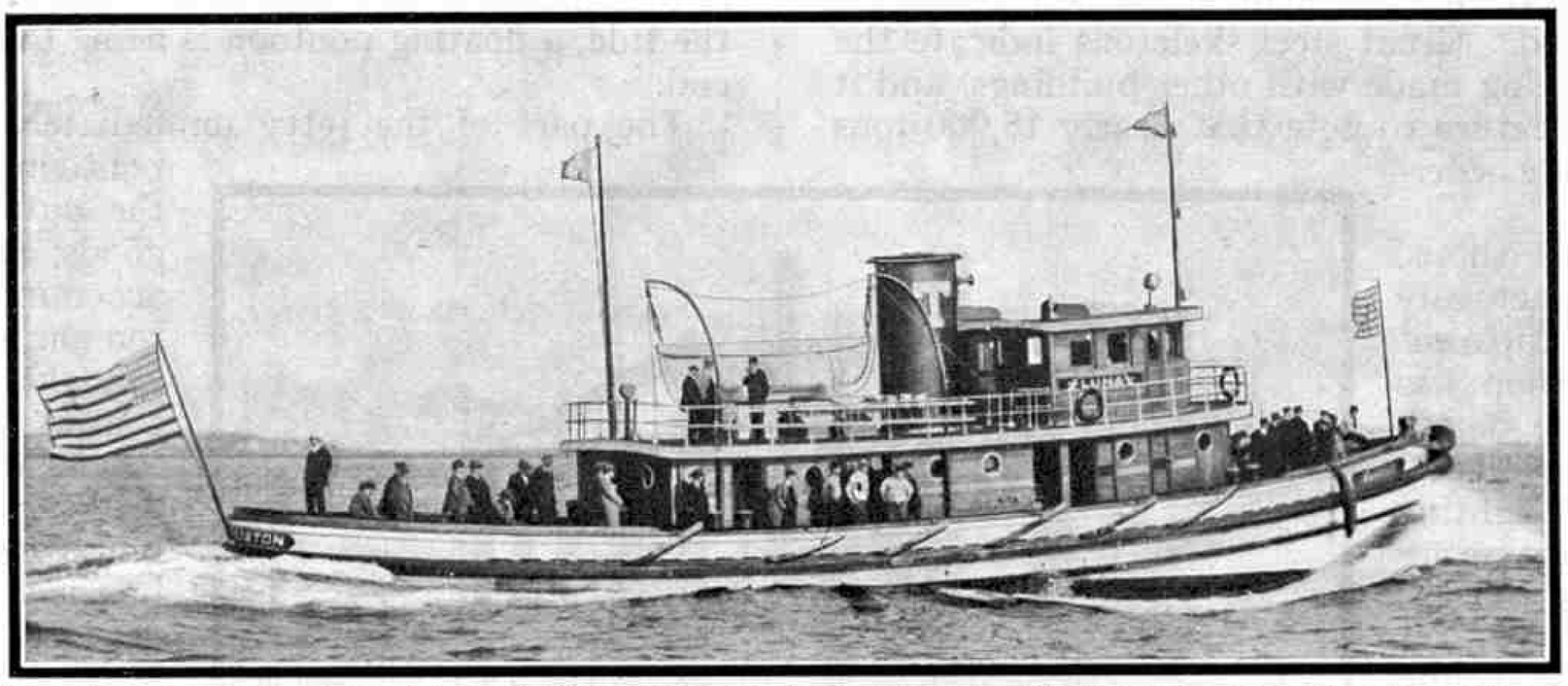
To the eastern part of the jetty will be delivered on barges the refuse from the South Hornchurch rubbish dump. This accumulated garbage, a malodorous landmark for many years, will be consumed in the power house at the rate of 1,000 tons per day, thus combining the dual ends of economy and public service.

The wharf throughout will be provided with the most modern equipment, including electric traction, electric cranes and electric conveyors. (Continued on page 396)



Diesel-electric Tugs for Boston Harbour

Two electrically-operated tug boats are now in service in Boston Harbour, one of these, called the "*Luna,*" being shown in the illustration on this page. The two are the first tugs with Diesel-electric drive ever constructed. Each is 90 ft. in length, and is driven by a single screw connected directly to a 515 h.p. double motor operating at 125 r.p.m. On each vessel two 213 k.w., 300 r.p.m. motor generators supply the necessary current, and these are driven by Winton engines, which are of the Diesel type. Variable voltage control is fitted. This may be operated from four stations, one being situated on each side of the pilot house, a third in the engine room and a fourth on the after deck. Power for auxiliary services is furnished by two 25 k.w., 300 r.p.m. generators coupled to the same shaft as the main generators.



The "Luna," the first tug to be fitted with Diesel-electric propelling machinery. This illustration is reproduced by courtesy of the International General Electric Co. Ltd.

South Africa's Largest Electric Furnace

An electric furnace now in use in the Transvaal for the manufacture of calcium carbide is believed to be the largest of its kind in the southern hemisphere, and is one of the largest in the world. Electric energy equivalent to 7,200 h.p. is required to operate it and it is capable of producing about 1,000 tons of carbide a month.

Powerful New Dredger for Aberdeen

A powerful new self-propelling grab hopper dredger was launched at Aberdeen a short time ago for use by the Aberdeen Harbour Commissioners. The vessel will greatly increase the capacity of the Harbour dredging plant, for it is capable of dealing with 290 tons of material in two hours. A powerful grab crane that has a radius of action of 30½ ft. is fitted. The new dredger has an overall length of 121 ft., and the propulsion machinery consists of a set of triple expansion engines.

Lightships with Diesel-Electric Drive

Although lightships are almost permanently anchored in position, they must be fitted with some type of drive in order to enable them to move back to their positions when blown away in storms, and to return to port for periodical overhauls. Until recently steam engines have been installed in these vessels, and it has been necessary to maintain a small fire so that steam may be raised quickly in emergency. Three lightships that are now being constructed for the United States Government will employ Diesel-electric drive, however, and they are expected to be more economical than steam lightships, for fuel will only be burned when power is actually required. A further advantage of the new lightships is that in storms their propellers may be operated at low speed in order to relieve the strain on the anchor chains.

The new lightships are the first to be equipped with Diesel-electric drive. Each vessel will be constructed of steel and will have a displacement of approximately 630 tons. Four generating sets will be installed on each boat, these consisting of Winton Diesel engines connected directly to General Electric generators. The propeller on each boat will be driven by a 350 h.p., 300 r.p.m. double motor, power for which will be supplied from the four generators connected in series. Sufficient power for lighting and other auxiliary purposes will be generated by one of the engines and this will be kept in constant operation.

A Floating Power Station

A floating Diesel-electric power station has been constructed for the use of an Electric Supply Company at Banjermasin, on the south coast of Borneo, in the Dutch East Indies. A small power station already exists on the site, but it was thought inadvisable to extend it when a greater output was required, for it stands on marshy ground. Instead it was decided that a new power station should be built on a pontoon moored close by. This was expected to be more serviceable than a land station built at a distance, and a further advantage is that a floating station may be moved to more suitable quarters in times of emergency.

The pontoon on which the station has been erected is 82 ft. in length, 26 ft. in breadth and has a draft of 5 ft. A Sulzer six-cylinder, four-cycle Diesel engine that is practically free from vibration has been installed. In this engine fuel is directly injected and the output is 600 b.h.p. at 250 r.p.m.

The energy generated is carried to the old power station by means of cables supported on floats, and only the mechanic in charge of the machinery need be in attendance on the pontoon.

The World's Speed Boat Record

A new world's speed boat record of more than 102 m.p.h. was established by Commodore Gar Wood, the famous American racing motorist. The record was set up in "*Miss America IX*" and exceeds by over 3 m.p.h. the record made on Lake Windermere by the late Sir Henry Segrave. "*Miss America IX*" is fitted with two 1,100 h.p. supercharged engines. Gar Wood broke the existing record three times in one day, his average speed on the final occasion being 102.155 m.p.h. This record was broken a few days later by Kaye Don, the British motorist, who achieved an average speed of 103.49 m.p.h. in "*Miss England II.*"

Unusual Pump Motors for Ford Works

The lower illustration on this page shows one of four vertical synchronised motors that have recently been installed at the Rouge River plant of the Ford Motor Company by the Westinghouse Electric Company. They will be used for driving pumps that operate on large quantities of water at a low head.

The motors are unusual in character, for they are designed for three-speed operation. At first they will be used with only two speeds and a third will be added later. They develop 700 h.p. at 277 r.p.m. and 350 h.p. at 138 r.p.m. The manner in which the motors and pumps are started is particularly interesting. The operation is automatic, the motor control being interlocked with that of the pump valve motor, and the desired operating speed is obtained by a selector push button control. Motors are started on full line voltage, the various steps in the operation being accomplished through different time relays. They begin on the low speed winding, regardless of the operating speed desired, and the transfer to the correct winding connections is made automatically at the proper time.

Another interesting feature of the motors is that they are designed to continue working on a voltage 25 per cent below normal. This allows them to continue in operation when other motors are being started, and also under emergency conditions.

Giant American Suspension Bridge

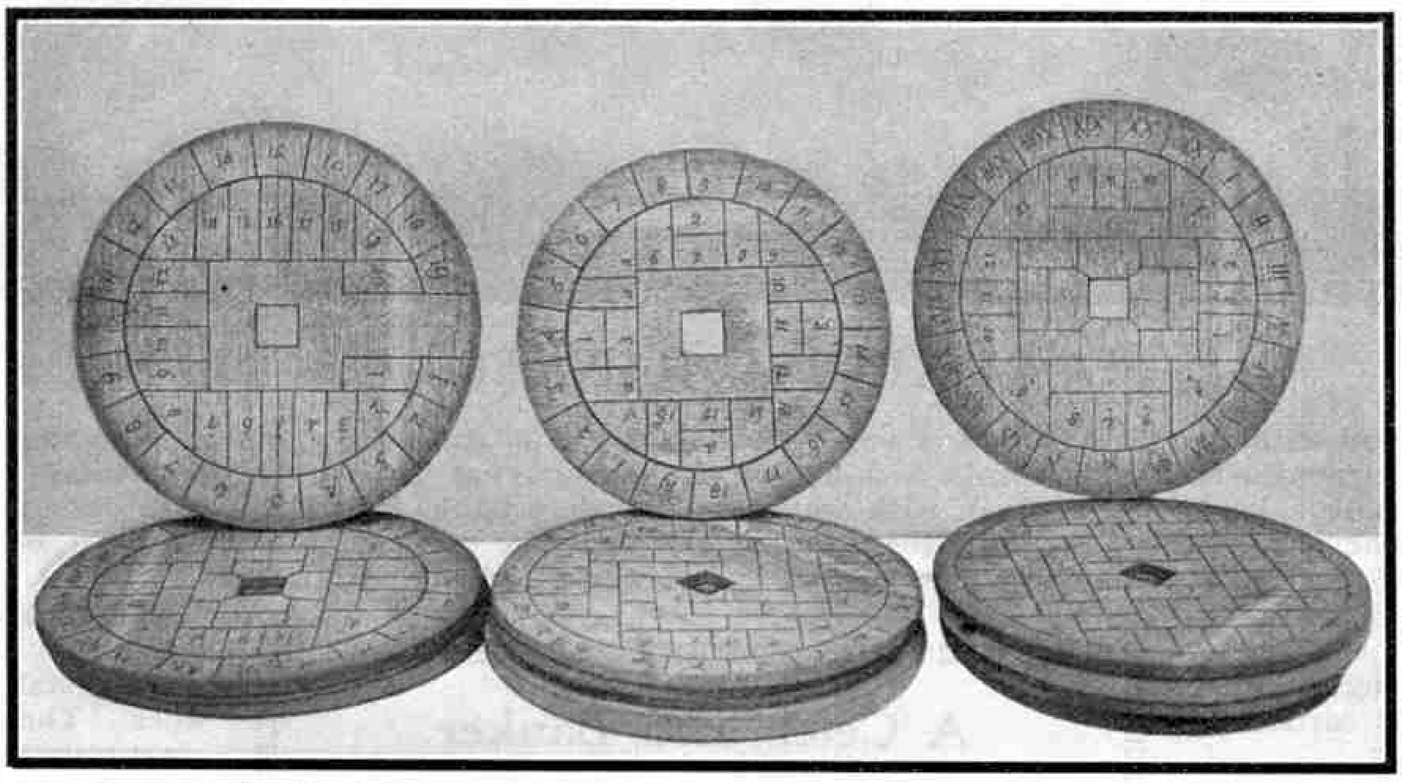
A bridge that will have the longest suspended span in the world is to be constructed across the Golden Gate, the waterway that separates the narrow peninsula on which San Francisco stands from the mainland to the north. The central span of this bridge will be 4,200 ft. in length. Thus it will be 700 ft. longer than the span of the suspension bridge now in course of erection across the Hudson River at New York, and will exceed by no less than 3,350 ft. that of the "*Ambassador*" Bridge at Detroit.

The supporting piers at the ends of the Golden Gate Bridge will be carried on concrete foundations embedded 20 ft. in solid rock at a depth of 65 ft. below the surface of the water. The piers themselves will be 740 ft. in height, and thus will be almost as high as the Woolworth Building. Beacons placed on the towers will serve as lighthouses for sea-going vessels and aircraft. There will also be observation and lookout rooms in the towers, and access to these will be gained by means of high-speed lifts.

The deck of the bridge will be at a height sufficient to allow the "*Majestic*," the tallest liner in the world, to pass beneath it. It will carry a 60 ft. roadway that will be capable of accommodating six lines of traffic, and there will be two sidewalks.

Motor Lorry with Eight-Wheel Drive

An eight-wheeled motor lorry designed for service on ground that is too rough for a six-wheeled vehicle has been produced by Guy Motors Ltd. It has two axles in front as well as in the rear. Oscillatory axles are employed and the drive is taken by all the wheels. Both sets of front wheels take part in the steering action.

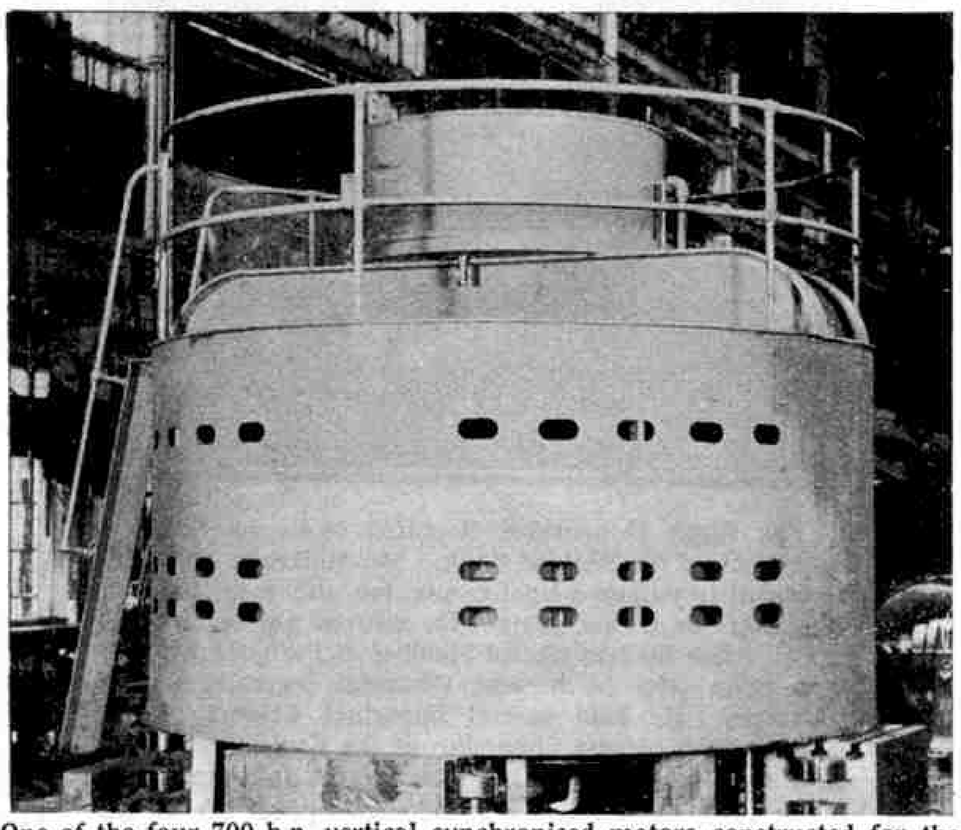


A number of wooden "drafts" made by John Rudyerd, to show how the stones in the foundations of the second Eddystone Lighthouse, built in 1706-9, were to be put into position. For this illustration we are indebted to the Royal Scottish Museum, Edinburgh.

Perhaps the most remarkable feature of the lorry is that it is capable of crossing trenches 6 ft. in width, and of practically any depth, for when driven over such trenches the front wheels do not fall into them, but only sink to a short distance depending on the flexibility of the road springs.

In order to assist in loading the lorry it is fitted with a winch, driven by the engine, that is capable of exerting a pull of seven tons. The gear-box of the lorry provides four speeds, and each of these may be used in conjunction with the winch in order to give an ample range of power for loading purposes.

Another interesting motor lorry produced in America is of the six-wheeled type and is claimed to be the most powerful yet constructed. It is fitted with two engines developing 275 b.h.p. at 2,800 r.p.m., and is capable of carrying loads of 40 tons.



One of the four 700 h.p. vertical synchronised motors constructed for the Ford Motor Company by the Westinghouse Electric International Company, to whom we are indebted for permission to reproduce this photograph.

Testing Pit for Waterwheel Generators

A pit for testing large pieces of machinery moving at high speed has been completed by the General Electric Company in America. This pit is the largest of its kind ever constructed, and it is claimed that with it tests may be made that cannot be duplicated anywhere else in the world. It has been built for the purpose of testing the rotors of waterwheel generators, which for the purpose are run at twice their normal speed, and it is capable of dealing with rotors of all sizes, including giants 40 ft. in diameter and weighing 500 tons.

The testing pit itself is a circular chamber 30 ft. in depth. It is surrounded by two concentric walls of heavily reinforced concrete between which there is a cushion of soft sand, and has a concrete and steel plate cover 8 ft. in thickness. This protection is necessary, for the speed of the rim of a 40 ft. rotor under test is nearly five miles a minute, and if such a rotor were to burst under the strain heavy pieces of metal would be thrown out at the tremendous velocity of 360 m.p.h. For this reason the pit is housed in a large brick and steel building in a field a quarter of a mile from the factory, and the control room is in an observation building 300 ft. from the pit. The instruments that enable the engineers to read the speed of a rotor under test, and to obtain visual or photographic records of its vibrations, are also installed in this building. An interesting feature is that a telephone in the control room is connected with a microphone in the pit, and the sounds transmitted by this means tell a skilled operator exactly how the rotor is behaving under the strain.

Electrical Machinery for Cunard Giant

It has been announced that the electrical requirements of the giant Cunarder now being built on the Clyde by John Brown & Co. Ltd. will be supplied by seven turbo-generators constructed by the British Thomson-Houston Co. Ltd. Four of these will be employed in connection with the main machinery and three will be used in the cooking and allied services.

Each set will consist of a 10-stage B.T.H. turbine, running at 5,000 r.p.m., connected through single reduction gearing to a D.C. generator that will run at 600 r.p.m. The designed normal output of each generator is 1,300 k.w. at 225 v., and the overload capacity will allow for an additional 50 per cent. over a maximum time of five minutes, or of 25 per cent. over a period of not more than two hours. It will be seen that the total output is 9,100 k.w., which is sufficient to meet the normal requirements of a small town. The sets are of the combined turbine and condenser type, the condenser being integral with the turbine. The whole unit may thus be arranged on the one floor level.

XIX.—A BANKER

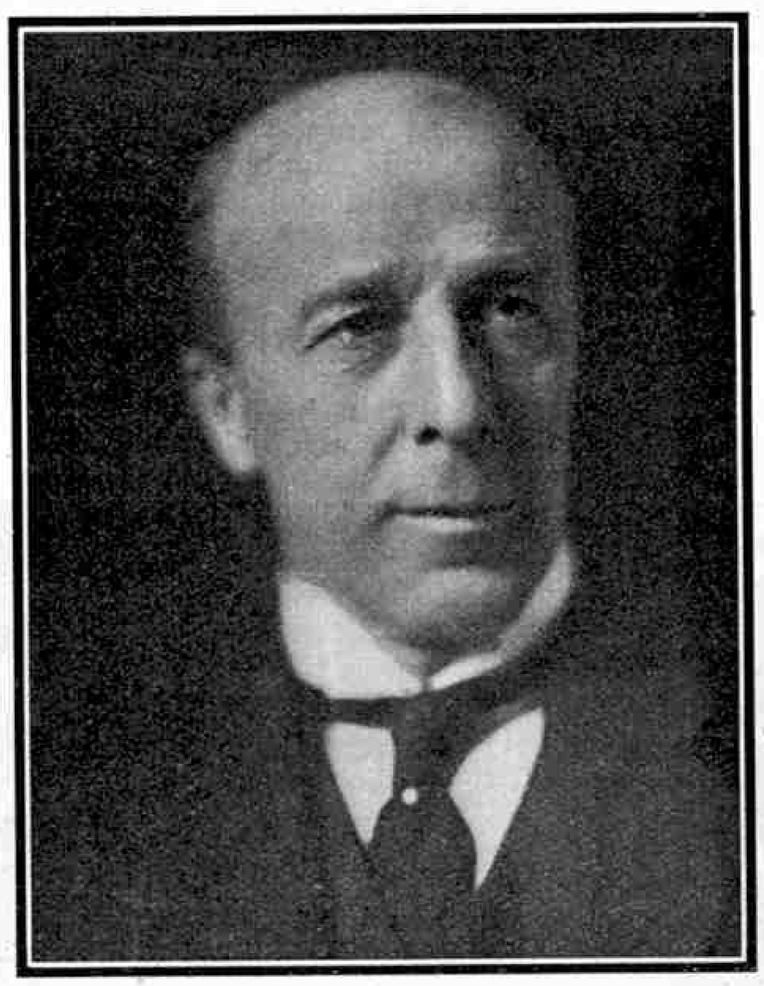
THIS month we are to deal with a profession that is very old, but has undergone extraordinary developments within the last 50 years. Originally a banker was a man with whom money could be deposited at fixed rates of interest, the banker making his profit by employing this money for purposes that gave him greater returns. Banking of this kind probably began as soon as money came into use among civilised peoples, and it was certainly carried on by the Greeks and Romans.

In the Middle Ages the world's bankers were usually Jews, who combined the banking business of the time with moneylending. People of this race are said to have founded a bank in Lombardy, Italy, as early as 808 A.D., and the name of Lombard Street, the great banking quarter of London, is a reminder that it was descendants of these Jews who first established themselves in London as money-lenders and bankers on a large scale. One of the earliest banks to be founded was the Bank of Venice, which was in operation as early as 1157; but the first institution to accept and use deposits on a large scale in the modern banking sense was the Bank of Amsterdam, founded in 1609. At that time Amsterdam was the great European centre where new coins were issued in exchange for clipped and debased money of all nations, and the bank was established for the purpose of keeping steady the rates of exchange.

In this country the goldsmiths of London formerly played the part of bankers, and they were particularly powerful under the Stuarts, to whom they lent large sums that were never repaid. To-day the chief banking institution of the country is the Bank of England. This was founded in 1694 for the purpose of lending money to the Government, whose official banker it has been ever since. It has grown steadily in strength, and is now the most powerful financial institution in the world.

During the early days of the 19th Century many private banks were founded. They financed general trade operations and increased rapidly in number and importance, but with the enormous growth of commerce during the second half of the century the task became too much for them. By means of amalgamation and purchase, stronger institutions were therefore formed, and these eventually developed into the great joint stock banks of to-day. The transactions of these banks run into hundreds of millions of pounds annually. The acceptance of deposits is only a small part of their activities, for they act as agents for commercial and industrial firms, large sums being paid easily and readily without actual exchange of coin, by means of the cheques and drafts issued by the banks. They also employ a proportion of the funds entrusted to them in financing industrial operations, thus encouraging the growth of business generally and so closely are modern banks interlinked with our commercial system that trade would be reduced to a state of chaos if the facilities they offer were suddenly withdrawn.

A Celebrated Banker



The Right Honourable Reginald McKenna, P.C., is Chairman of the Midland Bank. Mr. McKenna originally intended to pursue a legal career, but only practised as a barrister for a few years. He entered political life in 1895, when he was elected Member of Parliament; and ten years later he became Financial Secretary to the Treasury. He held several important Cabinet offices, and in 1915 became Chancellor of the Exchequer, a post that he occupied until the close of the following year.

In 1919 Mr. McKenna abandoned political life on his appointment as Chairman of the Midland Bank, and he is now a recognised authority on financial matters.

Complicated account-keeping is involved in banking, and large and skilled staffs are employed for this work. The duties of these staffs carry great responsibility, and this is especially true of the higher officials who direct the policy of a bank and keep a watchful eye on its many activities. The staffs of banks are therefore recruited from men of good education and character.

During recent years the advantages of banking accounts have become more evident, and the number of these has increased very rapidly. This has meant more routine work for the staffs, and machines have been brought in to enable them to deal with it. To-day banks are rapidly becoming mechanised. Adding machines have long been used, and many other ingenious machines have been designed to deal with the special requirements of bankers. These machines are accurate and easily operated, and they enable the work to be done far more quickly and economically than by older methods.

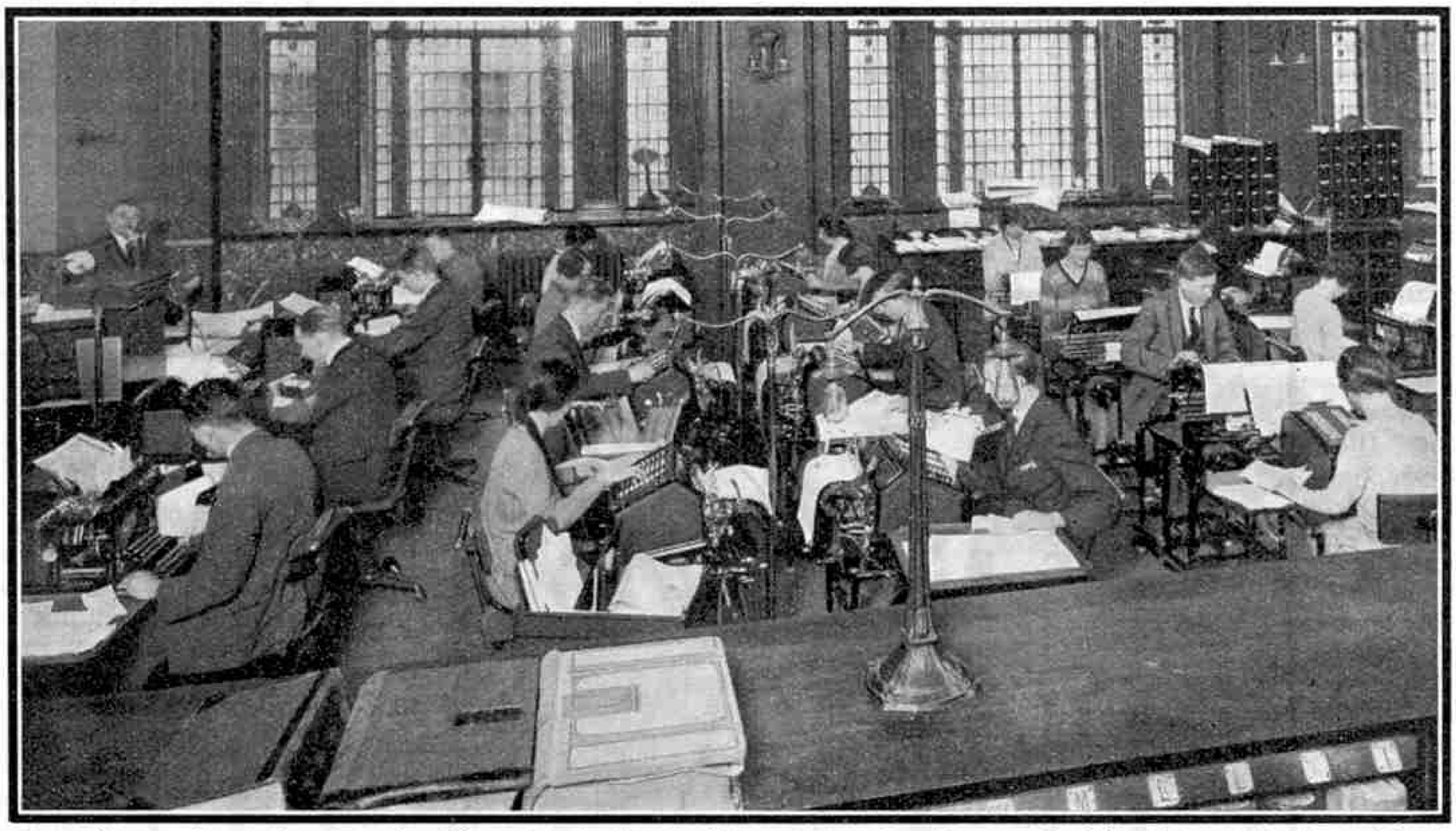
A point of importance is the effect of the introduction of mechanical methods on bank staffs. It might be thought that the greater use of machines would involve staff reductions. This is not the case, however, for the use of machinery has been forced upon the banks by the great increase in the amount of routine work necessary. Banks themselves are continually extending and opening new branches. Staffs are required for these branches and those who have been displaced by the introduction of accounting machines will be available for work of this description. To a certain extent this is to the advantage of the staffs, for after all, laboriously entering columns and rows of figures in ledgers is not banking, but book-keeping; and men with ambition will welcome the release from the monotony of such work that the introduction of machines brings with it.

Banking differs from many of the professions that have already been dealt with in this series in that those who enter it do not undergo a long and extensive preliminary training, and a large premium is not required. Banking methods are learned by actual practice, the beginner commencing at the bottom in a branch and working his way upward through the various grades of service, in accordance with his ability and capacity for work.

The first step is to take up a situation as a junior clerk in a branch of some bank. The usual practice is to enter one that is

situated conveniently near the home of the entrant, and now that so many branches of the great national banks have been established, this course offers no difficulty. Appointments are given to boys between the ages of 16 and 18 years, and they are greatly sought after. Banks are therefore able to choose the best of the applicants, and in many cases it is necessary that a boy should be nominated or supported by a director, an influential official, or a well-known customer if he is to secure an appointment. For the Bank of England, in fact, it is almost essential that an aspirant should be nominated by a director. The general training and education required is that of the ordinary public school or secondary school standard. Applicants should have passed the Matriculation examination, or one that is recognised as its equivalent; and the subjects to which special attention should be given are English, Modern Languages, Geography and Mathematics. Those who do not already possess Matriculation certificates, or their equivalent, are required to pass tests imposed by the bank they propose to enter.

Application for admission to a bank should be made immediately after the necessary examination has been passed, or even earlier, in this connection it may be noted that an applicant's social position may possibly be placed before his scholastic attainments. The names of those who desire to secure appointments are placed on a waiting list, and candidates are notified in turn of vacancies that arise. Naturally the period of waiting varies, and it may be as long as several months before the eagerly waited notice is received.



Accounting machinery plays a great part in modern banking, and in many large branches every book-keeping operation is carried out mechanically. For our photograph of a branch in which machines are in use we are indebted to Burroughs Adding Machine Limited.

The salary of a junior clerk on commencing work is a reasonable one. If employed in a London bank he may expect from £70 to £90 a year, and in the provinces the maximum commencing salary is about £70 a year. The hours vary in different types of branches and in all the work calls for great care and accuracy. Towards the end of each half-year the pressure is increased, for then work of a special character becomes necessary, this including the calculation of interest and the preparation of numerous returns.

It may be well to point out that banking is a career in which it is easy for a young man to be satisfied with a mediocre position, and to be content when he has attained a position as ledger clerk or teller. The salaries paid to bank officials are sufficient to keep them in moderate comfort, while their social position is also reasonably high, and they may look forward to the enjoyment of a pension after completing the necessary term of service. Higher positions do not become vacant very frequently, and there is keen competition for them. In banking as in other careers, keenness and ambition bring their reward, and young men who intend to make a success of their career should take every opportunity of extending their initiative and knowledge of its requirements. All boys entering banks as clerks should therefore be prepared to regard the years spent in the lower ranks as a kind of apprenticeship, and to devote them to a really serious study of banking in all its aspects. If any opportunity of advancement should arise, they will then be in a position to take full advantage of it.

The best means by which a young man may show his immediate superiors that he is keen to secure promotion is by taking the examinations of the Institute of Bankers. This Institute may be described as the professional association of those interested in the banking profession, and to-day the higher appointments in the banking world are more and more reserved for those who are Associates or Members of it. For this reason it is just as important that young bank clerks should become Associates of the Institute as it is that apprentice engineers should qualify for membership of the junior grades of one or more of the engineering institutions; and boys who intend to enter the profession will be well advised to study for the preliminary examinations while at school, or immediately after leaving.

The Institute of Banking arranges monthly lectures and discussions at its headquarters in London, and also at various provincial centres; and a monthly magazine dealing with matters of general interest to banks is published. The examinations that must be passed by candidates for admission to the various grades of membership are only open to those actually employed in banks. They are chiefly concerned with financial matters, but foreign languages also form a prominent feature of them. The great development in modern times of international trade has made languages of great importance to banks. The officials of most organisations have recognised this, and special prizes are now offered to employees who distinguish themselves in this direction, while facilities are given to selected candidates to enable them to make a special study of foreign languages.

Prospects in banking are quite good, and it must be remembered also that employment is secure, and a recognised scale of increases of salary is in operation in most of the banks of this country. Even if he does not rise to any higher situation than that of a ledger clerk, a steady man may obtain a salary of about £350 a year, and will receive a pension after service for a specified period. Most of those engaged in banking look forward to promotion to Accountantships, and more particularly to Branch Managerships. The salaries received in these positions vary according to the size of the branch and the responsibility involved. The manager of a small branch may receive a salary of little more than £350 per year, but considerably more is paid to those in charge of larger and more prosperous branches, many of which carry on a surprising volume of business. It is impossible to make any definite statement in regard to the salaries of high bank officials, for details of this kind are usually kept private.

A post that offers special attractions is that of Inspector of Branches. The work of this official is not so monotonous as the routine tasks dealt with in a head office or in a branch, and it carries with it a salary that is on an adequate scale. A further great advantage is that an Inspector also obtains splendid experience of banking work in districts and circumstances of many different types, and the experience that he gains is likely to be useful to him when he aims at higher posts at headquarters, where the general policy of the bank is decided.

There are also good openings in overseas banks, particularly in various parts of the British Empire and in South America. Formerly the great bulk of the banking business associated with overseas trade was in the hands of merchant bankers and strong overseas banks such as the Chartered Bank of India, Australia, and China, and the Hong Kong & Shanghai Banking Corporation Ltd. Since the War conditions have changed considerably. By means of amalgamations with smaller banking firms established for the special purpose of dealing with overseas business, the great British joint stock banks have entered this field, and are steadily extending their influence in international finance.

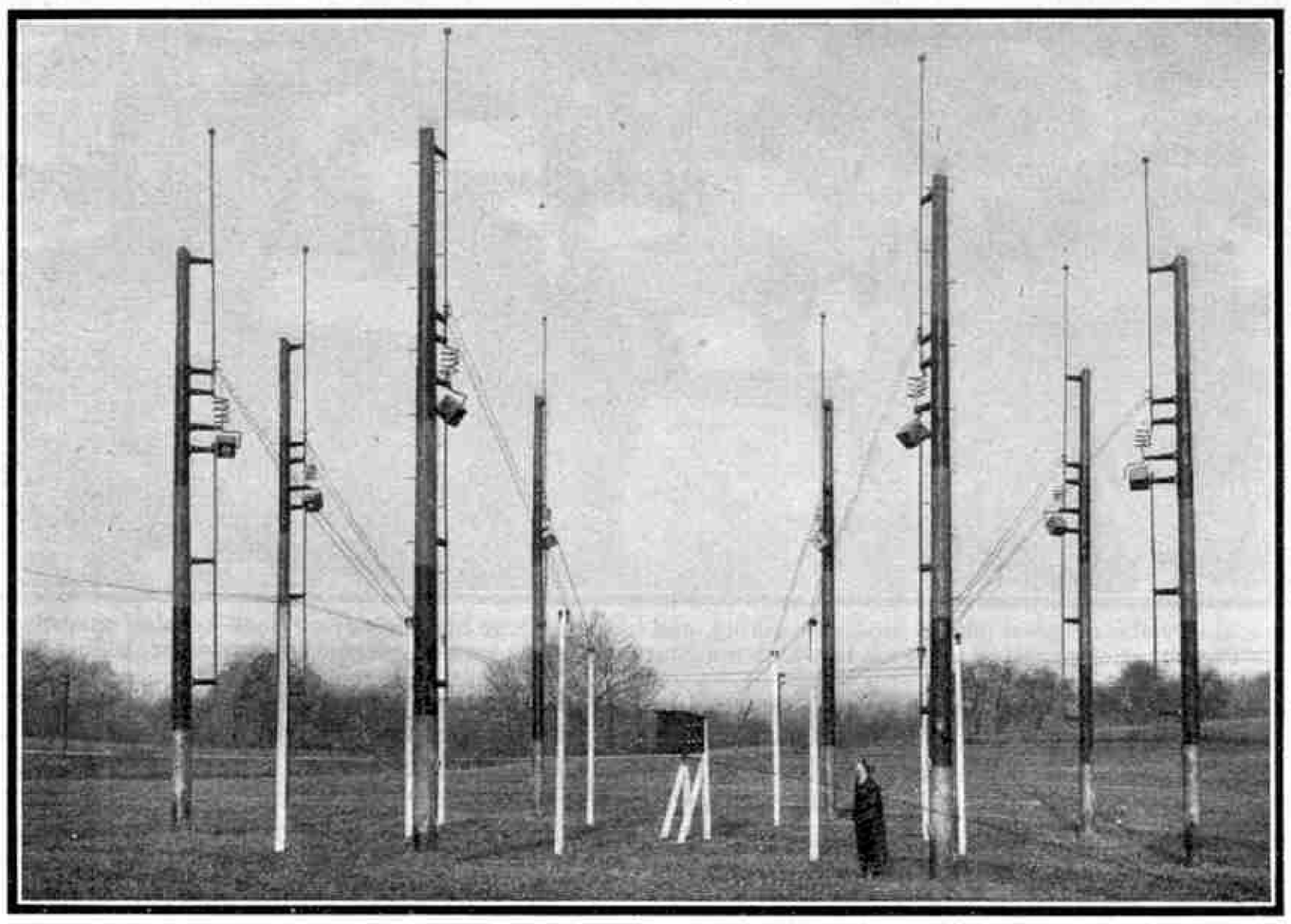
Good opportunities for capable men are to be found in overseas banks of the old type as well as in the foreign sections of British banks. The great Eastern banks, such as the two already mentioned, probably offer the best career to a young man who is prepared to live abroad. The salaries paid are adequate, and their employees hold positions that in a social sense are often similar to those of the Civil Service. In order to obtain a post of this kind nomination is usually required, and in certain instances previous experience of banking is necessary. *(Continued on page 445)*

A New Form of Transmitting Aerial

An entirely new type of aerial for wireless transmitting stations has been developed by the Westinghouse Electric Company and is now installed at its well-known station KDKA. Its purpose is to enable signals to be sent out that are powerful at a distance and comparatively weak nearby, thus making it possible for receiving sets near the station to tune in to distant programmes without suffering interference.

The aerial acts by repressing the wireless waves that travel along the ground, leaving those reflected from the Heaviside layer to affect distant receivers. In the case of short wave transmissions this effect is brought about by using eight vertical aerials arranged in a small circle. The ground wave from each aerial is absorbed by those from the others, and the result of this mutual interference is that only the sky wave travels outward. Thus the immediate vicinity of the station is free from overpowering radiation.

For longer waves a bird cage aerial erected on wooden poles arranged in a huge circle 800 ft. in diameter is used in order to give the same effect.



A new type of short-wave aerial installed at KDKA, the well-known Pittsburgh wireless station of the Westinghouse Electric Company, by courtesy of whom our photograph is reproduced. The aerial transmits signals that are powerful at a distance, but weak in the neighbourhood of the station.

It is interesting to note that similar means may be adopted to cut out the sky wave and give a strong ground wave, and thus the method may be applied to stations that require only to provide radiation for reception within a limited area.

Torpedo that Leaves No Visible Track

The latest development in naval warfare is an invisible torpedo. Those at present in use are driven by compressed air engines, and the air that bubbles to the surface of the water during the run of the torpedo betrays its track. This peculiarity often enables warships to avoid an oncoming torpedo or to explode it before it reaches its target.

The new weapon gives no indication of its approach, for it is driven by a small electric motor that takes current from light storage batteries. Torpedoes of the new type travel at speeds slightly less than those driven by compressed air, but it is believed that improvements to the batteries and motors will make them capable of a speed of 30 knots over a run of 12,000 yards.

Motor Driven by Sunlight

A problem that almost continuously attracts the attention of many scientists and inventors is that of deriving power direct from the Sun. In the usual form of plant the Sun's rays are concentrated by means of mirrors on cells containing water or oil, and the rise in temperature of the liquid is used as a source of energy. An entirely new direction has been given to these experiments by the invention of the photo-electric cell, for a German inventor has succeeded in constructing one that under the stimulus of daylight drives a half-volt motor.

In general appearance a photo-electric cell is similar to a wireless valve. It is evacuated or contains an inert gas at low pressure and has two electrodes, one of which is coated with sodium, potassium or some other substance that emits streams of electrons, or negatively-charged particles, when light falls upon it. The second electrode is usually given a positive charge in order to attract the electrons, and their passage across the cell constitutes an electric current. In the photo-electric cells now used in television and for other purposes, the current produced is very small. Apparently the German inventor has constructed a cell in which a larger current is obtained, and it is believed that the output may be increased far beyond the limits already attained.

Metal Bearing that Requires No Oil

A self-lubricating metal bearing has been produced in the research laboratories of the Westinghouse Electric Company. It is made by mixing metallic powders with materials that yield a soapy substance. The ingredients are subjected to a pressure of 40,000 lb. per sq. in., and the temperature is slowly raised to 400°F., or nearly twice that of boiling water. Half an hour later the pressure is increased to 200,000 lb. per sq. in. in order to complete the process.

Bearings made of the new metal may be mounted without oil or grease, and are particularly suitable for use in motors, such as the starting motors of cars, that are run intermittently, or in typewriters, calculating machines, microscopes and telescopes. They may also be employed in heavy machines. When used for this purpose they may be lubricated with oil in the usual manner, and have the advantage over ordinary bearings that they resist the heating effects of friction if the supply of lubricant becomes inadequate.

Tracer Pellets for Sporting Cartridges

Tracer bullets came into general use during the European War. In the base of one of these is a small proportion of combustible material that is ignited by the explosion of the cartridge, and this enables the course of the bullet to be traced almost to its destination.

The value of being able to follow the flight of a projectile is so great that the idea is now being applied to sporting cartridges. These contain a number of pellets, and of course, it is not so easy to apply the principle to them as to a single bullet. The problem has been solved by placing a special tracer pellet in the centre of the charge of shot. The combustible in this is ignited by the discharge and burns brilliantly for a distance of 75 yards from the muzzle of the gun. The pellet travels approximately along the axis of the cone formed by the spread of the shot in the charge, and thus serves as an indication of accuracy. The new cartridges are not intended for use in actual game shooting, but it is expected that they will prove useful for practice and in shooting at clay birds.

Electric Flash Lamp for Photography

One of the disadvantages of photography by flashlight is that the burning of the powders and sheets usually employed produces a considerable amount of smoke. This prevents their use in confined spaces such as the interiors of trains, airships or submarines, or in the operating theatres of hospitals. They also have the drawback that they cannot be used in such places as coal mines, where they may cause an explosion of fire damp, and in these and similar dangerous conditions photography is therefore almost impossible. Difficulties of this kind have now been overcome by the introduction of a glass bulb inside which a flash may be fired by electrical means. The device is silent, clean and safe in operation.

The bulb of the new photographic flash lamp contains oxygen and the filament is covered with a special preparation that is easily ignited and also with a quantity of thin aluminium foil. When the current is switched on, the heat produced by the burning of the filament brings about the combustion of the foil, which is accompanied by a flash of high actinic value that lasts for one hundredth of a second. The light produced has the advantage of being comparatively soft and diffused. Its efficiency for photographic purposes may be increased by means of a reflector and it is expected that photographs taken with its aid will not have the unnatural appearance that often results from the use of ordinary powders.

The current required for the operation of the lamp may be obtained from the mains, but an accumulator or a dry battery also may be used. A new lamp is required for each flash.

Testing Cans by Compressed Air

It is very important that tins used for preserving foodstuffs should be completely airtight, for admission of air would result in the deterioration of the fruit, vegetable, fish or meat contained in them. Testing the millions of cans used every year for this purpose is therefore a very important part of the work of producing them. A machine has now been introduced that enables the tins to be tested at high speed.

The machine is quite automatic in action. The tins to be tested reach it by means of a chute and are immediately clamped between cast iron plates and rubber discs on a large revolving wheel that dips under water in a large tank. Each can is filled with compressed air before reaching the water, and leaks are betrayed by the rise of escaping air bubbles. Immediately these are perceived the inspector in charge of the machine pulls down a lever that discharges the can through a separate chute. Tins that pass the test are automatically carried forward to the filling plant.

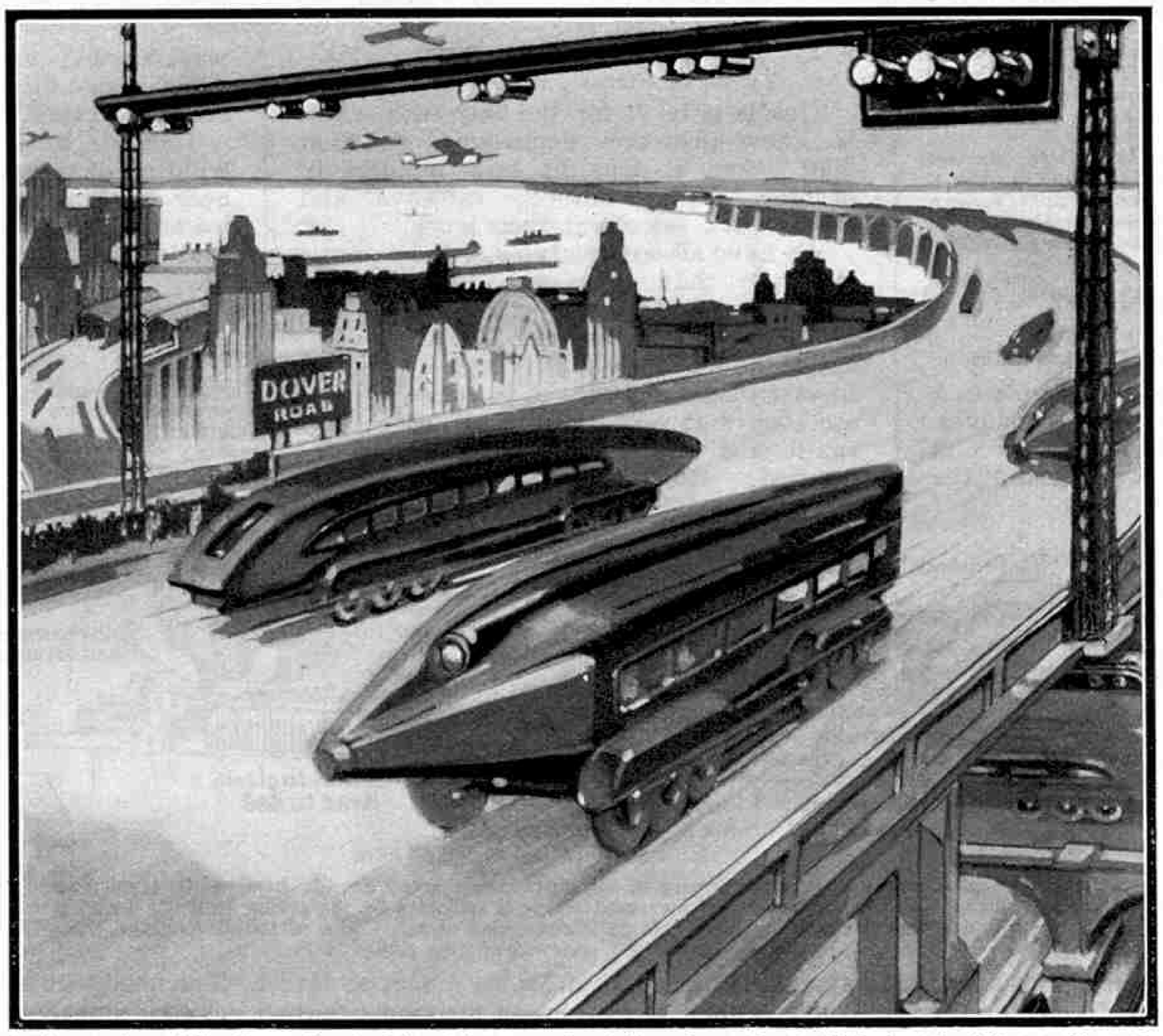
An Unbreakable Cinematograph Film

The breakage of films is a great cause of annoyance and waste in the cinematograph industry. Many efforts have been made to produce films that are unbreakable, and in the latest invention of this kind, the celluloid strip is sealed between pieces of thin steel in which are punched openings for the pictures and for the sprocket holes. The steel bindings are made in lengths of $4\frac{3}{4}$ in. and they are large enough to accommodate sections of film carrying 16 pictures, a number that is sufficient for a run of one second.

The new cinematograph film is intended for use in an automatic projector that is set in motion by dropping a coin in a slot, or by merely pressing a button. In this projector the sections containing the film are stacked horizontally in a feed magazine, and are drawn electro-magnetically into contact with claws that move them through the gate of the machine, across which streams the beam of light. They fall into a take-up magazine, at the bottom of which is a horizontal conveyor that carries them back to the bottom of the feed magazine, where lifting mechanism brings them into their original position once more. Continuous circulation of what in effect is an endless film is thus provided for.

It will be seen that the film travels horizontally through the gate instead of vertically, as in the projectors used in picture theatres. The beam of light required is provided by a 100-watt lamp and is projected upward through the lenses and the film. A mirror placed at an angle of 45° to its path reflects it horizontally to a translucent section on the side of the box containing the mechanism.

Steel-bound films have shown practically no signs of wear after having been passed no fewer than 15,000 times in succession through the mechanism described.



An impression of the Dover Road of the future, an elevated roadway along which great land liners will career to cross the Channel by means of an enormous bridge.

Blowing Out Electric Lights

An American engineer has invented devices that enable electric lights to be blown out and to be relighted by striking a match. The first of these is called the "breath relay." It includes a special spring contact switch mounted in a small tube that has a mouthpiece like that of a telephone. Speaking into the mouthpiece or striking it produces no effect, but a minute puff of wind directed into it closes the contacts and completes an electric circuit. This acts through a relay to open a switch that cuts off the current supply of the light controlled by the device.

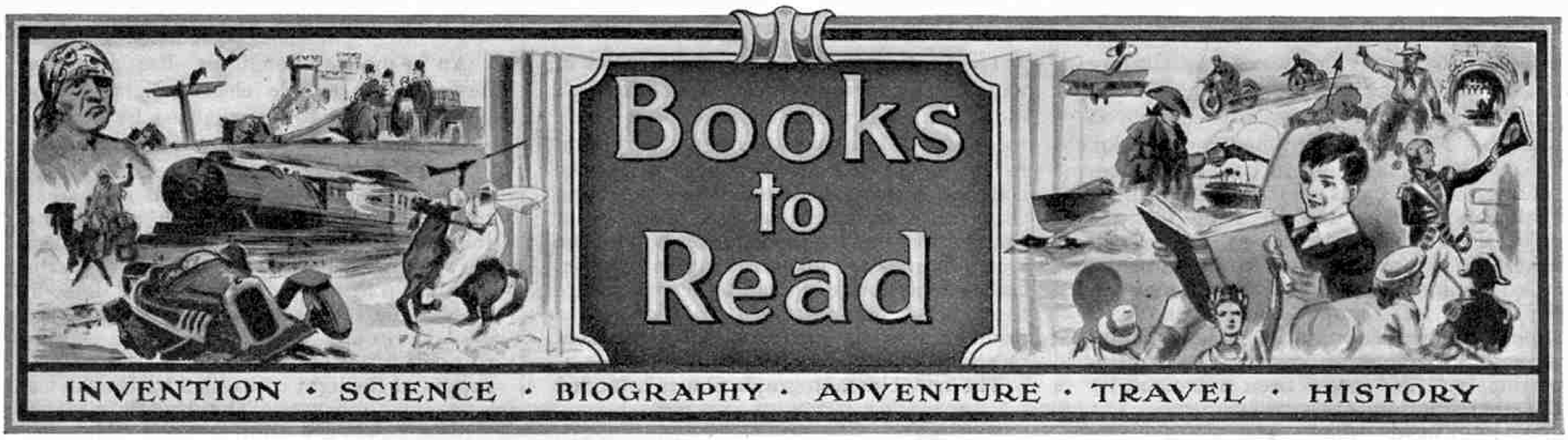
The breath relay is not a mere curiosity. Its purpose is to provide a switch that may be opened or closed when the hands or feet of the operator are otherwise occupied. It is expected to prove useful in the design of safety devices for use on motor cars, aeroplanes and many types of machines. Automatic devices to open doors, move the carriages of typewriters, turn pages of music, or carry out many tasks that normally involve interruption of other activities also may be brought into operation by the employment of the invention.

The second device makes use of an electric eye, or photo-electric cell, concealed in the base of the lighting fixture. When the rays from a lighted match fall on this cell a current flows between its electrodes, and this may be used through a relay to close the main circuit and thus to switch on the electric lights under its control.

Making Roads Safer for Foot Passengers

Many inventors have tried to construct devices that will reduce the number of deaths or serious injuries due to road accidents. The most recent of these is the "Clifford Auto-Saver," and its inventor claims that it will reduce by about 75 per cent. the risk of serious injury in accidents that involve pedestrians. There is great need for such an invention, for in 1929 no fewer than 4,035 foot passengers were killed, and 80,835 persons were injured in this country alone in street accidents.

The effective part of the Auto-saver is a roller with a corrugated surface that is carried in front of a motor car or lorry at a height of about 10 in. above the ground. Immediately it comes into contact with any obstacle, however slight in character, the roller is knocked down to a height of 3 in. and a contact switch brings into operation mechanism that causes it to rotate in the opposite direction to that of the road wheels. The result is that the obstacle is rolled along the road in front of the vehicle instead of being run over. It is said that injuries suffered by anyone rolled along in this manner are comparatively slight in character.



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Still More Machines"

By P. M. Baker
(Wells, Gardner, Darton & Co. Ltd. 7/6)

In this third volume, which completes a scheme initiated for describing machines, the author deals with machines used in telegraphy, telephony, wireless, and the machine-shop. He also gives some notes about the men who make the appliances described, as well as an account of their methods and their training, and the accuracy with which they work. A chapter on the munitions of war shows how engineering work is organised to deal with an emergency.

The author tells us in his preface that in his boyhood days he asked questions about the things that he saw around him—on the railway, on the canal, or in some works, perhaps. He found the answers were unconvincing—sometimes even they were jocularly misleading—and he finally concluded that his elders either did not know (as he shrewdly suspected) or did not want to tell him. In this book and in his previous two volumes, Mr. Baker has endeavoured to treat his readers as he would like to have been treated himself at that time.

He has succeeded very satisfactorily in explaining many of those interesting yet difficult problems that occur to most of us when we see machinery at work or engineering processes being carried out. The information he gives us is as accurate and as complete as the limitations of his books allow, and we feel sure that there are many "grown ups" who will not consider it a waste of time to read what has been written in these books.

The book under review is a fitting companion to its predecessors. It is written in a clear and simple yet technically sound style. The author goes straight to the heart of each mechanism in turn, and explains the underlying principle before he passes on to details of operation. The volume is profusely illustrated by clear line drawings that help to make difficult matters more easy of explanation.

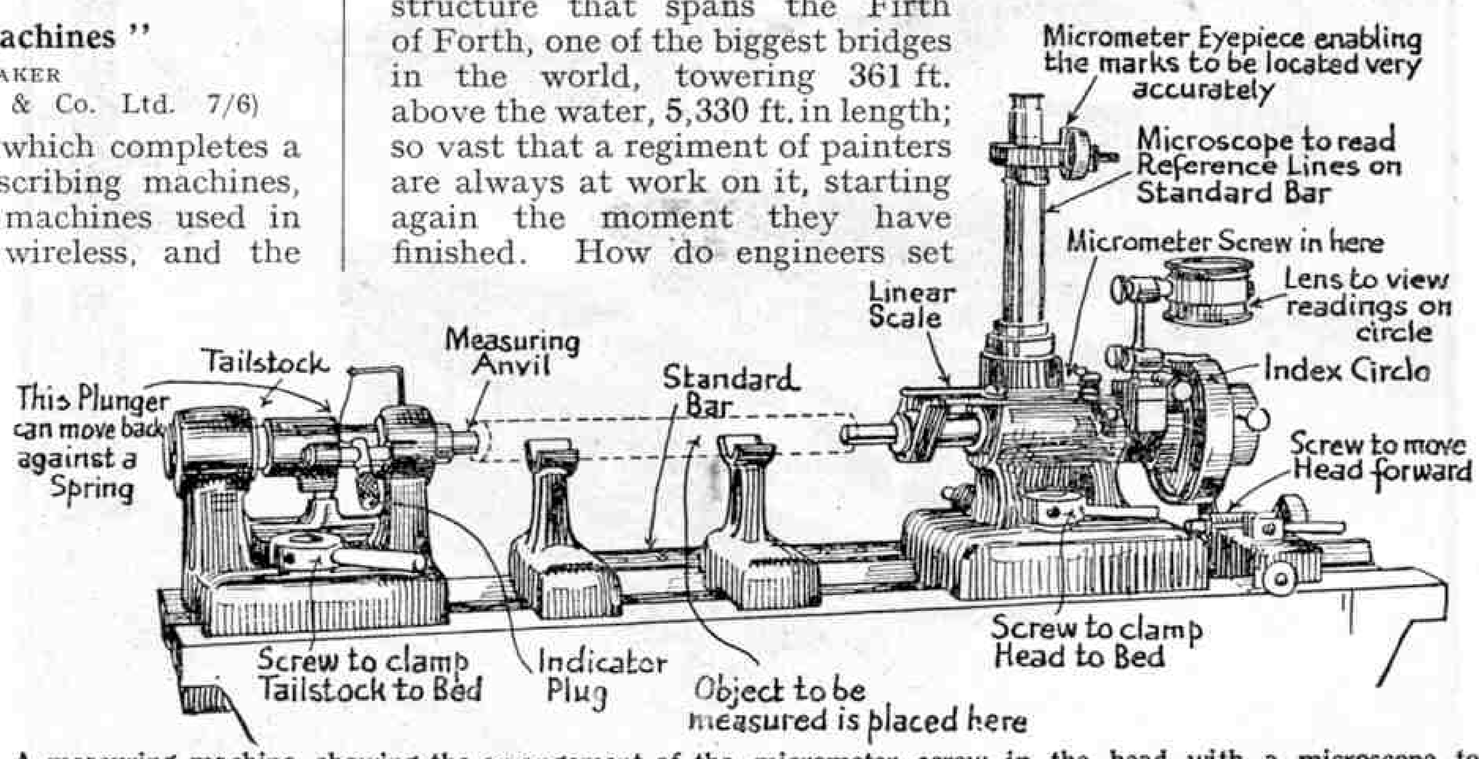
"What Engineers Do"

By W. D. Ninger. (Toulmin. 7/6)

This is a book for the boy who wants to know just how engineers "do their stuff," and it tells us how builders of bridges, dams, tunnels, railways and skyscrapers, set about their work.

We have all seen pictures of the gigantic structure that spans the Firth of Forth, one of the biggest bridges in the world, towering 361 ft. above the water, 5,330 ft. in length; so vast that a regiment of painters are always at work on it, starting again the moment they have finished. How do engineers set about building such a bridge? Not so far away is the Tay Bridge, a structure that replaces the earlier one, which was the scene of a terrible railway disaster when part of the bridge was carried away in a gale. How do engineers plan to avoid such disasters? We are told that it all works back to the prehistoric man who felled a tree trunk over a stream—perhaps it was too slender and he fell in and in this way learned to take the first steps to avoid bridge disasters. Similar safeguards are being taken by engineers to-day.

Then we read about the designing and building of the new Underground building near Buckingham Palace in London—the tower that was built over St. James Park Station was constructed whilst the trains ran as usual, even though its foundations were sunk deep in the clay beneath the track. We are told how tunnels are driven through mountains or under rivers, and how plans have been worked out even for a 25-mile tunnel under the Straits of Dover from England to France. We learn much about engineer's work in planning to build our roads and our railways; how materials have influenced construction; how aerial photography and practical astronomy help the engineer; of Man's struggle over water—how floods are controlled and about hydro-electric developments. All these matters give the author the subject for a fascinating story and he makes the most of them.



A measuring machine, showing the arrangement of the micrometer screw in the head with a microscope to read its exact setting. The "touch" of the measured article is indicated by it pushing back the spring plunger of the tailstock and letting the indicator plug, held by friction, sink round. One of the illustrations from "Still More Machines" reviewed on this page.

The engineer at work surveying virgin country with the use of a plane table. From "What Engineers Do" reviewed on this page.

"Holiday Haunts" for 1931

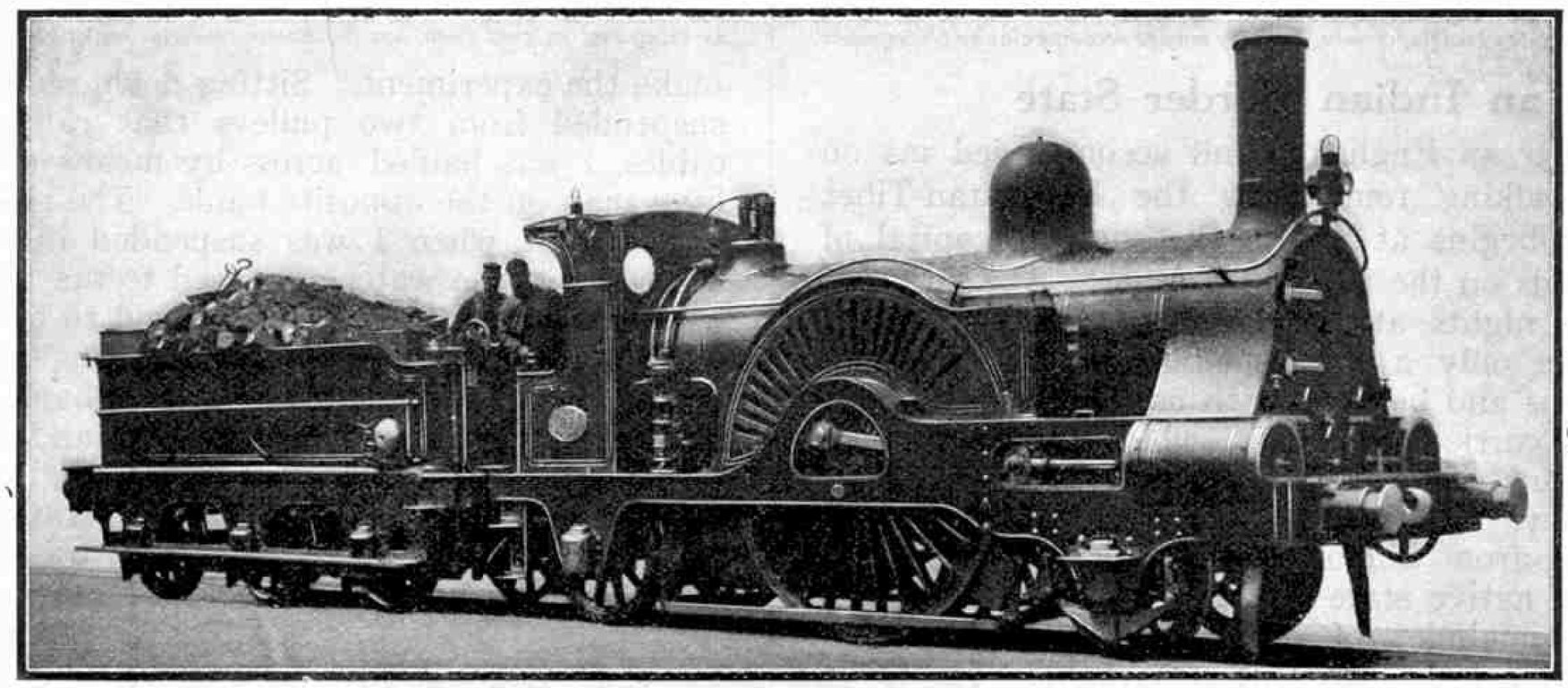
The arrival year by year of this remarkable publication of the Great Western Railway Company immediately sets one's mind soaring away to sea and country. This year's edition is even more successful than its predecessors. The contents have been rearranged with a view to making it easier for the reader to find the area in which he is most interested. The holiday region served by the G.W.R. is divided into the following seven areas, each of which is dealt with separately:—London and Southern Counties; The Cornish Riviera; Devon; Somerset, Dorset and Channel Islands; North Wales; South Wales and Monmouthshire; The Midland Counties, and the Isle of Man. In each section sufficient details are given to make clear the special nature of the attractions, and the many pages devoted to hotel, boarding house and private accommodation in each area make it quite easy to solve a problem that otherwise is often difficult.

In using this 1,000-page volume one is struck by the fact that it easily opens flat at any page. This improvement has been brought about by the use of the latest book-binding machinery by which

the volume is thread-sewn, instead of the pages being fastened together by wire stapling.

The most fascinating feature of the volume is, of course, the splendid photogravure illustrations, of which there are nearly 400, dealing with the whole of the areas described. A word of praise is due also to the remarkably good quality of the printing and general arrangement of the book.

"*Holiday Haunts*" is obtainable, price 6d., at all G.W.R. stations, offices, bookstalls and agencies, and from booksellers and newsagents in all parts of the country. Alternatively it may be obtained on application to the Superintendent of the Line, Great Western Railway, Paddington Station, London, W.2, for sixpence. No charge is made for postage.



Caledonian Railway No. 87, a 2-2-2 express engine, with driving wheels 8 ft. 2 in. in diameter, built in 1859 to the designs of Mr. B. Connor. The illustration shows the engine as subsequently modified by Mr. Drummond in 1883. (See below).

"Locomotives of the L.M.S., Past and Present"

(Locomotive Publishing Co. Ltd. 3/6 net)

It has long been a complaint among railway enthusiasts that no publication existed dealing adequately with the wide and interesting range of locomotive stock of the London, Midland and Scottish Railway, the largest of the four British railway groups. Grievances on this score have been very largely removed by the publication of "*Locomotives of the L.M.S., Past and Present.*"

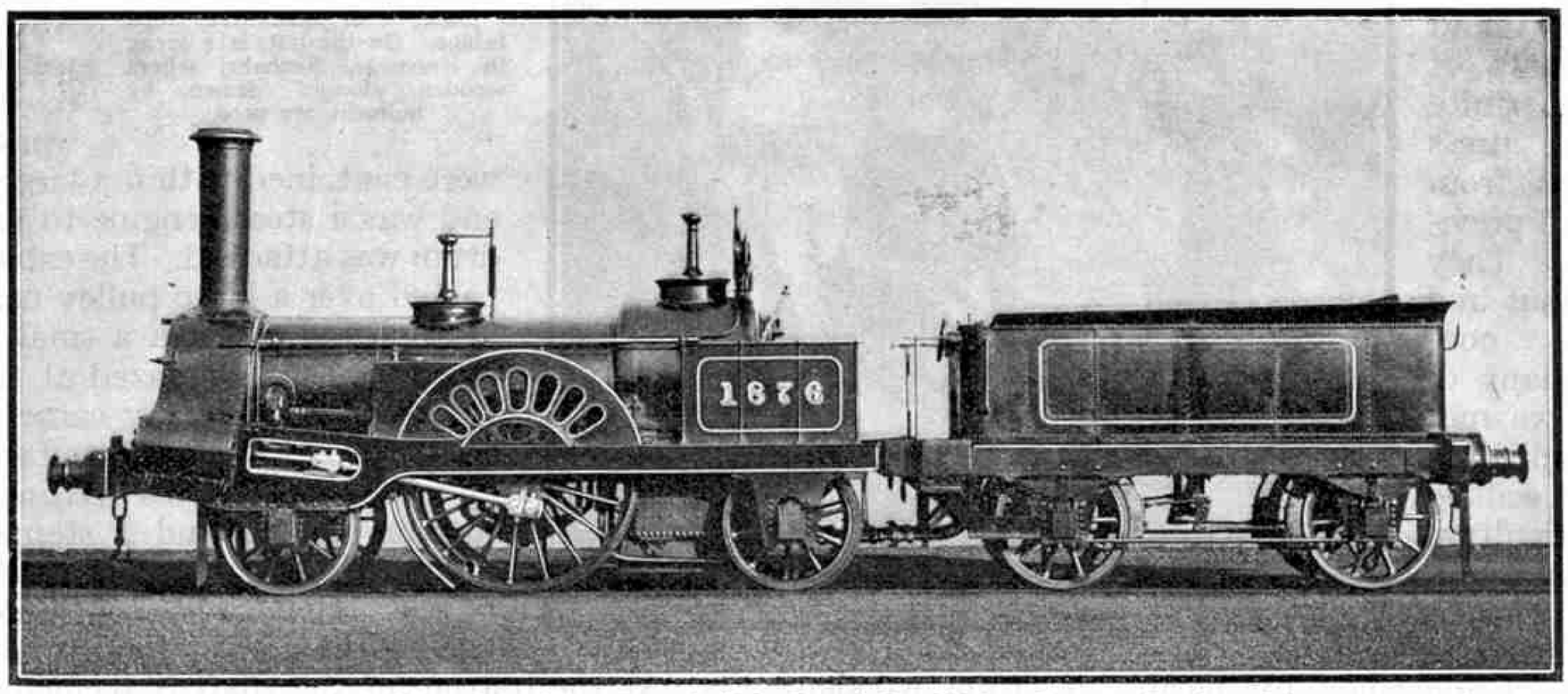
When one considers that the L.M.S.R. group includes the former London and North Western, Midland, Lancashire and Yorkshire, North Staffordshire, Furness, Caledonian, Glasgow and South Western, and Highland systems, and a variety of subsidiary companies, the new book appears disappointing in size. It succeeds in covering the ground fairly well, however, and it presents a broad outline of the development during a century or so of the locomotives of the companies comprising the group. Each of the main constituent companies is dealt with separately, the description of its locomotives being preceded by a brief but interesting account of the origin and development of the company. In such small compass it is clearly impossible to mention every type of locomotive introduced during the century, and a very successful effort has been made to select those locomotives that may be regarded as landmarks in construction.

The book is illustrated on a generous scale. There are eight excellent illustrations in colour depicting among other locomotives a "Royal Scot," a rebuilt "Claughton," a standard 4–4–0 express three-cylinder compound, and a 4–6–0 express locomotive of the Caledonian section. In addition there are over 70 well-reproduced photographs of locomotives, forming a comprehensive survey of the most outstanding types. One regrets that for the sake of the younger generation of railway enthusiasts that it should not have been possible to include among the colour plates two or three pre-group locomotives in the handsome livery of the old days.

The book concludes with a complete list of the named engines of the L.M.S.R. and tables of leading dimensions of the principal locomotive types on the system.

It is unfortunate that several mistakes have crept in. Most of these are clearly misprints that have escaped detection. For instance, a "Norris" engine is described in the caption as a "Morris"; and the "Hughes" four-cylinder 4–6–0's, which are correctly stated in the text to have appeared in 1908, are given the date 1907 in the caption. Again, the L. & Y. 0–8–2 tanks are described as 0–8–4's, and the L.N.W.R. G2 class as G4's. The last locomotive built for the Wirral Railway in 1914 has had its wheel arrangement transposed and appears as 4–4–0 instead of 0–4–4. One or two similar errors appear in the list of names, where the "Experiment" class are shown as including the later superheated "Prince of Wales" engines.

In the descriptive matter dealing with the locomotive policy of the L.M.S.R., the numbers of the standard 0–6–0 tender engines are given as 3835 to 4561, the last five of which were taken over recently from the Somerset and Dorset Railway. In the case of the 2 P 4–4–0's, however, the numbers are correctly shown as 563 to 635, but the Somerset and Dorset engines are mentioned separately, whereas these are actually included in the series as 633 to 635. In spite of these small errors, however, the book is certain of a warm welcome.



L.N.W.R. No. 1876, a 6 ft. single-driver of the Allan pattern built by Francis Trevithick at Crewe. Engines of the same general pattern were adopted on several other railways, including the Caledonian; and the main frames of this and the locomotive shown above are similar. These two illustrations are taken from "Locomotives of the L.M.S., Past and Present," reviewed on this page.

"Boat Building Simplified"

By Herbert H. Ashcroft

(Captain O. M. Watts Ltd. 3/6 net)

Boat-building on a small scale is one of the most fascinating pursuits that an amateur carpenter can undertake. Enthusiasm grows as the boat gradually takes shape, and finally there is the thrill of the first trip in a vessel of one's own construction!

The building of a clinker or carvel boat on orthodox lines requires considerable skill, and many an amateur carpenter, realising the difficulties, has decided to leave boat-building alone. The Ashcroft system described in this book solves all the more serious problems, and enables a beginner, with ordinary care and patience, to build a successful boat at the first attempt. The instructions given are complete and simple and are illustrated by photographs, and drawings that show the work at various stages. The book can be recommended to all readers who are interested in building a boat of their own.

From Our Readers

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

In an Indian Border State

Last summer an English friend accompanied me on a month's walking tour along the Hindustan-Tibet road. This begins at Simla, the summer capital of India, and ends on the Tibetan frontier. We intended to spend the nights at rest houses along the road. These provide only a bare shelter and we therefore took provisions and bedding with us. The baggage was carried by mules, which are the only means of transport available on such a journey.

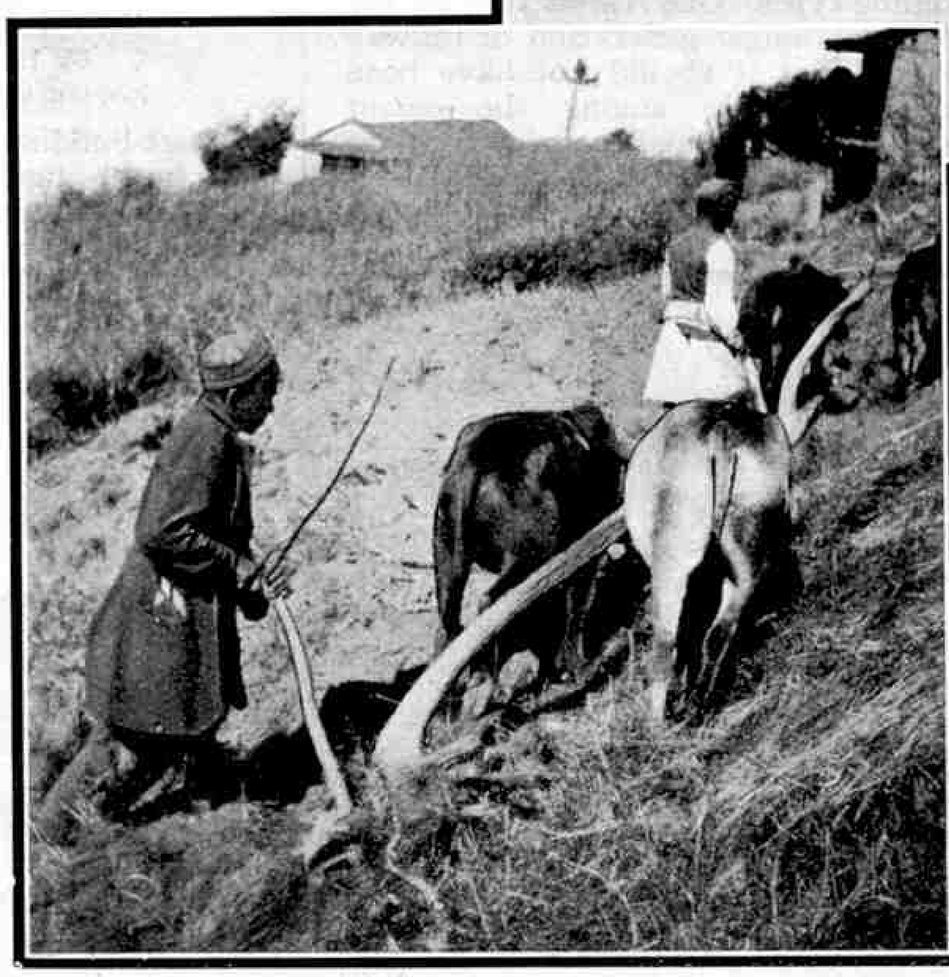
Sixty miles from Simla we reached the border of the native state of Bushahr, and during the remainder of our ninety-mile walk we travelled through this remarkable country. The ruler is H.H. The Raja Sahib Bahadur, who was then residing at Sarahan, his summer capital, where we had the honour of calling upon him. His Highness received us very cordially and spoke to us in Hindustani, for he knows no English.

On leaving Sarahan, we entered Kanawar territory, the northern portion of the state. We found the inhabitants of this district quite different in dress and customs from those we had previously met. They are industrious and spin wool continuously, many of the people we met actually spinning as they walked about. Agriculture is their chief occupation. This is primitive in character, the soil being tilled by means of crude wooden ploughs drawn by bullocks.

The Sutlej is the only considerable river in the State. It is used by the Forest Department of the Government of India for floating timber down to the plains. Some of the wood is cut in forests on the hillsides and the scantlings are brought to the water side on aerial ropeways having spans from 1,000 ft. to 3,000 ft. in length.

In certain places "jhulas," or single rope bridges, are still used, and we had the exciting experience of crossing the river on one of them. I was the first to make the experiment. Sitting down on a narrow board suspended from two pulleys that ran on fixed steel cables, I was hauled across by means of a rope pulled by a man on the opposite bank. The river was flowing swiftly, but when I was suspended in mid air above the current, the water appeared to me to be stationary while the banks and myself seemed to be rushing backward at a furious pace. On arriving at the opposite bank, I jumped off, and the seat of this primitive transporter bridge was then pulled back in order that my friend should be able to follow me.

CHAND MAL
(Roorkee, India).



Above, our reader, Mr. Chand Mal, Roorkee, India, is shown crossing the River Sutlej on a "jhula," or primitive rope bridge. On the left, is a scene in Kanawar, Bushahr, where wooden ploughs drawn by bullocks are used.

The Salt Mines of County Antrim

Recently my father and myself had the opportunity of visiting the salt mines of County Antrim. On arrival we were surprised to find that the works above ground were contained within a large shed. At one end was a steam engine to which a winding drum was attached. The cable from the drum passed over a large pulley near the roof and disappeared through a small square hole in the floor. As we gazed at the hole a small wooden box suddenly came up. This was the cage! It was not fitted with a guide rope and was by no means inviting in appearance, but my father and I stepped into it and descended 700 ft. at a speed of about 10 m.p.h., the cage continuously bumping against the sides of the shaft all the way down.

At the bottom of the shaft it seemed very dark, but when we became accustomed to the semi-darkness we saw that we were in a large hall containing immense pillars of rock salt that had been left in order to support the roof. In all directions were passages leading to the workings. There men were drilling narrow holes into the rock, and into these explosives were then placed. Next the men ran for shelter behind the pillars, the tiny lights on their heads twinkling uncannily as they did so. The charges were then detonated, and when the loose rock had stopped falling the miners began to remove the debris.

D. G. DICKINSON (Belfast).

In the Land of the Midnight Sun

On a cold and rather dull day about the middle of June, the vessel in which I was touring the Norwegian fiords steamed slowly toward the North Cape, the most northerly point of Europe. Everyone was on deck, full of eagerness to obtain the first glimpse of the Cape, and also to see the famous Bird Rock that would be passed on the way. Soon this came in sight. It is a grey rock that rises from a grey sea, but from a distance it seemed to be white owing to the multitude of gulls settled on it. When we came nearer we could distinguish the birds, many of which were perched on tiny ledges on the face of the precipitous cliff.

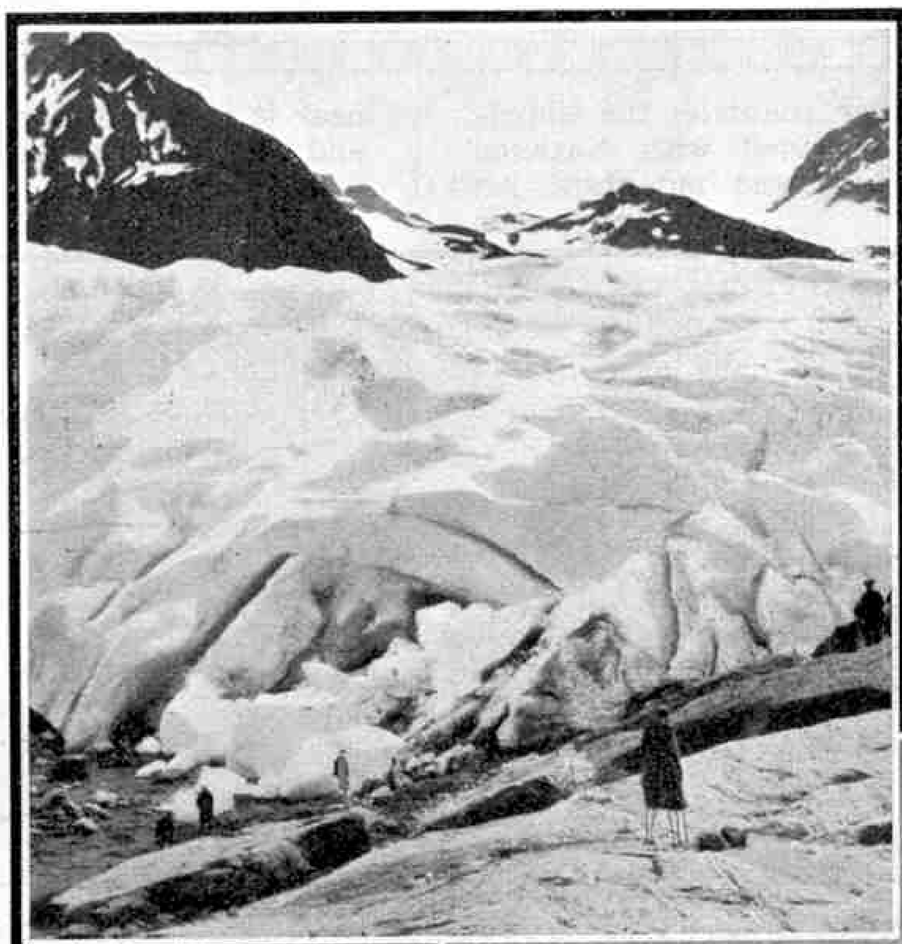
As we approached, only the lapping of the water at the foot of the rock and an occasional scream from a gull disturbed the silence. Suddenly the ship's siren was sounded, and immediately the birds flew up in a great white cloud, circling above the rock and nearly deafening us with their cries and the noise of the flapping of their wings.

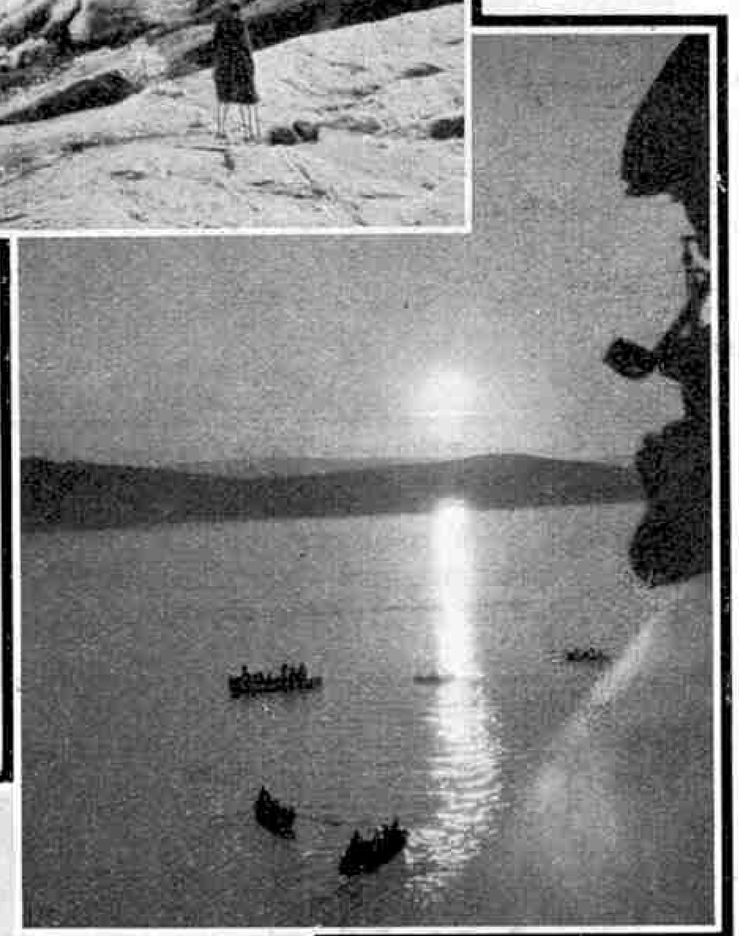
From the Bird Rock we passed on to the North Cape. This is only a piece of rock jutting out into the Arctic Ocean, but we were conscious of a thrill while gazing at it, for it is the end of a continent! We landed as soon as we reached the Cape, clambering over slippery planks on to the snow-covered ground below the rock itself. The only buildings were a tiny post office and a little wooden hut in which lived a man who sold post cards, stamps and cow bells to tourists.

I was very eager to see the midnight sun from the North Cape, but unfortunately the sky was covered with clouds. I saw it when returning southward and actually was present at a football match played at Tromsö at 11 o'clock at night.

Although in this region the sun is visible above the horizon all day long in midsummer, in bad weather it is very cold. At Hammerfest we went in a half-frozen state to see the lake dotted with ice floes, and the most northerly forest in the world, in which you could count the trees and almost the leaves. I was much warmer when visiting a glacier, for the sun shone brightly and I was able to look down into its deep blue depths without shivering. This was the Swartisen Glacier, a gigantic stream of ice that is about 35 miles in length. It is not near the North Cape, but reaches sea level at a part of the Norwegian coast that is just within the Arctic Circle.

MARY RIDDLE (Cardenden).





Within the Arctic Circle on a cruise along the coast of Norway. On the right is a photograph of the midnight sun seen from Tromsö, Norway. Above is a view of the Swartisen Glacier, a Norwegian ice stream 35 miles in length, and the photograph below is a view of the most northerly forest in the world.

A Visit to a Crane Works

A short time ago I had the opportunity of visiting an engineering works in which cranes are made. There I saw many interesting machines, prominent among which were a giant planer and a wonderful lathe. The second of these was at work on a gigantic bearing on which the jib and upper sections of one of the travelling cranes made in the works would eventually swivel. The inside diameter of such a bearing is about six feet, and I was greatly fascinated while watching the blade of the tool cut into the one clamped against the headstock of the great lathe.

The most interesting task carried on in the smith's shop while I was in the works consisted in cutting plates an inch in thickness by means of a blowpipe flame. This was fed by acetylene and oxygen, the first-named of these gases being stored in a red cylinder and the second in one painted black. The supplies of the two were regulated until the flame became a mere blue speck that cut its way through the metal with surprising ease.

My guide then showed me how shearing and stamping machines work, and his demonstration of stamping was very impressive — but not altogether for engineering reasons! He placed a sheet of metal under the stamper and pulled the lever that sets the machine in motion. The small disc of metal punched out rolled to my feet and I picked it up, only to drop it instantly, for it was far too hot to touch.

Before leaving the works I asked why the belts did not come off the pulleys on the shafts, suspended from the ceiling, from which the machines were driven. I then learned that the surfaces of the pulleys are not flat, but slightly convex, and centrifugal force causes the belts to move toward the highest point. As this is the middle their own rotation thus helps to keep them in place.

Before leaving I visited the drawing office, where I saw plans and blue prints of the different types of cranes built in the works. This I found very interesting, for after my tour of the factory I was able to realise how the ideas of the designers were carried out in practice.

W. J. REYNOLDS (Duffield).

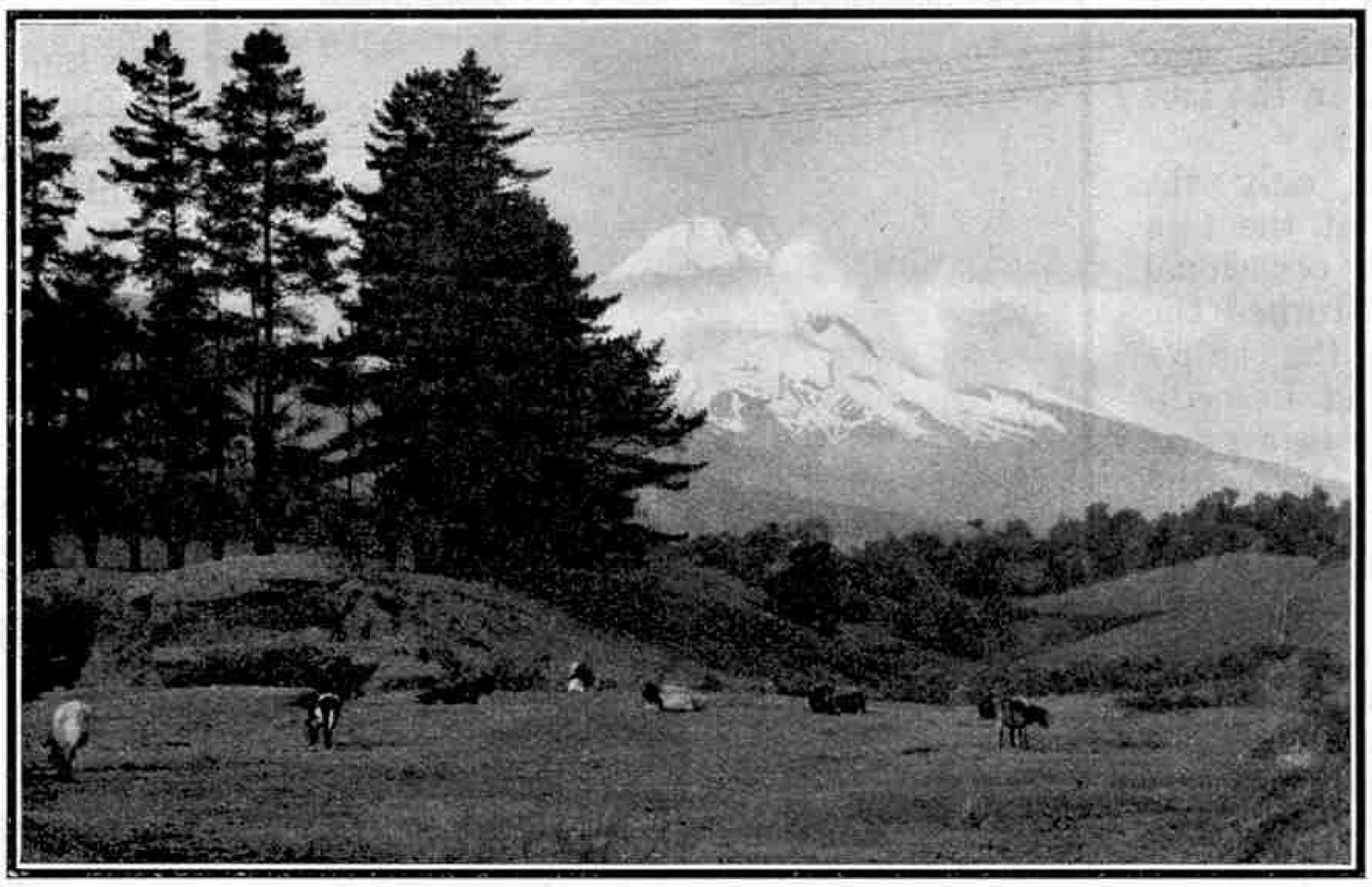
The National Parks of New Zealand

Three Million Acres of Reserves

By James Cowans

BY comparison with many much larger countries the islands of New Zealand are generously provided with National Parks, unspoiled areas of forest, lake and mountain, set aside as the people's recreation grounds for ever. The country is of such varied contour, one type of scenery so quickly gives place to another, that it was easy to select large areas of the different classes of landscape for preservation in their natural condition.

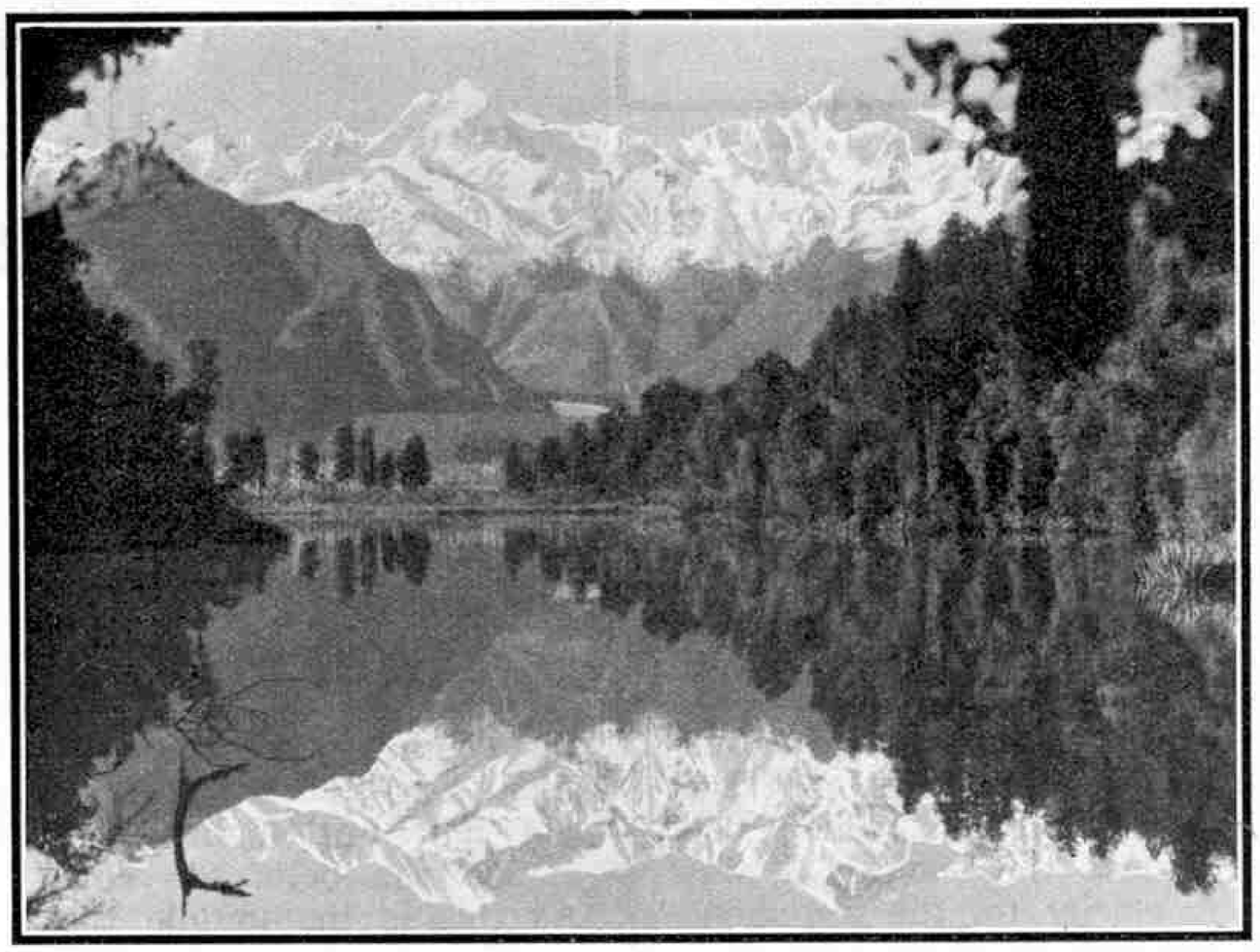
The forests were the first natural features to be considered for national conservation. The mountains and glaciers, gorges and lakes are not likely to suffer from the hands of Man, but the glories of the forests vanish so quickly from a land in its pioneering stages, that it was clearly the duty of the State to assure some of the splendid timber lands against destruction by settler and saw-miller. Thus New Zealanders and their visitors from overseas may be able to see ancient forests preserved in their original state. A strong public sentiment backs up the protective care of the Government in this matter of forest preservation, with which is bound up the preservation of the native birds.



Mount Egmont, 8,260 ft. in height, Taranaki, North Island, New Zealand. For the illustrations to this article we are indebted to the New Zealand Government Publicity Department.

The control of the various National Parks is vested in two Government departments, and several specially-constituted official boards.

There are altogether 3¼ million acres of territory officially classed as National Parks, and as reserves for scenic and historical purposes. Of this area the National Parks proper total 2¾ million acres. Actually part of this consists of that huge tract of wild country, the Fiordland National Park, in the south-west segment of the South Island, with an area of something over 2¼ million acres. Next comes the Arthur's Pass and Otira Gorge country, 167,000 acres, the eastern and western sides and the summit of the Southern Alps range at the saddle where the midland railway and road cross from the Canterbury Plains to the long, narrow littoral of the Westland, the golden coast of the old digging days.



A striking photograph of Lake Matheson, Westland, South Island, New Zealand.

The Tongariro National Park, the volcanic mountain land to the south of Lake Taupo in the heart of the North Island, is close on 150,000 acres. The Tasman Park, in the Southern Alps region, is 97,000 acres; and the Hooker Glacier Reserve near it is 38,000 acres. The Egmont National Park, the centre and glory of Taranaki Province, has an area of 79,000 acres of forest and peak.

First in importance among the northern reserves is the grand national playground that comprises the volcanic peaks Tongariro, Ngauruhoe and Ruapehu, and the region of mountain steppes and meadows surrounding them, with their forests, lakes and streams, and boiling and steaming craters. Ruapehu, the highest point of the North Island, is a little over 9,000 ft. in height, and has several smaller glaciers on its flanks, the most northerly glaciers in New Zealand. Its saucer-like summit is filled with ice, but in the heart of it there is a strange volcanic lake that is often at boiling heat and sometimes actually boils over like a geyser. Ngauruhoe Volcano, a beautifully symmetrical cone 7,500 ft. high, or 3,000 ft. above the plateau from which it rises, contains a deep crater that is always steaming, and occasionally bursts into active eruption. Unlike the great Hawaiian volcano, Kilauea, however, it does not discharge lava, but is an explosive crater shooting up ash, dust and rocks, which do no harm. They fall on its slopes, and so give a working illustration of the manner in which a volcanic cone is built up by its eruptions.

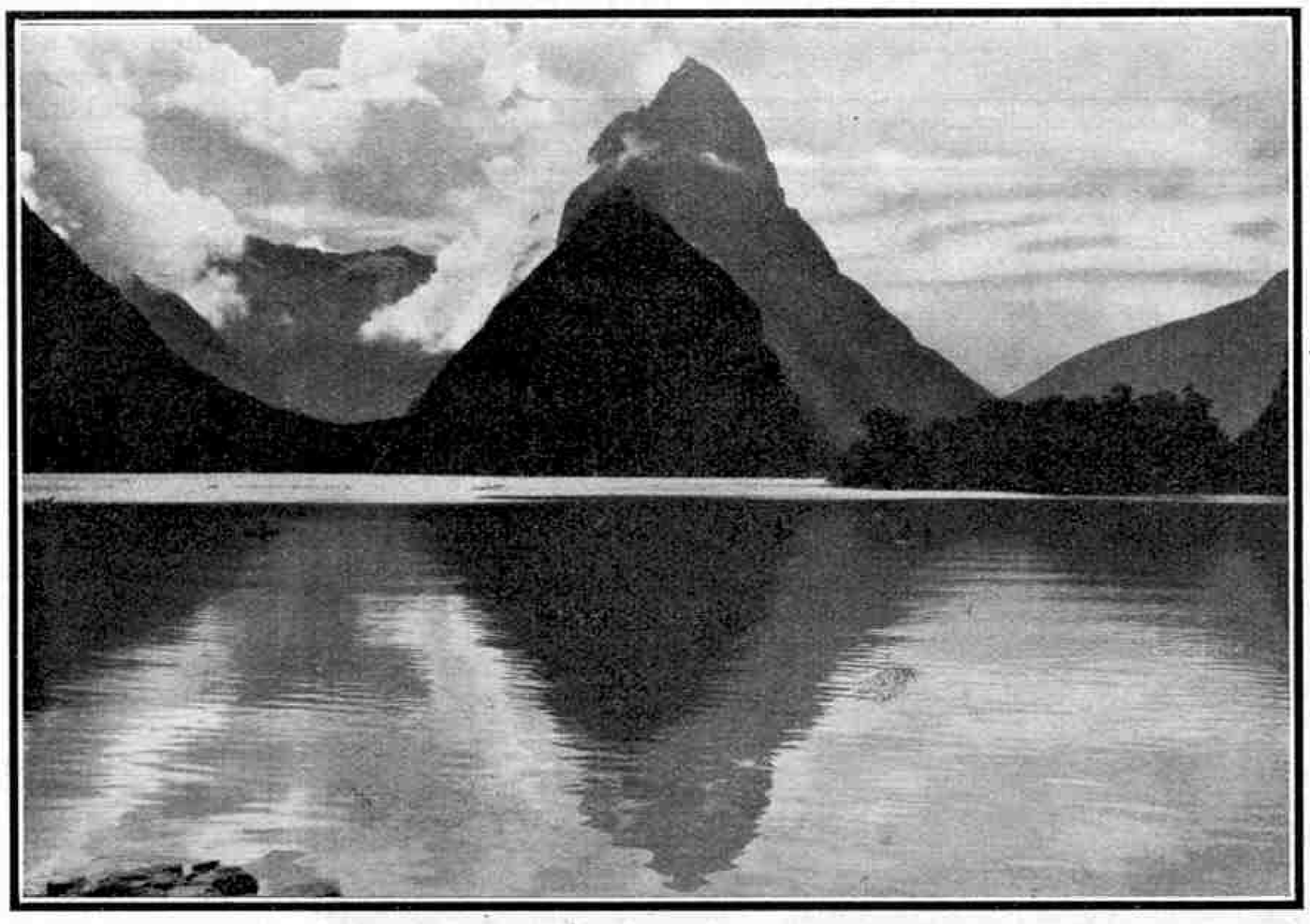
All around the peaks, and on the lower slopes is a charming park of alpine flowers in the months of November, December, January and February.

The famous Rotorua Taupo Thermal Region, with its myriads of boiling springs, geysers, warm streams, and other strange sights, is mostly owned by the State, but does not come exactly into the category of National Parks.

The noble snow-crowned peak called by the Maoris Taranaki, and by Europeans Mount Egmont, rising in lonely beauty above the plains on the west coast of the North Island, is surrounded by a circular area of rich and lovely rain forest. Its glittering summit is 8,260 ft. above the sea, and its symmetry and solitary majesty make it the most commanding mountain in New Zealand. Indeed, there is no lone peak in the world to surpass it in beauty. Scores of streams flow down

through the forest that clothes its lower parts, and form the sources of the rivers that fertilise the Taranaki Province, famed for its productiveness as a dairying country. This rain forest is of enormous economic value as the protective covering and conservation area of the water supply for the pastoral plains.

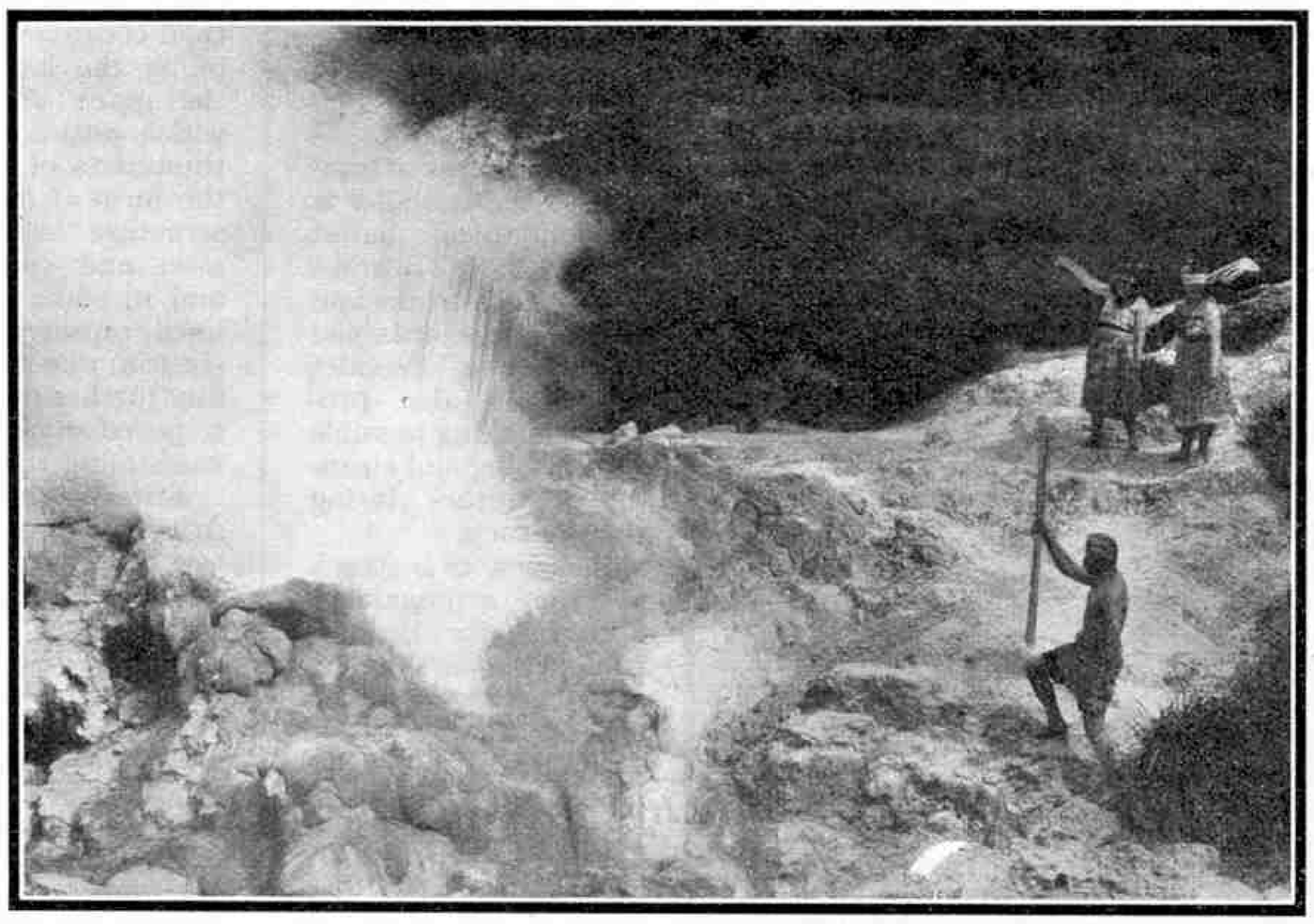
The necessity for protecting the extremely beautiful alpine flora of the Southern Alps is one of the chief reasons why large national reserves have been made in the Arthur's Pass-Otira zone, and the Tasman-Hooker glacier areas farther south. There is a gorgeous Rata forest, blazing with rich red flowers in mid-summer, on the western side of the dip in the range where the trans-alpine road goes, and where the railway penetrates the snowy tip of the dividing range by a tunnel 5¼ miles in length. Mountain flowers carpet the slopes and valleys in Spring and Summer. This region is becoming a favourite climbing ground, for here is the glaciated peak of Mount Rolleston, with the sources of the Waimakariri and other strong mountain rivers.



The isolated grandeur of Mitre Peak, 5,560 ft., Milford Sound, South Island, New Zealand.

Passing Southland to the Aorangi or Mount Cook region there are thousands of acres of Nature's wild rock gardens in the valleys of the Tasman and the Hooker, flowing swiftly from the terminal faces of great glaciers that descend from the snowy neves in the heart of the Alps. The Hooker in particular is a marvellously lovely place in December and January, when the alpine blossoms, white, yellow and blue cover the moraine-strewn glen, through which a clean blue stream comes dancing to join the turbid glacial river. The great alpine buttercup, the celmisia or mountain daisy, and pretty blue gentians and forget-me-not-like flowers, cover the valleys and slopes for miles.

The bird life in these alpine parks is of uncommon interest. The blue mountain duck is to be seen on the streams, often sailing serenely down the rapids. Unfortunately the most interesting bird of all, the kea parrot, which used to go hopping over glaciers after travellers, and amuse itself by sliding down the iron roofs of the huts, is slaughtered, even in these mountain reserves, for the sake of five shillings head money. The kea is popularly credited, or rather debited, with the deaths of many sheep and lambs on the foothills, for the sake of the kidney fat; and sheep owners long ago declared war on them and induced the county councils and the Government to outlaw the bird. The exact degree of the kea's guilt as a sheep killer is still doubtful, but there is no doubt about the reward; and thus many people who have nothing to do with sheep stations earn five shillings for every head they produce. In the high mountain land, the breeding place of the kea, the bird is certainly guiltless of offence, and he is a very welcome sight to the high climber. It seems to the present writer that the vendetta is carried beyond all reasonable bounds, when the kea is allowed to be shot out in places that should be a sanctuary for all native feathered life.



Papakura Geyser in action, Rotorua, North Island, New Zealand.

The vast area of mountain, gorge and forest between the south-west coast and the great lakes of Otago and Southland is well named Fiordland. Not only are there many alp-walled sounds indenting the granite coast, but the enormous arms of the lakes are exactly like the sea-fiords—deep, island-strewn and palisaded by precipices, wooded and fern-fringed, and streaming with waterfalls.

There is room for adventurous exploration in much of this huge wilderness park. The only travel route from Fiordland, apart from a lone trail between Lake Manapouri and the coast, is the famous overland footroad from the head of the Lake Te Anau to Milford Sound. This wonderful track crosses McKinnons Pass, the view from which is one of the grand pictures of the world. Black and grey craggy peaks stand around like sentries over an enchanted land. Glaciers blaze in the laps of mountains; ice-borne cateracts stream down the precipices like white threads hanging on the mountain side; and rivers splashing with rapids flow through the densely-wooded valleys 2,000 ft. below. All around is a vast broken land of snow-tipped ranges and profound ravines, filled with forests, and resounding with the roar of waterfalls. The rainfall in this strange land is heavy, and the vegetation is of corresponding luxuriance and loveliness.

For a century and more, cargoes of Kauri pine, the greatest of all timber trees, have been shipped from North New Zealand to overseas ports, with the result that the vast forests of this grand tree that once covered the land have nearly all disappeared. Fortunately some considerable reserves have been made, and in the Waipoua State Forest in North Auckland, the Kauri is to be seen in its unspoiled primeval state growing in large groves.

Travellers entering Waipoua are always impressed by the dimensions of the trees, and frequently have compared the interior of a grove to the pillar-supported roof of some great cathedral. Waipoua is not officially classed as a National Park and sanctuary, but it is such in effect; and it is regarded as a kind of permanent Kauri museum where the forest may go on reproducing itself for centuries. At one time there was a suggestion that timber millers should be allowed to "have a cut at it," as it was expressed, but this was vigorously opposed by a very strong body of public feeling. It is recognised that, once commercial interests are permitted to drive a wedge into such a forest, it is doomed.

The road for motor traffic has been made through part of the forest, but beyond this Waipoua is much as it was a thousand years ago.

(Continued on page 401)

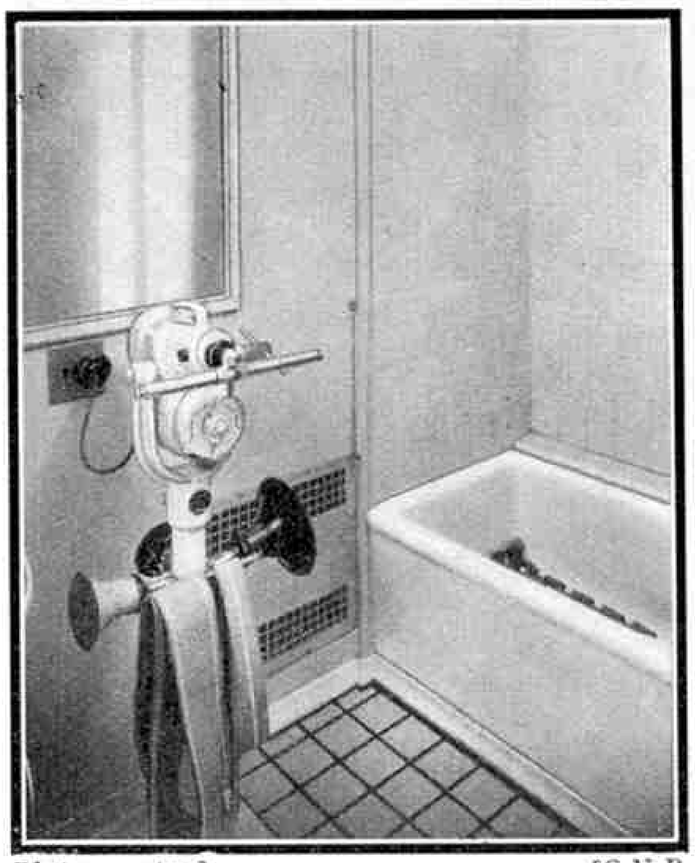
Luxury Travel in Canada

Splendid New C.N.R. Coaches

The lounge section of one of the "Bay" type coaches recently placed in service by the Canadian National Railways.

A SERIES of special coaches that set a new high standard of comfort for passengers have recently been placed in service by the Canadian National Railways. In the opinion of railway experts they are the most luxurious coaches in use on any railway in North America, and perhaps in the world. It has long been the contention of Sir Henry Thornton, President of the Canadian National Railways, that passengers making long journeys, such as those involved in a trip across Canada, are entitled to comforts reasonably approximating to those found in a modern ocean liner. The new coaches are a step in this direction. They are named after various famous Canadian bays, and therefore are known as the "Bay" type.

The most novel and striking feature in these coaches is a miniature gymnasium that occupies a compartment at one end of the coach. In spite of its necessarily small size it is equipped with an astonishing number and variety of appliances for the use of passengers. It contains among other things an electric massage and vibrator machine and a hand-and-foot-operated wall-type weight exerciser; and in an adjoining cubicle there is a hot and cold water shower bath. The floors of the gymnasium are covered with maize-coloured square corked tiling with black interliners, and the bath is of ivory-coloured semi-vitreous porcelain, with walls of sea-green tiling with black inlay. A hairdressing saloon, in charge of an experienced expert, adjoins the gymnasium, and is a boon particularly to ladies anxious to repair the ravages of travel on a long journey.



Photos courtesy] [*C.N.R.*

A corner of the miniature gymnasium in the new coaches, showing electric massage vibrator and shower bath cubicle.

The first of the new series of cars have been in service long enough to demonstrate fully the great popularity of these two features.

Scarcely less attractive to the traveller is a miniature buffet where light refreshments, cold drinks and ices may be obtained at any time. A valet service is also provided, making possible the pressing and cleaning of clothes during the journey.

A new note is struck in the arrangement and interior decoration of the cars, which is in keeping with the luxurious nature of the equipment. The lounge, which seats 38 people, is 51 ft. in length, and has comfortable chairs arranged in such a manner that any tendency to monotony is entirely avoided. One section of the lounge, for instance, is arranged for the convenience of card players; and other sections are set aside for those who wish to read, or to enjoy the ever-changing panorama of a Canadian train journey.

The windows of the cars are considerably larger than usual, and provide an unobstructed and wide view of the country through which the train passes. The panes are of Vita-glass, permitting the passage of the health-giving ultra-violet rays of the sun, and thus making possible restrained sun-bathing on route.

The cars are equipped also with combination radio-gramophone sets in charge of a trained operator. For occasions when only a few passengers are inclined to listen, earphones are provided; while loudspeakers are used for general entertainment.

The colour scheme is particularly pleasing. The lounge and the passage way are finished in English harewood, which is an English white sycamore treated by a special impregnation process in order to produce a beautiful silver colour. The piers and panels are lined with Coromandel, or Macassar ebony, inlays. All model fixtures and trimmings are finished in ormolu gold. The ceilings are of light Nile green, and the furniture is of solid Honduras mahogany. The cars are 84 ft. 7½ in. in length.

Special attention has been given to the ventilation of these cars, and motor-driven fans have been placed in the deck ventilators to exhaust the hot air.

From Marshland to Factory—

(*Continued from page 383*)

Facing the centre of the jetty the main office block is in course of erection. This consists of a three-storey building with staff garage at the rear; and additional three-storey office blocks are already erected at each corner of the main manufacturing and assembly shops.

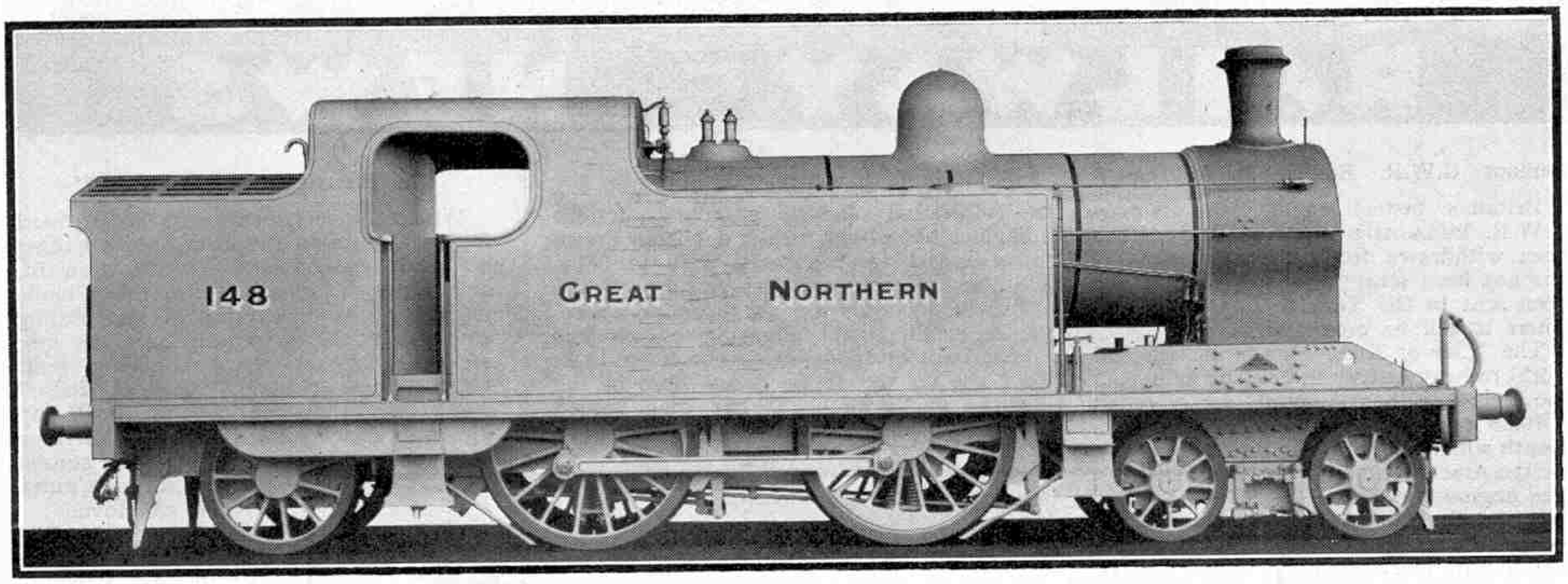
It seems scarcely credible that the whole of this vast undertaking is being built on what was originally marshland. When work was begun on the site, it was found that 30 ft. of mud existed beneath the thin crust of the top-soil. The engineers were then confronted with the herculean task of piling the land to support the weight of the giant concrete and steel buildings, which ultimately are to be equipped with thousands of tons of additional weight in the form of machinery. The whole of the structure stands on massive pillars of steel and concrete, driven 50 ft., 60 ft., and in some cases 70 ft. into the ground, until repeated blows with a four-ton or six-ton pile-driver were unable to make any further impression. Even the shortest required some 200 blows each, and in some cases more than 500 strokes were required.

Fifteen thousand of these piles have been driven to date, every one bearing a number and history; its location, the date on which it was driven into the subsoil, and the number of blows it received, being recorded. So closely were the piles driven that, in many instances, the earth rose several feet under their pressure; and there are places where the ground to a depth of 70 ft. is practically solid concrete. When one considers the enormous strength of this foundation, it is possible to realise the immense amount of work that has been carried out under circumstances of extreme difficulty since the time, nearly two years ago, when the site consisted of the treacherous soil of an Essex marsh.

The time is rapidly approaching when this industrial wonderland will throb with the activities of from 15,000 to 20,000 workers; when huge machines of amazing precision will hum ceaselessly, and when the ordered efforts of a gigantic organisation will open a new era for the Essex town of Dagenham.

An Irish 4-4-2 Tank Locomotive

Local Services on the G.N.R.



THE wheel arrangement of the locomotive shown in the accompanying illustration is a very useful and popular one. It may be considered to be the logical development in tank engine form of the popular 4–4–0 that for many years was almost the standard British express locomotive type, and which is still widely used to-day. In tank locomotives the engine and the boiler are disposed in a similar manner to those in the tender locomotives, but a trailing carrying axle supports the bunker, and side tanks are provided for the water supply. At one time 4–4–0 tank locomotives were used a great deal, but as heavier duties were imposed upon them a larger bunker capacity became necessary in order to enable the locomotives to cover greater distances between visits to the coal stage. Trailing wheels were therefore added to allow an enlarged bunker to be accommodated.

The first tank engine of the 4–4–2 wheel arrangement, with inside cylinders, on a British railway, was placed in service in 1888 on the former Taff Vale Railway, which was the oldest public railway in Wales. Three engines were built in that year by the Vulcan Foundry of Newton-le-Willows, and three others were added in 1891. Engines of the same wheel arrangement, but with outside cylinders, had appeared previously, however, notably on the then London Tilbury and Southend Railway. These fine engines were very famous in their day. They were a distinct step forward in tank engine design, for they had coupled wheels 6 ft. in diameter, and cylinders with a bore and stroke of 17 in. × 26 in. They may be considered to have inaugurated the modern tendency towards what we may term express tank engines, which approximate in size and power to the express tender locomotives. Examples of this are found in the "County" tanks of the G.W.R., and the "Precursor" tanks and the well-known Horwich 4–6–4 "Baltic" tanks of the L.M.S.R. The former London, Brighton and South Coast Railway also largely employed tank engines, not only for suburban services, but also for express work, the latest "Baltics" on this line being a good deal larger than any tender engine working on the line in pre-grouping days.

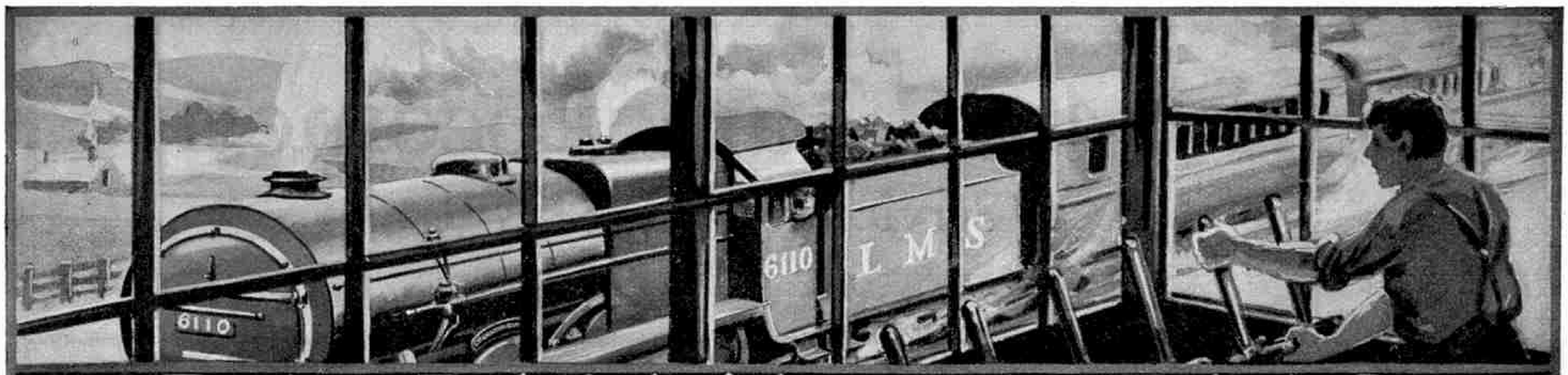
The inside cylinder 4–4–2 tank has been used to a considerable extent in British practice, and while there are some large and powerful engines built upon this plan, there are many of more moderate dimensions. Of English lines, the Great Northern, the Brighton, the London and North Western and the Great Central all operated engines of this type, and there were also notable examples on other lines, such as the North Staffordshire Railway. In Scotland the type is employed on the North British section of the L.N.E.R., while several are to be found on the Great Northern Railway of Ireland. It is with these G.N.R. tanks that we are now principally concerned.

The engine illustrated is one of a batch fitted with superheaters. Some engines of the same type were introduced in 1913 by Mr. G. T. Glover, but these were not superheated. The general appearance, as will be seen from the illustration, is neat and compact, and there are many points of interest in the design. Thus in order to obtain the required proportion of braked weight the bogie wheels are brake fitted, the blocks being plainly visible in the photograph. These are operated by a separate cylinder carried on trunnions between the bogie frames. The trailing wheels are carried in a Bissel truck, radial horn guides being fitted for additional security. The cab, bunker and side tanks have a neat outline, and the cab roof is of a similar pattern, with rounded corners, to that found on many engines on the English Great Northern Railway. The coal grid bars on the bunker, instead of being disposed vertically, are arranged to slope inward from the bunker top, so that the view from the rear windows is not obstructed when the bunker is full. This, as may be imagined, is a distinct advantage to the enginemen when the locomotive is travelling backward.

Combination injectors and a sight-feed lubricator are fitted, and wherever possible details are of standard types in use on the system. The cylinders have a bore and stroke of 18 in. by 24 in. They actuate the driving and coupled wheels of 5 ft. 9 in. diameter through specially light connecting and coupling rods. The bogie wheels and the trailing wheels have diameters of 3 ft. 1½ in. and 4 ft. respectively. The total wheelbase of the engine is 28 ft. 4½ in.

The boiler, which has a diameter of 4 ft. 3 in. is 10 ft. 2 in. in length in the barrel, and has a tube heating surface of 757 sq. ft. A 16-element Robinson superheater with a heating surface of 193 sq. ft. is fitted, and the fire-box, which is 5 ft. 5 in. in length and 4 ft. 7 in. in width provides 106 sq. ft. of heating surface, and has a grate area of 18.3 sq. ft. The boiler works at a pressure of 175 lb. to the sq. in., and is relieved by two safety valves of the Ross "Pop" pattern. The total weight of the engine in working order is 65 tons 15 cwt., and the maximum axle loading is 17 tons. The side tanks have a water capacity of 1,185 gallons, and the bunker tank holds 615 gallons, the total amount of water carried being thus 1,800 gallons. Levelling pipes, of course, connect the tanks, and these are protected by the metal guards seen below the footplate behind the cab footstep. The bunker coal space accommodates 3½ tons of coal and the tractive effort of 85% of the working pressure is 16,763 lb.

The Great Northern Railway of Ireland was incorporated in 1876, the system being built up by the amalgamation of a number of small concerns. It runs from Dublin to Belfast, through Drogheda, Dundalk and Newry, and its lines also serve Enniskillen, Bundoran and Londonderry.



RAILWAY NEWS

Famous G.W.R. Engine in Retirement

Britain's fastest engine, the famous G.W.R. locomotive *"City of Truro,"* has been withdrawn from active service. It has not been scrapped, however, but has been sent to the York Railway Museum, where it will be preserved.

The *"City of Truro"* made British and world railway history in 1904 by achieving the highest authentic speed ever recorded —102.3 m.p.h. on the run up from Plymouth when competing for the American mails. The engine was therefore the first form of locomotion to pass the 100 m.p.h. mark, and even to-day still holds the speed record for a railway locomotive.

The "City" class of engines are of the 4–4–0 type and were constructed at Swindon in 1903/4. At that time they were the principal passenger engines on the G.W.R. system, being used on all the main express services. One of the class headed the special train run to Plymouth on 14th July, 1903, for His Majesty King George, then Prince of Wales, and also was employed on the preliminary run on 30th June, 1904, of the *"Cornish Riviera Express,"* regular service starting next day.

The *"City of Truro"* was completed at Swindon in May 1903. At first the locomotive bore the number 3440, but in December, 1912, this was changed to 3717. During its 27 years of service the engine ran over a million miles. After its withdrawal from service it was sent to Swindon to be renovated and later it was sent to York. As it did not make this final journey under its own steam, but formed part of a goods train, the connecting and coupling rods of the engine were taken off and carried on the tender. They were placed in position again after the arrival at York.

New Type of Petrol Tank Car

A new enlarged type of petrol tank car has recently been built for the Anglo-American Oil Company. It runs on two 4-wheel bogies. The tank is cylindrical in shape and has a carrying capacity of 35 tons, or more than 10,000 gallons of petrol.

L.M.S.R. Locomotive News

Additional 0–8–0 standard freight engines have been turned out from Crewe works and are numbered 9610 to 9614.

Some 4–4–0 passenger engines of the "Class 2" type are on order at Crewe.

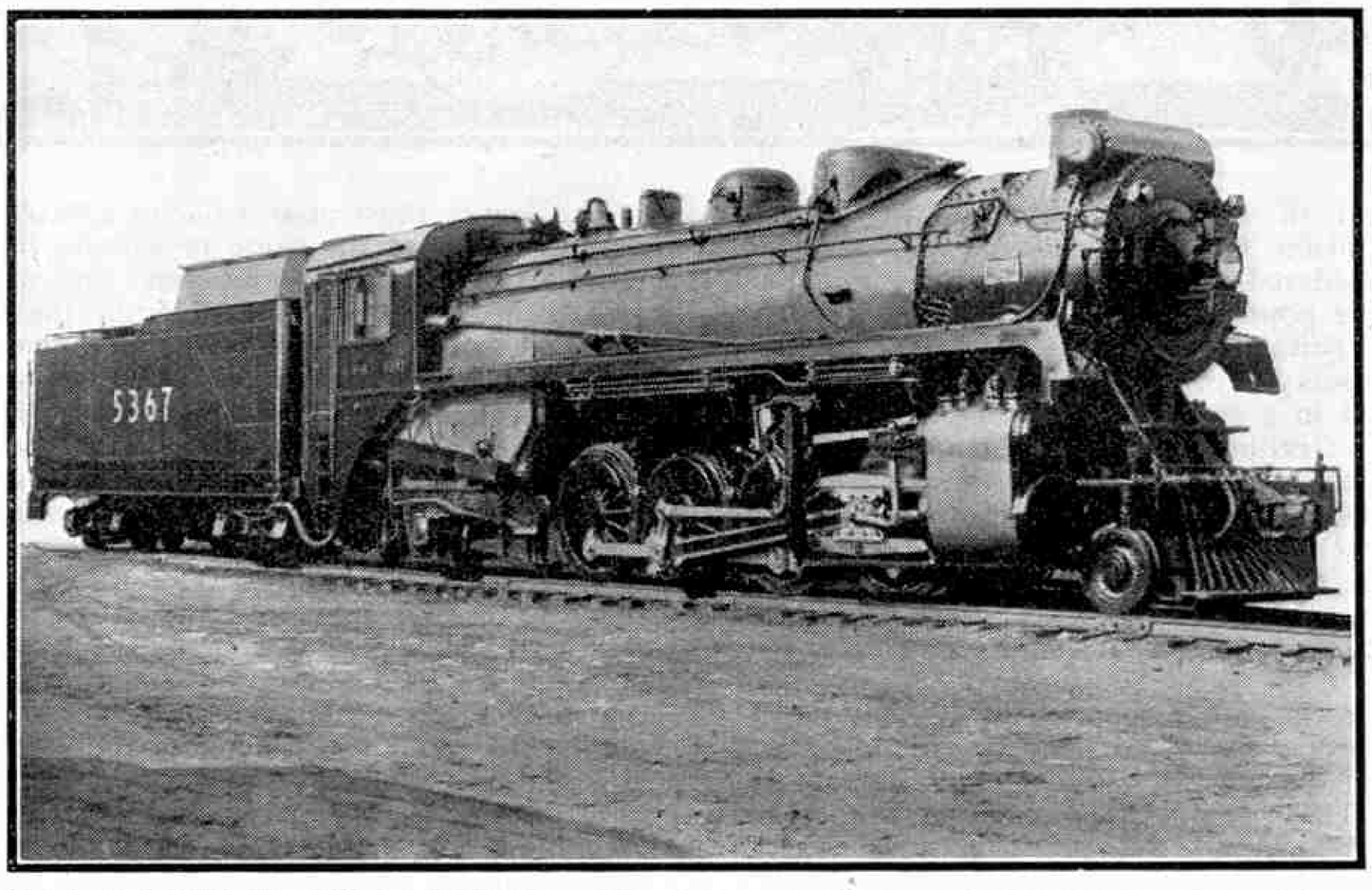
A small Diesel shunting engine has been built by Hudswell Clarke & Co. Ltd., for use on the 18 in. gauge lines in the works at Crewe. It has been named *"Crewe"* and is proving efficient in the performance of its duties.

Two more 4–6–0 engines of the L.N.W.R. "Prince of Wales" class have been altered to fit the Midland loading gauge. They are: No. 5628, *"R. B. Sheridan,"* and No. 5709. Among the engines recently withdrawn from service are No. 7564, an L.N.W.R. 0–6–2 tank, and No. 1562, a N.S.R. 0–6–0 tank. No. 5012, *"John Ramsbottom,"* one of the famous "Jumbos," is at present stored in the paint shop at Crewe.

The engine working the London to Glasgow and Edinburgh express that was derailed with such disastrous results at Leighton Buzzard on Sunday, 22nd March, was No. 6114, *"Coldstream Guardsman,"* of the "Royal Scot" class.

Metropolitan Railway Improvements

The enlargement of Euston Square Station to accommodate longer trains is nearing completion, and work of a similar nature is now being commenced at Great Portland Street Station.



C.P.R. Locomotive No. 5367, a 2-8-2 freight engine. The large cylinders and massive moving parts that are characteristic of the powerful locomotives of the North American Continent are very apparent. Our photograph is reproduced by the courtesy of the Canadian Pacific Railway.

The Electric "Southern Belle"

Whilst the electrification of the Southern Railway route to Brighton and Worthing is being energetically pushed forward, active preparations are also being made in order to have ready all the new rolling stock that will be required for the new services. Special stock is being built for the new electric *"Southern Belle,"* consisting of twelve coaches made up of two six-coach units. London to Worthing trains will also consist of two six-coach units, dividing at Hove.

It is intended that trains shall leave Victoria for Brighton at each hour, and also at 26 and 46 minutes past the hour. From London Bridge also there will be services at each hour, and at 16 minutes past, for Brighton. Between Brighton and Worthing there will be four trains an hour. These will consist of four-coach units.

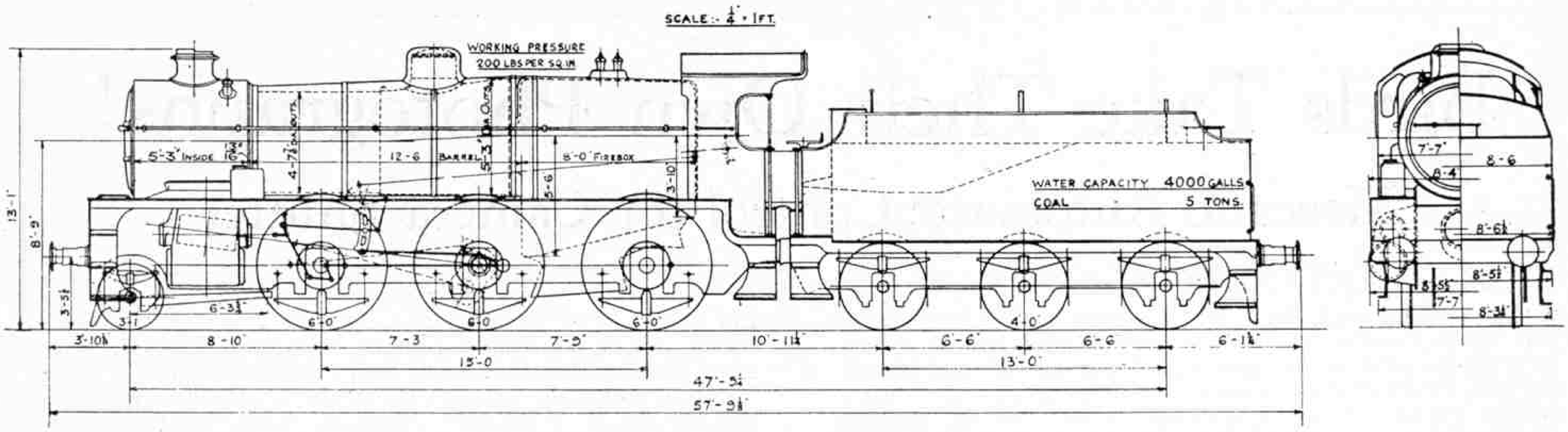
The signalling sections on the London-Brighton line will be controlled by the three-aspect colour light system, each section not exceeding 1,500 yards in length.

It is evident that good as the present steam services on these routes may be, the new electric services will be far better.

Locomotive Additions on L.N.E.R.

Three new locomotives of the 4–6–0 "Sandringham" class have recently been put into service on the L.N.E.R. and are stationed in the Ipswich District. Their names and numbers are:—No. 2824, *"Lumley Castle"*; No. 2825, *"Raby Castle"*; and No. 2826, *"Brancepeth Castle."*

As mentioned in last month's *"Railway News,"* two locomotives of the same class —No. 2822, *"Alnwick Castle"* and No. 2823, *"Lambton Castle,"*—were recently completed, and a further batch of ten are being constructed. These will take their places in service in the Great Eastern Area, and by the time the holiday season comes along, fifteen new engines will be regularly engaged in hauling express passenger trains between Liverpool Street and East Anglian holiday resorts. This class is proving very satisfactory and economical.



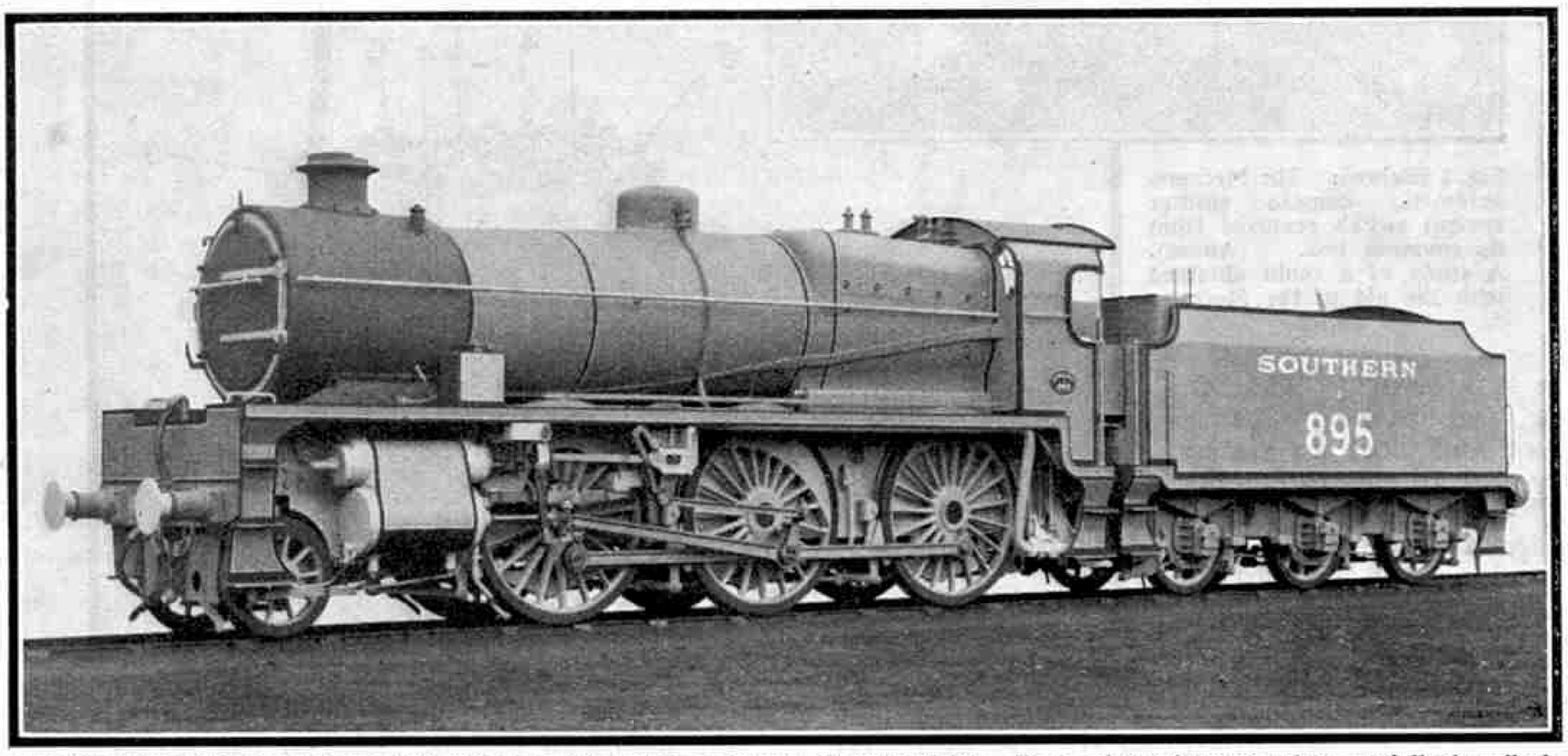
New S.R. Locomotives

The lower illustration on this page shows one of 20 new three-cylinder express passenger engines of the 2–6–0 type that are being built at Eastleigh Works to the design of Mr. R. E. L. Maunsell, and the diagram at the head of the page gives its leading dimensions. The new locomotives will be numbered A.891 to A.910 inclusive and will form what is known as the "U.1." class. Those numbered 891–5 are already in traffic.

The three cylinders of the new class are of 16 in. diameter and 28 in. stroke, and their driving wheels are 6 ft. in diameter. Their boilers have a working pressure of 200 lb. per sq. in., a total heating surface of 1,810.6 sq. ft. and a grate area of 25 sq. ft. The tractive force at 85 per cent of the boiler pressure is 25,387 lb. The weight of each engine in working order is 65 tons 6 cwts. Each is fitted with a tender that carries 4,000 gallons of water, and 5 tons of coal, and weighs 42 tons 8 cwts. This tender is similar to that fitted to the "Schools" class, but has the front end raised to accommodate the Eastern Section draw and buffing gear between engine and tender.

It will be noted that although they form a new class, engines of the "U.1." type closely resemble those of other S.R. classes. They are practically identical with locomotive No. A.890, a 2–6–0 engine produced by the conversion of a three-cylinder 2–6–4 tank of the "K.1." type built in 1925. Their boilers are interchangeable with those of the "N.1.", "U" and "W" classes, and the motion, cylinders and many other details of the new locomotives are interchangeable with the corresponding parts of the "N.1." three-cylinder goods engines Nos. A.876–880.

The new locomotives will be employed chiefly on passenger trains on the heavily graded routes between Waterloo and Portsmouth, Charing Cross and Hastings, and in the West of England.



A locomotive of the "U.1" class, 20 of which are now being constructed at Eastleigh. The engines of the new class are fully described in the accompanying article, and for our photograph and the dimensional diagram of one of them that appears at the head of the page, we are indebted to the Southern Railway.

Railways and the Use of Steel

It is of interest to note that next to the shipbuilding industry the railway companies are the largest purchasers of iron and steel in this country. Over 1,400 miles of track are laid or renewed yearly, and for this alone more than 200,000 tons of steel rails must be purchased. In addition, the four companies in a normal year use about 230,000 tons of steel for bridges, steel sleepers, fishplates, axles and tyres, boiler tubes, steamships, cranes, and other purposes.

No fewer than 62,000 steel sleepers of home manufacture are to be laid this year by the G.W.R. in half to one mile lengths in various parts of the system. The Company already have over 136,000 steel sleepers laid in the permanent way and this year's programme will bring the total mileage laid with steel sleepers up to 94 miles.

The Southern Railway has just placed orders with British firms for 32,000 tons of steel rails and 5,000 tons of steel sleepers. The intensified electric services on this Railway, with their quick acceleration and deceleration, wear out the rails very quickly, and a number of the new rails are to be treated by a special process in the hope of lengthening their life.

It is interesting to recall that some experimental metal sleepers were once laid on the former L.N.W.R., but their life was shorter than expected. A section of the North Eastern Railway also was laid with steel sleepers in 1919, with good results. The outcome of the present experiments will be closely watched, but some time must elapse before any definite conclusions can be drawn.

Remarkable N.E.R. Engines Scrapped

Among recent locomotive withdrawals are two distinguished N.E.R. 4–4–0 engines Nos. 1869 and 1870. They were built in 1896 in readiness for the possible renewal of railway racing in that year, and were given coupled wheels of the exceptional diameter of 7 ft. 7¼ in. They did not prove any speedier than similar engines with 7 ft. wheels, however, and they remained the only two of their class.

Rail Length Increase on Canadian Railway

Having adopted steel rails weighing 130 lb. per yd, as standard for primary lines, the Canadian National Railways is now experimenting with rail lengths of 66 ft. Although rails as long as 60 ft., 79 ft., and even 100 ft. have been used in some parts of Europe, the practice has not hitherto been considered desirable in Canada, where extremes of climate, severe frosts and difficult conditions in the spring months present problems that are quite different from those encountered in the British Isles, and lengths of 33 ft. and 39 ft. are standard in the Dominion.

Experiments with the 66 ft. rail show that there will be no greater difficulties in regard to contraction and expansion than with the shorter rails, while the cost of rail joint fastenings will be reduced and the track structure strengthened. The C.N.R. programme for the season includes the laying of 200 miles of 130-lb. rail.

New L.N.E.R. Express Train Stock

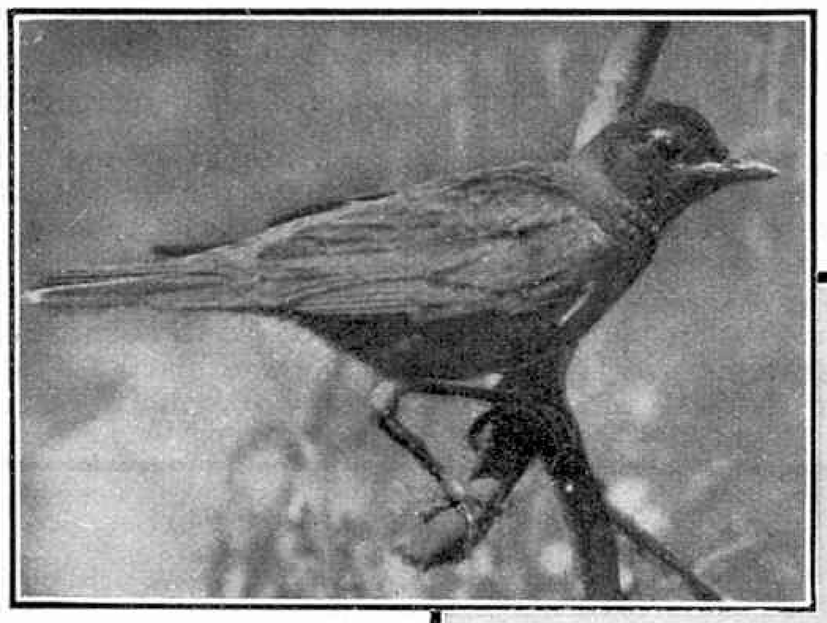
A new train has been put into service on the L.N.E.R. route between Leeds and Glasgow. The new stock has been built in the L.N.E.R. workshops to the designs of Mr. H. N. Gresley and includes the most up-to-date type of restaurant car with electric cooking equipment. It travels daily from Leeds to Glasgow and back via York, Newcastle and Edinburgh, making a round trip of 555½ miles.

Birds Take Their Own Photographs!

Meccano Automatic Control for Camera Shutter

NATURE study with the aid of a camera is a most fascinating hobby, and a collection of photographs showing various aspects of plant and animal life is not only of great interest, but also of considerable value. The photography of plants is perhaps the easiest branch of nature photography, for whatever troubles we may have with the wind, we do know at any rate that the plant will not run away as soon as we approach it! Birds and small animals of the woods and fields are not only difficult to find when we want them, but still more difficult to photograph when we have found them, on account of their extreme nervousness and the rapidity of their movements.

The general procedure in taking photographs of such creatures as birds is first of all to find a place frequented by birds, and then to hide in bushes or bracken, or in a specially constructed shelter, and wait until a bird alights near by. Then arises the problem of making the exposure before the bird flies away. The Meccano device described in this article has been designed to remove much of the uncertainty of bird photography, and it enables excellent photographs to be obtained with comparatively little difficulty.



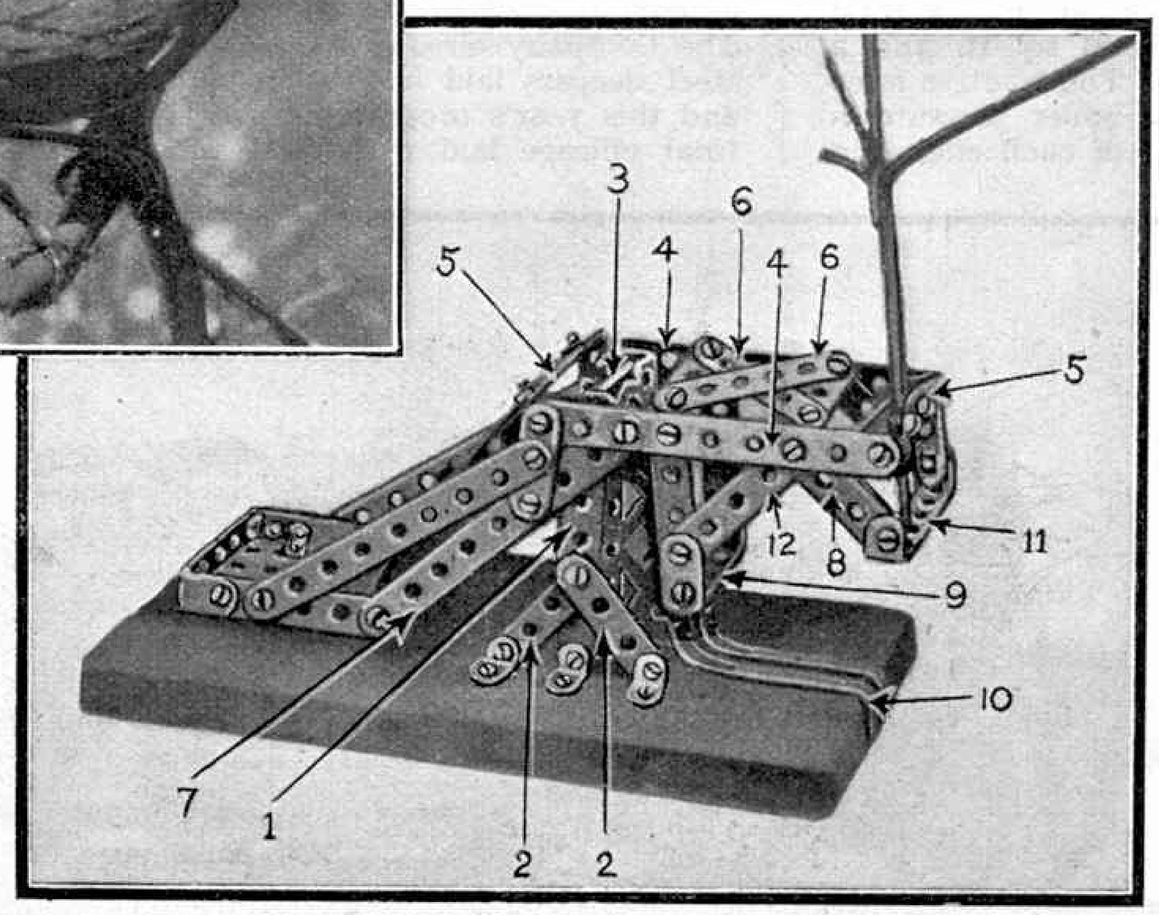


Fig. 1 (Below). The Meccano automatic camera shutter control switch removed from its covering box. (Above). A study of a robin obtained with the aid of the Meccano device.

The device consists of a switch constructed in the form of a balance, at one end of which is secured a stout twig. The bird alights on the twig, and its weight causes the balance to pivot and close an electric circuit. A battery and an electro-magnet, the latter coupled to the shutter of the camera, are included in the circuit, and when the switch is closed by the bird the shutter is operated and the picture is taken. Thus the bird may truly be said to take its own photograph! The balance switch is also connected to a circuit containing an electric bell, so that immediately the photograph is taken the bell rings, informing the operator that it is necessary to re-set the switch and change the plate or film for the next exposure.

The model is concealed in a wooden box covered with bark, and having a small hole at one end through which the twig is passed. This box is shown tilted back in Fig. 2, to show the device in position. A similar box is used to conceal the camera itself and the shutter operating gear.

If constructed carefully the complete system will be found to be very reliable in action. The photograph of the robin reproduced on this page, which was taken with a reflex-type camera controlled by the Meccano device, gives some idea of the excellent results that may be obtained.

The Meccano Model

The construction of the Meccano model may be followed from Fig. 1. The standard on which the balance portion of the switch pivots is mounted on a hardwood baseboard. Alternatively a base may be built up from Meccano Flat Plates and Angle Girders. The standard consists of two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips 1, between which is secured a $3\frac{1}{2}''$ Braced Girder. The standard is secured to the baseboard by Angle Brackets and Wood-screws, and is held in an upright position by the 2″ Strips 2.

One arm of the balance consists of two $4\frac{1}{2}''$ Strips 4, spaced apart by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips 5, and braced by 3″ Strips 6 secured diagonally between the Strips 4. To the underside of this arm two 2″ Strips 8 are fixed, and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 11 is secured between their ends. This last-mentioned Strip forms the lower support for the twig, the end of which is tapered so that it can fit into the centre hole in the Strip 11. The twig is clamped in position against the Double Angle Strip 5 by means of a $1\frac{1}{2}''$ Strip and two $\frac{1}{2}''$ Bolts.

Two $2\frac{1}{2}''$ Strips 12 are secured to the Strips 4 in the position shown, and two 2″ Strips, also attached to the Strips 4, are joined to the ends of the Strips 12. Two Flat Brackets are also secured at this point. A $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 9, bolted between the Flat Brackets, forms the "shorting bar" of the switch, the downward movement of the balance arm 4 causing this Strip to bridge the two contacts 10, and thus complete the electro-magnet circuit.

The second arm of the balance is composed of two $4\frac{1}{2}''$ Strips 7 secured to the Strips 4. Two $2\frac{1}{2}''$ Strips are secured to the ends of the Strips 7, and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is bolted between them. A $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate is secured to the $2\frac{1}{2}''$ Strip by means of Angle Brackets, and forms a tray on which small weights may be placed to obtain the correct balance. The contacts 10 consist of strips of brass $\frac{1}{4}''$ wide secured to the baseboard by small wood-screws.

These strips should be bent at right angles below the Meccano Double Angle Strip 9, and their ends bent over so that the Double Angle Strip 9 can make sound electrical contact with them when the balance arm is depressed.

The complete balance arm is pivoted on a 3″ Axle Rod 3 journalled in the top holes of the Strips 1.

The electro-magnetic gear for operating the shutter of the camera should next be built. The actual design and arrangement of this mechanism will depend on the make and type of camera used, and no standard model can be described. The popular "box" pattern of camera is generally fitted with a shutter of the lever type, while the more expensive folding types incorporate a push release connected to the shutter by a flexible cable.

If the shutter of the camera is of the lever type, the simplest method of arranging the magnet release is as follows. A short length of Meccano Spring Cord is attached to the projecting end of the release lever and anchored to a framework composed of Meccano parts secured to the case of the camera. The tension of the Spring should be adjusted so that normally it pulls the shutter lever across the slot. An electro-magnet is next secured in the frame. A suitable magnet may be built up by winding a Meccano Bobbin to capacity with No. 26 S.S.C. wire, and connecting the ends of the winding to 6 B.A. Terminals mounted on the frame, but insulated from it by means of Insulating Bushes and Washers. The wound Bobbin should be clamped to the framework by Strips. The magnet should be mounted in such a position that an Axle Rod passed a short distance into the core

of the Bobbin will act as a "catch" on the shutter lever, and prevent the tension spring from drawing it over and thus making an exposure. When a current is passed through the magnet winding, however, the Rod is drawn into the core of the Bobbin, thus releasing the shutter lever, which is immediately drawn over by the Spring and an exposure is made.

With a camera having a push release a different arrangement will be necessary. In this case the control push should be clamped in a vertical position and the electro-magnet arranged to release a small weight that presses on the push and thus operates the shutter.

To wire up the system, a length of thick insulated wire should be led from one of the contacts 10 of the balance switch to one end of the electro-magnet winding mounted on the case of the camera. A length of wire should be used to join the other end of the magnet coil to one pole of a 6-volt Accumulator, while the remaining pole of the accumulator should be connected to the second contact 10 of the balance switch. A length of twin flexible insulated wire should be attached at one end to the contacts 10 and at the other end to an electric bell and a dry battery. The bell must, of course, be placed at a considerable distance from the camera and switch. If the device is arranged in the garden the bell could be placed in a shed, or it might even be arranged to ring in the house. The further the bell is away, however, the more flex is required, and too great a length is not desirable.

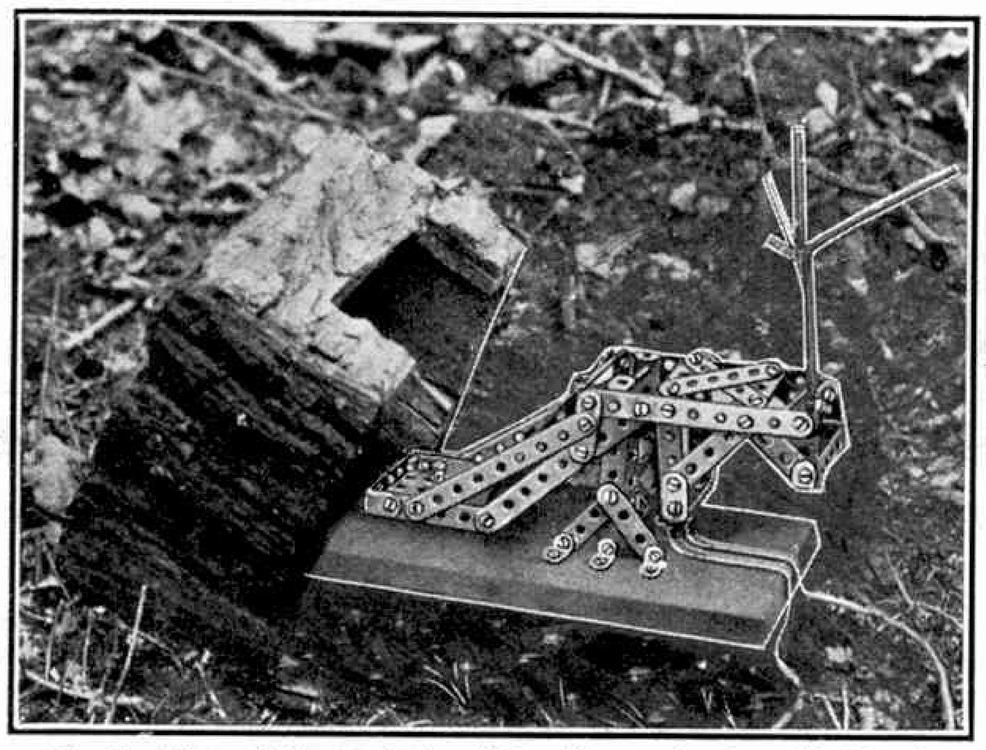


Fig. 2. View of the control switch with covering box tilted back.

The balance switch is placed near some spot where birds are known to congregate, and the device wired up as already described. The camera is carefully focussed on the twig in the position in which this will be when the weight of the bird rests upon it. The catch of the shutter release mechanism is then set in the "on" position, and finally the bark-covered boxes are placed over the switch and the camera. All is now ready for the photograph, and the operator has only to retire to a suitable distance and wait patiently, and of course in perfect quietness. Presently, if circumstances are favourable, there will come the tinkle of the bell that proclaims the fact that one of our feathered friends has obligingly taken its own photograph!

Overseas Contest Results—(*Cont. from page 408*)

A. Robert, submitted a model of a Bleriot XI monoplane, a type that was popular about 1909 in the days when aircraft designing was in its infancy. Nowadays, of course, Bleriot XI's are to be seen only in museums! Robert's model is interesting, however, for he has endeavoured to reproduce one of the first machines in which any attempt was made to provide closed accommodation for the pilot.

A very weird model came from G. A. Laskaris, who submitted a model "rotor-plane," fashioned on the principle of the Rotor Ship, which was described in the "*M.M.*" some time ago. I am afraid machines of this type would not be of much practical use, but the model possesses interest due to its originality. Revolving Boilers take the place of the wings of an ordinary aeroplane, and they are driven by an Electric Motor mounted in the fuselage.

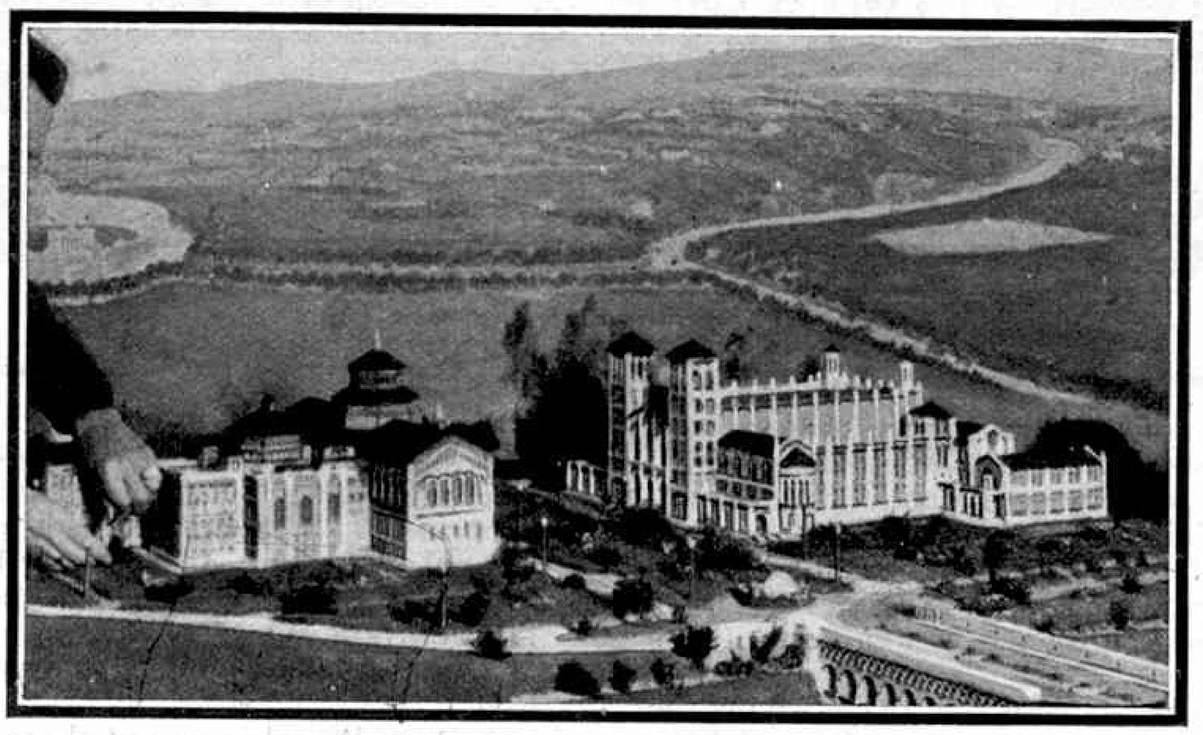
Quite a number of model autogiros were included among the entries in this Contest and one of the best examples of this type of aircraft came from Arnold Brightwell. Many boys confuse autogiros with helicopters but really an autogiro is fundamentally different from an helicopter for it cannot rise vertically from the ground. The idea of the autogiro is that in the event of the engine driving the airscrew stopping, the machine can still parachute safely to the ground, its rate of drop being retarded by the rotating horizontal windmill with which it is fitted. A helicopter, on the other hand, is intended to rise vertically from the ground and in order to enable it to do so the windmill planes with which it is fitted have to be power driven, of course. The windmill of an autogiro, however, is not power driven, but revolves on account of the airstream that strikes against its rotor blades as the aeroplane moves forward.

The National Parks of New Zealand—

(*Continued from page 395*)

In another part of the North Island there is a region of mountain and forest that almost seems planned by Nature for the purpose of a wild woodland park. This is the Urewera country, through which a road from Rotorua is being pushed on towards Lake Waikaremoana. It is at present owned by the Maoris, but much of it is destined to become a National Park for the sake of its glorious scenery. Range after range rises to the clouds, and almost everywhere for 50 miles or so the mountains are clothed with forest. The small Maori population cultivate the more open parts, and there are some semi-primitive villages with their carved meeting-houses. The greater part of the roughly circular tract of territory is bush. It is of little use for settlement, and so the wooded ranges are likely to be preserved in their present condition—a place of beauty and solace for the traveller, and a home of refuge for the native birds, especially those sweet little singers, the tui and the bellbird.

New Zealand has every reason to be proud of her wonderful National Parks.



An interesting scenic model of a university for Los Angeles, California. Models of this type are largely used by architects to illustrate their schemes.

Bridging San Francisco Bay—(*Cont. from p. 381*)

At that time a bridge across Carquinez Straits was not considered economically practicable, and the ferry steamer "*Solano*" was built to carry passenger and freight trains across the Straits. This huge ferry boat attracted widespread attention. Not only was it the largest ferry boat in the world, being 420 ft. in length, 116 ft. in width and 17 ft. in height, but also it was the first vessel in which the principle of a truss bridge was used in constructing the hull. It had a displacement of 5,450 tons, and was capable of carrying on its four tracks two locomotives and 24 passenger cars, or two locomotives and 36 freight cars. The "*Contra Costa*," which was added to the service in 1914, is 13 ft. longer and 2 ft. higher than the "*Solano*," and has a displacement of 7,198 tons. With the opening of the bridge the useful career of these fine boats is at an end.

The first shovelful of soil was moved at Suisun Point on 3rd May 1929, but actual construction on the bridge site was not commenced until the month following. Its completion ahead of schedule constitutes a record for engineering projects of this kind. The placing of 21,000 tons of steel in nine truss spans, in the lift span and towers, and of the viaduct approaches was completed in the remarkably short time of 11 months.

The Martinez-Benicia bridge is in many respects a very remarkable structure. The whole project was a bold one, and the originality of the methods employed in building the bridge and the speed at which the work was carried out attracted widespread attention. It must be regarded as one of the finest of the many great engineering undertakings that have been brought to completion by the Southern Pacific Railroad.

Suggestions Page

(231)—A Meccano Front Wheel Drive

(*R. Blake, Twickenham, Middlesex*).

The great majority of cars on the road to-day are propelled by means of the rear wheels. This arrangement, although so popular, suffers from several disadvantages, the most serious of which is the liability to skid. When the direction of the motion of a car is changed in turning a corner, the tendency is for it to continue travelling in the original direction—in other words to skid, and this is intensified considerably by the effect of the rear wheel drive. If the engine drives the front wheels, however, it will be seen that a car will be drawn or pulled round a corner instead of being pushed, as is the case with the more usual form of transmission, so that the danger of a front wheel skid is greatly reduced. Many other advantages are claimed for this unique form of transmission, such as a low slung body, made possible by the elimination of the cardan shaft and the ordinary type of back axle, and the greater steering "lock" that may be placed on the front wheels. All these effects combine to make a car that is extremely safe to handle on bad road surfaces and under adverse weather conditions.

Meccano is an excellent medium for demonstrating mechanisms of all kinds, so that it is not surprising to learn that many readers have turned their attention to the designing of front-wheel drives, with the result that we have received many suggestions of this nature. It would appear, judging from the suggestions received, that most boys have only a vague idea of the difficulties in designing such a mechanism, so that it may be useful to consider some of the more important points before passing on to the description of the model shown in Fig. 231.

One of the first problems to be considered is that of conveying the drive from the engine to the front wheels. Whatever form of drive is employed, it must be such that the front wheels may be freely turned for steering purposes, and also may rise and fall easily under the action of the springs. A well-known make of British front wheel drive car employs universally jointed drive rods to attain this end, which is quite satisfactory in actual practice; but we are immediately confronted with an acute problem when an attempt is made to apply such a method to Meccano practice.

A Meccano Universal Coupling cannot be used to articulate the drive rod on account of its length. The reason for this statement will be readily seen when it is remembered that the centre of the Universal Coupling must coincide with the point about which swivels the stub unit. This is done in order to prevent the end of the drive rod describing an arc when the front wheels are put over to "full lock." By making the centre of the stub pivot and the Universal Coupling coincident, the road wheel is placed at a considerable distance from the pivot. This is a very undesirable state of affairs, as actually the wheel should be as close as possible to the pivot in order to make steering easy and to reduce the bending stresses on the stub axle unit.

This is a point that almost every contributor misses, and it will be observed that even in the model about to be described the position is far from ideal. It may be mentioned here that particulars of a new Meccano front wheel drive will shortly be published in the "*M.M.*" In this model particular attention has been paid to the points just referred to, and by the employment of an entirely novel form of universal coupling the wheel track has been made practically coincident with the centre line of the pivot pins.

The front axle of the model shown in Fig. 231 consists of two pairs of $5\frac{1}{2}''$ Strips spaced apart by three Washers on the shanks of the bolts connecting them together. Each stub axle on which the road wheel is mounted, and is free to revolve, is secured in the plain transverse bore of a Coupling. A 1″ Rod is secured in each end of the Coupling. A $\frac{3}{4}''$ Pinion 4 is mounted boss downward on the upper 1″ Rod, and the lower Rod is journalled in the end holes of the front axle.

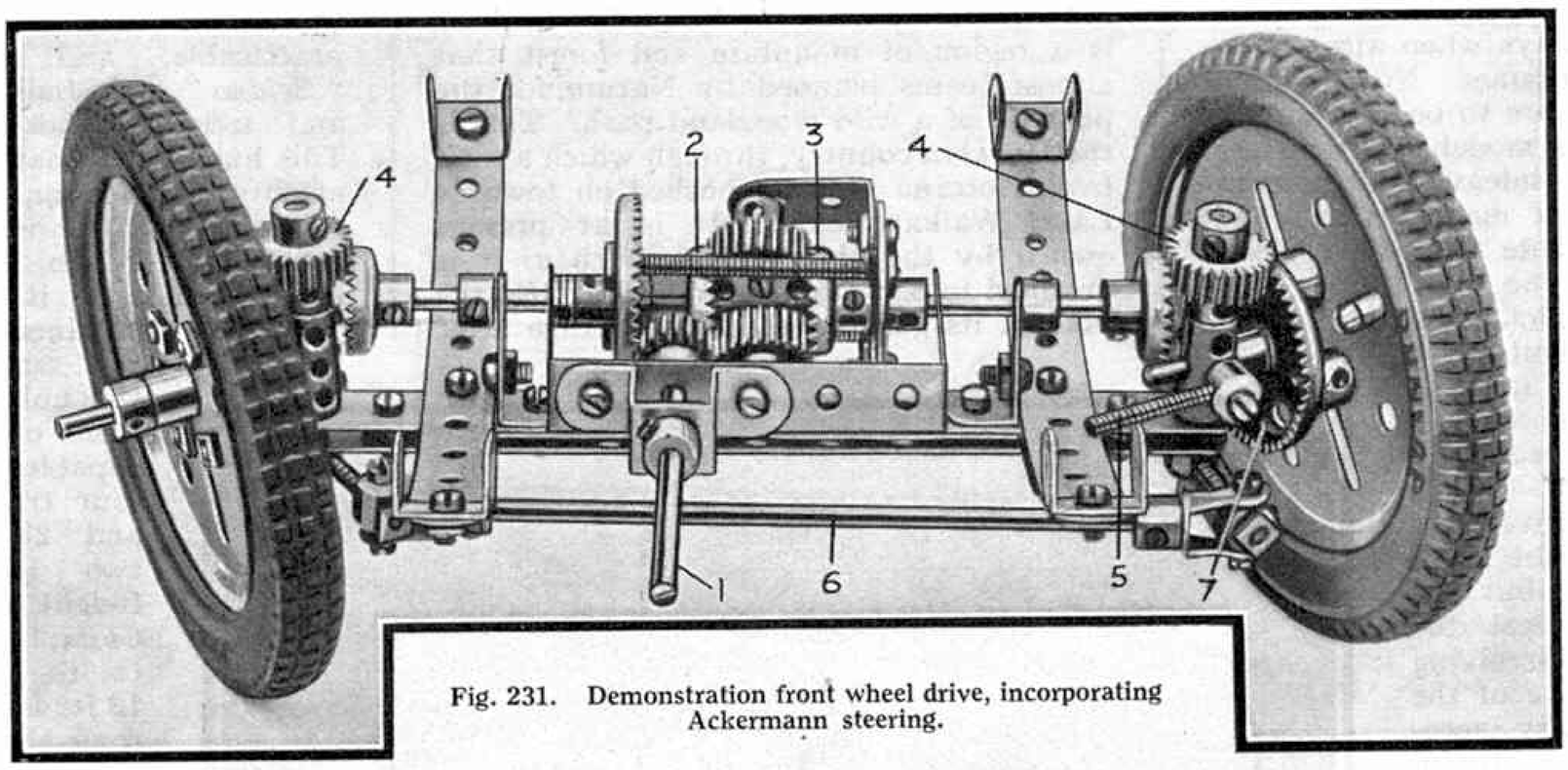


Fig. 231. Demonstration front wheel drive, incorporating Ackermann steering.

The $\frac{3}{4}''$ Pinion is in constant mesh with a $1\frac{1}{2}''$ Contrate 7 that is secured to the road wheels by bolts. A $\frac{3}{4}''$ Contrate Wheel, also in mesh with the Pinion, is secured on the end of each of the Rods leading from the differential. The outer ends of these Rods are journalled in $1'' \times \frac{1}{2}''$ Angle Brackets; and the inner ends are journalled in the longitudinal bore of a Coupling, a $\frac{3}{4}''$ Contrate 2, 3, being secured to each Rod. The Coupling has secured in its centre transverse bore a $1\frac{1}{2}''$ Rod on which run $\frac{3}{4}''$ Pinions in constant mesh with the $\frac{3}{4}''$ Contrate Wheels 2 and 3. A $1\frac{1}{2}''$ Contrate Wheel is mounted freely on the Rod carrying the Contrate 2, and is driven by means of a $\frac{1}{2}''$ Pinion secured on the Rod 1.

A Bush Wheel is mounted loosely on the opposite Rod against the Boss of the Contrate 3, and is connected by 2″ Screwed Rods to the $1\frac{1}{2}''$ Contrate, so that the two parts turn as one unit. Two $1'' \times \frac{1}{2}''$ Angle Brackets bolted to the Bush Wheel engage with the ends of the Rod carrying the $\frac{3}{4}''$ Pinions. The Rod 1 is connected to the gear box of the chassis, and in order to allow for the vertical movement of the complete unit, due to the springing, it will be found necessary to incorporate two Universal Couplings between the output shaft of the gear box and the end of the Rod 1. The latter may, of course, be made much shorter than that shown in the illustration, but it is rather a disadvantage that the space taken up by the gear box and front axle unit is so great, as it makes the bonnet of the car unduly long.

A 1″ Screwed Rod is inserted in the tapped hole of a Collar on the lower extremity of the 1″ Rod forming each stub axle pivot, and is provided with a Swivel Bearing that serves as a means of connecting it to the track Rod 6.

The drag link from the steering arm is connected to a 1″ Screwed Rod 5, which is screwed into a Collar fixed to the Coupling by a bolt that is inserted in its tapped hole.

(232)—A Silent Overhead Camshaft Drive

(*S. Long, Nottingham*).

Other things being equal, a car engine fitted with overhead valves is more efficient than one employing side valves, on account of the fact that the combustion space may be given a better shape, and the compression ratio may be increased due to the elimination of the awkward passages that have to be cast in the heads of side-valve engines.

The valves of such engines may be operated either by rocker arms and push rods from a camshaft placed in the position common with side-valve engines, or the camshaft itself may be placed above the head and parallel with the crankshaft, so that the cams act directly on the ends of the rockers. The last-mentioned method is the better of the two for many reasons, but the drive from the crankshaft to the overhead camshaft must possess hard-wearing qualities, be comparatively noiseless, and must not require constant checking for adjustment. Fig. 232 illustrates a Meccano demonstration model of an extremely novel form of patented overhead camshaft drive that has remarkably long wearing properties, is noiseless, and requires practically no adjustment for long periods.

The Meccano model consists of two Rods mounted in suitable bearings one above the other. The lower Rod is driven in actual practice by a 2 : 1 reduction gear off the front end of the crankshaft; and the upper Rod represents the overhead camshaft. Each Rod has three Eccentrics secured to it, the point of maximum throw of each being 120 degrees from that of its fellow on the same Rod. Each set of Eccentrics on the lower Rod is connected to those on the camshaft by Strips bolted to the eccentric "straps." Careful adjustment of the Eccentrics on their respective Rods in relation to one another is necessary in order to obtain a smooth and easy drive.

(233)—An Automatic Crane Brake

(*D. Vickery, Manchester*).

Safety appliances of various kinds are fitted to all modern cranes, on account of the stringent regulations that are made by the authorities with a view to safeguarding life and property. Limit switches are provided to stop overhauling of the load, and also when fitted to the luffing gear prevent the jib exceeding the limits of the luffing range.

The device indicated in Fig. 233 is a novel form of automatic brake that may be fitted to any model crane. It remains off during the hoisting of the load, but at once applies a retarding effect when the handle is released or an attempt is made to lower the load. An additional feature of the device is that its braking power varies with the load on the crane hook—a heavy load giving a powerful retarding effect and vice versa.

A 1½″ Pulley Wheel 1 is fixed to a Rod that is journalled freely in the sides of the jib. A Ratchet Wheel is secured also on the same Rod. A 2″ Strip 2 is mounted on this Rod, and has a Pawl attached pivotally to it in such a manner that the Pawl engages with the teeth of the Ratchet Wheel. One end of a piece of cord 3, attached to the end of the 2″ Strip, is passed round a 1″ Fast Pulley on a Crank Handle forming the hoisting barrel, and is attached finally to the base of the model. The hoisting cord is passed under the 1½″ Pulley on its way to the jib head.

When the load is hoisted in, the 1½″ Pulley is rotated so that it slackens the

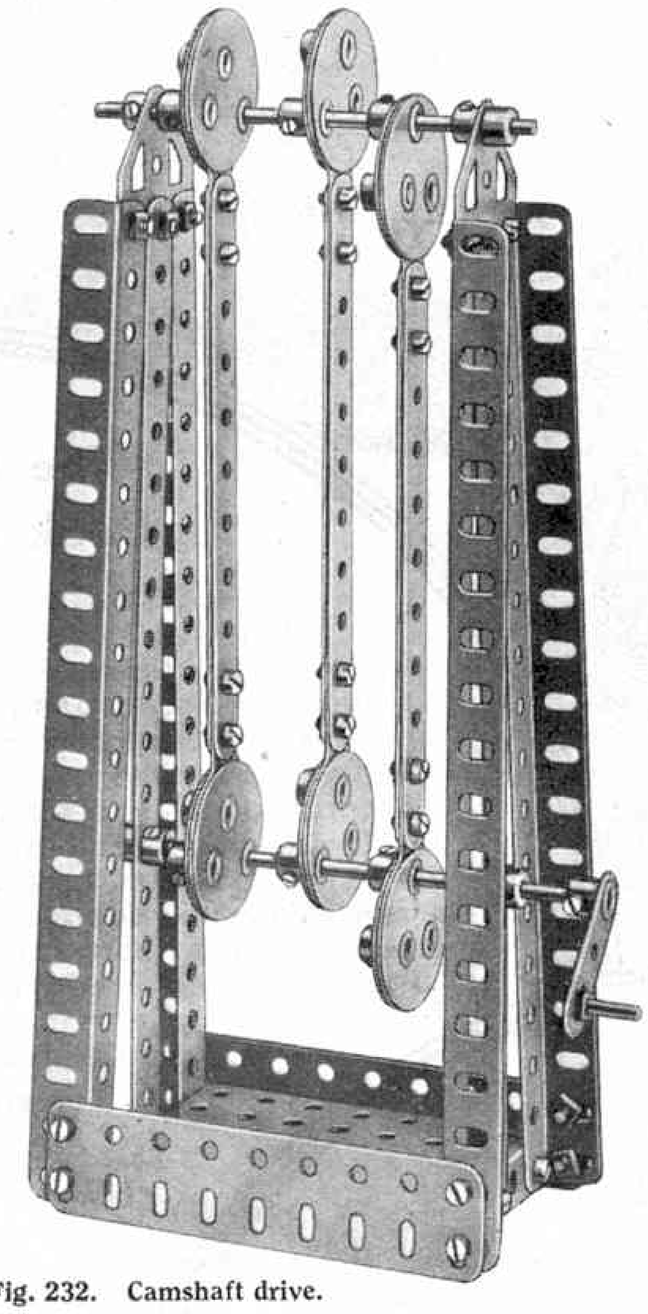


Fig. 232. Camshaft drive.

brake cord and then the Pawl trails idly over the teeth of the Ratchet Wheel. When the load is lowered, however, the Pulley is rotated in the reverse direction, which results in the tightening of the brake cord. Owing to the manner in which the hoisting cord passes round the

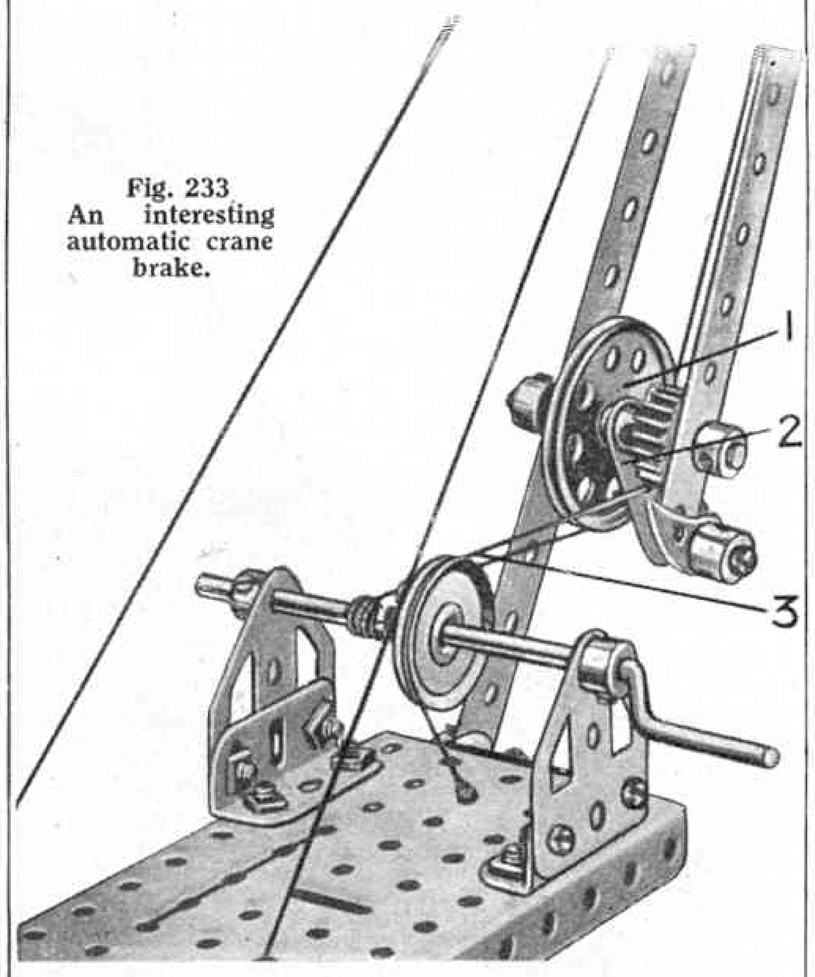


Fig. 233 An interesting automatic crane brake.

1½″ Pulley, the braking power of the device depends on the frictional grip between the Pulley and cord, and this in turn depends on the load on the end of the crane hook.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

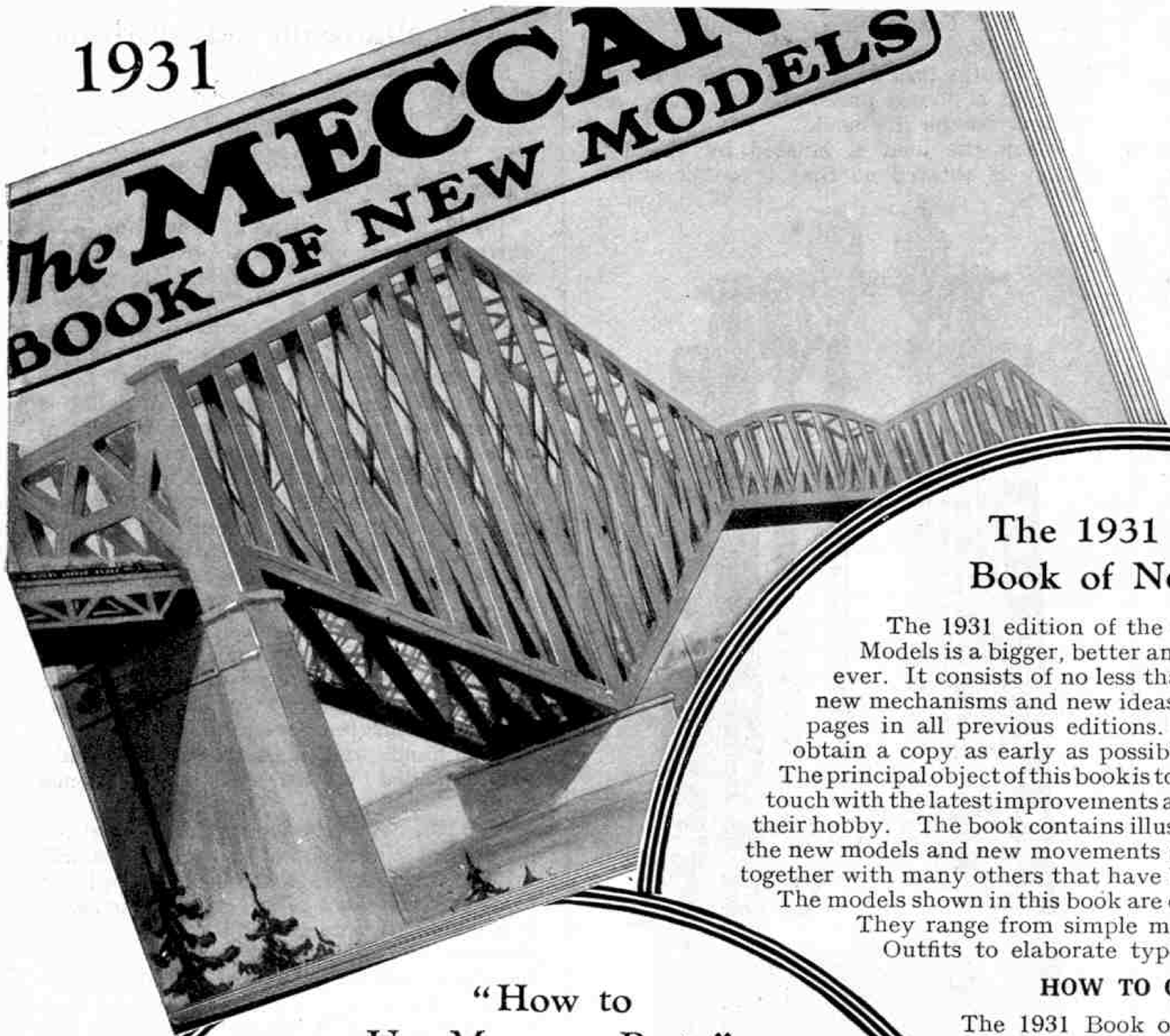
(M.117). A Centrifugal Governor.—An extremely neat centrifugal governor is the work of W. Dunn, Belfast. It consists essentially of two ½″ × ½″ Angle Brackets secured by their round holes between the jaws of an End Bearing in such a manner that the arms bearing the slotted holes point away from each other. A Collar is secured to a bolt free to move in the slot of each Angle Bracket. When the device is rotating, the Collars fly out as the result of centrifugal force, and bear against the inside periphery of a fixed 1⅛″ Flanged Wheel.

(M.118). A Novel Puzzle.—A new puzzle sent in by E. Marchant, Oxford, consists of a Wheel Flange and four Ball Bearings. The problem is to get the balls on to the four holes without any of them falling through the centre hole of the Wheel Flange. This puzzle certainly requires a steady hand, and it is to be thoroughly recommended as an excellent patience tryer!

(M.119). A Fret-saw Machine Repair.—Owners of Hobbies fret-saw machines will know that there is a device for applying tension to the saw blade. After some usage it is liable to break, and a repair may be effected by means of Meccano parts as recommended by B. Stuart, Londonderry. A 9½″ Strip is fastened in a Strip Coupling, in the other end of which is secured a 6½″ Screwed Rod. A Strip is passed through the slot in the lower arm of the machine and the Screwed Rod is passed through the slot in the upper arm. A Rod with two Collars on it prevents the Strip from slipping back through the slot, and a Threaded Boss is run on to the Screwed Rod. The Threaded Boss presses on to the upper side of the slot in the upper arm so that in screwing it down the correct amount of tension may be put on the saw blade.

(M.120). A Motor-driven Interrupter.—A Motor-driven interrupter for a spark coil is the suggestion of K. Wright-Cameron, Birkenhead. A Bush Wheel is secured to the armature spindle of an E.1 Motor, and a short stiff piece of copper wire is secured by a bolt in each of the eight holes of the Bush Wheel, so that the complete unit resembles a rimless wheel. The tips of the spokes of the wheel dip into a trough of mercury, which may be built up from Double Angle Strips, etc., or may be made as a special part. One end of the primary winding of the coil is taken to the trough and the other end connects with the armature spindle of the Motor. A Motor-driven interrupter is much more effective than one of the more common type, as it produces a more rapid "make and break" of the primary current.

(M.121). A Novel use for Meccano.—Another practical use for Meccano is revealed by S. Cook, Bromsgrove. At a recent carnival held in this town the canopy over the carnival queen's car was composed of a framework of Meccano Strips and Girders, over which was stretched fabric. This is certainly a novel use for Meccano and one in which readers who are actively concerned in carnivals or amateur theatricals may be interested, for Meccano Strips are more easily worked than wooden strips.



Two Books for every keen Meccano Model-builder

The 1931 "Meccano Book of New Models"

The 1931 edition of the Meccano Book of New Models is a bigger, better and more thrilling book than ever. It consists of no less than 40 pages of new models, new mechanisms and new ideas, as compared with only 24 pages in all previous editions. Every Meccano boy should obtain a copy as early as possible.

The principal object of this book is to keep Meccano model-builders in touch with the latest improvements and developments connected with their hobby. The book contains illustrations and details of the best of the new models and new movements submitted in recent competitions, together with many others that have been designed by our own experts. The models shown in this book are of outstanding interest and variety. They range from simple models that can be built with small Outfits to elaborate types that will appeal to older boys.

HOW TO OBTAIN THE BOOK

The 1931 Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free. New Zealand and South African price 1/– from dealers, or 1/2 post free from our agents. Australian price 1/9 from dealers, or 1/11 direct from our agents. Canadian price, 25 cents from dealers or 30 cents, post paid, from Meccano Ltd., Toronto.

"How to Use Meccano Parts"

Every Meccano model-builder who wants to build better models should have a copy of this Manual. Its main purpose is to outline the principal uses of the standard parts that together constitute the Meccano System. Detailing every function of every part would be almost impossible, but we believe that by pointing out the special purposes for which the various parts have been designed, together with a few of the other uses that have been suggested from time to time by Meccano boys themselves, we shall help Meccano enthusiasts to build more interesting models, and also to construct them on scientific and practical lines.

HOW TO OBTAIN THE BOOK

We advise every keen Meccano boy to obtain his copy of this new Manual as early as possible. It may be obtained from any Meccano dealer, price 6d., or direct from Meccano Ltd., Old Swan, Liverpool, price 7d. post free. (Overseas price 9d. from dealers, or 10d. post free from our agents. Canadian price, 15 cents from dealers or 20 cents, post paid, from Meccano Ltd., Toronto.

MECCANO AGENCIES

AUSTRALIA : E. G. Page & Co., 52, Clarence Street, Sydney (P.O. Box 1832K).

NEW ZEALAND : Models Ltd., P.O. Box 129, Auckland (Kingston Street).

CANADA : Meccano Ltd., 34, St. Patrick Street, Toronto.

SOUTH AFRICA : Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).

MECCANO LTD.
OLD SWAN
LIVERPOOL

Grand Model-Building Contest

For No. 2 and No. 7 Outfit Models

Seventy-eight Valuable Prizes to be Won

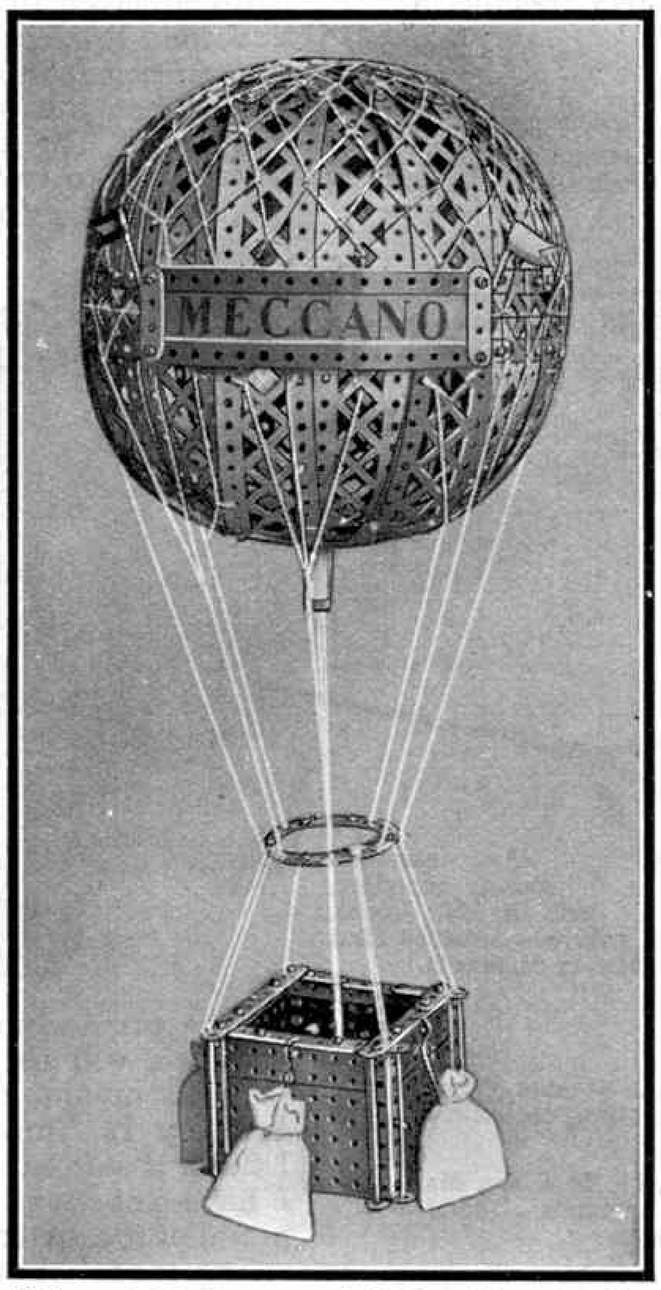
HERE we give details of the last of the 1931 series of Meccano "Outfits" Model-building Contests. In this contest prizes are offered for the "Best Models Made Entirely from Either a No. 2 Outfit or a No. 7 Outfit." Readers who possess larger Outfits than No. 2 may of course enter, provided that they use only those parts that are contained in the No. 2 Outfit. It is of course not necessary to use all the parts contained in the Outfit.

Competitors may build any model they like, and they should try to be as original as possible in their choice of subject.

There will be two Home Sections, as follows: Section A, for models built entirely from the parts contained in No. 2 Outfits by competitors living in the British Isles. Section B, for models built entirely from No. 7 Outfits, by competitors living in the British Isles. There will also be two Sections for Overseas competitors. Section C, for models built from No. 2 Outfits; Section D, for models built from No. 7 Outfits. Each Section is open to readers of all ages. A separate set of prizes will be awarded in each Section. Competitors may submit both a No. 2 Outfit model and No. 7 Outfit model if they wish, but no competitor can win more than one prize in this contest.

Suitable prize-winning models will be illustrated in the "*M.M.*" and also will be included in forthcoming Meccano Manuals of Instruction. Full lists of prize-winners will be published in the "*M.M.*" as soon as possible after the closing dates.

When a competitor has completed his model he should take as good a photograph of it as possible, or make a careful drawing of it; and submit one or the other, together with any description that may be necessary to make the construction perfectly clear. Boys who do not possess cameras, and who in addition are not good at drawing, need have no hesitation in sending in rough sketches, provided that these are clear enough to enable the judges to form an estimate of the merits of the model.



This model balloon was built by Albert Pattijn, Brussels, and was awarded a prize in a recent French model-building Contest. Excellent work has been done in shaping the "bag" from Braced Girders. Note the novel application of the Meccano Ball Race!

Each photograph or drawing sent in must bear the competitor's age, name and address on the back, together with the letter A, B, C, or D, indicating the Section in which the entry is submitted. Each competitor must enclose with his entry a complete list of the parts required to build the model.

Envelopes containing entries should be addressed: ("No. 2") or ("No. 7") "Outfit Contest," Meccano Ltd., Old Swan, Liverpool; and should be marked in the bottom left-hand corner with the appropriate letter indicating the Section.

The closing dates for this competition are as follows:—Home Sections A and B, 30th June, 1931, Overseas Sections, C and D, 31st August, 1931.

Photographs or drawings of unsuccessful models will be returned to the senders provided that a stamped addressed envelope of the necessary size is sent with the entry. It should be noted, however, that photographs or drawings of prize-winning entries become the property of Meccano Ltd.

The following is a complete list of the parts contained in the No. 2 Outfit:—10 of No. 1; 14 of No. 2; 2 of No. 3; 12 of No. 5; 2 of No. 6a; 4 of No. 8; 8 of No. 10; 4 of No. 11; 12 of No. 12; 2 of No. 12a; 1 of No. 13; 2 of No. 15; 1 of No. 15a; 4 of No. 16; 2 of No. 17; 4 of No. 18a; 1 of No. 19; 1 of No. 19s; 4 of No. 19b; 4 of No. 20b; 4 of No. 22; 2 of No. 22a; 1 of No. 23; 1 of No. 24; 1 of No. 34; 14 of No. 35; 1 of No. 36; 60 of No. 37; 6 of No. 37a; 14 of No. 38; 2 of No. 40; 1 of No. 44; 1 of No. 45; 1 of No. 48; 8 of No. 48a; 1 of No. 52; 2 of No. 54; 1 of No. 56a; 1 of No. 57; 2 of No. 62; 4 of No. 90a; 2 of No. 99; 2 of No. 100; 6 of No. 111c; 1 of No. 115; 4 of No. 125; 2 of No. 126; 2 of No. 126a.

A full list of the parts contained in the No. 7 Outfit may be found at the back of the No. 4-7 Instructions Manual.

The Prizes

The following Prizes will be awarded in each of the Sections B and D.

First Prize: **Cheque for £3 3s.**
Second Prize: **Cheque for £2 2s.**
Third Prize: **Cheque for £1 1s.**
Ten Prizes of Meccano goods to value 10/6.
Five Prizes of Meccano goods to value 5/-.

The following Prizes will be awarded in each of the Sections A and C.

First Prize: **Cheque for £3 3s.**
Second Prize: **Meccano goods to value £2 2s.**
Five Prizes of No. 2a Accessory Outfits, value 12/6.
Five Prizes of Meccano goods to value 5/-.
Ten Prizes of "Famous Trains" by C. J. Allen.

Next Month's Contest

A splendid opportunity to win a money prize, which will come in useful for the summer holidays, will be offered in a big "Crane" Competition, full particulars of which will appear next month. Any type of crane may be submitted. Start building now!

Results of Meccano Model-Building Contests

By Frank Hornby

Christmas "Simplicity" Contest (Home Sections)

"SIMPLICITY" model-building contests show no signs of losing their popularity. Indeed, the number of entries received in the Home Sections of the Christmas "Simplicity" Contest was nearly double that in former contests of the same nature, and, what is equally satisfactory, the ingenuity shown in constructing realistic models from very few parts remains at a high level.

The full list of prize-winners is as follows :—

Section A (for competitors over 14 years of age).

FIRST PRIZE, cheque for £3-3s.: Robert Carmichael Storrar, Letham Ladybank, Fifeshire. SECOND PRIZE, cheque for £2-2s.: R. N. Tilley, Chelmsford. THIRD PRIZE, cheque for £1-1s.: John T. Thomson, Finchley, N.3.

SIX PRIZES, of Meccano goods value 10/6: T. D. Collier, Daybrook, Notts.; K. R. Dixon, Romily, Cheshire; H. Elderfield, Shoreditch, London, E.2; J. P. Smith, Kings Lynn; E. V. Smith, Solihull, Birmingham; H. E. Tomlinson, Thornton-le-Fylde, Blackpool.

SIX PRIZES, of Meccano goods value 5/-: A. C. Cochrane, West Derby, Liverpool; E. R. Hall, Middlesbrough; N. G. Jones, Holyhead; H. MacRobert, East Kilbride, Lanarkshire; J. Payne, East Ham, London, E.6; S. Wotherspoon, Waterloo.

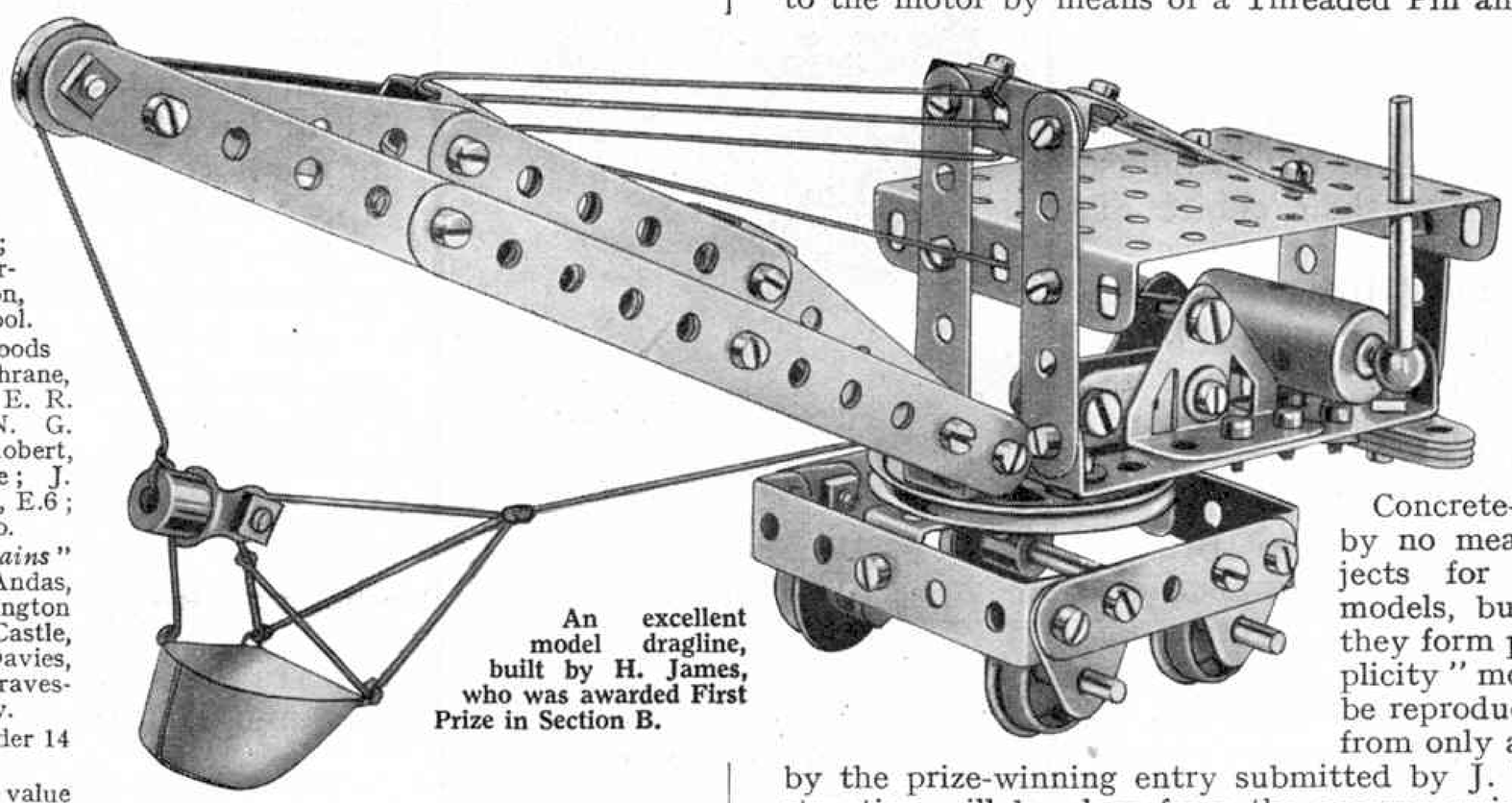
SIX PRIZES, of "*Famous Trains*" by C. J. Allen: J. J. Andas, Gateshead; J. Church, Langton Matravers, Dorset; David Castle, Kidlington, Oxford; J. Davies, Nantwich; K. Dalzell, Gravesend; John Groves, Shipley.

Section B (for competitors under 14 years of age).

FIRST PRIZE, Meccano goods value £2-2s.: H. James, Harlington, Middlesex. SECOND PRIZE, Meccano goods value £1-1s.: Frank Stoakes, Copnor, Portsmouth. THIRD PRIZE, Meccano goods value 10/6: R. York, Meersbrook Sheffield.

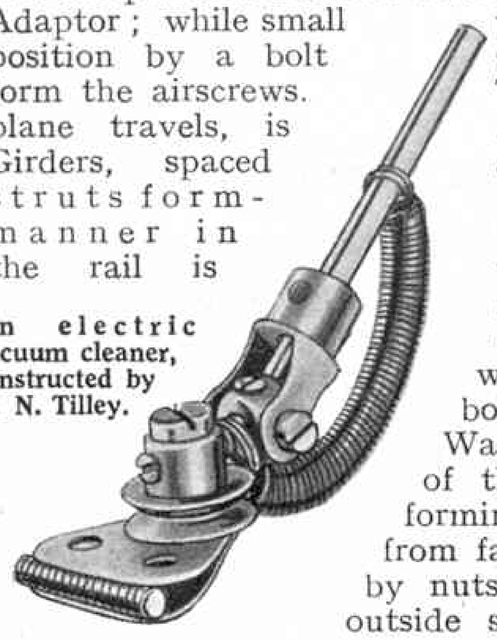
SIX PRIZES, of Meccano goods value 5/-: W. Cawthra, Bradford; H. Clare, Manchester; A. Linford, Eynesbury, St. Neots, Hunts.; M. Langlands, Dundee; F. Munro, Sheffield; E. Tuxford, High Somerby, near Barnetby.

SIX PRIZES, of "*Famous Trains*" by C. J. Allen: D. Crichton, Riddrie, Glasgow, E.1; E. Mead, London, S.E.18; R. McLean, Oxford; A. W. Shaw, Stalybridge; S. G. Summerfield, London, N.16; J. O. Townsend, Gloucester.



An excellent model dragline, built by H. James, who was awarded First Prize in Section B.

The entry that interested me most in Section A is the miniature George Bennie Railplane. Undoubtedly this model is full value for the First Prize it was awarded, and R. C. Storrar, its builder, is to be congratulated on his ingenuity, for it would be hard indeed to suggest any improvements on his fine work. The construction of the railplane itself is a splendid example of simplicity model-building. It will be seen from the accompanying illustration that it is composed of a Sleeve Piece, fitted at each end with a Chimney Adaptor; while small pieces of Spring Cord, held in position by a bolt secured in each Chimney Adaptor, form the airscrews. The gantry, or rail on which the plane travels, is formed from two lengths of Angle Girders, spaced apart about ¼" and supported on struts formed from Strips. The ingenious manner in which the car is suspended from the rail is worthy of note. The Sleeve Piece is fitted with two bolts as shown, and they each carry a Washer, which is pushed up to the head of the bolt so that the lower face of the Washer slides on the upper surfaces of the flanges of the Angle Girders forming the rail, and so prevent the car from falling. The bolts are held in place by nuts screwed against the inside and outside surfaces of the Sleeve Piece.



An electric vacuum cleaner, constructed by R. N. Tilley.

Another praiseworthy entry from Section A is the miniature "Rocket" locomotive shown below the Bennie Railplane in the composite illustration, where it forms a striking contrast with the latest mode of transport! It was built by H. Elderfield, and I would like to congratulate him on his success in obtaining so close a resemblance to the famous old engine.

Second Prize in Section A was won by R. N. Tilley, who built the miniature vacuum cleaner shown in one of the illustrations. In appearance the model resembles one of the well-known Hoover machines. The motor is represented by a ½" Pulley, secured by a Pivot Bolt to two 1" Triangular Plates. The handle is attached to the motor by means of a Threaded Pin and a Swivel Bearing, while the dust bag is represented by a Spring. Tilley has built quite an ingenious model, and one that is quite original so far as Meccano competitions are concerned, for I do not recollect seeing an entry of this type in any previous Contest.

Concrete-mixing machines are by no means uncommon subjects for ordinary Meccano models, but it is seldom that they form prototypes of "Simplicity" models. That they can be reproduced remarkably well from only a few parts is shown by the prize-winning entry submitted by J. Thomson. Its construction will be clear from the accompanying illustration.

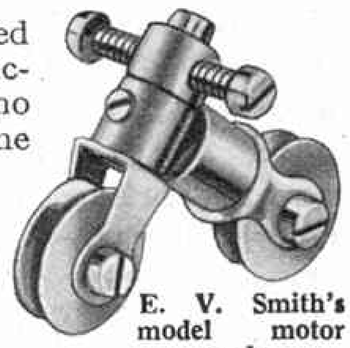
In my opinion the most creditable work in this Contest has been done by H. James, the builder of the dragline illustrated here I think it safe to say that this is the best "Simplicity" model that I have yet seen. Considering his age, James should feel highly proud of the distinction he has most worthily earned in this Contest.

The model represents one of the 120-ton draglines used in the working of a gravel pit belonging to the James Sand & Gravel Company. The construction of the winch and the neat businesslike appearance of the boom, coupled with the ingenious use of a Dredger Bucket for the shovel, all go to make the model full of interest for model-builders.

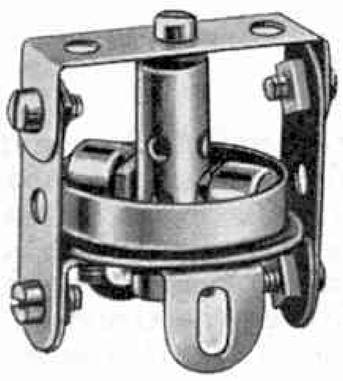
Second Prize in Section B was won by F. Stoakes, who submitted a number of ingenious models, including a field gun, a cabin monoplane, a racing car, and a machine gun and gunner. I hope to reproduce one or two of these models in a special "Simplicity" model-building article in a future "*M.M.*," and for the time being I will say no more about them. I would like to congratulate Stoakes on his drawings, however, in the preparation of which great care and patience is displayed.

A model of a Handley Page "Hannibal" aeroplane, in which the fuselage is formed from Couplings and Collars slipped on a Rod, won Third Prize in Section B, for R. York. The upper and lower wings consist of a 5½" and a 3½" Strip respectively, and realistic bracing is carried out with string.

A model railway breakdown crane attracted my attention, chiefly on account of its constructional details. It was built by T. D. Collier, who was awarded a prize in Section A. Each of the two bogies with which the model is fitted are made from two 1½" Strips bolted to a Double Bracket, which is pivotally attached to a 2½" Strip that forms the base of the superstructure. The wheel axles, of which there are four, are journalled in the end holes of the 1½" Strips.



E. V. Smith's model motor cycle.



A mortar mixer, by J. T. Thomson.

The cab is made from a Channel Bearing, bolted between the ends of a Double Bracket. The last-mentioned part represents the back of the cab, and is held in position by the bolt on which the rear bogie pivots. The front of the cab is made from a Flat Bracket bolted to an Angle Bracket which, in turn, is bolted to the base of the superstructure. The jib is a 1½″ Axle Rod, which carries at its lower end a Swivel Bearing that is connected to the base 2½″ Strip by means of a bolt nipped by the set-screw in the spider of the Swivel Bearing. The jib head is a small Fork Piece, carrying in its arms a ½″ Bolt over which passes the hoisting cord.

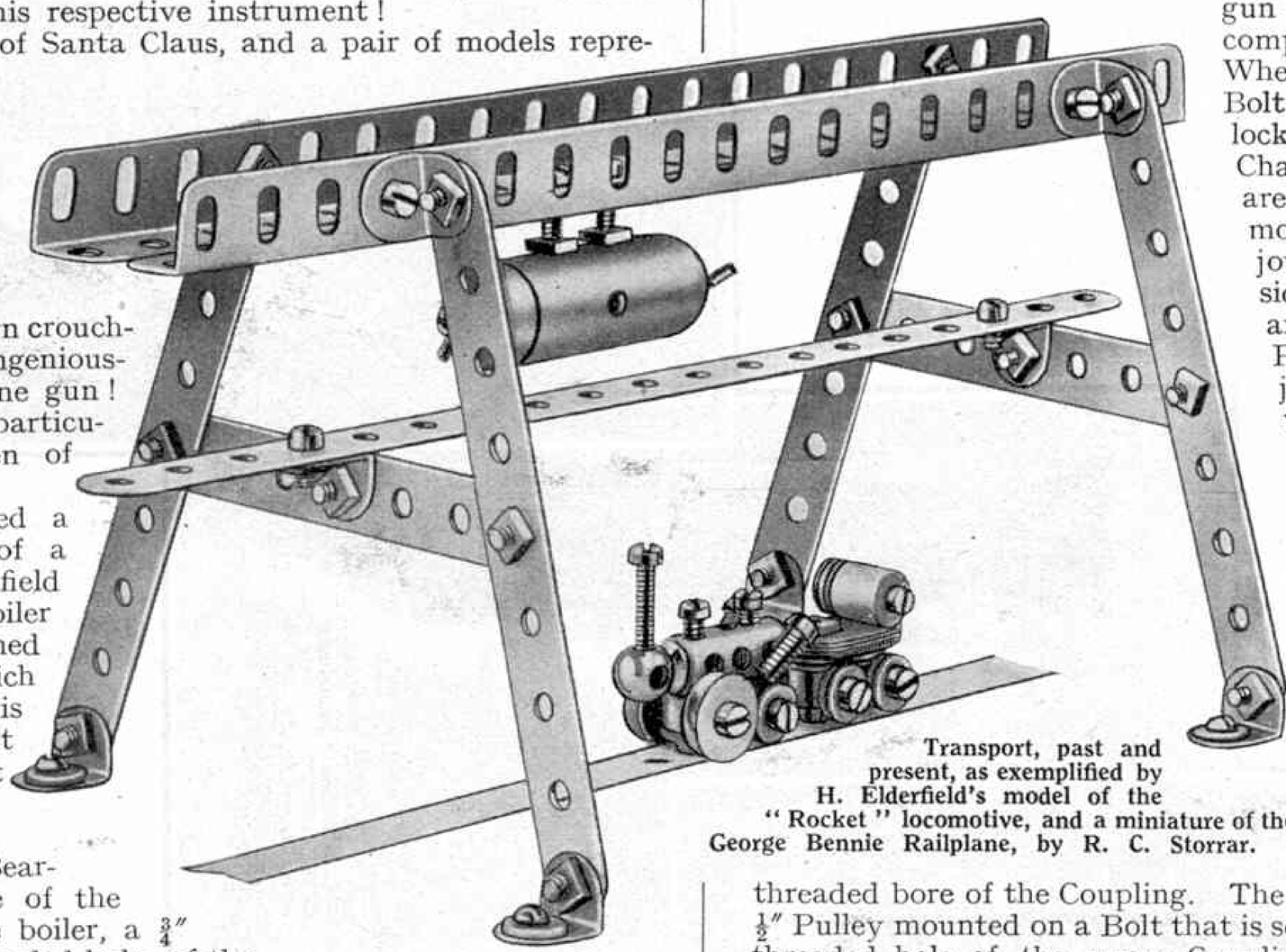
J. P. Smith chose a very novel subject for his prize-winning entry. It is a Meccanoland jazz band. The players include saxophonist, drummer, violinist, pianist, and banjulele player, each complete with his respective instrument!

An amusing figure of Santa Claus, and a pair of models representing respectively a greyhound chasing a rabbit, and a "Chicago gangster," won a prize for H. E. Tomlinson. The gangster (a "man" built up from short Rods and Couplings) is shown crouching by the side of an ingeniously constructed machine gun! This evidently is a particularly vicious specimen of the type.

W. Cawthra earned a prize with models of a traction engine and a field gun. The cab and boiler of the tractor are formed from a Coupling, to which a second Coupling is bolted at vertical right angles. The front wheel axle is attached by means of the spider from a Swivel Bearing to the underside of the Coupling forming the boiler, a ¾″ Bolt in one of the threaded holes of the spider being screwed into the Coupling. The road wheels are journalled on ½″ Bolts secured in the spider. A ¾″ Bolt in one of the end transverse holes of the Coupling representing the boiler makes an admirable chimney.

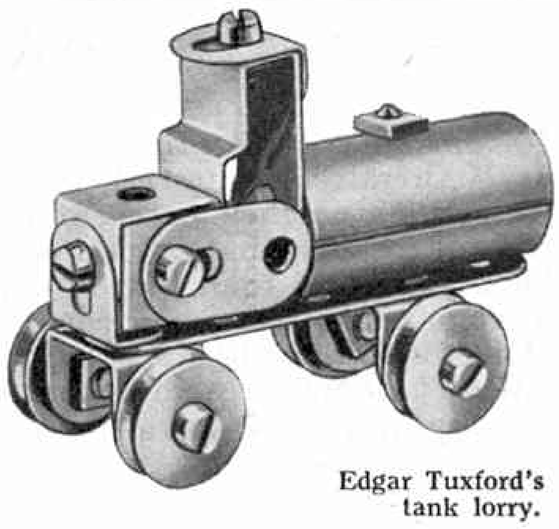
A miniature steam wagon complete with trailer is a sturdy little model built by M. Langlands, and I would have illustrated it if the photograph Langlands submitted had been clear enough for reproduction.

E. Tuxford won his prize with the model tank lorry illustrated here.



Transport, past and present, as exemplified by H. Elderfield's model of the "Rocket" locomotive, and a miniature of the George Bennie Railplane, by R. C. Storrar.

Models of motor cars, locomotives and aeroplanes are good subjects for "Simplicity" efforts, and many models of this type are usually submitted. Some competitors, however, manage to get off the beaten track, and to devise new models. The present Contest produced several models of this kind, and one of the best is an armoured car of the type used to a great extent during the Great War. It was built by E. Mead. The body consists of an inverted Channel Bearing, and the gun (a Threaded Pin) is mounted in a turret, which is free to rotate through a full circle, thus allowing the gun to be aimed to any point of the compass. The turret is a Flanged Wheel loosely mounted on a ¾″ Bolt passed through the Wheel and lock-nutted in the top of the Channel Bearing. The rear wheels are formed of 1″ Pulley Wheels, mounted on a 1″ Rod that is journalled in the holes in the sides of the Channel Bearing, and the front wheels are ½″ Pulleys mounted on bolts journalled in a Double Bracket that is attached by a Flat Bracket to a 1″ Reversed Angle Bracket which, in turn, is bolted to the Channel Bearing.



Edgar Tuxford's tank lorry.

Another good model is a telephone entered by A. Shaw. It is made up from a Coupling and a Threaded Coupling mounted on a 1″ Axle Rod, the Threaded Coupling being secured by means of a Bolt to a 1″ loose Pulley, passed through the Pulley and then screwed into the threaded bore of the Coupling. The mouthpiece of the 'phone is a ½″ Pulley mounted on a Bolt that is screwed into the end transverse threaded hole of the upper Coupling.

The earpiece is a further Coupling to which a ½″ Pulley is attached at one end. The earpiece hangs on a Threaded Pin, which is screwed into the Coupling that supports the mouthpiece.

The model as built by Shaw will not stand upright, owing to the head of the bolt holding the loose Pulley to the Threaded Coupling projecting beyond the edges of the Pulley. This difficulty could be overcome by using a fast Pulley and an ordinary Coupling instead of a Threaded Coupling. The 1″ Rod could then be held by the set-screw of the Pulley, thus eliminating the projecting bolt.

Christmas "Parts Required" Contest (Home Section)

The task of making a correct list of the parts required to build the Meccano model Army Tank that was illustrated on page 984 of the "*M.M.*" for December 1930, proved more difficult than we ourselves anticipated, and no single competitor in the Home Section succeeded in making an absolutely correct list. A few competitors managed to compile fairly accurate lists, however, and the prizes were therefore awarded to them in order of merit, the biggest prize being allotted to the competitor whose list most nearly corresponded with the actual parts used in building the model.

The following competitors secured prizes.

First Prize, Meccano goods value £1-1s.: L. C. H. Willis, London, S.E.9. Second Prize, Meccano goods value 15/-: Colin F. Allen, Thorpe Bay, Essex. Third Prize, Meccano goods value 10/6: R. Nicholas, Portsmouth, Hants.

Six Prizes of Complete Instruction Manuals: William Crichton, Riddrie, Glasgow; J. Hodgson, Goodmayes, Essex; Victor C. Kaile, Mayford; R. Redman, Tonbridge; H. R. Smith, Wallington, Surrey; J. Williams, Llandebie, Carmarthen.

Twelve Prizes of Meccano Engineer's Pocket Books: D. Brown, Aldershot; J. Bell, Ascot; D. Crowley, Birmingham; G. Emery, Birmingham; A. Huben, East Sheen, S.W.14; J. Kirkland, Cambuslang, Lanarks.; J. L. Leeson, Brigg, Lincs.; K. Magee, Eccles, Manchester; E. Mallalieu, Leamington Spa; W. Parfitt, Beckenham; D. Redgwell, Sutton; S. Somerville, London, N.10.

The Overseas results will be published as soon as possible.

In view of the large number of entries received in this Contest further competitions of the same nature will be announced from time to time in the "*M.M.*" and many handsome prizes will be given. Meccano enthusiasts should watch for particulars of the next contest.

First "Errors" Contest (Overseas Section)

In this Contest readers were asked to make lists of all the errors in the design and construction of the Meccano model motor cycle, illustrated on page 887 in the "*M.M.*" for November, 1930.

Success in the contest demanded, of course, a good knowledge of motor cycle construction, in addition to model-building principles.

The biggest prize was awarded to the competitor whose list contained the largest number of errors actually appearing in the model; the second prize to the next highest, and so on. Under this system the following competitors secured prizes:—

First Prize, Meccano goods value £2-2s.: Jack Shanks, Sharbot Lake, Ont., Canada. Second Prize, Meccano goods value £1-1s.: J. A. Gomes, Bandra, Bombay, India. Third Prize, Meccano goods value 10/6: N. Siddall, Kimberley, S. Africa.

Six Prizes, of Meccano goods value 5/-: A. Harvey, Gisborne, N.Z.; W. G. Hobbs, Pretoria, S. Africa; C. J. McCain, Leichhardt, Sydney, Australia; J. David Siddons, Wainwright, Alberta, Canada; C. W. Sharpe, Nelson, New Zealand; B. D. H. J. Silva, Kotahena, Colombo, Ceylon.

Six Prizes, of "*Famous Trains*" by C. J. Allen: P. L. Bargellini, Florence, Italy; Alan Mack, Pietermaritzburg, Natal, S. Africa; R. A. P. Misra, Rewa, Central India; D. Maver, Brooklyn, Maitland, S. Africa; E. C. Stonyer, South Canterbury, New Zealand; D. C. Tzitzinias, Salonica, Greece.

As in the Home Section several competitors included errors that did not actually exist in the model, but speaking generally, competitors found the task of compiling comprehensive lists quite easy. Many mistakes were due to competitors choosing a definite prototype for the Meccano model, and not taking into consideration the variations in design of the numerous types of machines now on the road.

"Aircraft" Contest (Overseas Section)

IN announcing the prize-winners in the Overseas Section of the "Aircraft" Contest, I wish to congratulate Overseas competitors on their excellent model-building ability. They will be glad to know that on this occasion their work reached an even higher standard than that of competitors in the Home Sections, a very creditable achievement when one remembers the fine Home Section models, a selection of which were illustrated in the "*M.M.*" for March. Home competitors must look to their laurels!

The full list of prize-winners in the Overseas Section is as follows:—

FIRST PRIZE (Cheque for £3-3s.): K. Tanner and C. Robert (joint award), Kenilworth, Johannesburg, South Africa. SECOND PRIZE (Cheque for £2-2s.): P. Tombeux, Courtrai, Belgium. THIRD PRIZE (Cheque for £1-1s.): J. O. Roca, Barcelona, Spain.

SIX PRIZES (Meccano goods value 10/6): A. Robert, Turffontein, Johannesburg, South Africa; Allan Lancefield, Saskatoon, Saskatchewan, Canada; J. van der Deure, Bennekom, Holland; Edgar Bridgland, Calgary, Alberta, Canada; F. Brook, Sea View, Natal, South Africa; W. M. Flanderka, Bambalapituja, Colombo, Ceylon.

TWELVE PRIZES (Meccano goods value 5/-): F. Pantanella, Rome, Italy; P. L. Bargellini, Florence, Italy; E. C. Stonyer, Kakahu, South Canterbury, New Zealand; D. N. Parton, Elizabeth Bay, Sydney, Australia; V. C. Gracie, Plumstead, Cape, South Africa; J. B. G. Ringnalda, Leeuwarden, Holland; G. A. Laskaris, Athens, Greece; A. E. Brightwell, Morrinsville, Auckland, New Zealand; C. A. Myers, Christchurch, New Zealand; E. Bonnici, Valletta, Malta; Charles Galdes, Valletta, Malta; Salvatore Galdes, Valletta, Malta.

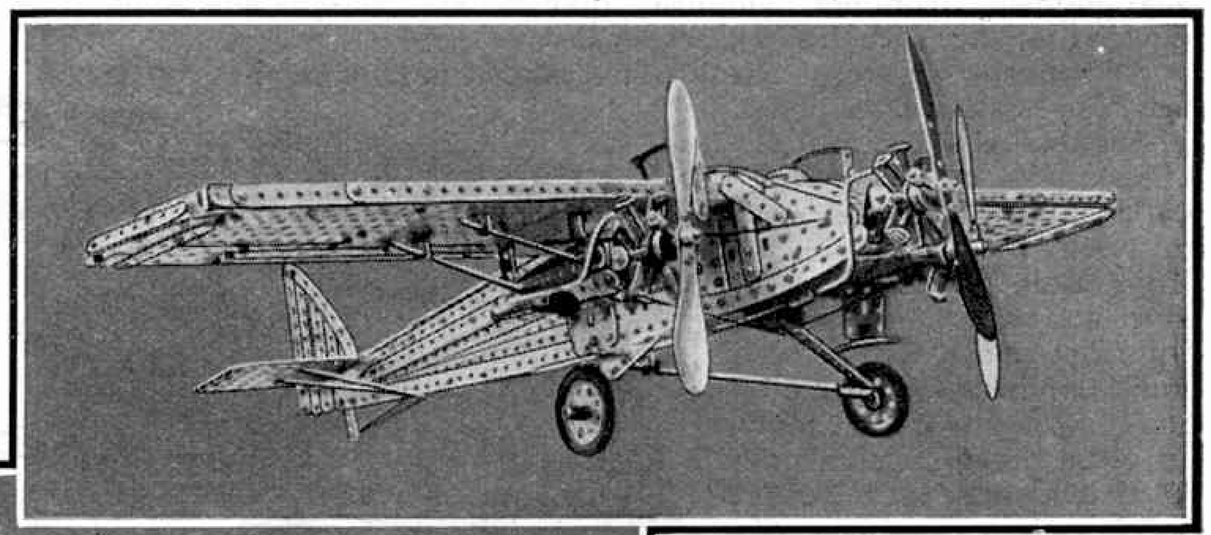
SPECIALLY COMMENDED (Certificate of Merit and Engineer's Pocket Book): V. M. Noguera, Buenos Aires, Argentine; K. McKay, Westmount, Quebec, Canada; E. Smith, Clifton, Johannesburg, South Africa; Pete Anagnostopoulos, Athens, Greece; J. J. Pienaar, Johannesburg, South Africa; Don Redman, Calgary, Alberta, Canada; W. Figgins, Timaru, New Zealand; E. Cardale, Wellington, New Zealand; Harry Maud, Petone, New Zealand; K. J. Orams, Blenheim, New Zealand; Walter Fagg, Milton, Otago, New Zealand; Donald Murray, Rondebosch, South Africa; A. Johnstone, Piora, via Casino, N.S.W., Australia; B. D. H. J. Silva, Kotahena, Colombo, Ceylon.

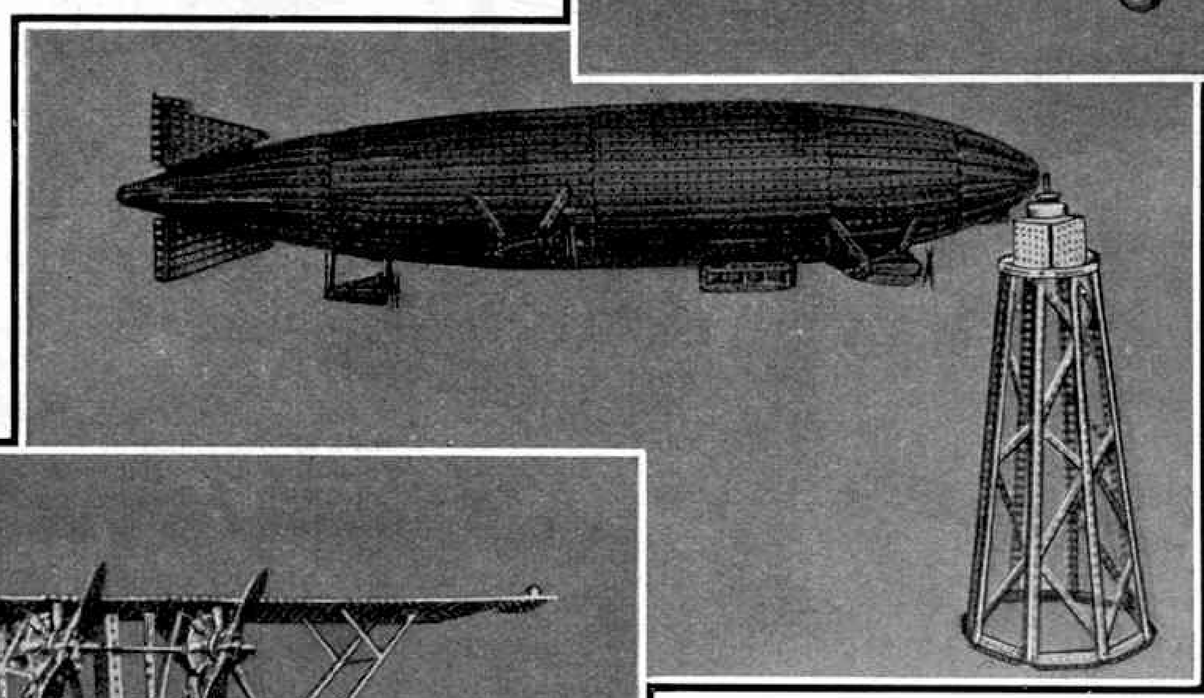
The majority of Meccano boys, no doubt, could design and build fine large models if they had sufficient parts at their disposal, but unfortunately their limited supplies of Strips and Girders, etc., prevent them from attempting very big models. These boys might well follow the example of C. Robert and K. Tanner of Johannesburg, who, in order to increase the resources at their command combined their Outfits, and built a splendid model of the R.101, which is illustrated herewith. As a result they secured First Prize in the Overseas Section of the "Aircraft" Contest. Incidentally, their success brings to mind the old saying "two heads are better than one," for it is quite probable that if these competitors had submitted separate models neither would have won a prize, simply because the wealth of constructional detail, which is a vital necessity in large models, would necessarily have been absent. The length of the model R101 is nearly 4 ft. and it weighs no less than 30 lb.

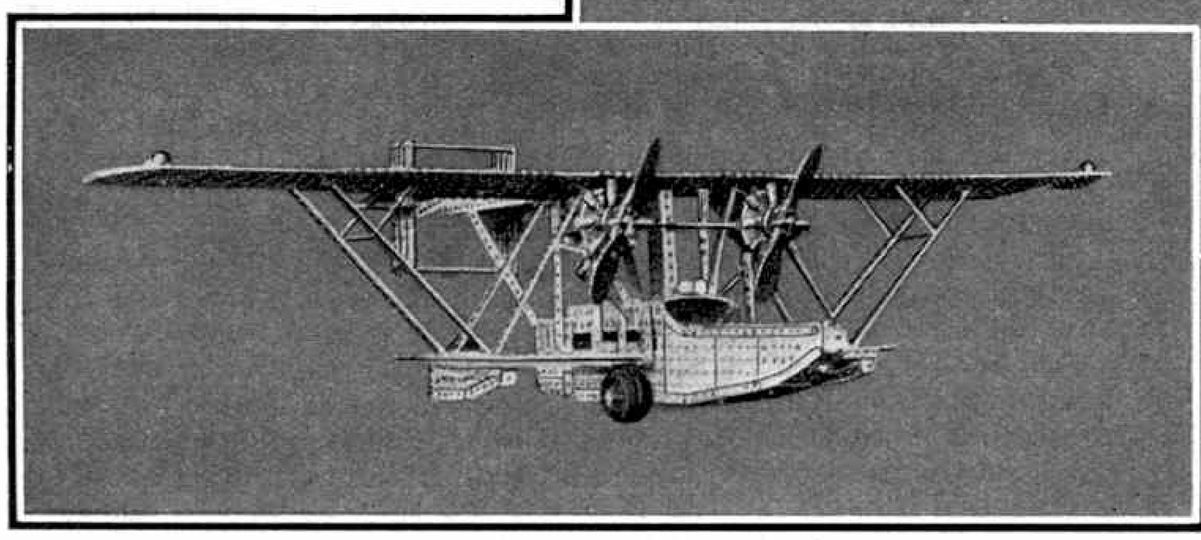
The ribs for the framework are made up as follows. In the nose of the airship is a Hub Disc followed by a Circular Strip (old type). Next to this is a built-up circular girder of the same diameter as the new Circular Strip. This is followed by a second Circular Strip (old style), and then comes another circular girder. Strips are bolted to all of these members to form the outer casing. A Clockwork Motor is secured inside the model, and operates through a system of Bevels, the propellers on each of the five engine cars. Windows are well represented at the sides of the ship by Windmill Sails, and a passenger gangway is formed from a Channel Bearing. A Coupling, fixed to a compound Axle Rod that passes from the nose right through to the tail of the ship, makes an admirable mooring eye, by means of which the airship is made fast to its mooring mast.

The mooring mast is built up from 18½" Angle Girders bolted to eight 3½" Angle Girders at the base. The 18½" Angle Girders are joined at their upper ends to Hub Discs, and a drum is formed from 2½" × 2½" Flat Plates made up into a box and crowned with a Boiler End and a 1⅛" Flanged Wheel, the whole being held in position by a compound Rod passing right through the structure. The mooring eye of the airship fits over the top of this Rod when in position.

While on the subject of airships, I must mention another model of this kind that won the Third Prize for J. O. Roca. Although only a small model, it is a remarkably clean job, and it is unfortunate that the photograph submitted is unsuitable for reproduction.







Top: J. B. G. Ringnalda's "Westland Wessex" monoplane. Centre: The fine model of the R.101, built by C. Robert and K. Tanner, Johannesburg. These competitors were awarded First Prize. Bottom: A good model of a "Sikorski S.38" amphibian aircraft, by Pierre Tombeux.

The model is 5½" in diameter at the widest part, and 25" in length, and with the exception of the control cabin is composed chiefly of Strips. The control cabin is made from Angle Girders, the elongated holes of which make realistic windows. Couplings joined to Handrail Supports are used for each of the four engine cars.

The Second Prize was well earned by Pierre Tombeux, with a good model of the Sikorski S.38, a nine-seater amphibian aircraft suitable for either commercial or naval purposes. The model is shown herewith. The two Pratt and Whitney "Wasp" engines of the prototype are represented in the model by two units of eight Worms each bolted round a Bush Wheel, with an exhaust system of Spring Cord "pipes." The "engines" are carried on a well braced framework of Rods and Swivel Bearings, anchored to both the upper and lower planes. The two airscrews are driven from an Electric Motor housed in the hull, and the engine nacelles are neatly streamlined with Strips. Twin wheels, formed from 1½" Pulleys and shod with Dunlop Tyres, are fitted. The somewhat unorthodox design of the craft can be better explained by describing briefly the actual machine.

The wing design combines the good qualities of the monoplane with the constructional advantages of the biplane, the main wing being supported by struts from a very small lower wing or stub plane. The tail surfaces are supported on outriggers connected to the main wing by a pair of struts from the rear of the hull. The hull has a length of 30 ft., and beam of 5 ft. 2 in. The hull displacement is 24,500 lbs. and it has a maximum width over chines of 6 ft. 10 in.

W. M. Flanderka's entry is a model of a dual control "Cherub"-engined Bristol "Brownie" monoplane.

Quite a neat and well-built model is that entered by Allan Lancefield. It represents a Fairchild monoplane, and it is particularly interesting on account of its soundly constructed fuselage, which is built up from various lengths of Strips. The "engine" is made from a 3" Pulley Wheel, to which two Strips are bolted by means of Angle Brackets, the Strips being bent into circular form of such a diameter as to grip securely around the outside of a Boiler End. The airscrew is formed from two Meccano Propeller Blades, bolted to a Bush Wheel, which is secured on a short Rod journalled in the centre hole of the Boiler End and held in place by means of Collars.

(*Continued on page 401*)

In this page we reply to suggestions for new and improved Meccano parts that are submitted by readers. We receive many hundreds of these suggestions, and in order to provide additional interest for contributors we are offering a prize of 10/- for the best idea sent in during each month. Any number of ideas may be submitted by each reader, but each suggestion must be written on a separate sheet of paper, and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

MAGNETISED SCREWDRIVER.—We have received a number of queries regarding the method of magnetising the screwdrivers by means of a solenoid connected to an accumulator, mentioned in this page of the March issue. The following information will be of use to model-builders. The Meccano Screwdrivers can be magnetised by winding a coil of about 50 yds. of 26 S.C.C. wire around the shaft of the Screwdriver, and connecting the ends of the coil to a 6-volt Accumulator. A coil consisting of 25 yds. of No. 23 S.C.C. wire can also be used if a battery of not more than 2-volts (a single cell of an accumulator for instance) is connected to the coil. If it is required to magnetise the Meccano Special Screwdriver (the blade of which can be passed through a standard hole), a Meccano reel of 50 yds. of 26 S.C.C. wire (electrical part No. 313) can be slipped over the blade intact, and the ends of the wire connected to the accumulator. Readers will note that 50 "turns" were mentioned in the March paragraph, but this should have read "yards." If insufficient wire is used for the magnetising coil too large a current will flow from the accumulator. (*Reply to A. J. Roberts, Leytonstone, E.11; R. H. Radcliffe, Harrow, and others*).

IMPROVED SWITCH ARM.—The "stop, start and reverse" switch fitted to the Meccano No. 6 Motor is provided with three perforated arms arranged at right angles to each other. Strips and other parts may be secured to these arms so that the Motor can be controlled from various positions in a model. These arms project only ½" outside the Motor casing and it is very rarely that they get in the way in a model. Your suggested modification to the switch, however, would make it slightly more compact. Your idea would be to provide the switch with only one perforated arm, and arrange the pivot so that the arm could be locked in either a vertical or a horizontal position. This idea is quite ingenious and we hope to give it consideration. (*Reply to J. P. Smith, Kings Lynn*).

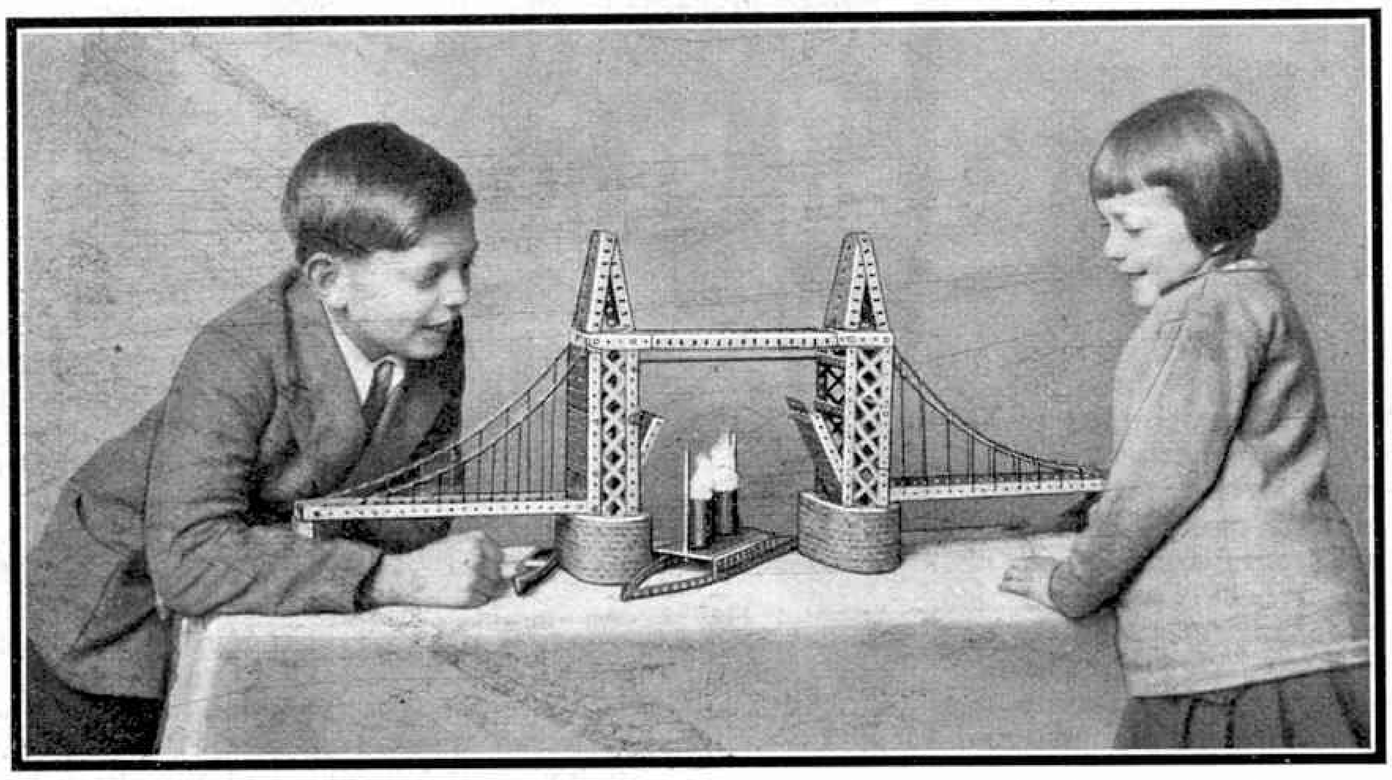
SLOTTED STRIP.—In order to increase the adaptability of the standard Strips you suggest that the ½" equidistant holes should be connected by slots approximately 1/16" wide. Special bolts having their shanks shaped so that they could be passed in the slots, would be used with these special strips. By bolting two of the special strips together and adjusting the securing bolts in the slots as required, it would be possible to obtain a wide range of lengths. This scheme possesses possibilities, and we shall give it careful attention. (*Reply to A. C. and S. C. Ellis, Northampton*).

MINIATURE INSULATORS.—Small porcelain or ebonite insulators fitted with a screwed metal shank for attachment purposes, might be of use in electrical mechanisms. It is doubtful whether these insulators would possess any advantages over the Fibre Bush and Washer insulation scheme at present used in the Meccano system, and it appears to us that the existing method of insulating parts from each other is more widely adaptable than your proposed method. We are nevertheless keeping your idea in mind (*Reply to T. Stokes, Cambridge*).

FEATHERED SHAFTING.—Your idea for securing special strips of metal to the standard Axles, has possibilities. The strips would be clamped to the standard axles by means of special collars. Gears and Pinions, having their bosses suitably keyed, could be moved up and down on the shafts. We shall consider this idea. (*Reply to A. A. Sutton, Cremorne, N.S.W., Australia*).

HOIST BARREL.—A drum on which cord could be wound would be useful in models of cranes and hoisting mechanisms of various kinds. It is not really necessary to introduce a special part for this purpose, however, as hoist barrels or drums can be devised from existing parts. Quite an efficient barrel can be formed by securing a Meccano Wood Roller (part No. 106) between two Pulleys or Face Plates. A small barrel can also be formed from a Sleeve Piece and two ¾" Flanged Wheels. Although a hoist barrel can be reproduced in this way, we are keeping your idea in mind as a specially manufactured barrel would possess certain advantages not to be found in the built-up pattern. (*Reply to F. Johnson, Manchester*).

LARGE BUFFERS.—Meccano 1" fast Pulleys make excellent buffers for large models of locomotives, buffer stops, etc. (see the Meccano Baltic Tank Locomotive Super Model No. 15). If it is required to reproduce Buffers of the "spring type" the Pulleys can be mounted on Axle Rods and controlled by means of Compression Springs. (*Reply to J. R. Moulsdale, Hull*).



Pride of craftsmanship ! Our photograph shows two young Meccano enthusiasts, Arthur Davey and his sister Mildred, of Wood Green, London, proudly inspecting their handiwork—a splendid model of the Tower Bridge complete with bascules and approach spans.

Operating a model after it has been built provides one of the greatest pleasures of the Meccano hobby, as will be evident from the happy expressions on the faces of these clever young constructors.

ELECTRIC RADIATOR.—The construction of apparatus from Meccano parts for working from the mains is not advisable, owing to the danger of the high voltage, and the difficulty of providing adequate insulation. We note that you have been experimenting with the construction of an electric fire using Meccano parts for the framework, and you suggest we supply special resistance elements and reflectors to enable electric heaters of various kinds to be built up. We are unable to consider this for the reasons stated above and we would impress on you the danger of carrying out experimental work using the house lighting mains when parts not specially designed for high-voltage work are employed. (*Reply to F. C. Hutchison, Oxford*).

INSULATING PLATES.—Your suggestion for perforated plates made from insulating material will be considered. (*Reply to P. B. Aitken, Stamford*).

DRIVING BELTS.—Elastic bands are excellent for use as "transmission belting" between two Meccano Pulley Wheels. The difficulty with these bands, however, is that they are effective only when stretched to a certain tension, and when either too slack or too tight, do not transmit the drive effectively. This necessitates the use of a very large range of sizes of bands if the transmission system is to fulfil all requirements. We therefore consider it better to form endless transmission belts for use with the Pulleys from suitable lengths of Meccano cord. We would also remind you that the Meccano Spring Cord can be used effectively as a transmission belt with the Pulley Wheels. You should couple the Cord together with the special Spring Cord Coupling Screw (part No. 58a). (*Reply to R. Dawson, Manchester*).

MULTIPLE-THROW CRANKSHAFT.—A very satisfactory small multiple-throw crankshaft can be built up from Meccano Double Arm Cranks and short Axle Rods, while a crankshaft with an even smaller throw can be assembled from Collars and short Rods (see Suggestions Section for July, 1930, Miscellaneous Suggestion No. M.91). Crankshafts built up in this way are, in the main, more adaptable than specially manufactured multiple-throw shafts, and we think you will find the built-up article very satisfactory. (*Reply to R. S Davis, Weston-super-Mare*).

SPECIAL RODS.—Rods having each end threaded for a short distance would have a very limited application. The existing range of Threaded Rods fulfil all the functions of your proposed rods very efficiently. (*Reply to R. Glover, Grimsby*).

THREADED BUSH WHEEL.—A bush wheel fitted with a threaded bush could be used as a support for a Threaded Rod in a screw adjustment mechanism. The function of this part is, however, covered by the Meccano Threaded Crank (part No. 62a), and a Coupling can also be used for this purpose in certain mechanisms. A Bush Wheel of this type would, however, provide a very neat and solid support for a Threaded Rod and we are keeping your idea in mind for further consideration. (*Reply to W. E. Miles, Norwich*).

BRAKE BANDS.—We note your idea that we should introduce special semi-circular members that would be fitted around the flange of the large Flanged Wheel and suitably pivoted so that a compact external-contracting brake could be built up. A screw-operated double band brake is described under S.M. 106 in the Standard Mechanisms Manual (see page 20), and in this Strips are used as the adjustable brake bands. Your proposed brake assembly would, however, be more compact than S.M. 106 and we shall keep your idea in mind. (*Reply to E. Coker, Lancaster*).

MILLED KNOB.—A metal knob suitably milled or kurled so that it could be gripped easily by the fingers would be of use in screw adjustment mechanisms. We are keeping your idea in mind, but we would at the same time point out to you that a Meccano 1" Gear Wheel makes an excellent control knob, the teeth of the wheel providing a very good grip for the fingers. A Meccano ½" Pinion Wheel may be used similarly when a small knob is required. (*Reply to R. Corton, Edinburgh*).

METAL FOIL.—Metal foil for covering models can be obtained from any metal merchant. (*Reply to J. Westhuijzen, Springfontien, South Africa*).

The best idea sent in during the month of March was for a new type of trunnion. This part was suggested by two model-builders, J. A. Rodriguez, of Montreal, Canada, and P. G. W. Walker, of Harrow. The monthly prize of 10/- has therefore been divided between these two competitors.

New Meccano Models

Coal Tipper—Variable Condenser—Mortar Mill—Mouse Trap—Motor Chassis

OUR collection of new Meccano models this month is a very varied one. First there is an ingenious working model of a coal tipper (see Fig. 1); this model may be used in conjunction with a Hornby layout. In Fig. 2 is shown a variable air-dialectric condenser constructed entirely from Meccano parts; model-builders who are also radio enthusiasts will find this useful. The model mortar mill and mouse trap shown in Figs. 3 and 5 respectively are both "working" models. The motor chassis illustrated in Figs. 4 and 6 completes the collection. This model will be welcomed by those model-builders who wish to build a simple chassis incorporating some of the mechanisms found in an actual car.

Automatic Coal Wagon Tipper

Speed in handling is the controlling factor of economy in all problems of modern transport, and many ingenious mechanical devices have been invented within recent years for speeding up the handling of various kinds of merchandise. One of the most interesting of these is the mechanical coal tipper, a Meccano model of which is illustrated in Fig. 1.

The prototype of the Meccano model is used in many dock sidings for the speedy discharge of coal, etc., from railway wagons into barges or steamers at the dockside. The model will add a realistic touch to a Hornby Train layout.

Each of the main vertical columns consists of a $12\frac{1}{2}''$ and a $5\frac{1}{2}''$ Angle Girder overlapped three holes. The platform carrying the truck is constructed from $5\frac{1}{2}''$ Strips, and it slides freely between the upright members. Four cords of equal length attached to each corner of the platform are taken over Pulleys at the top of the structure and are wound round each of the Rods 4. A 57-teeth Gear Wheel is mounted on each of the shafts 4, and a $\frac{1}{2}''$ Pinion secured on the Rod 5, meshes with both Gear Wheels. The Rod 5 is rotated by means of a Crank Handle coupled to the shaft 5 by two Sprocket Wheels and an endless length of Sprocket Chain.

The Hornby truck rests on a pair of rails consisting of $5\frac{1}{2}''$ Strips 1, which are pivoted at their front ends on $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. A Strip 2 is secured to a transverse Strip fixed across the rails, and a length of cord is tied to its end, so that when the platform reaches a certain height the truck is tipped. A Spring 3 is attached to a length of cord in order to keep the platform in a horizontal plane when the truck tips.

To keep the truck in place on the rails, a pivoted Strip 6, with a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket attached at one end, can be swung round so that the Angle Bracket engages with the back of the truck. Further $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets on the top of the vertical Strips are arranged to engage with the top edges of the truck.

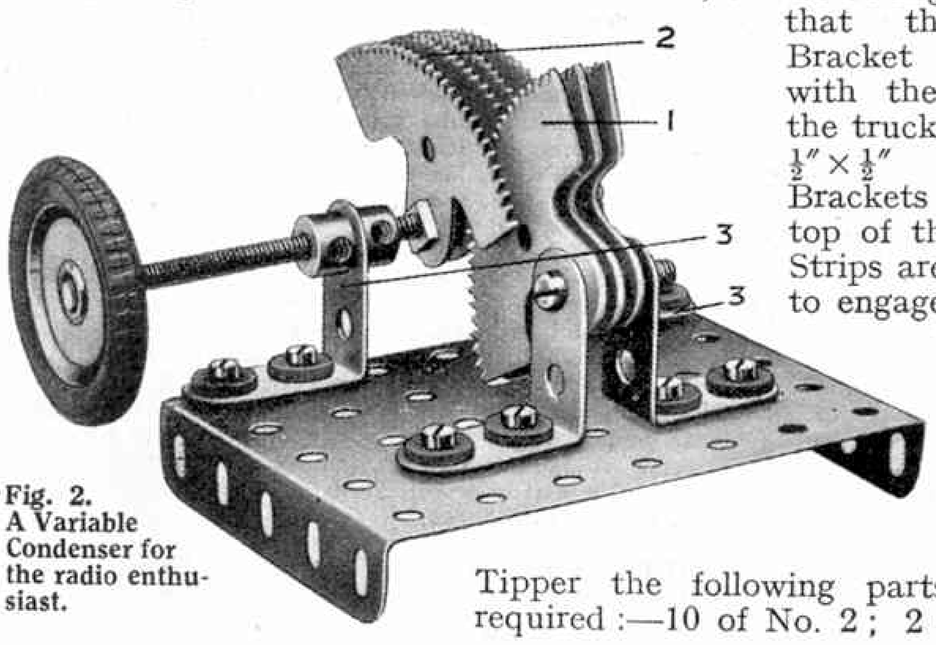


Fig. 2. A Variable Condenser for the radio enthusiast.

In order to construct the Coal Tipper the following parts will be required:—10 of No. 2; 2 of No. 3; 6 of No. 4; 9 of No. 5; 4 of No. 8; 4 of No. 9; 21 of No. 12; 3 of No. 14; 3 of No. 15; 1 of No. 19s; 1 of No. 22; 3 of No. 22a; 1 of No. 26; 2 of No. 27a; 12 of No. 35; 85 of No. 37; 9 of No. 37a; 6 of No. 38; 1 of No. 40; 1 of No. 43; 1 of No. 46; 3 of No. 48a; 2 of No. 52; 1 of No. 53; 1 of No. 54; 9 of No. 59; 30″ of No. 94; 1 of No. 95; 1 of No. 96a; 2 of No. 100; 2 of No. 111; 1 of No. 115; 2 of No. 126.

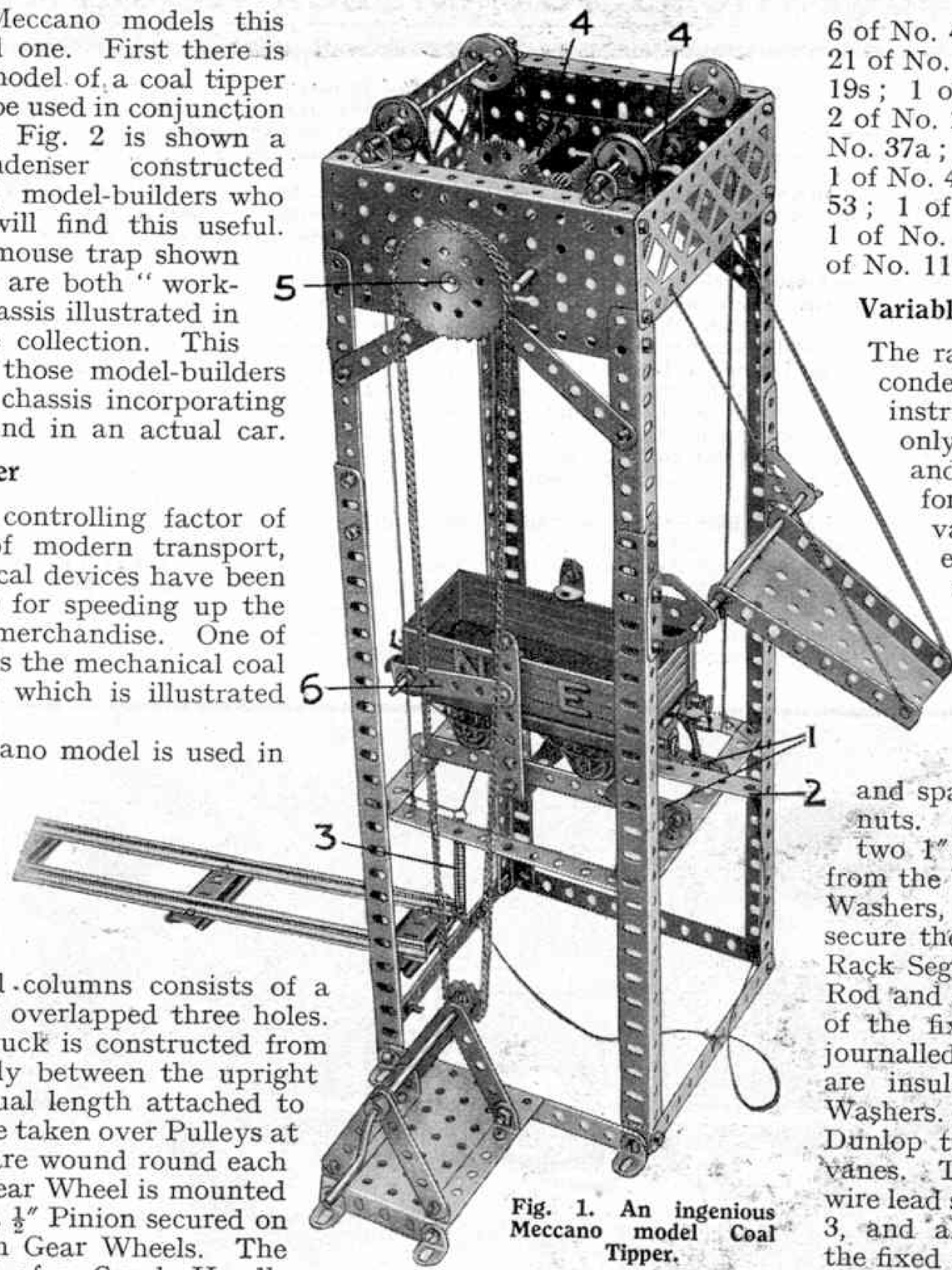


Fig. 1. An ingenious Meccano model Coal Tipper.

Variable Condenser

The radio experimenter will find the variable condenser shown in Fig. 2 a handy little instrument. The condenser is fitted with only three fixed and four moving "vanes" and it does not possess sufficient "capacity" for tuning the aerial coil of a crystal or valve receiver. It can, however, be employed in conjunction with a large variable condenser to give a "vernier" adjustment of capacity. Other uses for the device are as a balancing or neutralising condenser and as a reaction condenser.

The Rack Segments 1 forming the fixed vanes are clamped on a $\frac{3}{4}''$ Bolt, and spaced apart from each other by means of nuts. The fixed vane assembly is supported on two $1'' \times 1''$ Angle Brackets that are insulated from the base by means of Insulating Bushes and Washers, 6 B.A. Bolts and Nuts being used to secure the Brackets in place. The second set of Rack Segments 2 are secured on a $3\frac{1}{2}''$ Threaded Rod and spaced by means of nuts as in the case of the fixed vanes. The $3\frac{1}{2}''$ Threaded Rod is journalled in the $1'' \times 1''$ Angle Brackets 3 which are insulated from the base by Bushes and Washers. A 1″ fast Pulley fitted with a 1″ Dunlop tyre is used for controlling the moving vanes. To connect the condenser in circuit a wire lead should be attached to one of the Brackets 3, and also to one of the Bracket ssupporting the fixed vanes.

The parts that will be required for the Variable Condenser are:—4 of No. 12a; 1 of No. 22; 10 of No. 37a; 1 of No. 53; 3 of No. 59; 1 of No. 80a; 1 of No. 111a; 7 of No. 129; 1 of No. 142c; 8 of No. 302; 8 of No. 303; 3 of No. 304; 8 of No. 305.

Mortar Mixer: A Novel Meccano Model

The counterpart of the Meccano model shown in Fig. 3 is often to be found near the site of a building under construction. An actual mortar mixer is generally driven from a mobile petrol tractor by means of a belt or chain, and the Meccano model can be set in motion by coupling a Meccano Clockwork or Electric

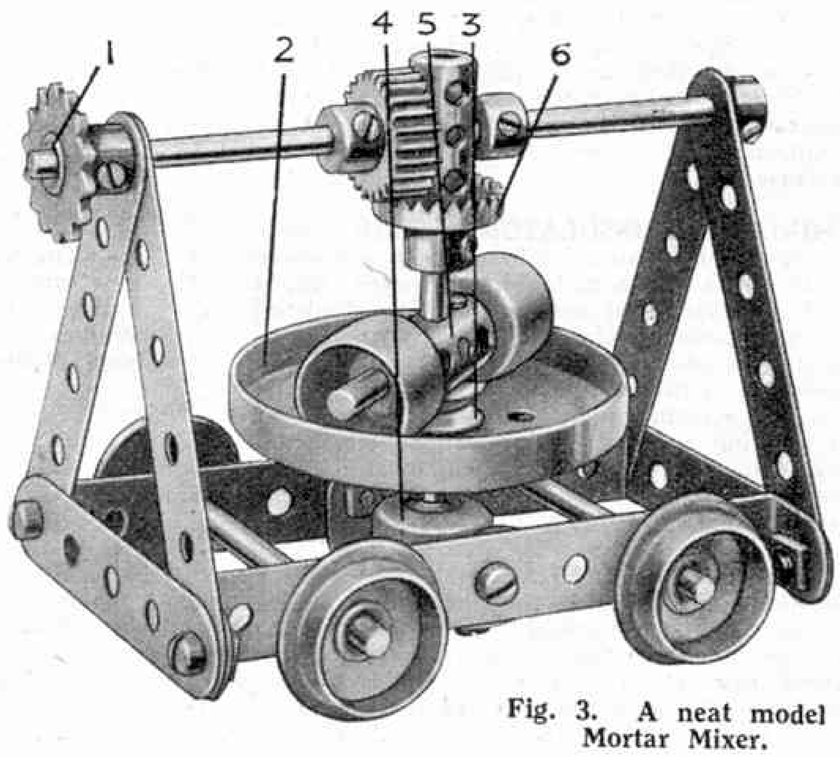


Fig. 3. A neat model Mortar Mixer.

Motor to it by means of an endless length of Sprocket Chain.

The road wheels are carried on $2\frac{1}{2}''$ Rods journalled in two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, which are secured together at their ends by means of $2\frac{1}{2}''$ Strips. The Rod carrying the $\frac{3}{4}''$ Sprocket 1 is journalled in the top holes of two 3″ Strips bolted to the $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips carrying the road wheels.

The Wheel Flange 2 is clamped between a $\frac{1}{2}''$ fast Pulley 3 and a Socket Coupling 4, the boss of the Pulley being secured in the Socket Coupling. The lower end of the Socket Coupling fits over the boss of a Double Arm Crank that is secured by means of two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets to the frame of the model.

The Rod, carrying the Coupling 5 and Contrate 6, is journalled in a Coupling at its upper end, and in the $\frac{1}{2}''$ fast Pulley 3 at its lower end.

In order to build the Mortar Mixer the following parts will be required :—4 of No. 4 ; 2 of No. 5 ; 2 of No. 12 ; 1 of No. 15a ; 2 of No. 16a ; 1 of No. 18a ; 2 of No. 18b ; 4 of No. 20b ; 1 of No. 23 ; 1 of No. 25 ; 1 of No. 29 ; 8 of No. 37 ; 2 of No. 48b ; 4 of No. 59 ; 1 of No. 62b ; 2 of No. 63 ; 1 of No. 96a ; 1 of No. 137 ; 2 of No. 164 ; 1 of No. 171.

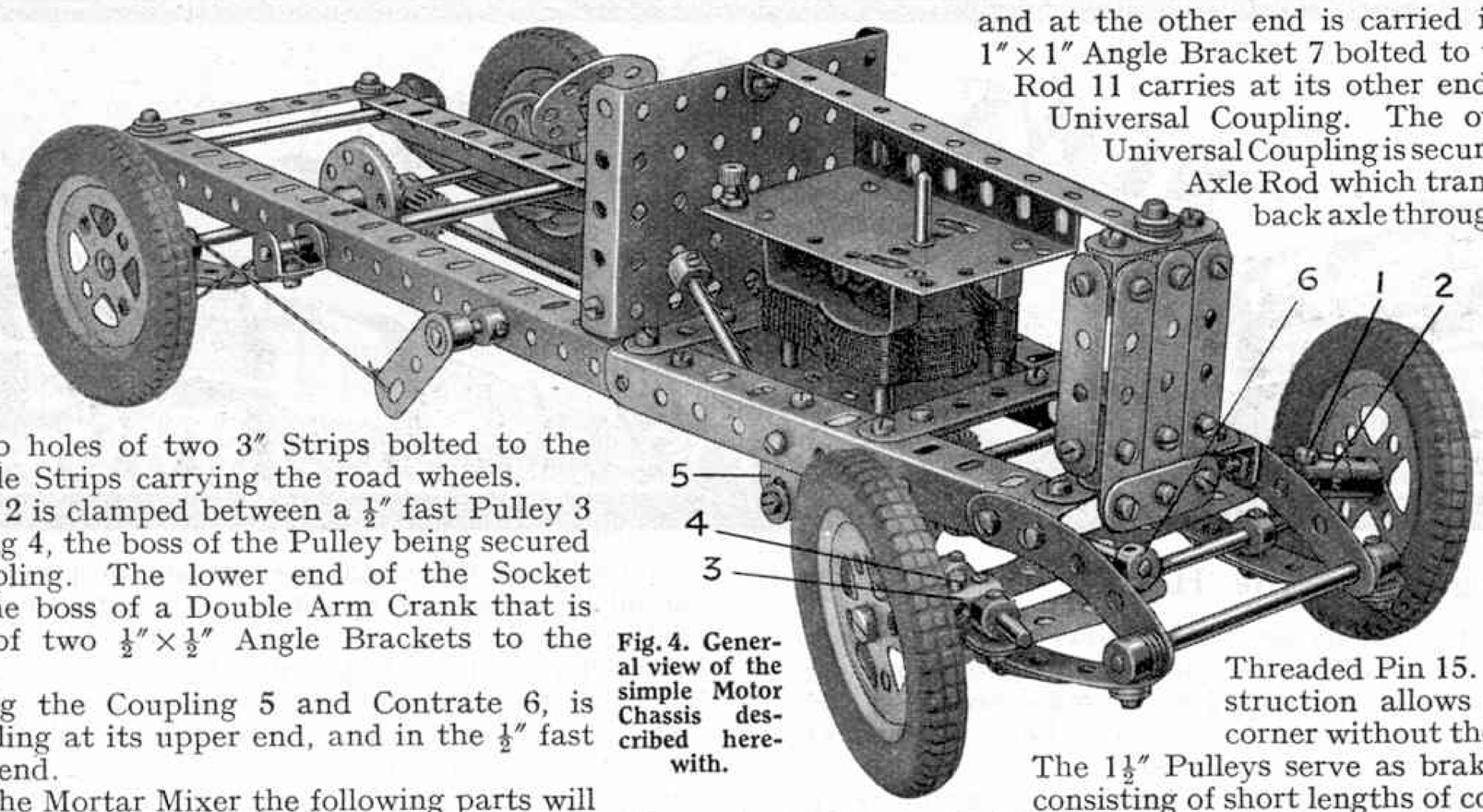


Fig. 4. General view of the simple Motor Chassis described herewith.

A Practical Meccano Mouse Trap

The death-dealing "weapon" shown in Fig. 5 is a remarkably efficient instrument and woe betide the adventuresome rodent who endeavours to sample a dainty morsel of cheese placed on the hook!

A $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is secured across the centre of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and a $2\frac{1}{2}''$ Strip is pivotally attached to each end by means of a $\frac{1}{2}''$ Bolt and two nuts. The $2\frac{1}{2}''$ Strips are connected together by a $2\frac{1}{2}'' \times 1''$ Double Angle Strip. A Double Bracket, secured to the Plate, forms a journal for a sliding $3\frac{1}{2}''$ Rod carrying at one end a Collar and at the other end a Coupling, in the end transverse hole of which a 1″ Rod is held. This Rod forms a "catch" and engages the centre hole of the $2\frac{1}{2}'' \times 1''$ Double Angle Strip, and the Collar at the other end of the Rod is engaged by a $1\frac{1}{2}''$ Strip pivoted by its centre hole on a $\frac{1}{2}''$ Bolt passed through a Single Bent Strip. A second $1\frac{1}{2}''$ Strip carries a hook made from a length of wire, on which the bait is placed.

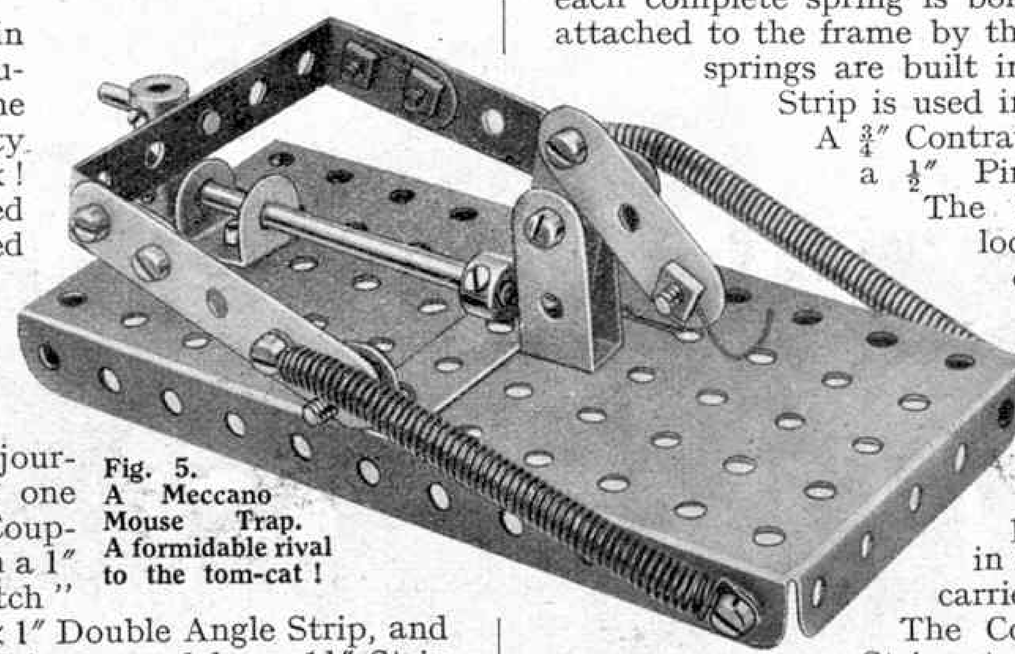


Fig. 5. A Meccano Mouse Trap. A formidable rival to the tom-cat!

Immediately a mouse touches the bait, the movement is transmitted through the $1\frac{1}{2}''$ Strips to the sliding Rod, which, in turn, releases the catch, thus allowing the Springs shown in Fig. 5 to pull the $2\frac{1}{2}''$ Strips over sharply so that the mouse is trapped between the Double Angle Strip and the base plate.

The Meccano Mouse Trap contains the following parts :—2 of No. 5 ; 2 of No. 6a ; 1 of No. 11 ; 1 of No. 16 ; 1 of No. 18b ; 11 of No. 37 ; 5 of No. 37a ; 4 of No. 38 ; 2 of No. 43 ; 1 of No. 46 ; 1 of No. 48 ; 1 of No. 52 ; 1 of No. 59 ; 1 of No. 63 ; 1 of No. 102 ; 2 of No. 111 ; 1 of No. 111c.

Electrically-Operated Motor Chassis

The model chassis shown in Figs. 4 and 6 has a distinctly "sporty" appearance. The model is driven by an E1 Electric Motor and incorporates correct Ackermann steering, contrate and pinion transmission and semi-elliptic springs for front and back axles.

The E1 Electric Motor is secured to the chassis by bolting it to a 3″ Strip near the radiator, and clamping it to a $3\frac{1}{2}''$ Strip situated under the dashboard. A Worm on the armature spindle on the underside of the Motor meshes with a $\frac{1}{2}''$ Pinion mounted on one end of the $2\frac{1}{2}''$ Rod 11. This Rod is journalled at one end in a Double Bracket secured to a $1'' \times \frac{1}{2}''$ Angle Bracket 8, and at the other end is carried in the top hole of a $1'' \times 1''$ Angle Bracket 7 bolted to two $3\frac{1}{2}''$ Strips. The Rod 11 carries at its other end, one section of the Universal Coupling. The other section of the Universal Coupling is secured on the end of a 5″ Axle Rod which transmits the drive to the back axle through a $\frac{1}{2}''$ Pinion and $1\frac{1}{2}''$ Contrate. A $1\frac{1}{2}''$ Pulley, and a 2″ Pulley fitted with a Dunlop Tyre, are secured at one end of the back axle, and the other end carries similar Pulleys, but they are not secured on the Rod, connection between them being made by a Threaded Pin 15. This method of construction allows the car to turn a corner without the aid of a differential.

The $1\frac{1}{2}''$ Pulleys serve as brake drums, the brakes consisting of short lengths of cord, passed round the Pulleys and tied to Cranks secured on a $4\frac{1}{2}''$ Rod that is journalled in the sides of the chassis. This Rod carries also a Coupling fitted with a Rod which forms the brake lever.

Each of the front springs consists of a $1\frac{1}{2}''$, $2\frac{1}{2}''$, and $3\frac{1}{2}''$ Strip, which are secured together in the centre by a bolt screwed into the threaded hole of a Collar carried on the front axle. One end of each complete spring is bolted to a Collar and the other end is attached to the frame by the shackles shown in Fig. 6. The rear springs are built in a similar manner, but an extra $4\frac{1}{2}''$ Strip is used in each.

A $\frac{3}{4}''$ Contrate 14 on the steering column engages a $\frac{1}{2}''$ Pinion carrying a Threaded Pin 13. The Pinion is carried on a Pivot Bolt locknutted in one of the threaded holes of the Collar 12. The Threaded Pin 13 carries a Swivel Bearing that is connected by a short Rod to a Collar 6, which is secured to a 2″ Strip coupled by means of a Collar to a Coupling 3. The Coupling carries one of the front wheels and is pivotally mounted on a $\frac{3}{4}''$ Bolt secured in one of the threaded holes of a Collar carried on the front axle.

The Collar 4 (Fig. 4) is connected by a $4\frac{1}{2}''$ Strip, to a second Collar 10 carried on a $\frac{3}{4}''$ Bolt secured to a Coupling supporting the second front wheel. The Collar 9 supports a $\frac{3}{4}''$ Bolt on which the Coupling carrying the front wheel pivots.

It will be noticed that the pattern of E1 Electric Motor, fitted with an extended armature shaft of standard "axle" size, is incorporated. Those constructors who are in possession of E1 Motors, fitted with the thin armature shaft and special pulley, can use them in this model if they proceed as follows. The special pulley should first of all be removed. A small quantity of metal foil should then be wrapped round the projecting portion of the shaft so as to increase its diameter to that of a standard Axle Rod. The Worm may then be slipped over the foil and secured in place by means of two set-screws.

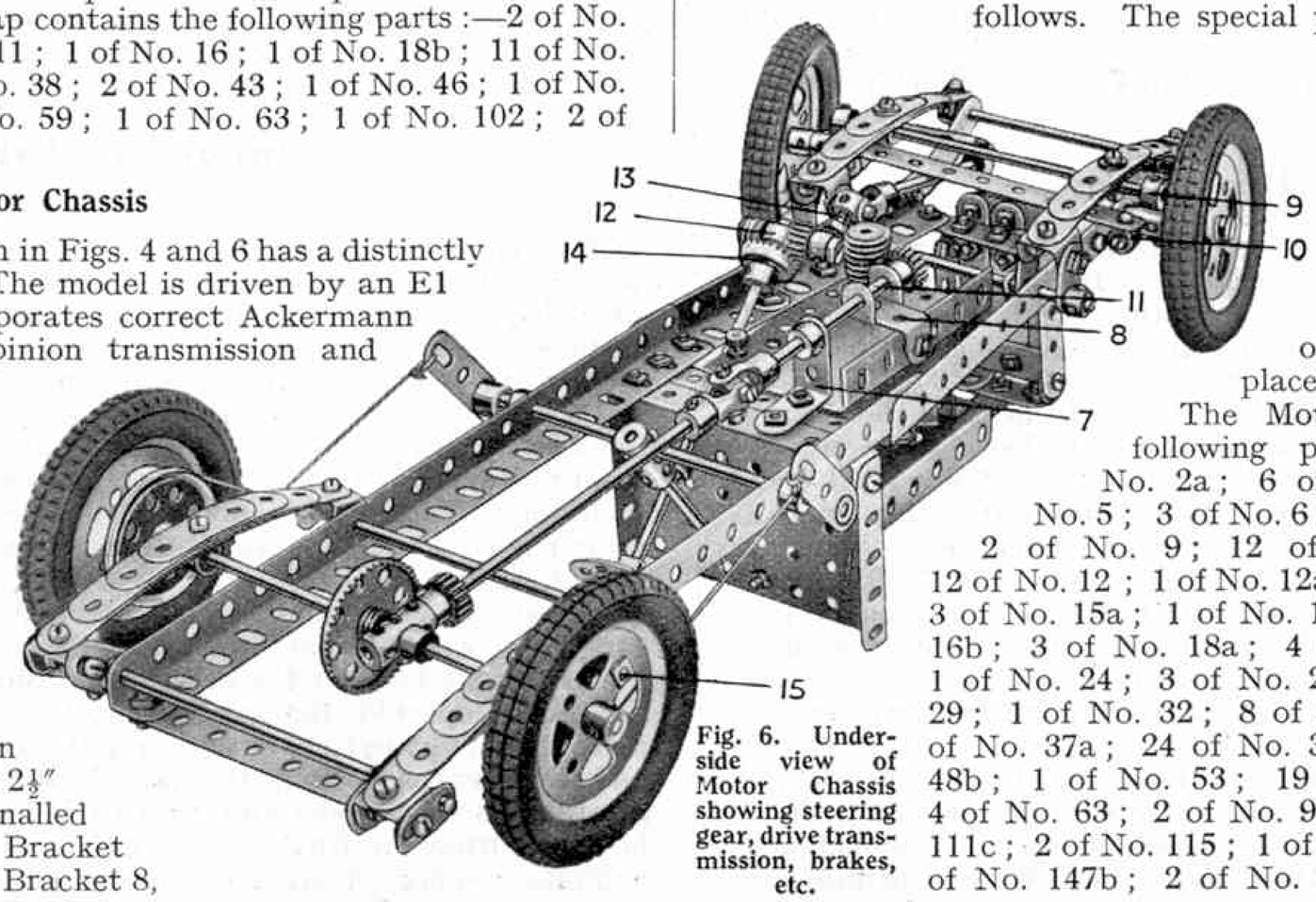


Fig. 6. Underside view of Motor Chassis showing steering gear, drive transmission, brakes, etc.

The Motor Chassis contains the following parts :—1 of No. 2 ; 3 of No. 2a ; 6 of No. 3 ; 1 of No. 4 ; 8 of No. 5 ; 3 of No. 6 ; 6 of No. 6a ; 2 of No. 8a ; 2 of No. 9 ; 12 of No. 10 ; 7 of No. 11 ; 12 of No. 12 ; 1 of No. 12a ; 1 of No. 14 ; 4 of No. 15 ; 3 of No. 15a ; 1 of No. 16 ; 1 of No. 16a ; 1 of No. 16b ; 3 of No. 18a ; 4 of No. 20a ; 2 of No. 21 ; 1 of No. 24 ; 3 of No. 26 ; 1 of No. 28 ; 1 of No. 29 ; 1 of No. 32 ; 8 of No. 35 ; 63 of No. 37 ; 12 of No. 37a ; 24 of No. 38 ; 1 of No. 40 ; 1 of No. 48b ; 1 of No. 53 ; 19 of No. 59 ; 2 of No. 62 ; 4 of No. 63 ; 2 of No. 90 ; 3 of No. 111 ; 2 of No. 111c ; 2 of No. 115 ; 1 of No. 116a ; 4 of No. 142a ; 3 of No. 147b ; 2 of No. 165 ; 1 E1 Electric Motor.

Progress of the H.R.C.

When the H.R.C. attained its second birthday in October last I referred briefly on this page to the wonderful progress that the scheme had made from its inauguration. I remarked that the prospects for the future were very bright, and that "the winter of 1930-31 should be one of record progress."

The session has realised fully all expectations. The membership of the H.R.C. now exceeds 25,000, and it is growing steadily at an average of 1,000 new members every month. At the time of writing these notes, there are no fewer than 185 Incorporated Branches. In addition there are 200 Branches in course of formation, and it is expected that a large proportion of these will qualify for incorporation at an early date. All this goes to prove that the organisation has fulfilled the aims and objects with which it was launched, namely, to assist the many thousands of Hornby Railway owners to obtain the best possible interest, fun and excitement from their hobby. The scheme was the result of a vast amount of careful thought and organisation, and the H.R.C. is now recognised as the greatest association of miniature railway enthusiasts in the world.

Although the progress already made is very gratifying, I am hoping for even greater things in the near future. I am looking forward confidently to the membership of the H.R.C. passing the 35,000 mark, and the number of Incorporated Branches exceeding 200, by the close of this year! There is nothing like aiming high, and I want my ambition in respect to this great organisation to be shared by every member. To this end I ask each one to make 1931 a special recruiting year, and, by introducing his friends to the pleasures enjoyed by himself as a member, ensure that our joint ambition will be achieved.

Members of the Swansea Model Railway Club, Branch No. 140. Chairman, Mr. A. D. Lawrence, Secretary, Leslie T. Levitt. This Branch is also an affiliated Meccano Club and the two sections are successfully run together.

Summer Programmes

My recent notes on the subject of arranging visits to places of railway interest have brought me letters from several secretaries who point out that they can only arrange a few such visits, and that these do not by any means fill up the available half holidays and long evenings.

I appreciate that it may not be possible to arrange more than two or three official visits during a session, but these can be supplemented by informal visits to local points from which a good view of an interesting section of line may be obtained, either from a bridge or from the fences flanking the permanent way. Such a fence makes an excellent observation post, and good fun is to be had by noting the numbers and other details of various types of locomotives that pass. If each member is equipped with a notebook and pencil and makes his own observations, these can be afterwards compared and the railway knowledge of the members as a whole increased.

Informal visits of this nature need not always be the sole feature of an outing, and they can be incorporated very pleasantly in a ramble or a picnic outing. In all cases, however, it should not be forgotten that the permanent way, and all land within the boundaries of the track, are private property. In addition care should be taken not to get into any situation where there is the slightest danger to members, or any risk of causing trouble or inconvenience to railway officials.

During the next three or four months the light in the evenings will be quite good for photography, and all Branch members who possess cameras should be prevailed upon to bring them out and to use them for the mutual benefit of the Branch. On official visits to places of interest cameras should not be used until it has been made quite clear that photography is permissible but on occasions of picnics, rambles and the setting up of outdoor layouts there should be ample scope for interesting work.

Good photographs depicting the activities of Branches are greatly appreciated at Headquarters, and I hope to receive many photographs of this kind during the coming summer. As far as space allows those that are suitable will be published on the H.R.C. pages of the "*M.M.*"

It is a good plan to arrange at least one outing during the summer for purely social purposes. On this occasion railways should be forgotten, and the sole object of everybody concerned should be to have a thoroughly good time. I need say nothing as to details, for I know that these may safely be left in the hands of Chairmen and secretaries. Such outings offer the best opportunity for obtaining a good photograph of the whole of the members of the Branch. They are always popular events, and with a little trouble it is generally possible to fix a date upon which every member can be present. With this object in view it is usually best to arrange the outing before the commencement of the general school holidays, as for some considerable time afterwards members are likely to be very much scattered.

An Interesting Exhibition

An interesting exhibition was held recently by the Colwyn Bay H.R.C. Branch. This was the Branch's first effort of the kind, and in spite of many counter-attractions the number of visitors who attended was very satisfactory. A model railway layout was installed on trestles, and an imposing array of locomotives and rolling stock was mustered to operate the services on it. The track was laid out in the form of an oval and included both clockwork and electric rails, and at times there were three trains running simultaneously. At the main station six tracks were laid down, including sidings, and here the various trains were marshalled for their trips. Eight clockwork locomotives were in use over a long period, with only short intervals, and a Metropolitan locomotive was kept at work almost continuously. Other features of the exhibition were Meccano models built by members, and a Transporter Bridge lent for the occasion by Meccano Ltd. A model of the now departed Blackpool Wheel aroused great interest by reason of its sound construction and particularly silent working, and this was adjudged the best model on view. Prizes were awarded to this model and to two interesting Stiff-leg Derricks. Members from the Rhyl Branch gave valuable assistance, and the exhibition reflected great credit on all concerned.

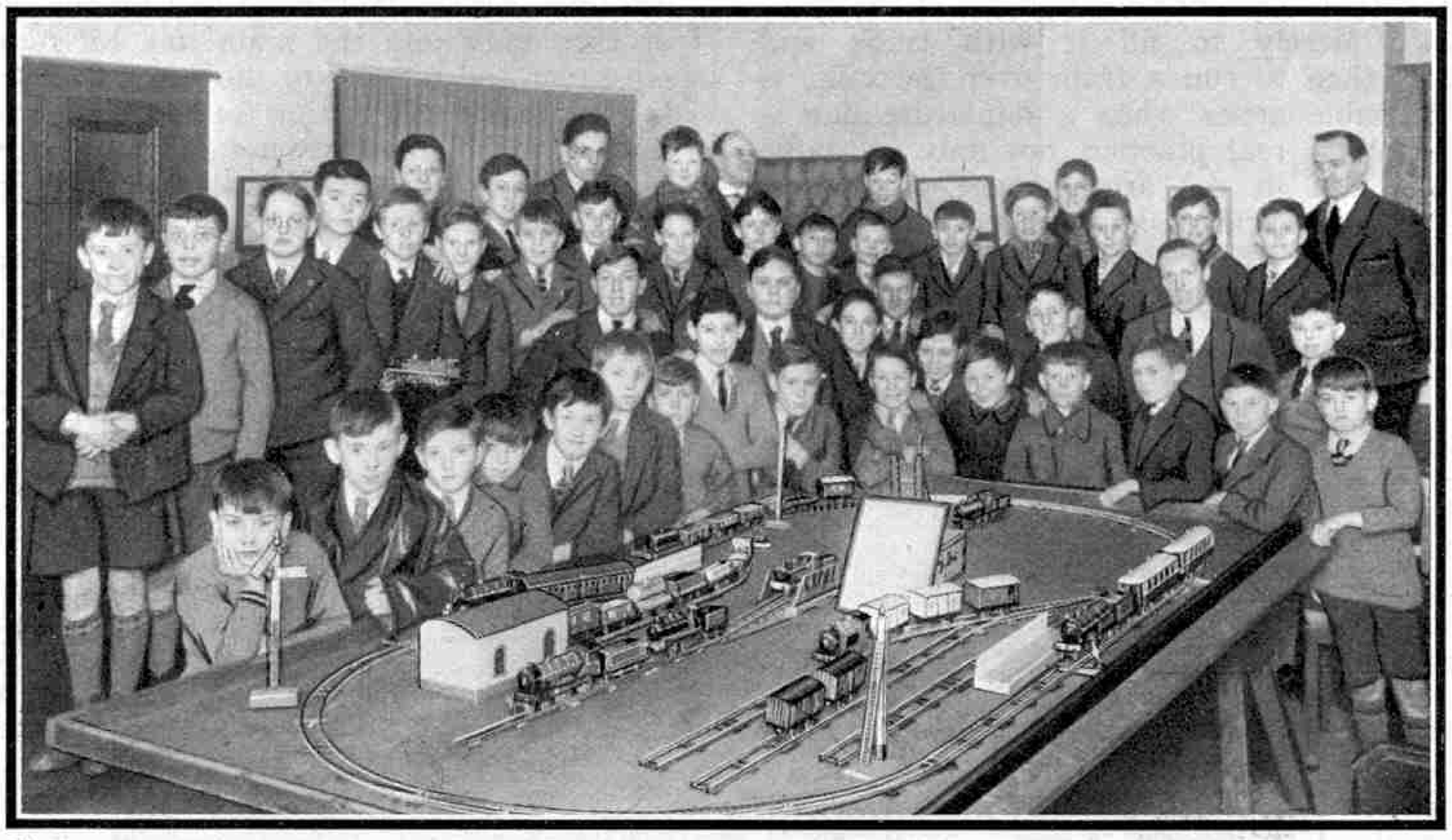
Branch Notes

ALL SAINTS BOYS' CLUB (STONEYCROFT).—As the Branch is still in the experimental stage no attempt has been made to run to timetable, activities being confined to the testing of the locomotives for speed and hauling power. The Branch has been very fortunate in being presented with a large amount of Hornby rolling stock and accessories and several locomotives. It is now possible to make a second track in addition to the Branch layout. A visit to the works of Meccano Ltd. is being discussed, and it is hoped to carry this out in the Easter holidays. Secretary: Mr. Harry Farnham, 10, Aylesford Road, Old Swan, Liverpool.

COLET COURT SCHOOL.—A large amount of new track has been bought out of the Branch funds and the members have been presented with the necessary boards on which to lay it. The general plan of the track has been decided upon and work is proceeding. An interesting visit was paid to the Old Oak Engine Sheds (G.W.R.). The members were allowed on the footplates of several of the "King" class locomotives, and were taken into the firebox of one and were permitted to go underneath another. A visit was paid to the repair sheds attached to the engine sheds. Visits are being arranged to Paddington Station, Nine Elms Engine Sheds, and the A.E.C. Motor Works, Chiswick, and it is also hoped to pay a visit to the Bank of England. Secretary: D. J. Higgens, 28, Hillersden Avenue, Barnes, S.W.13.

WEST NORWOOD.—The Branch visited the locomotive depot at Nine Elms. The driving mechanisms of locomotives of the "Lord Nelson" and "King Arthur" classes were explained. The members were given quite a long footplate ride on locomotive No. 778 of the "King Arthur" class. They then inspected the enormous coal hopper in which the coal wagons and their contents are lifted bodily to the top of the hopper and their contents tipped into bins. Three locomotives of the "Lord Nelson" class were seen, including the last one built, No. 865 "*Sir John Hawkins.*" Afterwards the large hydraulically worked turntable was inspected. Great interest was shown in the underneath view of a "King Arthur" class locomotive which was seen from the repair pits between the tracks. Secretary: W. H. Bugg, 80, Wolfington Road, West Norwood, S.E.27.

NOTTING HILL.—Four track meetings have been held and the percentage of successful trains amounts to 63 per cent. of the total number run. About 28 per cent. are known as "standard," and the remaining 9 per cent. are below standard. Shunting operations are usually "standard." A visit was paid to Paddington and keen interest was taken in the building operations in progress. The "*Cornish Riviera Express*" hauled by "*King Henry VI*" attracted a great deal of attention. Members find it extremely interesting to keep notebooks and jot down names and numbers of locomotives seen during these outings. A non-continuous layout is to be planned, as the present one, although excellent for shunting operations, is too crowded. Secretary: Mrs. H. Sharp, 110, Cornwall Road, Notting Hill, London.



Photo] [*H. A. Smith, Liverpool*

A group in the Branch room of the All Saints Boys' Club (Stoneycroft) Branch, No. 161 : Chairman, Mr. W. Walker ; Secretary, Mr. Harry Farnham. The members of this Branch recently incorporated, are keen Hornby Train enthusiasts. The Branch layout is well equipped and interesting trials of locomotives have been carried out on it.

EXHALL.—The colour light signals are proving extremely useful, the operators at the various stations despatching and receiving trains in accordance with the indications given. It was suggested that the Branch should be divided into two sections, but this motion was voted against. It has been decided to incorporate another straight-through station in the Branch layout. Secretary: M. Melville, Exhall Vicarage, Nr. Coventry.

WESTBURY HOUSE MODEL RAILWAY CLUB.—Attention is being paid to the making of accessories and the painting of posters to add to the realism of the Branch track. The Branch tunnel has been reconstructed. The members have been invited by the local stationmaster to inspect West Meon Station (S.R.) and Signal Box. Secretary: Peter Chamberlin, Westbury House, West Meon, Hants.

WOODFORD.—A timetable has been drawn up and is proving very satisfactory. The electric light signalling apparatus has been re-wired so that it is operated from one battery only. A most enjoyable party was held at the house of one of the members during the month. Games and competitions were held and prizes were presented to the winners. Secretary: J. H. Skelt, "Walberswick," Woodside Road, Woodford Wells, Essex.

Further Branches in Course of Formation

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

BRADFORD—H. Crapp, Wharncliffe Stores, Eccleshill, Bradford.

BRENTWOOD—Alan R. Cockell, 82, Park Road, Brentwood, Essex.

CARDIFF—J. H. Stephenson, 5, Kyveilog Street, Canton, Cardiff.

CHALFONT ST. PETER—E. Meredith, Hill House Lodge, Chalfont St. Peter, Bucks.

DUNDALK—J. Minogue, St. Mary's Road, Dundalk.

GOODMAYES—Donald Rooke, 46, Talbot Gardens, Goodmayes, Essex.

GREENOCK—Wallace McAdam, 191, Eldon Street, Greenock.

LEEK—W. Graham Venables, "Blackacres," Leek, Staffs.

LONDON, S.E.19—G. v de Bogaerde, 3, Vermont Road, Upper Norwood, London, S.E.19.

LONDON, W.12—C. Bullen, 20, Curwen Road, Shepherds Bush, London, W.12.

ST. IVES—Rex Hamilton, Borthallan Farm, St. Ives, Cornwall.

OVERSEAS

INDIA—B. C. Khumbatta, Khumbatta Mansions, Opp. Juma Musjid Fort, Broach.

INDIA—B. G. Mansukhani, Spril Road, Ferozepore Cantt. Punjab.

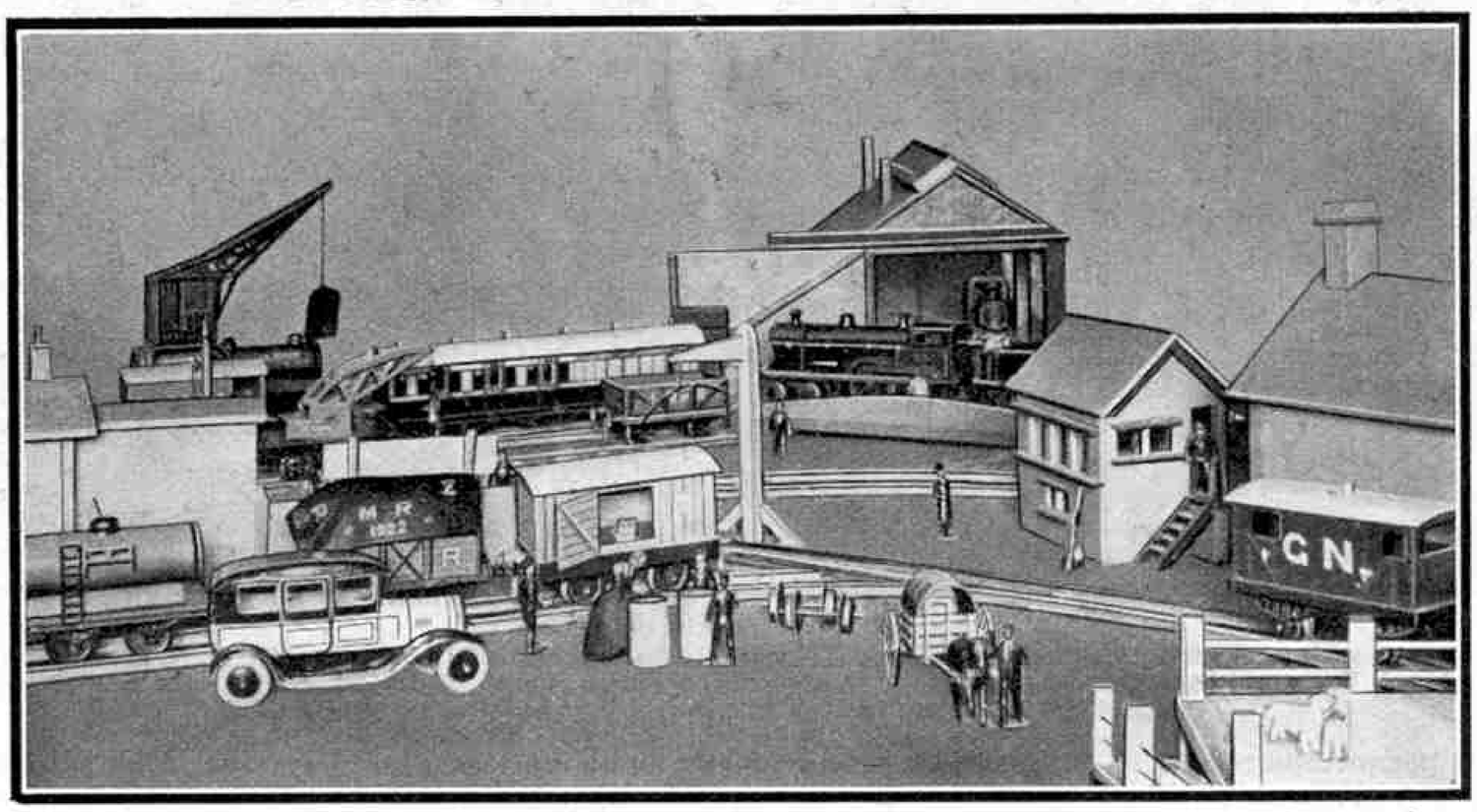
Further H.R.C. Incorporated Branches

164. "THE PLASHET" (LONDON)—Mr. M. Horovitch, 26, Masterman Road, East Ham, London, E.6.
165. WEST LONDON—J. H. G. King, Ashington House, 317, New King's Road, London, S.W.6.
166. "EAGLEHURST" (PALMERS GREEN)—R. J. Cotton, 236, Princes Avenue, Palmers Green, London, N.13.
167. KING STREET (DUNDEE)—T. Sharpe, 12, King Street, Dundee, Scotland.

XXIX.—INTERESTING WORKING ON A READER'S LAYOUT

ONE of the chief difficulties of laying out a miniature railway is that of making the best use of the space available. Merely to fill it with track and accessories, and then to run a train over the rails, is quite easy. Trouble arises when a miniature line is required to represent real practice, not only in traffic operations, but also in the arrangement of sidings, engine sheds, signals, bridges and other characteristic features of a railway. The solution to the problem is not always easy, and sometimes it is necessary to limit the scope of the line in order to ensure that certain essential features are correctly reproduced.

It should be remembered that the first attempt to build up a model railway does not usually produce the best arrangement. Modification of a well-known plan may give a layout that meets most of the requirements of a model railway owner, but experiment is often necessary. This is always interesting in itself and usually suggests other possibilities in regard to the layout of the track and work on it. Keen owners of Hornby Railways delight in experiments of this kind, and are never satisfied until they have tried out a number of schemes in order to find the one that is best suited to their requirements, or makes the utmost of the space and equipment at their disposal.



A busy corner of the interesting railway operated by P. W. Suart at Clevedon. The wagons in the foreground are being unloaded and there is a general air of bustle about the scene.

The lower illustration on the opposite page shows the plan of a layout that is fairly comprehensive, although it occupies a relatively small space, and upon which operations of a distinctly interesting type may be carried out. The owner and only operator of the line is P. B. Denny (H.R.C. 1587), Bexhill-on-Sea, who has planned the track formation throughout and has installed it in a space of 10′ 6″ by 9′ 6″. The track consists primarily of an outer oval on which are arranged two passing stations, X and Y, a long tunnel T and a viaduct V. On the inner loop of the oval is situated one platform of a central station, which is a combined terminal and through station. The main line may be reached from the terminal platforms in this station in two different directions. Trains may use the two points forming a crossover by the footbridge and branch off to the right, or they may join the main line by running past the crossover and turning to the left. Full accommodation is provided at this station for the locomotives, an engine shed, turntable and water tank forming the equipment of the depôt, and there is also a siding for the storage of coaching stock.

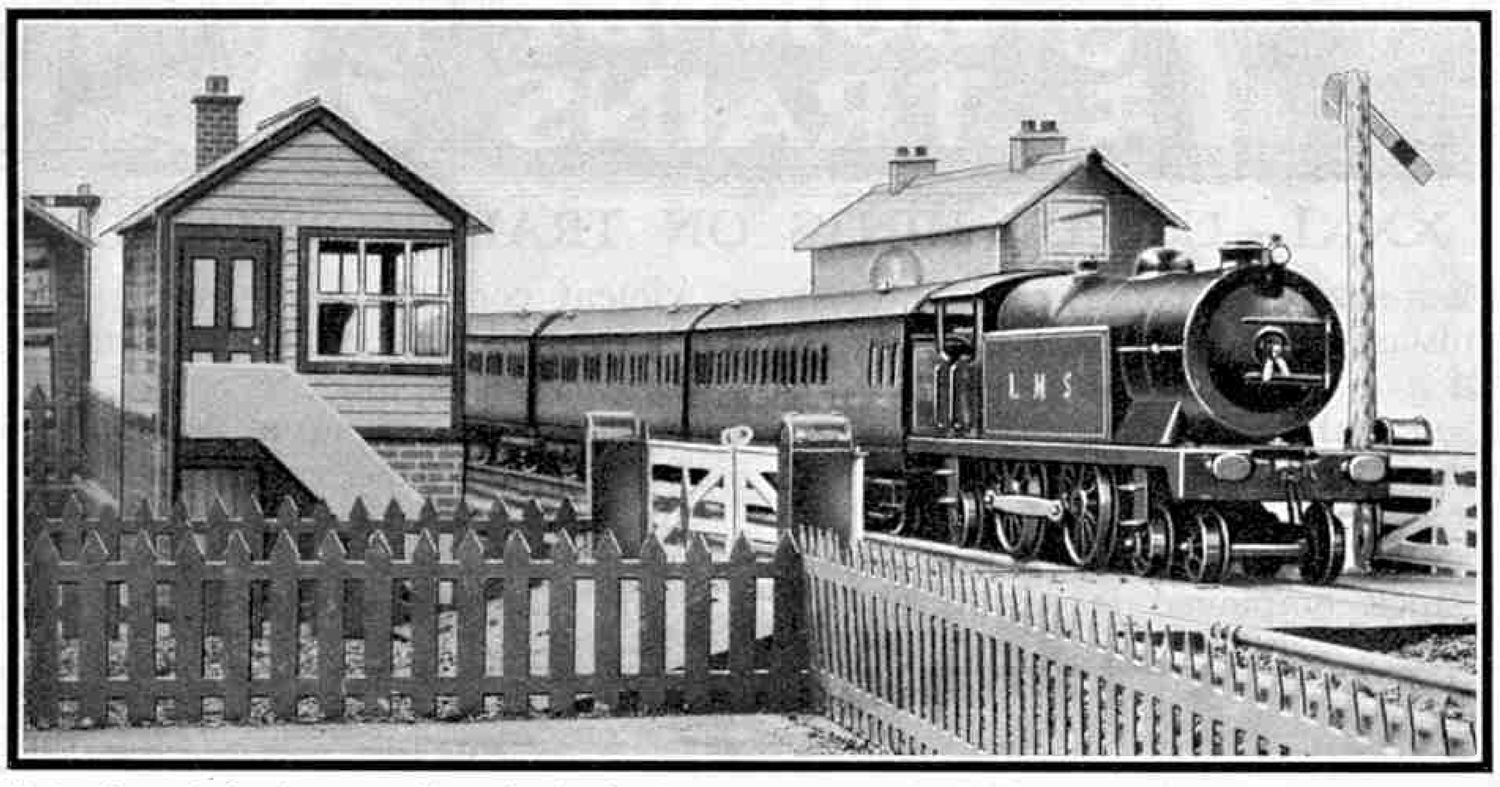
Near station Y on the main line a point is situated which gives access to the goods yard. This is well laid out for dealing with the traffic on the line and there are four roads, giving ample accommodation. At the end of the first road is a covered goods depôt and adjoining this is a large warehouse building. A coal office is an interesting feature of the yard and there are also stables for the accommodation of the horses that draw the various road vehicles coming to the yard. The two longest sidings enclose a goods loading platform D, which is provided with a crane. Between these sidings is a shorter line that runs as far as the end of the goods platform and is terminated in the usual way by buffer stops. This goods yard is particularly interesting, for the rails between the main line points and the first points met with in the yard are arranged to form a small "hump" for shunting purposes. This is a distinctly modern feature on a miniature layout.

The line is adequately signalled. Three cabins are provided, but these and other accessories are not shown in the diagram in order to avoid overcrowding it. The main signal cabin is situated between the end of platform 3 and the footbridge, and is provided with a Hornby Control Lever Frame. The other cabins are placed at or near the stations X and Y. These are included for the sake of realism in appearance, however, all signals and points being controlled from the main cabin, which is conveniently placed for the single operator usually in charge of the layout. The dotted portion of the track indicates the tunnel. It will be seen that this is of quite realistic length and, in accordance with a plan frequently

suggested in the "*M.M.*," it occupies a corner of the model railway.

Very interesting working may be performed upon this well-arranged layout and variations in the methods of train running may easily be introduced if desired. Since the lines serving platforms 1 and 2 of the central station are terminal roads they may be used very appropriately for trains starting and finishing their journeys, while through traffic is dealt with on No. 3.

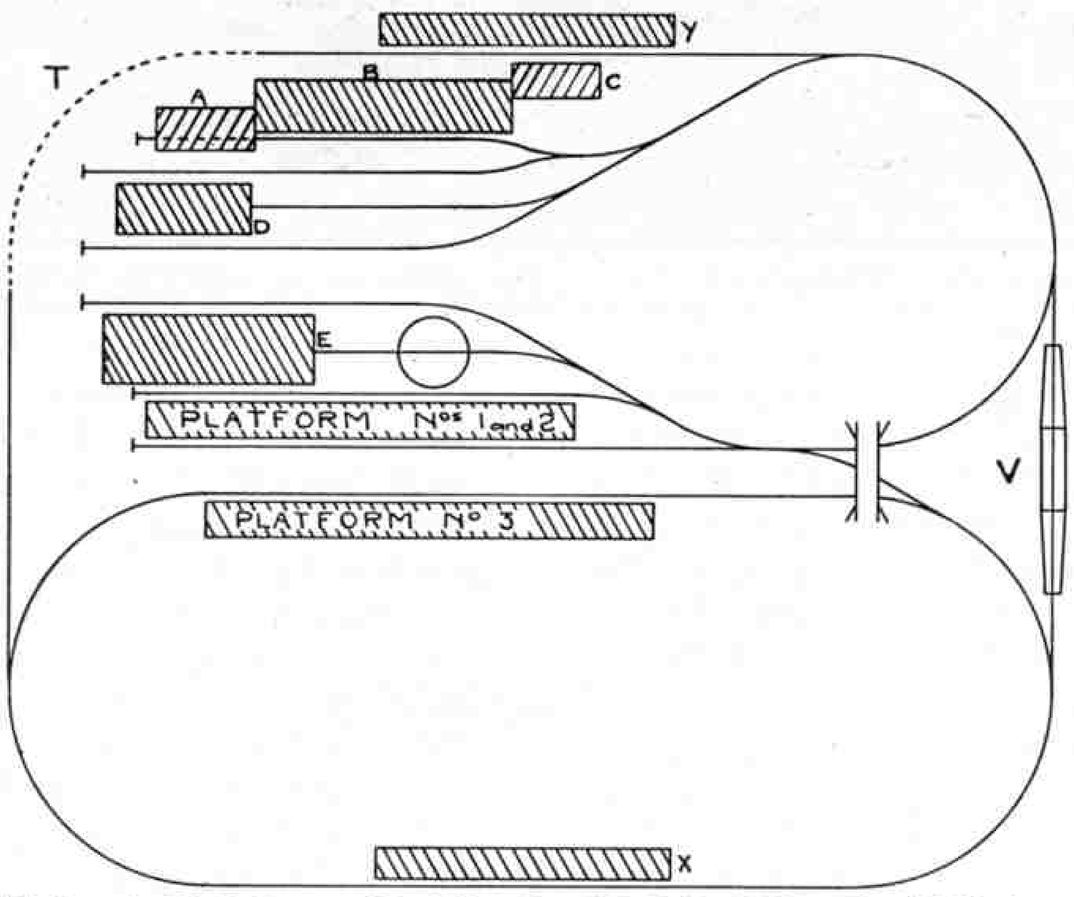
The layout and its equipment are well suited to shorter-distance local traffic and a certain amount of goods working. As the engine shed accommodation is limited, tank locomotives are to be preferred for operations of this kind. The owner of the layout actually uses a No. 2 Special Tank engine such as that shown in one of the accompanying photographs. This is excellent practice, for many 4–4–2 tanks are similarly employed on real railways.



A stopping train leaving a wayside station hauled by a Hornby No. 2 Special Tank Locomotive. These engines are very suitable for general work on a layout of the kind described in this article.

Owing to the compact nature of the layout train operations may be carried out quite quickly. For example, on one run the engine may leave its shed and take water at the tank before bringing a train of coaches from the carriage siding out behind the points and pushing them into platform 1. Its journey with the train may be made either direct to station Y or over the crossover and so to station X. Possibly it does not stop at either of these as yet, but completes a circuit of the main line, threading the tunnel and crossing the viaduct on the way.

Further circuits of the main line may follow and then the train may be required to call at platform 3 of the main station. This stop may represent a halt at an important junction and is possible whatever the direction taken at the start. An interesting scheme would be to arrange a connecting train to meet the more important one at this stop. For this purpose, a branch line train may have been assembled alongside platform 1 during a previous stop of the express. A small tank engine and two or three coaches will be a suitable make-up for the "local." This may be allowed to follow our train upon its journey after the stop referred to, and soon after the express has come to rest at the platform 3 the connecting train may be run into platform 1 or 2 as required.

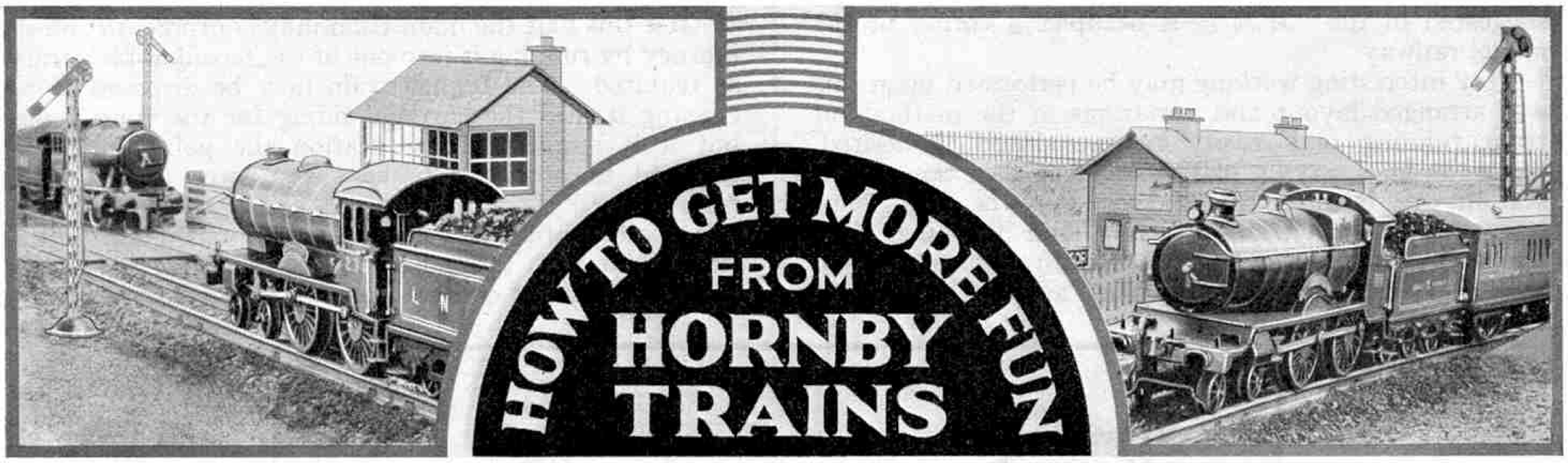


The layout of P. B. Denny of Bexhill-on-Sea (H.R.C. No. 1587). The chief features are indicated by letters as follows: A, Goods Depot; B, Warehouse; C, Coal Office and Stables; D, Loading Platform; E, Engine Shed; T, Tunnel; V, Viaduct; X, Y, Wayside Stations.

After this halt the main train may continue, to end its journey by running it into one of the terminal platforms, as required. The branch train may be disposed of by running it into the carriage siding for the time being, but if it remains in the station the points must be watched in order to prevent the later arrival from running into it.

A useful feature of the layout is the triangular formation of the rails formed by the viaduct portion of the main line and the curved branches that lead from it to the centre of the layout. There are no facilities at platforms 1 and 2 in the main station for running an arriving engine round its train, but we may get over the difficulty by turning the whole train round in three movements. It is backed out of the platform over one of the two curved branches until it is clear of the main line points. The viaduct is then crossed and the train proceeds until the last vehicle is clear of the other main line points. Finally the train is backed into the platform with the engine in the right position for making another journey. If the coaches are not immediately required for further service they may be pushed into the carriage sidings and the engine may then proceed to the shed.

Movements quite as fascinating may be carried out when dealing with goods traffic. The accommodation and equipment of the yard are extensive and the actual loading and despatch of various consignments of freight may therefore readily be performed. The chief interest in these will be the shunting of the wagons into the appropriate roads. If a train has been assembled by its own locomotive, it will be necessary to back the train into the yard on returning after a journey round the layout, for the points would then be approached in the trailing direction. If it is required to run the train straight in, the approach must be made in the opposite direction. This can be effected by allowing the small tank engine used for the branch train to marshal the wagons, draw them out of the yard and round into platform 2 of the main station. The larger engine may now come from the shed and couple up to the train. It draws the train out, leaving the small engine at the buffers and proceeds on its journey.



XXXI.—USEFUL HINTS ON TRAIN FORMATION

TRAIN formation is a subject of considerable interest to railway enthusiasts and is of great importance to the owner of a miniature railway who wishes to operate his track on realistic lines. Correct understanding of the problems involved helps greatly in making model railway working a faithful reproduction of that carried out on a large scale, for on any model railway the rolling stock employed is as prominent as the locomotives and its use in the wrong manner is an obvious and serious defect. Accessories and scenic effects certainly help in producing the correct atmosphere, and if they are badly grouped, or omitted altogether, the appearance of an otherwise good layout may be spoiled. But the use of the most elaborate stations, bridges, tunnels or scenery will not compensate for the running of trains incorrectly assembled. For instance, nothing looks more unrailway-like than a model train made up of a haphazard collection of rolling stock of various types. On real railways such an assembly is only seen on an empty stock train, the modern tendency being to provide special vehicles for the principal services, and to have them as uniform as possible.

A train of Hornby Metropolitan Coaches entering a station. These coaches are very suitable for the longer-distance suburban trains, which run on quite fast timings and are frequently hauled by express tender locomotives.

The making up of a passenger train should be done in a siding, or series of sidings, as is the case on actual railways, but if lack of space makes this impossible, the operation may be carried out in the station. For this purpose the Hornby No. 1 and No. 1 Special Tank Locomotives are admirably suited. These engines are capable of realistic shunting work and are useful generally as "carriage pilots." The distances to be covered by the shunting engine are invariably short. It is therefore a good plan not to wind the mechanism fully but to follow the scheme several times mentioned in the "*M.M.*" and to give the key only a sufficient number of turns to enable the engine to carry out the necessary operations. A little care in this respect will avoid violent contacts between the engine and the coaches, or other rolling stock, that may lead to broken buffers and bent couplings.

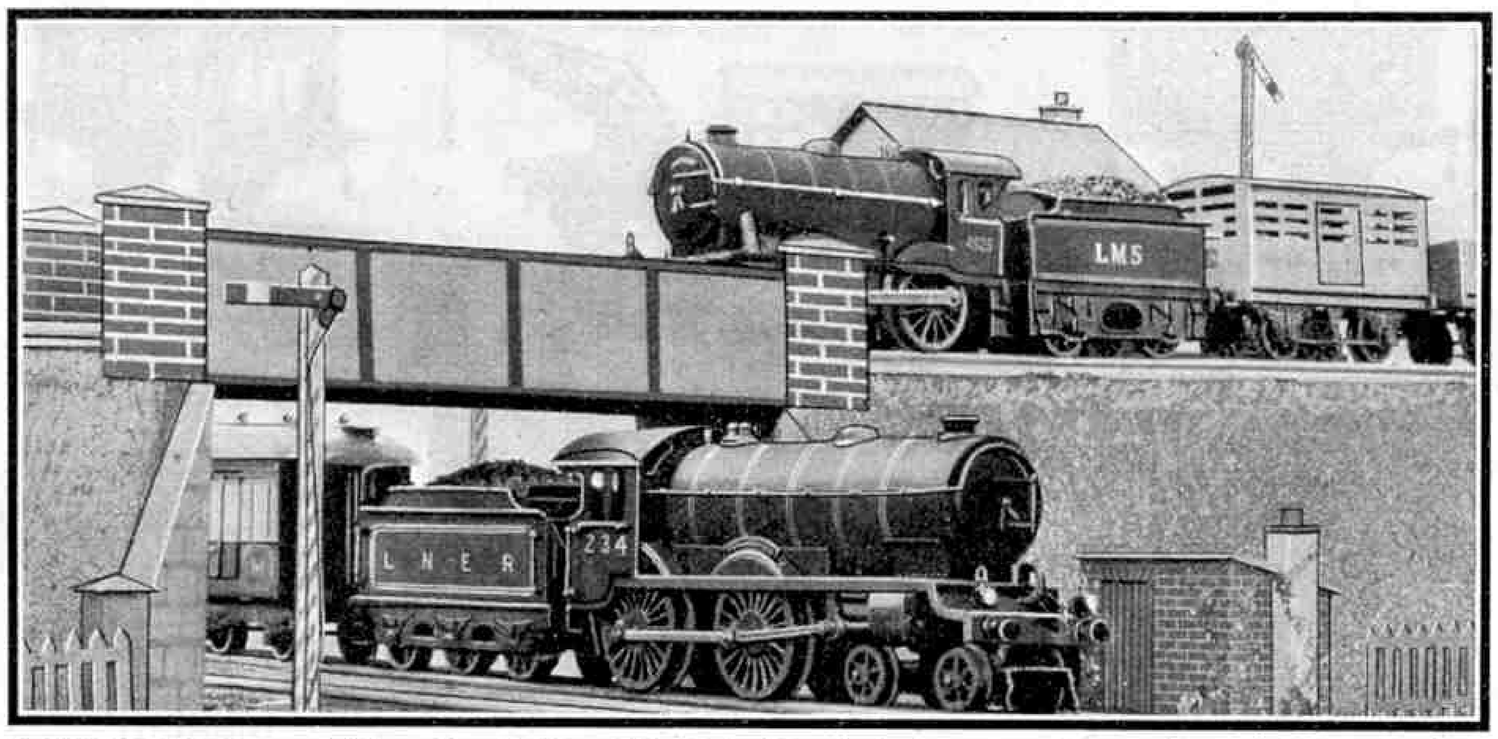
In the making up of passenger trains and, in fact, of trains of any kind, great care should be taken to complete the train with an appropriate guard's van. Trains also should not be made too long, for on a miniature layout a long train looks no more realistic than a short one, and is liable to introduce unnecessary complications in operation. For instance, it may be necessary for a long train to draw up twice at some wayside stations on a layout, and this may be a cause of considerable delay.

The range of passenger coaches available in the Hornby Series allows trains to be made up that are representative of almost any class seen on our railways. Taking first suburban trains, these may be formed of either No. 1 Passenger Coaches or Metropolitan Coaches. The smaller vehicles will be found particularly useful on "intensive" suburban services, for they do not take up too much space in a busy terminus, and are easily dealt with by the locomotive. The larger bogie stock will be found more suitable for what we may term residential traffic from outlying districts, for these trains run at a higher speed and cover fairly long distances between stops.

A guard's van or composite coach is necessary at each end of a suburban train, as it is not usually convenient to re-marshal the train at the suburban or main terminus. In real practice such trains usually are made up in sets. Each set is numbered and the name of its home shed or district is also shown. These indications are very useful for reference when operations are conducted according to timetable. Where there is a van or composite coach at each end of a train, it is only necessary for the engine to run round to the other end on arrival at its destination in order to be in position for the return journey. If a "turnover" locomotive is available, so much the better,

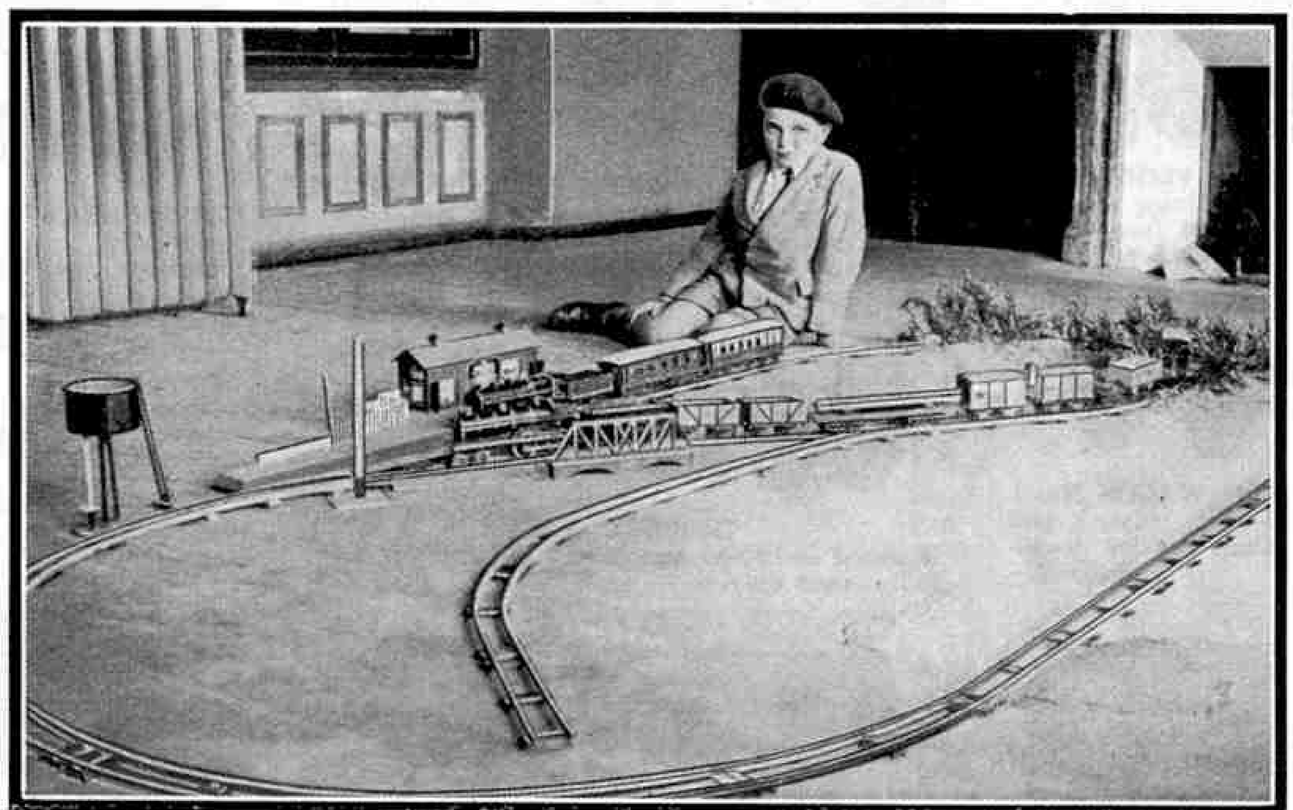
and the locomotive that brought the train in will be able to act in a similar manner for the next train arriving after its own train has departed.

Long-distance expresses may consist of any of the Pullman or Saloon Coaches in the Hornby Series. For the "crack" main line expresses the No. 2 Special Pullman Cars are to be preferred, while for intermediate class passenger trains the ordinary No. 2 Pullman Cars or No. 2 Saloon Coaches are very well suited. A train composed of coaches of the second type has a very realistic appearance, and represents effectively a class of train that is very frequently seen on British railways. Trains similarly made up are used extensively for the long-distance excursions that are so popular to-day, and when running trains of this description Hornby Railway owners may follow the practice. The appearance of such a train when headed by a locomotive bearing a "Special Train" number on a board in front is very satisfactory and its inclusion in a miniature railway service adds considerably to the realism and interest of operations.



A Pullman express passing beneath a bridge while a mixed goods train crosses above. A composite coach of the express is just coming into view.

Correctness in making up a goods train is perhaps even more important than in the case of a passenger train. The assembly should be carried out in the sidings or yards adjacent to the goods station. In real practice the making up of long goods trains with wagons for numerous destinations is a highly interesting operation, and usually is carried on in "hump" and "gravitation" yards. Such yards have been mentioned in the "*M.M.*" from time to time, and a detailed description of what is perhaps the most up-to-date yard in the country—that at Whitemoor, on the L.N.E.R.—appeared in the "*M.M.*" for November, 1930.


K. J. Richards of Liancourt, France, and his Hornby layout. A Hornby "Nord" locomotive is at the station, and a goods train composed of various wagons is waiting for it to proceed.

In making up trains in the ordinary way on a Hornby layout the "fly-shunting" method is specially suitable. Where this is employed the engine is not required to take the trucks all the way into the siding. Instead they are given an initial push and complete the short journey under their own momentum. The engine is set in motion, pushing before it the trucks, which are not coupled up to it. Shortly before reaching the points leading to the road desired, the engine is stopped quickly, with the result that the trucks themselves run on into the siding. In model railway practice it will be found useful to employ a brake rail for bringing a locomotive to a standstill quickly. If this method is adopted by Hornby Train enthusiasts, splendid results will be obtained, particularly if the wagons are loaded and are fitted with Mansell wheels. Fly-shunting should not be carried out too vigorously when near buffer stops or stationary trucks, for derailments and other mishaps may ensue with disastrous results, but a little practice will soon make the operator efficient in carrying out this interesting operation.

Express goods trains, as all Hornby enthusiasts will agree, are quite as fascinating to run as express passenger trains. A large number of express goods trains are run on real railways for the conveyance of perishable goods, such as fruit or fish. The practice of naming such trains is general among the staff dealing with them, and is officially recognised on the G.W.R. For instance, a certain express train from Birkenhead to Smithfield is named "*The Meat,*" its purpose being indicated by its name. Similarly a fruit train from Worcester to Cardiff is called "*The Worcester Fruit.*"

Representative express goods trains may easily be made up with Hornby rolling stock, vehicles that may be employed for this purpose including the No. 1 and No. 2 Luggage Vans, Biscuit Vans, Refrigerator Vans, Milk Vans, and others. Certain loads may require a train of their own. Thus we find that mineral trains, milk trains, parcel trains and others are run regularly. Mineral trains may be composed of Hornby Open Wagons, loaded with real coal that has been washed and fixed in position in the manner recently described in these pages. Such a train looks very realistic on a Hornby railway, and is an excellent miniature representative of many trains that run to London from South Yorkshire, Nottinghamshire, the Midlands and elsewhere, conveying coal for redistribution in Southern districts.

For the conveyance of ballast, sandstone and similar materials, the various Hopper and Tipping Wagons in the Hornby Series may be employed. On a stopping goods train, where roadside work is to be carried out, it is usual to place wagons in the order in which they are to be detached from the train. Thus the wagons nearest the engine are those that will be uncoupled first.

HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines, strongly built and beautifully enamelled.

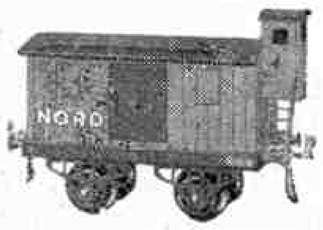
Ask your dealer to show you the full range of Hornby Rolling Stock.

PETROL TANK WAGON "PRATTS"
Beautifully finished. Price **2/6**

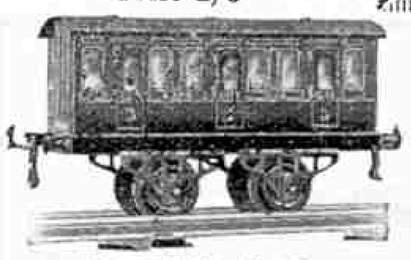
PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/6**

PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**

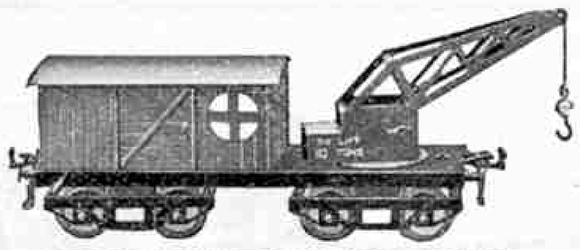
OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/6**



BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**



***HORNBY No. 1 PASSENGER COACH**
Realistic in design and fitted each side with opening doors. Price **2/6**

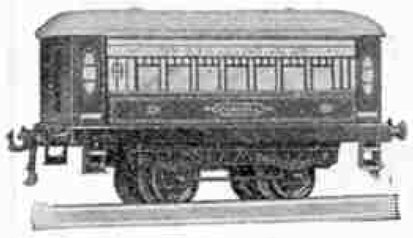


***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

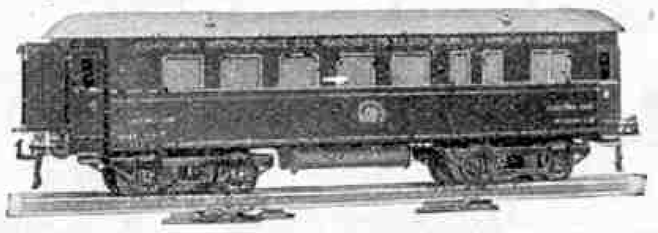
GUARD'S VAN
Realistic design, fitted each side with opening doors. Obtainable in L.N.E.R., L.M.S., G.W. or S.R. colours. Price **3/-**

WAGON (French Type)
Lettered "Nord." Highly finished in colours. Price **3/3**

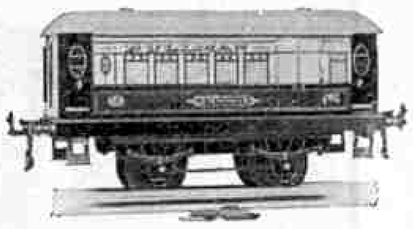
MILK TRAFFIC VAN
Fitted with sliding doors. Complete with milk cans. Price **3/6**



No. 1 PULLMAN COACH
Realistic design. Beautiful finish. Price **3/6**

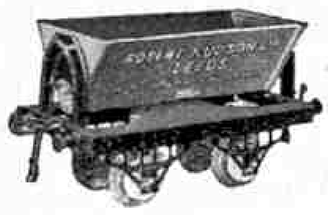


RIVIERA "BLUE" TRAIN COACH
"Dining" or "Sleeping."
This is a beautiful model, substantially built and well finished. Suitable for 2-ft. radius rails only. Price **14/-**

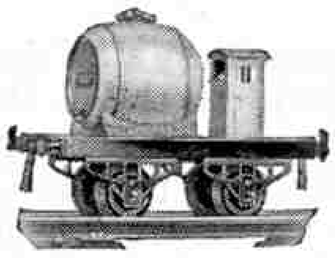


No. 1 PULLMAN COACH COMPOSITE
A well designed model. Richly finished. Price **4/-**

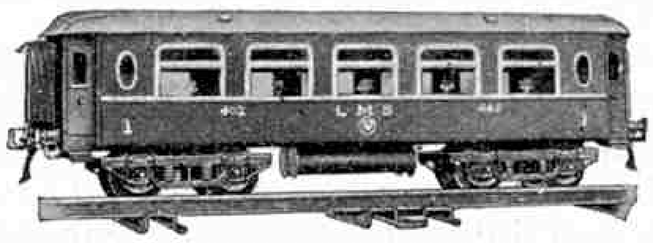
GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**



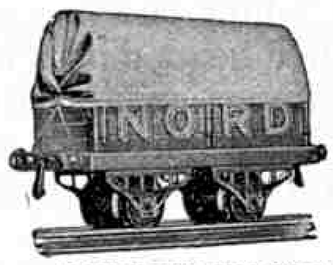
SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/-**



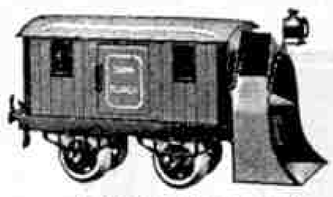
No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**



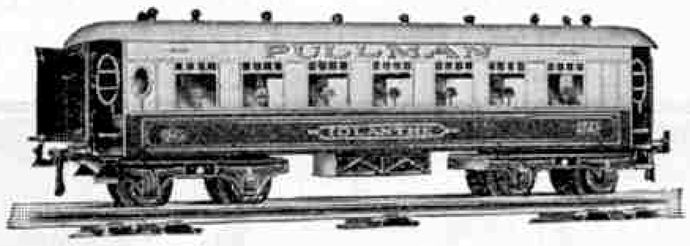
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type, lettered "Nord." Price **3/-**

ROTARY TIPPING WAGON
Finished in orange. Price **3/-**

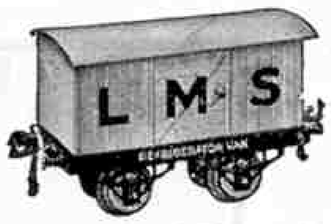
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



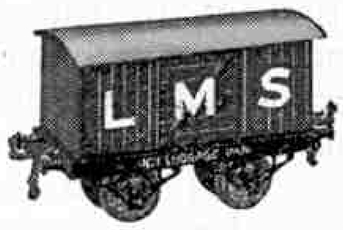
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



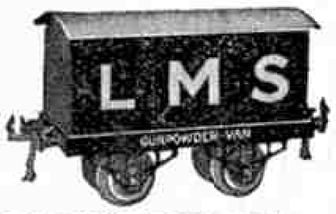
HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/-**



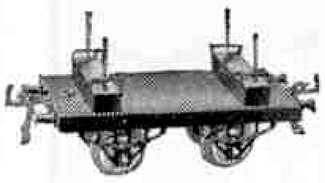
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/9**



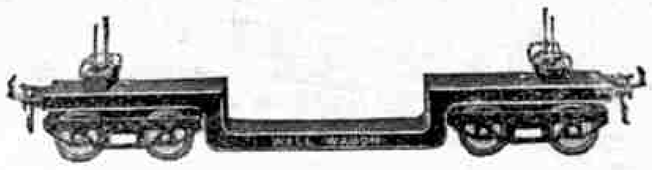
***LUGGAGE VAN No. 1**
With opening doors. Price **3/6**



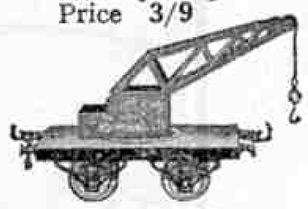
***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/6**



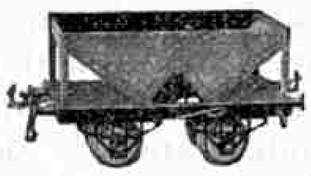
LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/-**



TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

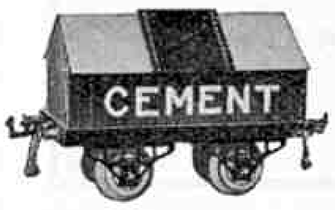


CRANE TRUCK
Finished in brown and blue. Price **3/6**

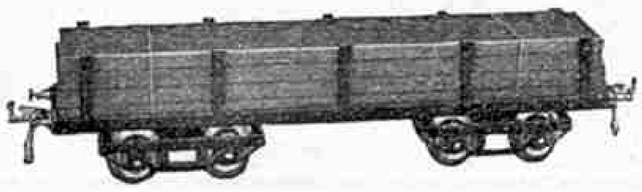


***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

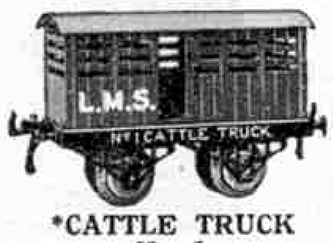
BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**



CEMENT WAGON
Finished in red. Price **3/-**



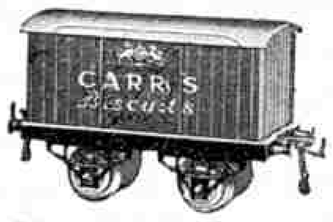
TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**



***CATTLE TRUCK No. 1**
Fitted with sliding doors. Very realistic design. Price **3/3**

MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**

JACOB'S BISCUIT VAN
Finished in crimson lake. With opening doors. Price **3/6**



CARR'S BISCUIT VAN
Finished in blue. With opening doors. Price **3/6**

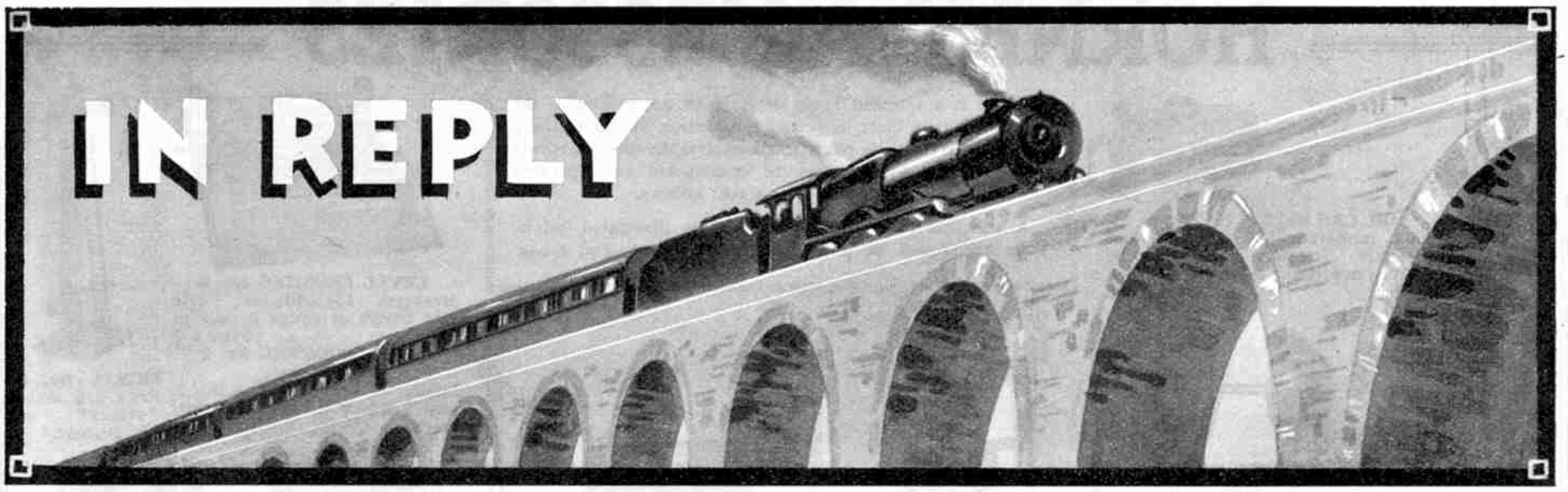
LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/-**

**In L.M.S., L.N.E.R., G.W., or S.R. lettering.*

CRAWFORD'S BISCUIT VAN
Finished in red. Opening doors. Price **3/6**

SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL



Suggested Hornby Train Improvements

LARGER RANGE OF HORNBY ELECTRIC LOCOMOTIVES.—We note your suggestion that additional electric locomotives should be available in the Hornby Series, and agree that a wider choice of models would be an advantage to those with electric layouts. You will no doubt be pleased to hear that we are considering the application of electric motors to several existing locomotives, but no definite decision has yet been reached in the matter. Further developments will be announced in the "*M.M.*" in the usual manner. (*Reply to F. W. Coleman, Southport*).

DUMMY BRAKE GEAR FOR HORNBY PULLMANS.—It is certainly gratifying to possess a train of coaches fitted with the numerous details found in actual practice. Their fragile nature when reproduced in miniature, however, and the possibility of damage owing to derailment or in handling, are serious objections to their use. In the case of brake gear, the brake cylinders and the rods would be out of sight beneath the coaches, and would be scarcely noticed when operating the train, if at all. Increased cost is also an objection, and frequently this is out of proportion to the advantage gained. (*Reply to V. Royden, Huddersfield*).

AIR WHISTLE ON HORNBY LOCOMOTIVES.—We were interested in your proposal that we should provide a working whistle in the cab of Hornby locomotives and that it should be operated by pressing a rubber bulb hidden in the tender. This scheme is ingenious, and no doubt would be welcomed by many Hornby enthusiasts. The majority, however, would not be willing to pay the increased price necessary for locomotives so fitted. As many of the latest Hornby tenders are internally fitted, the accommodation of the bulb would probably occasion some difficulty. (*Reply to B. Reece, Peterborough*).

L.N.E.R. TRIPLET RESTAURANT CAR SETS.—These would look realistic on a model railway, but unfortunately they could only be manufactured in the colours of the L.N.E.R. and G.W.R. However, when the system of articulating coaches is adopted by all four groups, we shall then consider introducing such coaches into the Hornby System, and your suggestion will then be reconsidered. (*Reply to L. James, Doncaster*).

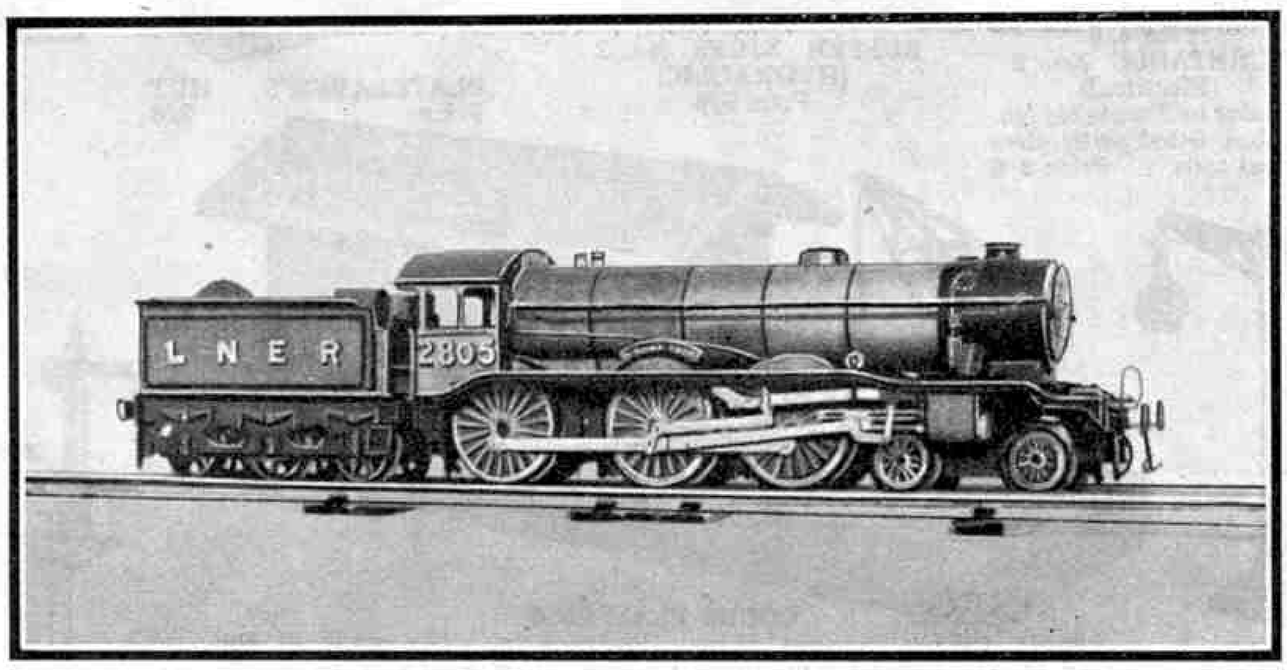
"M" PULLMAN COMPOSITE.—This no doubt would make a very realistic addition to the "M" Series, and we are filing this suggestion for further consideration. As you are no doubt aware, there is already available in the series a No. 1 Composite Pullman Coach, and we suggest that you make use of this. (*Reply to N. G. Hopkins, Bowness, and others*).

HINGED RAIL.—Your suggestion for the introduction of hinged rails for use on a movable section of track near the door is interesting, but we doubt if there would be much demand for this accessory. It is a fairly simple matter for Hornby enthusiasts to attach hinges to the baseboard, and so arrange the ordinary track in order to overcome this difficulty. An article on lifting bridges and safety gates was included in the "*M.M.*" for June 1929, and we suggest that you obtain hints from this. (*Reply to B. P. Holding, Bournville*).

TRUCKS LETTERED L.N.E.R.—It is certainly true that all our L.N.E.R. trucks have the letters N.E. on the sides. This is quite in accordance with actual practice, however, as the L.N.E.R. do not place the full initials on any of their goods rolling stock. (*Reply to H. E. Gibson, Peterborough*).

"M" SERIES JUNCTION SIGNALS.—These would, we think, supply an interesting addition to the "M" accessories, and your suggestion will be filed for consideration when we are again revising and making additions to this series. (*Reply to M. Ross, Portsmouth*).

EMBANKMENTS.—We are afraid that this suggestion is not practicable from a manufacturing point of view. Embankments are features of a model railway that are much better designed and made by each railway owner for himself, in order to satisfy his special requirements. Hints on their construction have been given in the "*M.M.*" from time to time. (*Reply to B. H. Bradford, Cricklewood*).



A fine example of the use of cardboard for miniature locomotive construction. This realistic reproduction of the L.N.E.R. "Sandringham" class locomotive No. 2805 "Burnham Thorpe," is the work of our reader Mr. M. B. Flanders of Walthamstow.

8-COUPLED TANK LOCOMOTIVE, S.R.—A model of this class of locomotive would look very fascinating on a model railway. It is extremely doubtful if 8-coupled locomotives would traverse 2 ft. radius curves, however, and in any case no suitable mechanism is at present available. The cost of manufacturing such a locomotive would also be high. (*Reply to E. Walshaw, Battersea*).

OUTSIDE CONDUCTOR RAIL FOR ELECTRIC TRACK.—We hardly agree with your statement that an electric conductor rail placed outside the running rail would facilitate the working of points. The difficulty of the gap in the "live" rail of the existing Hornby Points is overcome by twin collectors on the locomotive, and therefore does not make any difference in the running of the train. Moreover, an outside rail would have to be broken at the points, and outside collectors would occasion some difficulty and extra cost. (*Reply to C. J. Baker, Prestwich*).

RAIL ADAPTORS.—In reply to your query as to how to join Hornby rails to a section of Meccano track, we have recently introduced a form of rail adaptor, which may be joined by means of a nut and bolt to the end of a section of Meccano track. It is fitted with a pin for insertion in the end of Hornby rails, and thus allows them to be joined together very effectively. (*Reply to J. F. Newsome, Christchurch*).

LONGER SLEEPERS.—Your suggestion that sleepers of Hornby rails should be made longer in order to look more realistic is good, and in fact has already had some consideration. We do not think that such an alteration as this is necessary at any rate at present. The rails would fulfil the same purpose, but they would require more space in packing and storage. The scheme therefore cannot have further attention at present. (*Reply to F. Hutchinson, Northampton*).

G.W.R. VANS FOR GRAIN TRAFFIC.—These vans are certainly interesting, and would add to the realism of a miniature G.W.R. system. As is frequently the case, however, they are essentially characteristic of G.W.R. practice, and do not therefore lend themselves to reproduction in the style of the other groups. Their long wheelbase also would probably cause trouble, so that we are not able to consider their reproduction at present. (*Reply to H. Clark, Chester*).

FEED WATER HEATING APPARATUS FOR No. 3 LOCOMOTIVE L.N.E.R.—Although apparatus of this kind, together with the necessary pumps and piping, is in use on the L.N.E.R., No. 4472 is not one of the engines so fitted. It would not be correct therefore, to provide our No. 3 "*Flying Scotsman*" locomotive with the fittings in question. Apart from the increased cost of such additions, the appearance of the locomotive would hardly be improved by the projection on the top of the smoke-box representing the heater. We regret therefore that your suggestion cannot be adopted. (*Reply to F. Singleton, Newark*).

NEW L.M.S.R. "RO-RAILER."—Your suggestion for the reproduction of this novel form of transport in the Hornby Series is interesting. As the vehicle in question is as yet in the experimental stage, however, we are unable to do anything in the matter. If it becomes widely used in the near future we may consider its introduction. The model would probably be costly, however, and we think most Hornby railway enthusiasts prefer the more familiar locomotives and rolling stock used on our chief railways. (*Reply to F. Gibbons, Watford*).

ELECTRIC LUGGAGE TRUCK FOR PLATFORMS.—These are used to a great extent in real practice, particularly in terminal stations. A truck suitable for Hornby railways could of course be manufactured, but it is doubtful whether it would be worth while incorporating a mechanism for its propulsion. No great advantage would be gained, and the cost would be increased. The addition of this accessory will receive attention however, in due course. (*Reply to W. Greenfield, Bradford*).

BOGIE MILK AND PARCELS VANS.—There are, as you point out, large numbers of these vehicles in service on our railways, and a miniature reproduction would certainly be an interesting addition to the Hornby Series. The difficulty lies in the selection of a prototype sufficiently representative of the practice of the four groups, as we could not undertake a separate model for each. In the meantime we suggest you should use the Hornby No. 2 Luggage Van for trains conveying traffic of the kind you mention. (*Reply to S. Gleave, Hereford*).

NUMBERING, LETTERING, ETC.—We have frequently pointed out in these pages that, owing to our standardised methods of production, there is much difficulty in altering the lettering and numbers of the various types of locomotive in each of the railway groups. Small changes in detail in this connection tend to produce very large increases in cost of manufacture. Nevertheless we appreciate your suggestions and criticisms, and we may say that it is our intention to improve steadily upon our present selection of locomotives and rolling stock. We think you will agree that big strides have been taken in this direction during the past two or three years. (*Reply to R. N. Walker, Glasgow*).

HORNBY SERIES

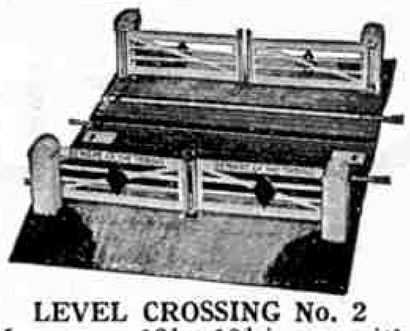
HORNBY ACCESSORIES

HORNBY SERIES

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

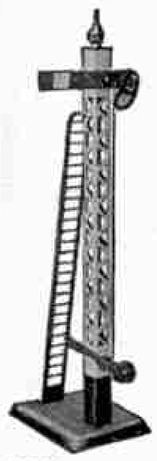
A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.

OIL CAN No. 2 ("K" Type)
This miniature Oil Can operates perfectly. The oil is ejected drop by drop by depressing the valve. Polished Copper. Price 3/6



LEVEL CROSSING No. 2
Measures 13½ × 10½ ins., with two tracks of gauge 0 rails in position .... Price 5/6

LEVEL CROSSING No. 2 (Electrical)
Similar to Level Crossing No. 2, but fitted with two electrical tracks ... ... Price 8/-



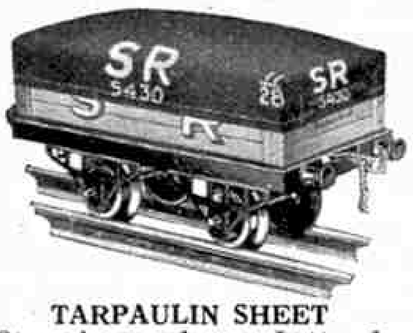
SIGNAL No. 2
Price 2/6 each. "Home" or "Distant."

DOUBLE ARM SIGNALS No. 1
Price 4/3 per pair.
DOUBLE ARM SIGNAL No. 2
(As illustrated).
Price 3/- each.

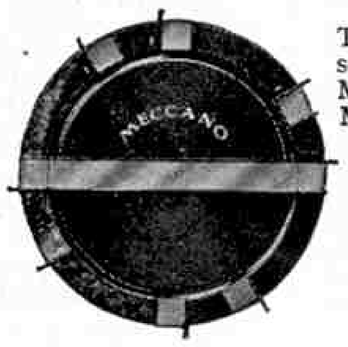
MANSELL WHEELS
These solid die-cast wheels are correctly designed and may be fitted to Hornby Wagons, Vans, Coaches, etc. Price, per pair, 4d.

M STATION SET, 7 pieces
Price complete 3/6
The components of the M Station Set may be purchased separately as follows:—M Wayside Station. Price, each, 1/-
M Signal Box ... Price, each, 6d. M Signals ... Price, each, 4d.
M Station ... Price, each, 1/3 M Telegraph Poles. Price, each 4d.

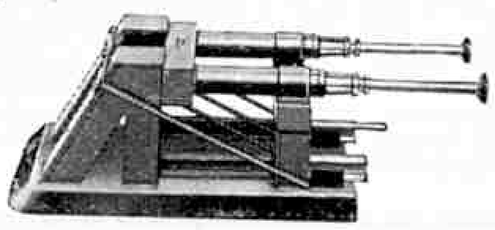
TUNNEL
Realistic and finished in colours ... Price 7/6



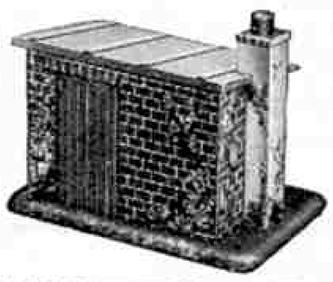
TARPAULIN SHEET
Strongly made. Lettered L.M.S., G.W., N.E. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price 3d.



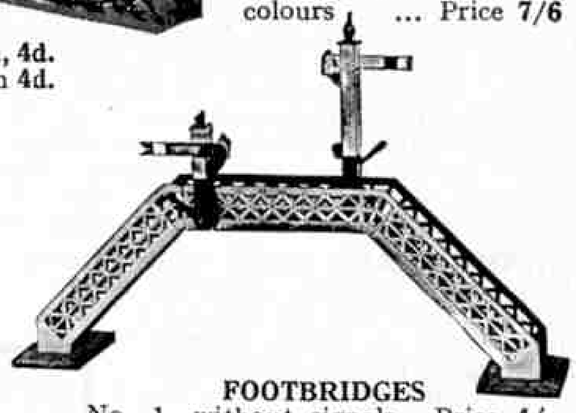
TURNTABLE No. 2
Price 4/6
TURNTABLE No. 2 (Electrical)
Similar to Turntable No. 2, but fitted with electrical rails ... Price 8/6



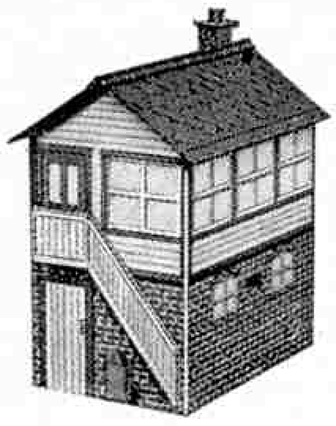
BUFFER STOPS No. 2 (HYDRAULIC)
Price 5/6



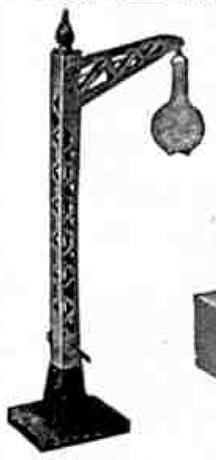
PLATELAYER'S HUT
Price ... 2/6



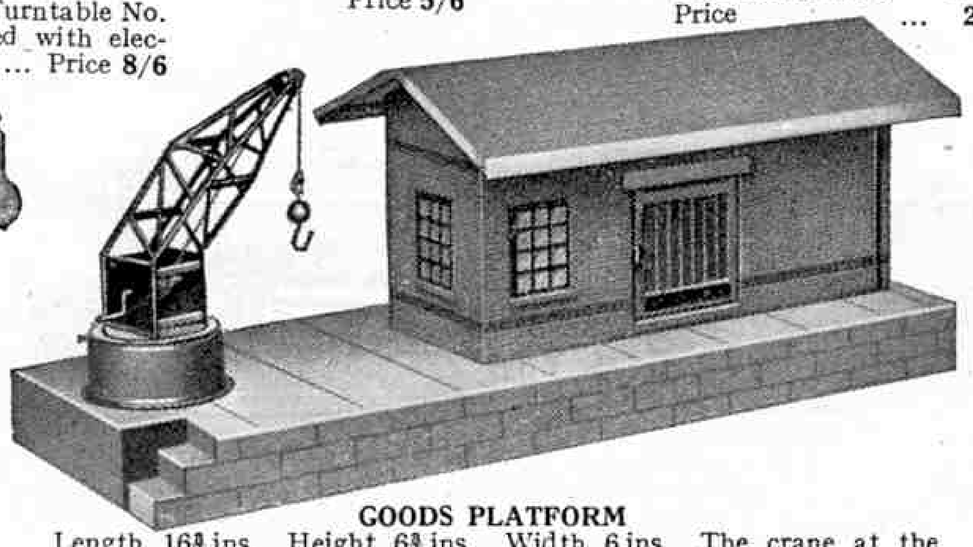
FOOTBRIDGES
No. 1, without signals. Price 4/-
No. 1a, with detachable tin-printed signal posts and arms ... Price 4/9
No. 2, with detachable enamelled signal posts and arms (as illustrated). Price 7/6
Signals only, for No. 2 footbridge. Price ... ... per pair 3/9



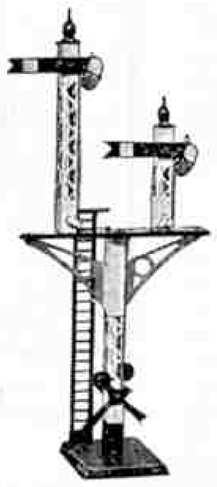
SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price 2/9



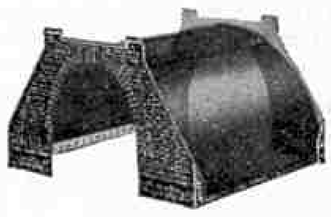
LAMP STANDARD No. 1 (SINGLE)
An electric flash-lamp bulb may be fitted into the globe. Price 3/6



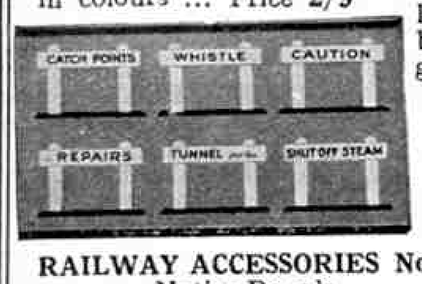
GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price 12/6



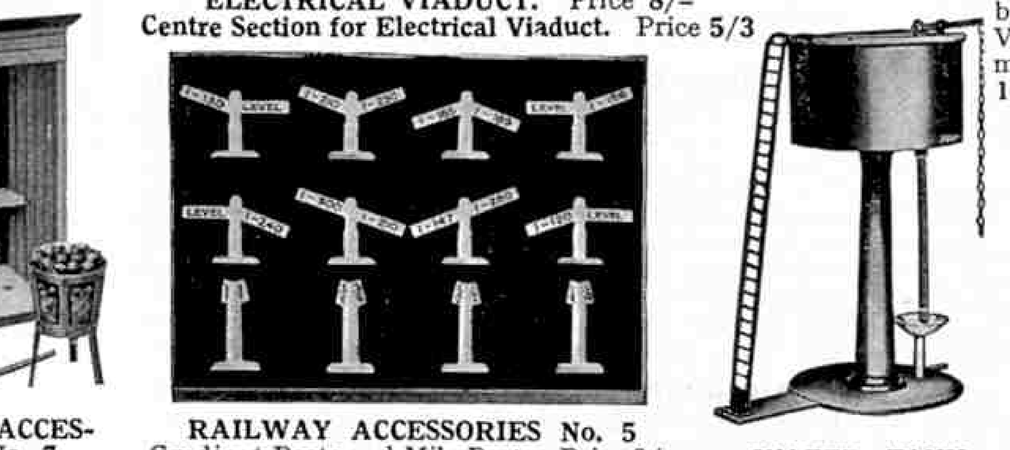
JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height. Price 6/-



TUNNEL ENDS
These Tunnel Ends add realism to Tunnels made of cardboard, or other suitable material. They may be fitted into position quite easily. Price, per pair, 2/9

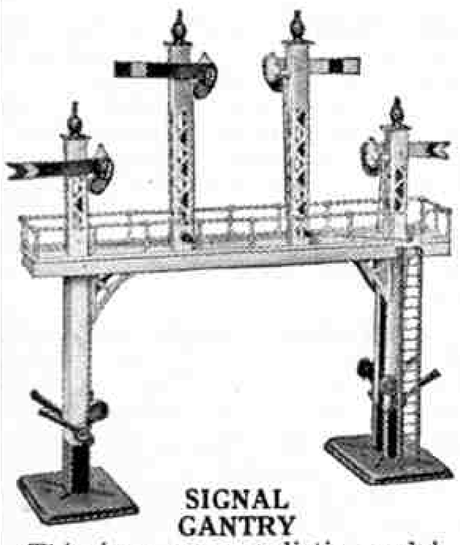


RAILWAY ACCESSORIES No. 8
Notice Boards.
Price, per set, 2/3



VIADUCT. Price 7/-. Centre Section only. Price 4/9
ELECTRICAL VIADUCT. Price 8/-
Centre Section for Electrical Viaduct. Price 5/3

RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price, per set, 2/6



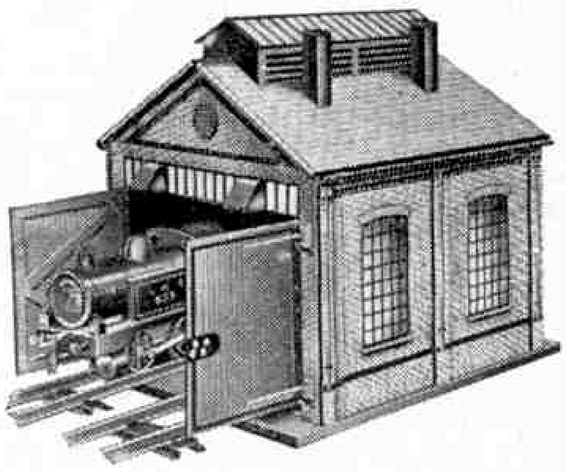
SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price 10/-

RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price 1/6

RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price 2/-

WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever. Price 8/6

RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable. Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price 12/6



ENGINE SHED No. 1
This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, and Locomotives of No. 0 and No. 1 types ... ... Price 15/-

H.R.C. COMPETITION PAGE

Third Locomotive Name and Number Contest

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

SOME time ago locomotive names and numbers were made the subject of several H.R.C. Competitions and the entries received for these were distinctly gratifying. Later other competitions were devised in which the names of locomotive designers were introduced and finally well-known expresses had their names converted into a jumble of letters from which H.R.C. members were required to pick out the trains concerned.

On account of the popularity of these contests, we think that the one presented this month will be welcomed by members. In this a return is made to the original form of contest, in which the names and numbers only of the locomotives are set down in a distinctly confusing manner. The sight of these will, we hope, puzzle the most seasoned number-taker and name-collector, and the entries received will show how far we are correct.

Each represents a well-known locomotive belonging to one of the four railway groups, and in order to assist new members to realise exactly what is wanted we give the solution of the first on the list. When rearranged "*Goinsnwk*" becomes "*King's Own,*" and once this has been settled it immediately becomes clear that the number must be 6161 instead of 6611. Competitors should take each number and name in the panel on this page and set it down on a sheet of paper. Opposite they should then place, as far as they can, the correct number and name, and the initials of the company owning the engine. When the list is completed, or when as many correct names and numbers as possible have been filled in, the sheet should be clearly marked with the name and address of the competitor, and also of course his H.R.C. number.

No.	Name	No.	Name
6611	Goinsnwk	4165	Surshahet
9265	Nmaan	7427	Hacncroo
2709	Ryngaeglr	8294	Ragtallhaec
737	Hintkuerg	8032	Natneger
2336	Raila	907	Livlasrisir
4373	Vorloilpe	871	Llavoegasir
6283	Houcgh	3435	Rairghurbalgtew
5237	Varherest	4925	Canliebiljairorie
507	Yormanglefa	1045	Darkwool
280	Ruderinros	4453	Fonglaim
6530	Gelmang	587	Werldhoo
7279	Rociec	4915	Chersvaleou
467	Donrenpag	244	Cheeaabyhd
3885	Thickhardrarwrig	9820	Nedlurceoio
3315	Lonandeal	3255	Barlroughom
486	Bishertinramfrisro	6345	Donladfarying
2166	Lierapsnas	246	Balsandheats
3049	Damitlanueeq	4008	Hastdowamerplec
8126	Dollfoan	9975	Boshfrier
3095	Gyengllo	3829	Formioneethytunoc
717	Mosesragrair	3375	Martgapin
5011	Donrukie	856	Sinjohnwarshik
8363	Tuckoldhanhonjab	5363	Themasgroyrlcte
3035	Wynlen	9586	Thonroajog

The contest will be divided into two sections—Home and Overseas. Prizes of Hornby goods (or Meccano if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors in each section who submit lists containing the highest number of correct solutions. A number of consolation prizes, consisting of copies of "*Famous Trains*" by Cecil J. Allen, also will be awarded, and competitors should send in their entries even if they have been unable to find the correct names and numbers in every case. In the event of a tie for any prize neatness will be taken into consideration in making a final decision.

Envelopes containing entries should be clearly marked in the top left-hand corner H.R.C. "*Loco Name and Number Contest No. 3*" and must be posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th May. Closing date for the Overseas Section, 31st August.

It must be remembered that the omission of the H.R.C. number from an entry will cause it to be disqualified. This is an important condition to which competitors should pay special attention, as its neglect in the past has occasionally caused promising entries to be discarded.

Electrical "Gadgets" on Clockwork Railways

In the H.R.C. pages of the "*M.M.*" we have published from time to time articles dealing with the application of electricity to clockwork railways. There are many interesting electrical schemes that can be added to clockwork layouts without interfering with the general arrangement, but at the same time adding a great deal of interest and realism. Among these may be mentioned the lighting of stations, either permanently or while a train is standing there; the lighting of goods yards and sidings; the illumination of signals, etc. From our correspondence we know that many H.R.C. members have experimented in this direction, and this month we offer prizes for "*The Best Suggestions for Adding to the Interest of a Clockwork Railway by Electrical Means.*" It must be understood clearly that the railway itself must be clockwork and not electric.

To the senders of the four best suggestions in each of the two sections, Home and Overseas, we offer prizes of Hornby Railway material (or Meccano if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be awarded.

Envelopes containing entries should be marked H.R.C. "*Electric Contest,*" and posted so as to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th May. The closing date for the Overseas Section is 31st August.

Drawing Contest

Drawing Contests with objects of railway interest as their subject maintain a steady popularity, and there is evidently a general desire that they should be continued. A reader has recently suggested that the subject for this month's Contest should be something connected with electric railways, and therefore we have decided to select "*An Electric Locomotive.*"

The electric locomotive is less attractive in appearance than its steam relative, on account of the fact that its moving parts are largely hidden. Nevertheless it has a very special interest of its own. In past issues of the "*M.M.*" we have published articles containing illustrations of electric locomotives, so that all readers should be familiar with their general appearance.

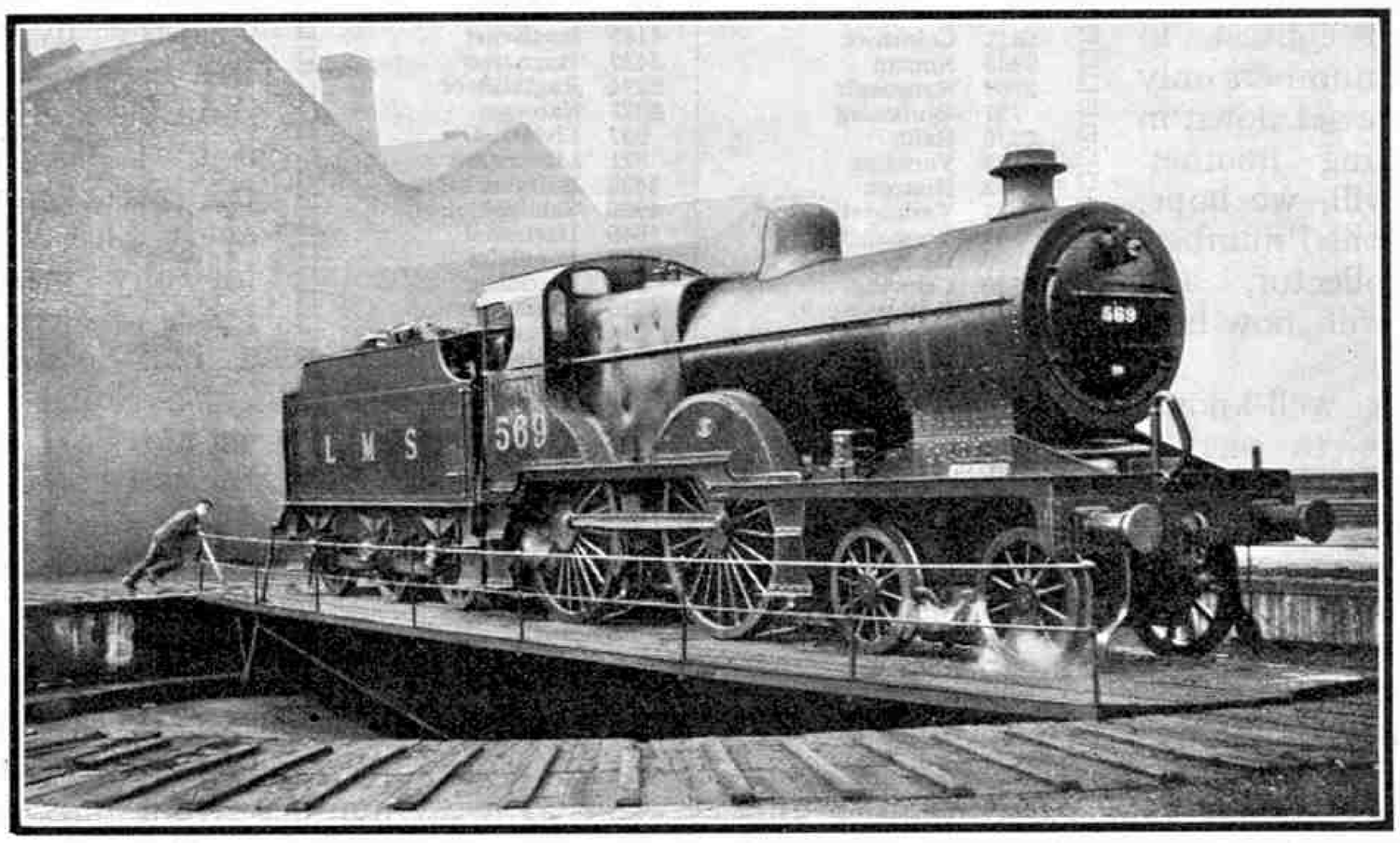
The contest will be divided as usual into two sections—Home and Overseas. To the senders of the four best drawings in each section Hornby Railway material (or Meccano products if preferred) to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded. In addition to these a number of copies of "*Famous Trains,*" by Cecil J. Allen, will be given as consolation prizes. Entries must bear the competitor's full name and address, and of course his H.R.C. membership number. Envelopes containing entries should be clearly marked H.R.C. "*Electric Locomotive Drawing Contest*" and posted so as to reach Meccano Ltd., Old Swan, Liverpool, on or before 30th May. Overseas—31st August.

Turntables in the Hornby Series

By "Tommy Dodd"

ALL Hornby railway enthusiasts know that it is necessary for every railway, real or model, to have some means of turning its locomotives round. The main purpose of turntables is for turning engines so that they may work chimney first when hauling trains. Locomotives having tenders are seldom used on trains with the tender leading, as this would be inadvisable if work at fairly high speed were required, apart from the discomfort occasioned to the crew. Turntables are therefore primarily intended for tender engines. It is not necessary for tank engines to be turned, as on these engines the men have some protection from bad weather when running in reverse, and the engines are designed to run either way with equal facility. It is however the usual practice nowadays to turn tank engines that are being used for fairly long-distance local services, as it is difficult for the enginemen to secure a good look-out over a large bunker full of coal.

Since the earliest days of railways in this country turntables have been used. The transfer of through carriages at junctions was frequently accomplished in this manner, and also the shunting of vehicles at carriage depôts. Turntables have necessarily developed in size and strength so as to keep pace with the growth of the locomotives, though in numerous cases the locomotives have outstripped the turntables and have had to be turned by other means.



A hand-operated turntable of the "well" pattern, at York. The battens laid round the edge of the well to give a foothold to the men are plainly visible, and the L.M.S.R. 4-4-0 locomotive shown is actually being turned. For this photo we are indebted to Mr. G. Wood of Halifax.

The kind of turntable most commonly used in this country is known as the "Well" type, which, as its name suggests, is situated inside a pit or well sunk in the ground. Substantial girders, well braced together, form the underframe of the table, and it is in order to secure sufficient depth for these to be of adequate strength that the pit is provided. Upon the underframe is fitted a wooden or metal platform for carrying the rails. In order to prevent accidents to men falling from the table into the pit, iron railings are usually provided at the side.

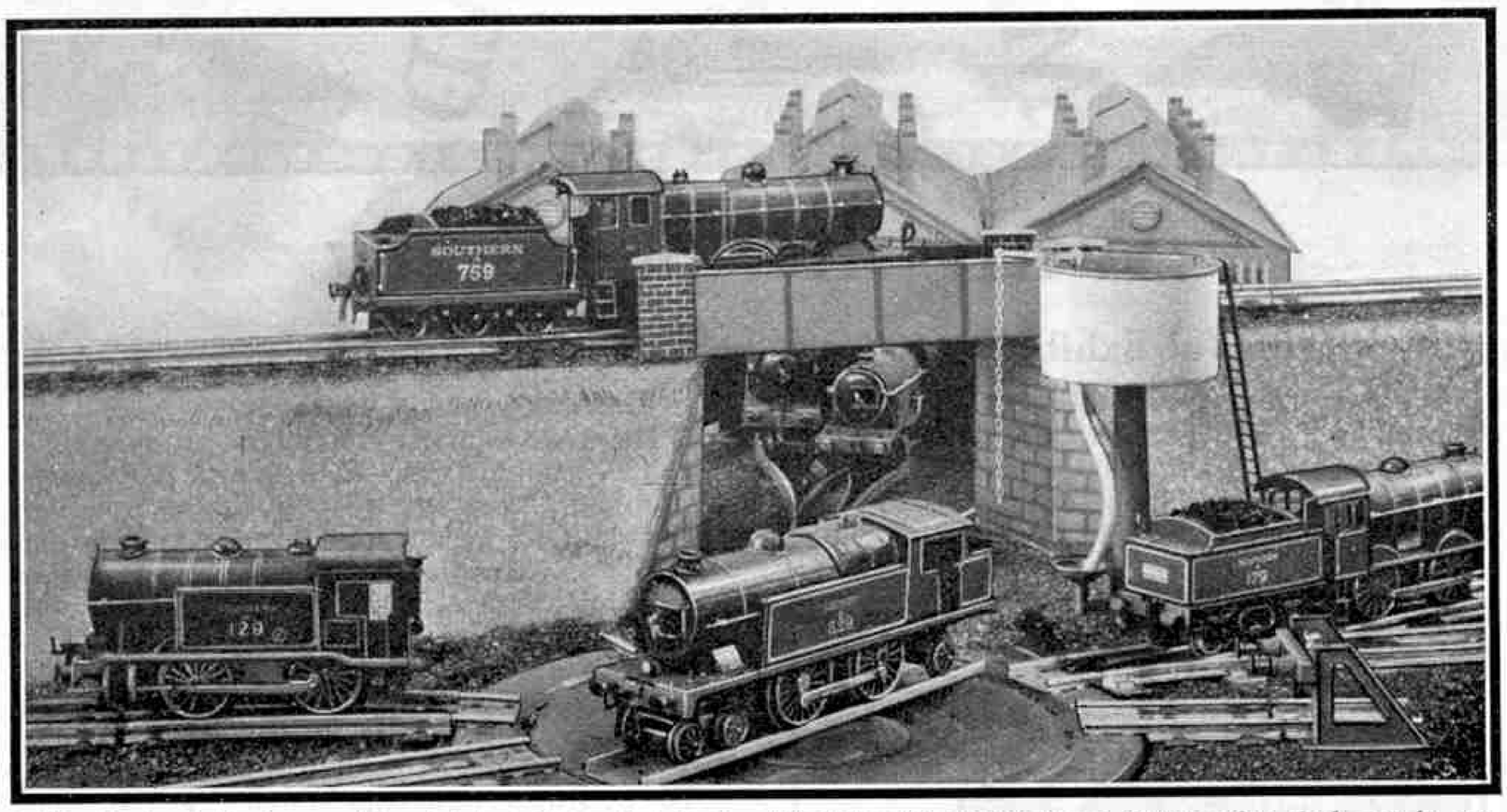
The girders are pivoted in the centre of the well, and are supported at the ends by wheels running on a circular single-rail track laid inside the well. The wall of the pit is usually of brick, while the edge at ground level is laid with wood for a width of about 3 ft. On this circular wooden path are laid battens to provide a foothold for the men engaged in turning an engine. A typical view of such a turntable appears on this page, and the engine upon it is actually being turned. In this case the turntable is manually operated by the engineman at the far side. In order to push the locomotive round, long iron levers are fitted at both ends of the revolving platform. There are in addition levers operating locking devices to secure the turntable in a suitable position to lead to any of the roads radiating from it.

Turntables nowadays are often fitted with an electric motor, and this is naturally a great help to the driver and fireman, as it relieves them of the effort required to move the table. An electric turntable is also much quicker in operation, and is therefore specially valuable when the time allowed for turning is short, and the engine is due away again fairly soon.

The diameter of a turntable is usually about 50 ft., and this will accommodate the majority of English engines of average size. Those installed recently are sometimes as much as 70 ft. in diameter, owing to the great length of engines of the latest designs. The smaller tables are quite common on lines where in pre-grouping days no very large engines were used. Where a turntable is employed to transfer engines from one road to another adjacent road after the manner of a traverser, it is usual to find that short lengths of rail are laid in a corresponding position on the opposite side, so as to aid the operator of the turntable to place the revolving portion against the track on which the engine is required to run off. It is a very fascinating sight to watch a long passenger locomotive being driven on to a turntable that will barely accommodate it, and Hornby Railway enthusiasts will no doubt have watched this operation scores of times. The buffers and part of the frame of the engine may considerably overhang the well, but it is the length of the wheelbase that counts, and possibly there will only be a few inches to spare at each end when the engine is finally placed. Such careful work as this requires a great deal of skill on the part of the enginemen, in order to fit the locomotive accurately on the table.

No pit is necessary for the balanced turntable that

is used a great deal by the Great Western Railway. The sides of these tables are usually built up of plate girders, and a pivot is situated in the centre of the floor. The ends of the table are supported on wheels running on a circular track as before, but this is laid at ground level, as the depth of the girder is above the turntable and not below it as in the "Well" type of turntable. An interesting feature is sometimes to be seen when there are turntables in the vicinity of railway repair shops or stations. In such cases the revolving platform, instead of being only sufficiently wide to accommodate one track, is built so as to cover the whole of the pit opening, and this prevents the possibility of accidents through anyone falling into the pit.



A Hornby turntable in use at a miniature locomotive depot. The layout is extensive and three engine sheds are in use, the centre one being of the "through" pattern. Additional realism is given to the picture by the "avoiding" line passing across on the embankment.

It may frequently happen that an engine working on an excursion train visits a town where there is no turntable in the district large enough to accommodate it, and so the only way of turning it will be by means of a triangle junction. This method is often used in preference to the turntable, where the latter is situated a considerable distance away from where the engine will be left till its return trip.

Other occasions of the use of the triangle occur when engines have to be turned quickly in a congested area, where access to the turntable may be difficult. A triangle junction proves useful when the L.N.E.R. special train that is run from King's Cross to Liverpool, in connection with the Grand National steeplechase, is hauled by one of the well-known "Pacific" engines. At Aintree, where the famous race is run, there is an L.M.S.R. locomotive depôt that formerly belonged to the Lancashire and Yorkshire Railway, and there are also in the same district two other locomotive sheds; but none of them possesses a turntable large enough to accommodate the "Pacific."

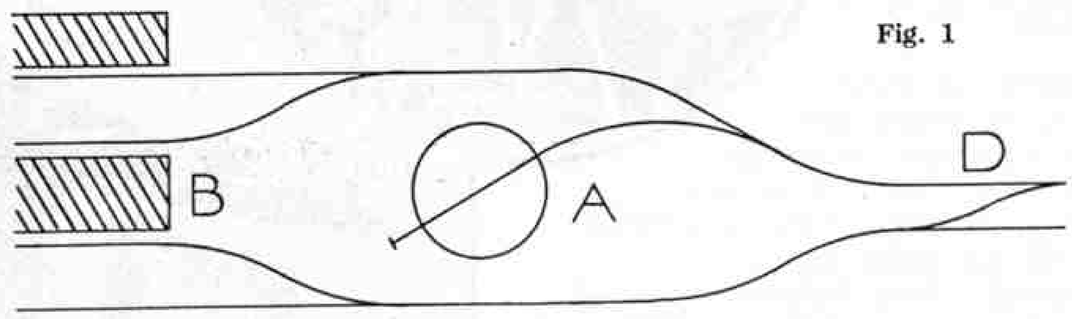


Fig. 1

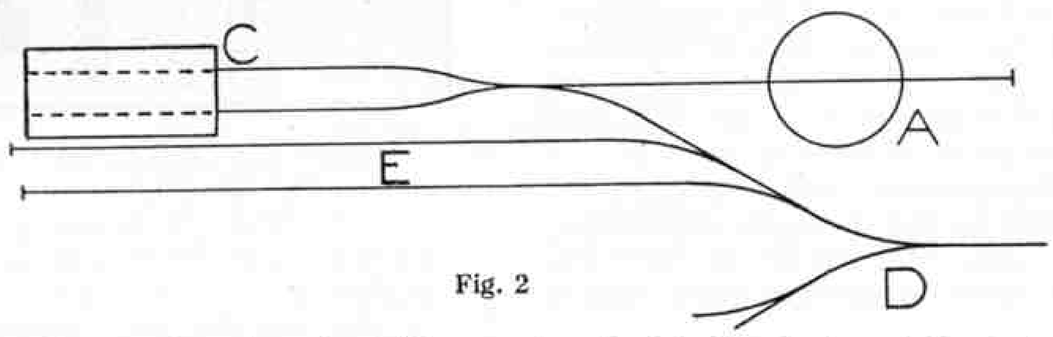


Fig. 2

The diagram shows how turntables may be situated—Fig. 1 at a station and Fig. 2 at a locomotive depot. These diagrams may be followed by reference to the letters marked on the plan. A, Turntable; B, Station Platform; C, Engine Shed; D, Main Lines; E, Engine Sidings.

In the Hornby System the turntables are of two types. The larger of the two is known as the No. 2 Turntable, and has a diameter of 13½ in. This can be used for many of the Hornby engines, while the No. 1 Turntable, 8½ in. in diameter, is only suited to the smaller locomotives. To the No. 2 pattern are fitted eight short pieces of track, to any of which a revolving portion, 11 in. in diameter, can be secured by a locking device, consisting of a lever dropping into a slot. On examining one of these accessories it will be noticed that this is as far as possible modelled on the "Well" type. The edge of the base is raised as high as the sleepers of ordinary rails, and then slightly slopes to the centre, where it rises sharply again to form a boss for the pivot of the revolving track.

An interesting addition is the No. 2 Electric Turntable. This has no counterpart in real practice, but it has been introduced into the Hornby System for the convenience of enthusiasts who operate electric layouts. The revolving part is fitted with a centre rail, as also is each of the short pieces of track radiating from the table. This enables an electric locomotive to be run on to the turntable, turned, and then run off without being touched by hand. This, of course, is a most realistic process, and adds greatly to the charm of operating a miniature electric layout.

Neither of the Hornby turntables allows the No. 2 Special or No. 3 locomotives to be turned with their tenders, but possibly a larger turntable will be available in the future.

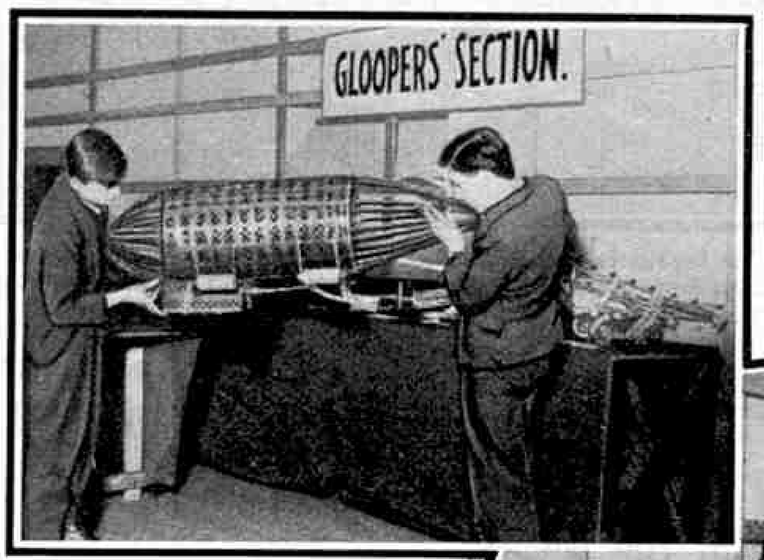
The space occupied by a large turntable is considerable, and for this reason Hornby enthusiasts often find it difficult to place it in a suitable position on a layout. In large stations, whether of the through or terminal pattern, a turntable will invariably be found. Often it is situated at the end of the platforms, in the space left by the lines widening out to serve them. This scheme can be well adopted on a Hornby railway, as shown in Fig. 1 in the accompanying diagram.

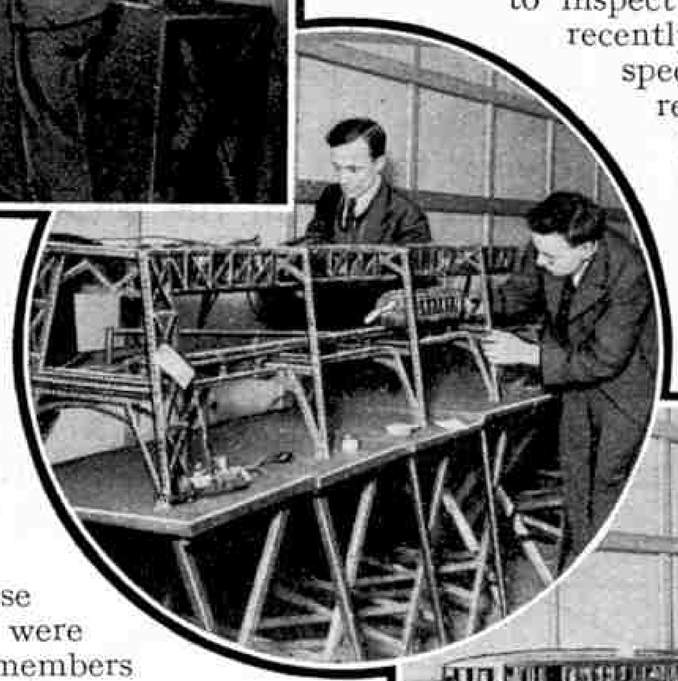
At locomotive depôts it often happens that more than one turntable is installed, usually one at each end of the shed. One will be quite sufficient on a Hornby railway, however, and it should be placed on a separate line, where it is easily reached from all roads in the shed. This is shown in Fig. 2 of the same diagram, which represents a locomotive depôt situated off the main track. Rarely in actual practice is a turntable used as a medium to reach the shed itself, though examples do occur. This is on account of the strain to which it would be subjected by the locomotives constantly passing over it. Also the turntable might be in use at times when engines were required either to leave or arrive at the shed, and this would result in difficulties and delays.

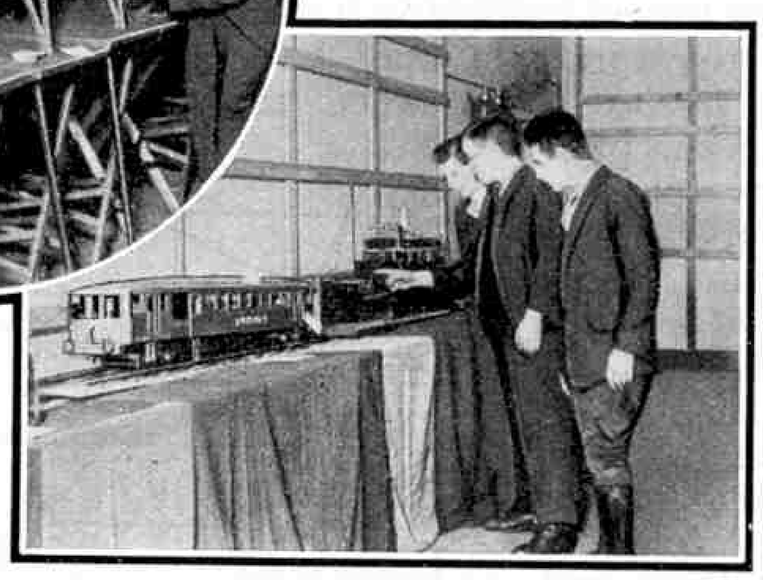
With the Secretary

A Wonderfully Successful Exhibition

One of the most interesting of recent exhibitions was that organised by the Newcastle-on-Tyne Meccano Club and Branch of the Hornby Railway Company. This was the second annual exhibition of the club and, as was the case with the first Exhibition held in February last year, it was arranged in conjunction with the "*Newcastle Evening Chronicle.*" It was held in the Chronicle Hall, and half the proceeds were allocated to the Sunshine Fund organised by that newspaper.







A few of the attractive models on view at the Second Annual Exhibition of the Newcastle Meccano Club. The working model of the Bennie Railplane shown in the central photograph attracted special attention.

Over 15,000 people visited the Exhibition, on the success of which the Club is to be congratulated.

The officials and members worked very hard in fitting up the Hall for exhibition purposes, and when all was ready they filled the benches with an imposing array of Meccano models constructed by themselves or by entrants in the many competitions that had been organised in connection with the exhibition. A very interesting feature of these competitions was that a proportion of them were open to Meccano model builders who are not members of the club. This is an excellent plan that may be recommended to other clubs, for it arouses great interest and is a means of attracting enthusiastic recruits of an ideal type.

A remarkable gathering was present when Alderman David Adams, Lord Mayor of Newcastle-on-Tyne, opened the exhibition. The Lord Mayor paid a wonderful tribute to the value of Meccano, and showed how greatly the splendid collection of models on view had impressed him. He told the members of the club and the large number of visitors present that on leaving the Hall he was going to an assembly of civil engineers, and expressed his intention of telling them that his visit to the Meccano Exhibition had shown him that civil engineers were only grown-up Meccano boys, and their bridges, dams and other structures were simply full scale Meccano jobs!

The Romance of Meccano

To the Meccano boys present, the most interesting event of the evening undoubtedly was the address of Mr. Frank Hornby, the President of the Meccano Guild. Mr. Hornby made a special journey north in order to be present, and he delighted everybody in the great audience by his romantic account of the invention of Meccano and its amazing development. They were enthralled as he talked about his schemes and ambitions as a boy, when he tried to discover the secret of perpetual motion. He did not then know that perpetual motion is impossible, of course, but this was fortunate, for his efforts to solve the problem enabled him to acquire valuable all-round engineering knowledge and set him thinking along the lines that eventually led to the invention of Meccano.

There were many difficulties to overcome before the invention was thoroughly established, and Mr. Hornby said that he was more than compensated for the trouble and hard work involved in this task when he looked round at the exhibits, with the excellence of which he was greatly impressed. He congratulated the Newcastle club on the enthusiasm and enterprise that had enabled them to tackle successfully the organisation of such a large Exhibition.

When the opening ceremony had been successfully carried through, a signal was given, and the motors were switched on, revealing the fact that most of the models on view actually worked. The visitors were fascinated by the Aeroplanes, Locomotives, Transporter Bridges, Lifts, Roundabouts and other models, and found it very difficult to tear themselves away from one in order to inspect the next. A model of the great arch bridge recently constructed across the Tyne naturally attracted special attention, and this was shared by a splendid reproduction of "No. 10000," the famous L.N.E.R. high-pressure locomotive that is shedded at Gateshead. The exhibition remained open for ten days. The many working models were regularly demonstrated by members of the club and in addition two Hornby Railway layouts were in active operation practically throughout in accordance with a carefully planned timetable. The efforts of the members were rewarded by a wonderful attendance. In spite of snowy weather, over 15,000 people visited the exhibition, and the club and the Sunshine Fund of the "*Newcastle Evening Chronicle*" shared between them the handsome sum of £88.

* * *

I have been asked to announce than an Exhibition is to be held on the 9th of this month by the Wembley M.C. in St. Michael's Church Hall, Tokyngton. The Exhibition will be opened at 3.0 p.m. and there will be no charge for admission. Interesting models will be on view, and Meccano boys and "*M.M.*" readers in the vicinity are cordially invited to be present.

Proposed Clubs

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

BOURNEMOUTH—A. O'Callaghan, "Shamrock Villa," Hosker Road, West Southborn.
ENFIELD—J. Field, 16, Harman Road, Bush Hill Park.
LONDON—E. Goldspink, 84, Sussex Street, E.14.
MANCHESTER—J. Heald, 32, Markington Street, Moss Side.
SWITZERLAND—W. Sommer, 6 rte de Florissant. Geneve.

Hampstead and Cricklewood M.C.—The programme has included Lantern Lectures, visits to Museums and other places of interest, and a Conjuring Entertainment. Hornby Train Evenings have also been held. The first Exhibition organised by the club was a great success, a fine display of models being given. Club roll: 13. *Secretary:* A. D. N. Nabarro, 87, Priory Road, London, N.W.6.

Westbury M.C.—Competitions, Games Nights, a Mock Trial and a Debate on "*Summer Time*" have been included among recent meetings. Members have also been busy preparing for the Exhibition, which was a great success. A visit was paid to the Letchworth Telephone Exchange, and a Club Library has been formed. Club roll: 24. *Secretary:* E. D. Move, 24, Burnell Rise, Letchworth, Herts.

Barton-on-Humber M.C.—Models constructed by members are now displayed regularly in a local shop window, those shown recently including the Transporter Bridge and the Big Wheel. A neat card informs onlookers that models have been made by members of the club and many new members have been enrolled as a result of this scheme. A splendid programme has been arranged, and includes Meccano Model-building Nights, Lectures, and Hornby Train nights. "Hat" night also has been introduced. Club roll: 12. *Secretary:* H. Wood, 37, Castle Dykes West, Barton-on-Humber.

Holy Trinity (Barnsbury) M.C.—The Twelfth Annual Exhibition was a great success, the models shown being of a high standard, and particularly notable for originality in design. They included a Tramp Steamer, a model of the George Bennie Railplane, a Chocolate Machine and a Tramcar. On the Handicrafts Stall some very fine woodwork was displayed, and the model railways on view, one of which was fitted up and operated entirely by juniors, also attracted considerable attention. Members of the club took part in the visit of the Belfort Branch of the H.R.C. to the S.R. works at New Cross Gate Station. Stamp Collecting and Chemistry Sections have been re-started, and Five-minute Talks are proving popular. The Seventh Annual Concert was held in April. Club roll: 45. *Secretary:* Mr. F. Randall, 43, Ripplevale Grove, Barnsbury, London, N.1.

Churcher's College M.C.—Although illness has seriously affected attendances, an interesting programme of Meccano Model-building Contests, Debates and Football Matches has been followed. A paper on "*The Submarine*" was read by the Head of the School. Outdoor activities have included a ramble and a tracking game, in addition to Football. Club roll: 25. *Secretary:* G. S. Finch, Churcher's College, Petersfield.

Royal Grammar School M.C.—Particularly interesting visits were paid to the Motor Show at Olympia, and G.W.R. Works at Swindon. Forty members attended the Motor Show and ninety-nine were present at Swindon. Papers by members on "*Stamp Collecting*" were heard at one meeting. A Lecture that attracted special attention was given by Mr. G. Eden, editor of "*Navy*," who gave a most enjoyable description of "*A Voyage Round the World in a Windjammer.*" Club roll: 150. *Secretary:* F. W. Essex, Royal Grammar School, High Wycombe.

Mall School M.C.—On Model-building Nights the construction and testing of models of racing motor cars is a great attraction. "Variety" nights are a new feature and usually include 'ghost' stories, told in a most blood-curdling manner. A Lantern Lecture on "*A Visit to Bournville Works*," kindly loaned by Messrs. Cadbury Bros., was shown to the members some time ago. A successful concert was given at the end of the School term. Club roll: 26. *Secretary:* K. Harrison, 51, Newry Road, St. Margarets, Twickenham, Middlesex.

Wembley M.C.—Model-building and Hornby Train Nights have been the chief activities. At one meeting members built models of recent inventions. Games Nights are popular and members enter into every feature of the programme with much enthusiasm. Preparations for the Exhibition have taken up a large proportion of recent meetings. Club roll: 12. *Secretary:* Eric Curtis, 45, Monks Park, Wembley, Middlesex.

Cranleigh M.C.—Steady progress is reported during the past session, and Meccano Model-building is greatly enjoyed. Hornby Train Nights are a great attraction. A permanent track is not used at present, and several interesting layouts have been worked out. Two billiard tables have been purchased for the use of members. Club roll: 14. *Secretary:* W. West, Police Station, Cranleigh.

Our photograph shows a group of members of King's School (Peterborough) M.C. This was affiliated on 4th March, 1930, with a membership of 21, under the Leadership of Mr. W. V. Garrard. An excellent programme of Model-building, Hornby Train Nights, Lectures and Debates is followed.

Leigh Boys (Sherborne) M.C.—Steady progress is reported. The chief activity has been Meccano Model-building, and a prize is given for the member having the highest marks at the end of the month. A Bagatelle Contest against the Girl Guides was much enjoyed, the Club scoring a narrow win. Permission has been secured for a party of members to pay a visit to Westlands and Petters Aeroplane and Engine Works. Club roll: 9. *Secretary:* C. Hannam, Holmbushes Farm, Longburton, Sherborne, Dorset.

South Croydon and Purley M.C.—Four of the members presented an Impromptu Play, improvising their parts very cleverly as they proceeded. A demonstration of working models constructed by the Junior members was a feature of a recent meeting, while two Debates have been held on "*Will Men Ever Reach The Moon*" and "*Should Submarines Be Abolished.*" The first of these created much amusement. Models of war-time articles were required in a "Simplicity" Contest recently held. Members worked hard in preparation for an Exhibition of models organised to raise funds for the hire of a new club room, the present room being too small for the increased membership. Club roll: 31. *Secretary:* G. C. J. Green, "Tygasome," Riddlesdown Road, Purley.

Laindon M.C.—Members greatly enjoyed operating a Meccanograph model loaned from Headquarters and inspecting its construction. The club's Hornby Train layout has been enlarged. Part of it is now laid with double tracks and all has been re-laid and re-ballasted. Meccano Model-building Evenings also have been held regularly. An interesting summer programme is being prepared. Club roll: 15. *Secretary:* J. P. Tourle, "St. Ives," Leicester Road, Laindon, Essex.

Falmouth Wesley M.C.—Many new features have been introduced into the programme, including an Officers' Surprise Evening that took the form of impromptu speeches. A club Magazine, known as the "*Meccanoite*," is now published at 1d. per copy. It is an interesting journal and contains club news, short articles and jokes. A Mock Court has been held and a new feature was a mock meeting of the Town Council, which gave rise to an interesting Debate on civic problems. Club roll: 27. *Secretary:* Mr. V. T. S. Jordan, "Trevose," Langton Terrace, Falmouth, Cornwall.

Manor House M.C.—Several short lectures on "*Aircraft*," "*East Africa*," and other subjects of interest have been given. A Contractors' Night was held recently and the proceedings so greatly interested Meccano boys who were present as visitors that several of them joined the club. Hornby Train nights have been held regularly and have been well attended. Club roll: 18. *Secretary:* J. F. W. Burrow, Manor House School, North Side, Clapham Common, London, S.W.

Clubs Not Yet Affiliated

Holloway M.C.—A club room has now been secured, and the members are very enthusiastic. A Social Evening recently organised was greatly enjoyed and five of those invited to be present were enrolled as new members. Club roll: 14. *Leader:* Mr. R. Barker, 38, Fortnam Road, Holloway, London, N.19.

Wilton (Salisbury) M.C.—At the opening meeting of the club it was decided to hold meetings weekly at the home of the secretary until a club room has been secured. Great interest is taken in Meccano Model-building, Electricity, and Stamp Collecting. A Library has been started, and books have been given by members. Games Nights are to be held once a month. A Draughts Tournament has been arranged, the winner to hold a Cup for a period. Club roll: 7. *Secretary:* B. Smith, 13 Kingsbury Square, Wilton, Wilts.

St. Peter's (Southwark) M.C.—A Leader has been secured and the club is making good progress. A special meeting was devoted to a discussion of "*Transport*," and a model of a Steam Lorry recently illustrated in the "*M.M.*" was constructed. The Hornby Track is to be fitted with colour light signalling. Members have designed a large model terminus station, which is being made on Fretwork evenings and promises to be a very impressive structure. Club roll: 7. *Secretary:* Sidney V. Leach, 77, Union Street, Southwark, London, S.E.1.

Mallow M.C.—A very interesting talk on the Shannon Scheme was given by a member at a recent meeting, and his talk was so much enjoyed that he was asked to repeat it. A club Magazine is under consideration. An Exhibition has been held. This included an extensive Hornby Train layout and was very well attended. Mr. D. Gyves has kindly accepted the Leadership. *Secretary:* W. Roche, 8, Spa Walk, Mallow, Co. Cork.

Bagshot M.C.—A club room has been secured and the members are very enthusiastic. The club is under the Leadership of Mr. F. E. Lee, and an excellent programme is being arranged. *Secretary:* E. Hart, No. 3, Providence Cottages, Guildford Road, Bagshot, Surrey.

Valley (Brisbane) M.C.—Meetings are held weekly, and recently a visit was paid to Sandygate, a seaside resort where the members spent an enjoyable time. Mr. W. Hansen, father of the secretary, has kindly accepted the Leadership, but more members are required. Club roll: 6. *Secretary:* W. J Hansen, 22, Wandoo Street, Valley, Brisbane, Queensland, Australia.

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THE SIMPLEST SNAP MAY EASILY WIN!

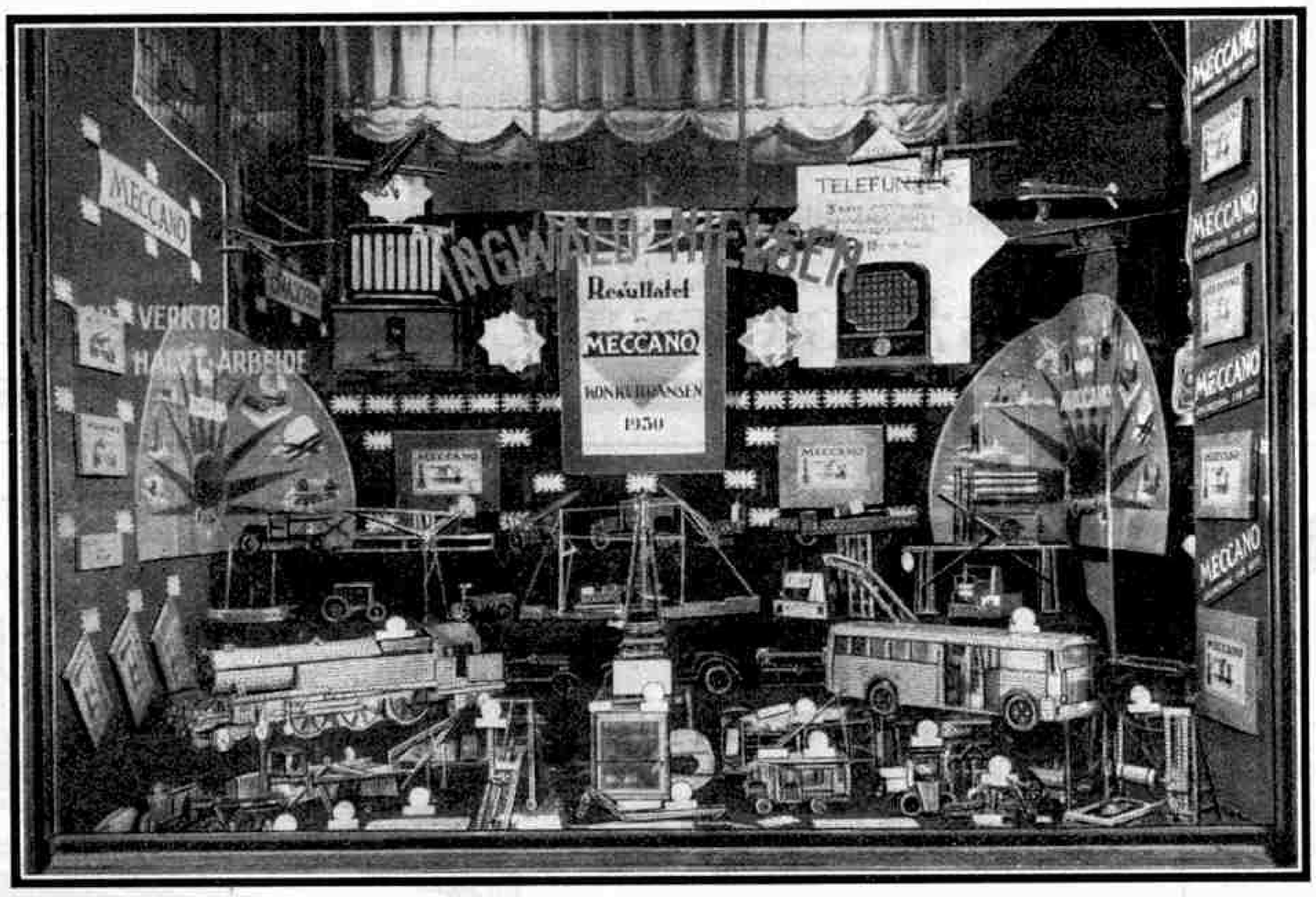
Meccano Model-Building in Norway

Splendid Entries in an Interesting Contest

SINCE conditions settled down after the Great War, Meccano model-building has grown rapidly in popularity on the Continent, and is spreading steadily to new areas. Progress has been specially marked in Norway, where Meccano is becoming a national hobby. We have recently received details of the results of the fifth Meccano Contest organised by Mr. Ingwald Nielsen, whose establishment in Oslo is famous as the Meccano distributing centre for Norway. This contest was divided into three sections, for competitors under 10, from 10 to 14, and over 14 respectively. It attracted a record number of entries, and the models submitted reached a considerably higher average standard than in previous contests. After the prizes had been awarded, Mr. Nielsen placed the winning models on view in his window, and the accompanying illustration gives some idea of the splendid display.

The outstanding entry in the class for boys under 10 was an ingenious and amusing model of a horse and cart, built by Kare Faye; and this model was deservedly awarded first prize in its class. Two particularly interesting examples of crane construction were submitted in this section by Rolfe Henning Ask and Arne Bruland, who were awarded second and third prizes respectively.

The first prize in the section for competitors from 10 to 14 was carried off by Per Oscar Johannessen with a large model of a locomotive. This splendid entry may be seen at the left-hand side of the window in the accompanying illustration. The second prize in this section was awarded to Knut Oxholm, who chose an original subject for his model—a Norwegian hay cart. This model was particularly well constructed. The third prize in this section was divided between Johan Isaksen and Carl Peter Blom. Isaksen submitted a model of a motor car lifting gear that is often used in garages for car inspection and repair; and Blom's model was an electric derrick crane. A special prize was awarded to Haakon Sorbye for his model of a mechanical excavator.



A selection from the splendid prize-winning models in the Fifth Norwegian Meccano Model-building Contest, displayed in the window of Mr. Ingwald Nielsen of Oslo.

Perhaps the most remarkable of all the models in the contest was the one entered by Rolf Olafsen, which carried off first prize in the class for boys over 14. The subject of Olafsen's model was the latest pattern of single-deck petrol omnibus, now in use in Oslo, and the model is a really excellent example of Meccano constructional work. It may be seen at the right-hand side of the window in the illustration. The mechanical portion of the chassis is very complete, incorporating a miniature engine, clutch, gear-box, universal joint, differential and brakes. The body-work also has been very carefully designed, and the interior is fitted with electric light. Folding passenger exits are another novel feature of this splendid model.

The second prize in this section, was awarded to Per Thoren for a model of a concrete mixer, and a printing machine built by Harold Ovland secured the third award.

So many excellent models were entered in the section for boys over 14 that it became a difficult matter to allot the prizes. Finally Mr. Nielsen awarded a special extra prize to Arne Hoel for his planing machine, and an honorary prize to Johan Magnussen for his model of a motor car with front wheel drive.

An interesting feature of the contest was the variety of small models submitted. In spite of their limited dimensions these models showed great ingenuity and originality in design, and they afford a striking example of what can be done by a clever Meccano boy with a small number of parts. As we have so often emphasised, mere size in a model counts for very little in a competition. The models that secure the chief awards are invariably those in which the component parts, whether few or many, are employed in such a manner that each serves a definite engineering purpose, and takes its share in completing the design.

The contest was a complete success, and it aroused great enthusiasm among Norwegian Meccano model-builders, who are looking forward keenly to the announcement of the next competition.

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THE "DEMON" TRACTOR. Price 7/6

Length 25½ in., span 23 in. Fitted 10 in. hand-carved and balanced propeller, patent double-bearing and shock-proof chassis, covered yellow proofed silk with identification discs. Weight and wind resistance are reduced to a minimum in this model, giving the utmost duration of flight. PERFORMANCE: Speed 16 m.p.h.; distance, 850 ft. average; ceiling, 80 ft.; rises from the ground. (Patent No. 296946).

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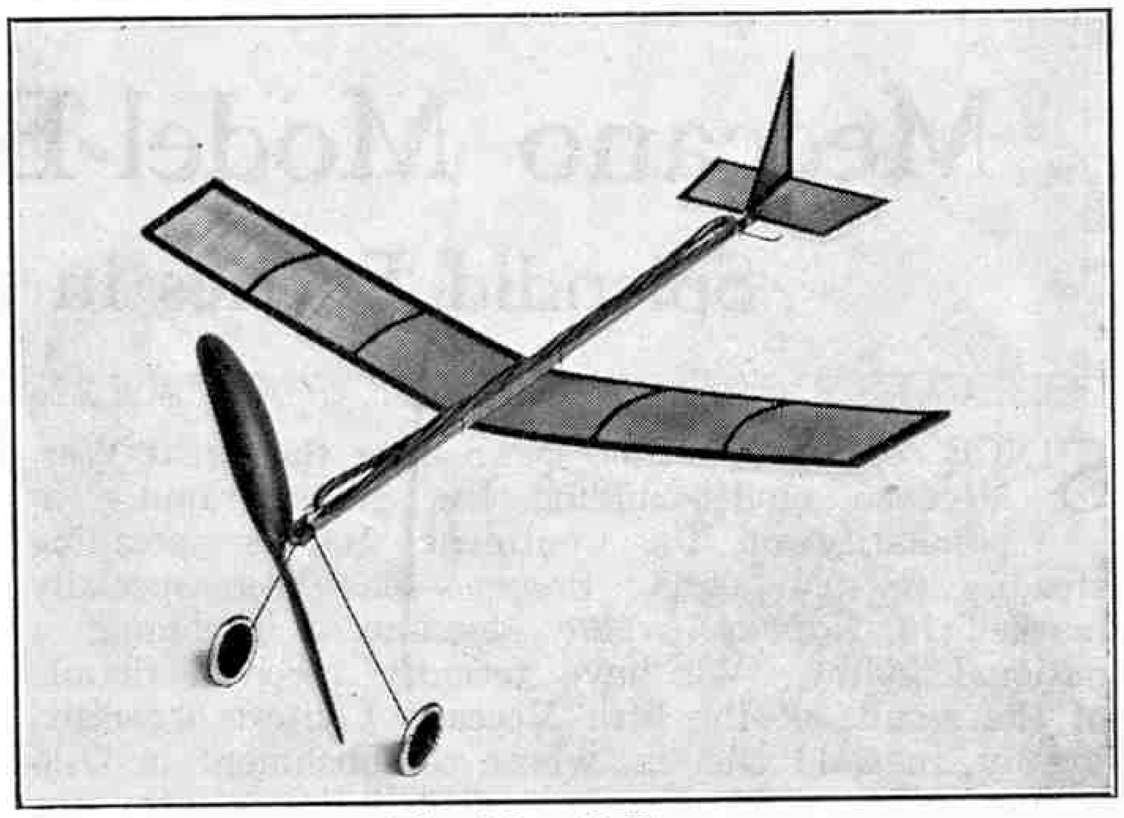

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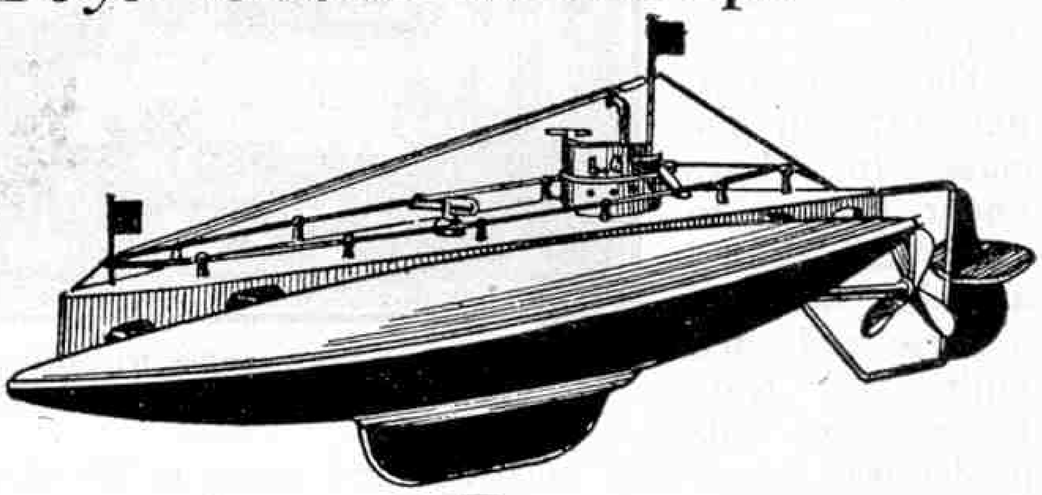

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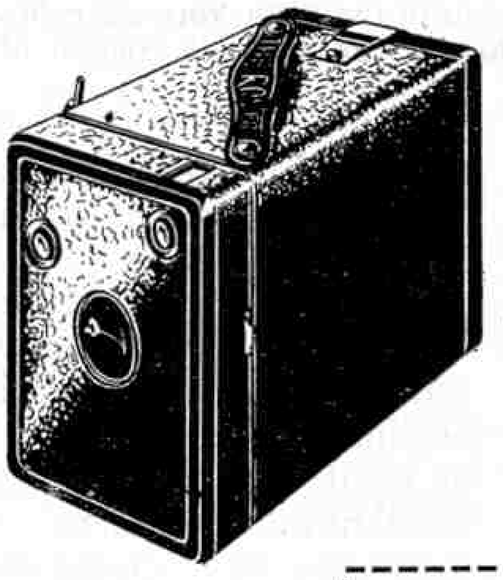

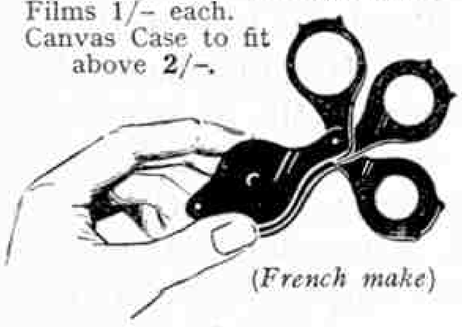

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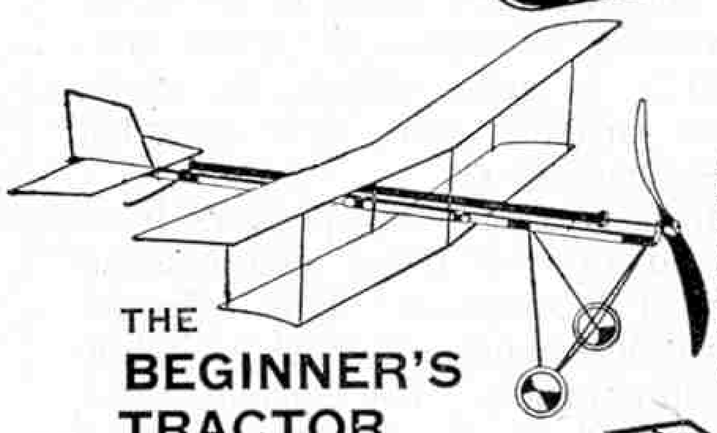
Well made in vulcanite with 3 separate lenses—thus a variety of magnifications may be obtained. Can be used as a burning glass, and for examining specimens. As supplied to schools and colleges. Post 2d. **2/6**

We stock all Hornby Train and Meccano Parts and can give prompt delivery to all parts of Britain.



THE BEGINNER'S TRACTOR MONOPLANE

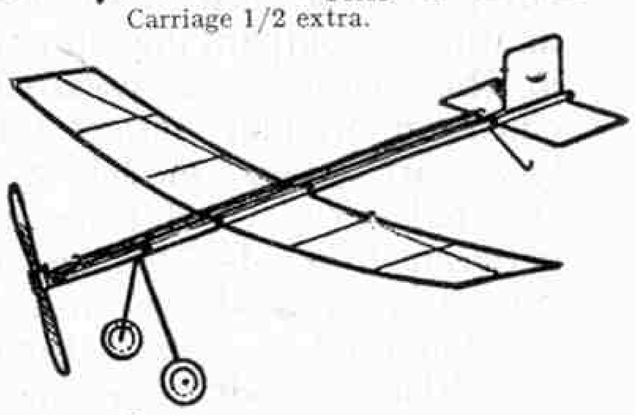
Designed by D. A. PAVELY, Holder of Seven Official Model Flying Records.

Set of materials for constructing a flying model that will rise from the ground, including drawing instructions, wood, silk, wire, etc. Post Free **5/6**

TRACTOR BIPLANE

A rising-off-the-ground Model equipped with two aluminium wheels, it has a span of 20" and is 21" in length. Weight 3 oz. Flies approximately 120 yards. Packed in cardboard box with instructions. Price **11/9**

Carriage 1/2 extra.



GAMAGES, HOLBORN, LONDON, E.C. 1 *City Branch: 107, Cheapside, E.C. 2.*

Competition Page

MISSING WORDS

Most of our readers enjoy competitions that involve the meanings and uses of words. This month's contest, therefore, should be greatly to their liking, for it involves considerable skill in choosing the right words to use in expressing simple ideas.

In the panel in the centre of the page there is a news paragraph concerning a celebration of considerable interest and centring round a subject that has been referred to on very many occasions in the "*M.M.*" It will be noticed that a number of words, 27 in all, are missing, dashes indicating the blanks that are to be filled. Each dash indicates one word, and it is important to bear in mind that the length of the dash has no relationship to the length of the word.

Underneath the unfinished paragraph, we have set out in alphabetical order the words that are to be placed in position, and the task our readers are asked to accomplish is to place these words in what they consider to be their correct positions in the paragraph. Every one of the words listed must be used, but not more frequently than it appears in the list. When all the words have been allocated to their positions, the paragraph should be carefully written out, with the missing words inserted in order to form the complete solution.

The greatest — system in the world has just — its jubilee. This is the Canadian Pacific Railway, which was — in 1881, and now — more than 21,000 miles of —, 500,000 tons of shipping, and 130,000 miles of — lines. In addition to all this it has — hotel and industrial —, and, in fact, the railway's — are worth over £268,000,000.

One — fact about the — is that it was the — Government that — the — of the line. After — 700 miles it decided the — was too — for it, and — it to a —, for the formation of which George Stephen was — responsible. Stephen, a Scot, who — life as a herd-boy, and had been a draper's apprentice in Aberdeen before emigrating to Canada, afterwards became Lord Mount Stephen.

It was — due to Stephen's energy and — that the railway was —. There were — difficulties to overcome, and at one — bankruptcy seemed — a matter of hours. But the railway was saved and, in the words of the King when Prince of Wales, "helped to make a nation."

assets	enormous	resource
Canadian	inaugurated	started
C.P.R.	interesting	syndicate
celebrated	interests	task
commenced	largely	telegraph
completed	much	time
completing	only	transferred
construction	principally	transport
controls	railway	vast

The competition will be divided into the usual two sections—Home and Overseas—and in each prizes of Meccano or Hornby Train products (to be chosen by the winners from our current catalogues) to the value of 21/-, 15/-, 10/6 and 5/- respectively will be awarded to the senders of the four most nearly correct solutions in order of merit. A number of consolation prizes also will be awarded. In the event of a tie for any or all of the prizes, the judges will take into consideration the neatness of the entry or its novelty of presentation.

Competitors are reminded that they must write only on one side of each sheet of paper used for their entries, and that their names and addresses must appear on each separate sheet.

No competitor may submit more than one entry, and this must be addressed to "Missing Words, Meccano Magazine, Binns Road, Old Swan, Liverpool," and sent to reach this office not later than 30th May. The closing date for competitors residing outside Great Britain and Ireland will be 31st August.

May Photographic Contest

As announced last month, our monthly photographic competitions this season are again being run to provide intending competitors with the widest possible scope, the prizes being offered for the best photograph submitted, irrespective of its subject. The only restrictions are that the exposure must be the work of the competitor, and a title must appear on the back of each print submitted.

Each month's competition will be divided into two sections, A for competitors aged 16 and over, B for those under 16, and prizes of Meccano or Hornby Train products, or photographic materials, as the winners select, to the value of 21/- and 10/6 respectively will be awarded to the best and second-best entries in each of the two sections. In addition, there will be a number of consolation prizes.

Entries must be addressed "May Photographic Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should reach this office not later than 30th May. The closing date for competitors residing outside Great Britain and Ireland will be 31st August.

COMPETITION RESULTS

HOME

"Romance of Transport" Essay.—The judging of this important essay contest proved one of the most difficult tasks our judges have ever had to face. The number of entries was much larger than we anticipated, and the majority of the competitors showed so excellent a knowledge of their subject that very few points separated the leading entries.

The judging of the Overseas section is now in progress, and next month we hope to announce the names of the winners in that section, together with that of the winner of the "championship" prize. In the meantime, prizes have been awarded to the following in groups A and C of the Home section:—

First Prizes: Section A, A. M. Johnston (Dunstable); Section C, M. R. B. Blackmore (Wellington, Som.); Second Prizes: Section A, A. Macdonald (Edinburgh); Section C, R. Wright (Shenley, Herts.). Consolation Prizes: A. Feltham (Worthing); E. Dunabin (Warrington); J. L. Lee (Bolsover); J. Redmond (Liverpool); A. Peters (Hitchin, Herts.).

Built Words.—We confess we had no idea of the appalling task we were imposing upon our readers—and ourselves—when we set the Built Words contest. We sustained a severe shock when the early entries arrived, showing totals of more than 2,000 words, all built from one innocent word tucked away in a small advertisement. Later, when figures of 3,000 became frequent, we realised that judging was going to be a really exhausting task. How lengthy and arduous this has been is shown by the fact that, if it were printed in our smallest type, the list submitted by the first prizewinner would occupy two full pages of the "*M.M.*"!

The prizes in the Home Section were awarded as follows:—1. G. S. Marsh (Blackpool); 2. J. Mann (Otley); 3. G. de Wit (Croydon); 4. L. A. Frayn (Plymouth). Consolation Prizes: G. Green (Purley); W. S. Harris (Cardiff); W. Horrocks (North Ferriby); G. H. Kent (Bexleyheath); H. C. Mason (Ashby-de-la-Zouch); A. F. Milburn (Chingford, E.4); C. J. Pitt (Alton); D. Wadsworth (Oldham).

Ideal Career.—1. J. H. Stevens (Westcliff-on-Sea); 2. A. H. Johnson (Dudley); 3. E H. Croston (Liverpool); 4. K. Bargh (Dronfield).

OVERSEAS

Ad-Brands.—An outstanding feature of this competition is the proof it affords that boys' tastes are much the same throughout the world. Actually five out of the six articles chosen by readers at Home, were the popular choice of the Overseas competitors.

The six most popular articles in the Home section were: Raleigh Cycles, Kodak Cameras, Ingersoll Watches, Swan Pens, Force Cereal Food and Lifebuoy Soap, in that order. In the Overseas section, Raleigh and Kodak remain at the head of the poll, but Lifebuoy, Force and Swan occupy the third, fourth and fifth places respectively, while Columbia Gramophones beat Ingersoll Watches for the sixth place by a very narrow margin.

A list giving the names of all the articles featured in the contest will be sent to any reader who applies for it.

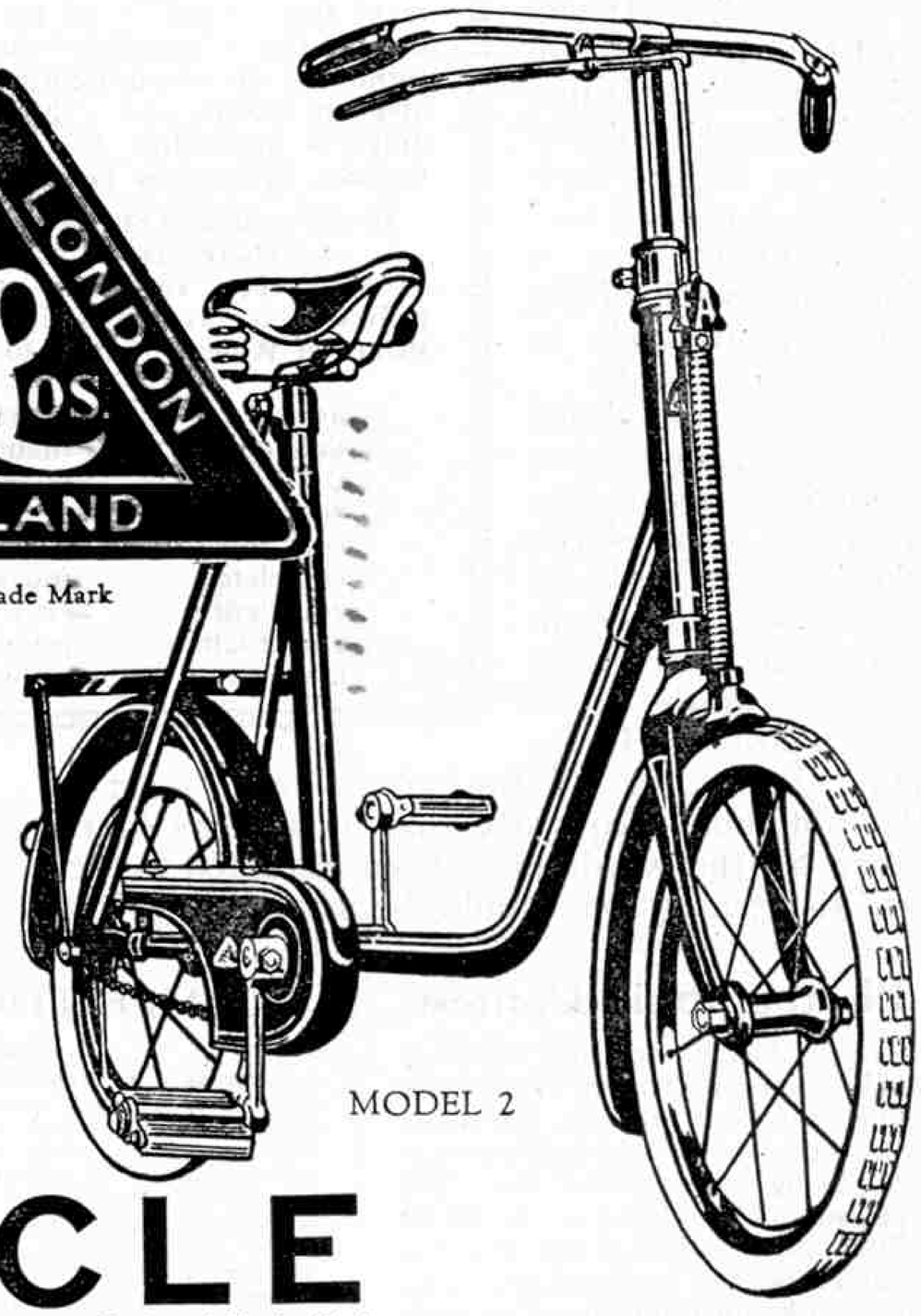
The names of the successful competitors are as follows:—1. P. Gregory (Istamboul, Turkey); 2. H. Heckman (Gibraltar); 3. H. Daston (Istamboul); 4. C. M. Dover (Benares, W.P., India). Consolation Prizes: V. Bey (Istamboul); C. Booth (Durban); R. W. Hope (Pretoria); V. C. Rodrigues (Berbice, British Guiana).

Doublets.—1. E. Harper (Cape Province); 2. J. A. Rodriguez (Montreal, P.Q.); 3. N. A. Bannatyne (Auckland, N.Z.); 4. Miss C. Gonsalves (Bombay). Consolation Prize: D. Young (Zululand).

Better looking bikes now than ever

MODEL 1

" What makes a first-class bike ? " We flattered ourselves that we'd settled that question outright when we produced the first Fairycycle—as handsome and sturdy an engineering job as the keenest critic could require. But there's nothing hidebound about us. Every chance that has offered of improving the Fairycycle has been taken eagerly. The latest improvement is the greatest yet, for looks. Chromium plating! You know that amazing untarnishable glitter, which never wears off? On all but the junior models, chromium plated fittings are standard now.



MODEL 2

FAIRYCYCLE (Regd. Trade Mark) **Model 1.** Tubular frame, 12″ wheels, ¾″ grey tyres, Spoon brake. Free wheel. Leather saddle. Black finish, N.P. bars and ball bearing pedals. **29/6**

FAIRYCYCLE (Regd. Trade Mark) **Model 2.** Tubular frame, 14″ tangent spoke wheels, 1.1/16″ white auto tread tyres, ball bearing pedals, Spoon brake. 2-coil leather saddle, chain cover, stand and carrier, reflector and tools. Black or blue, nickel plated fittings. **39/6**

FAIRYCYCLE

Registered Trade Mark

Besides the models specified above, Fairycycles are made in the following sizes at the prices stated :

FAIRYCYCLE (Regd. Trade Mark) **Model 3.** Tubular frame, 14″ wheels, 1.1/16″ white auto tread tyres. Ball bearing pedals and bottom bracket. Rim brake. 2-coil leather saddle. Chain cover, stand, carrier, reflector and tools. Black or blue. CHROMIUM PLATED FITTINGS. **49/6**

FAIRYCYCLE (Regd. Trade Mark) **Model 4.** Tubular frame, 14″ × 1⅜″ wheels, Dunlop pneumatic tyres. Ball bearing pedals and wheels. Rim brake. 2-coil leather saddle with tool-bag and tools. Chain cover, stand, carrier and reflector. Black or blue. CHROMIUM PLATED FITTINGS. **55/-**

FAIRYCYCLE (Regd. Trade Mark) **Model 5.** Tubular frame. 12″ × 2¼″ wheels. Dunlop pneumatic balloon tyres. Ball bearing pedals, head, hubs and bottom bracket. Rim brake. 2-coil leather saddle with tool-bag and tools. Chain cover, stand, carrier and reflector. Black or blue. CHROMIUM PLATED FITTINGS. **65/-**

FAIRYCYCLE (Regd. Trade Mark) **Model 6.** Tubular frame, 16″ wheels, 1.1/16″ white auto tread tyres. Ball bearings throughout. 3-coil spring saddle with tool-bag. Rim brake. Chain cover, stand, carrier and reflector. Black or blue. CHROMIUM PLATED FITTINGS, including rims. **59/6**

All these models, with the exception of Model 1, are finished in black or blue, with gold lines.

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Membership free to owners of genuine Fairycycles and badge attached to every machine. Fill up the form when you buy your Fairycycle, post it to Lines and you will then become a member. The badge is shown on the bicycle.

Fairycycles can be obtained at all good toy shops, or illustrated leaflet will be sent on request.

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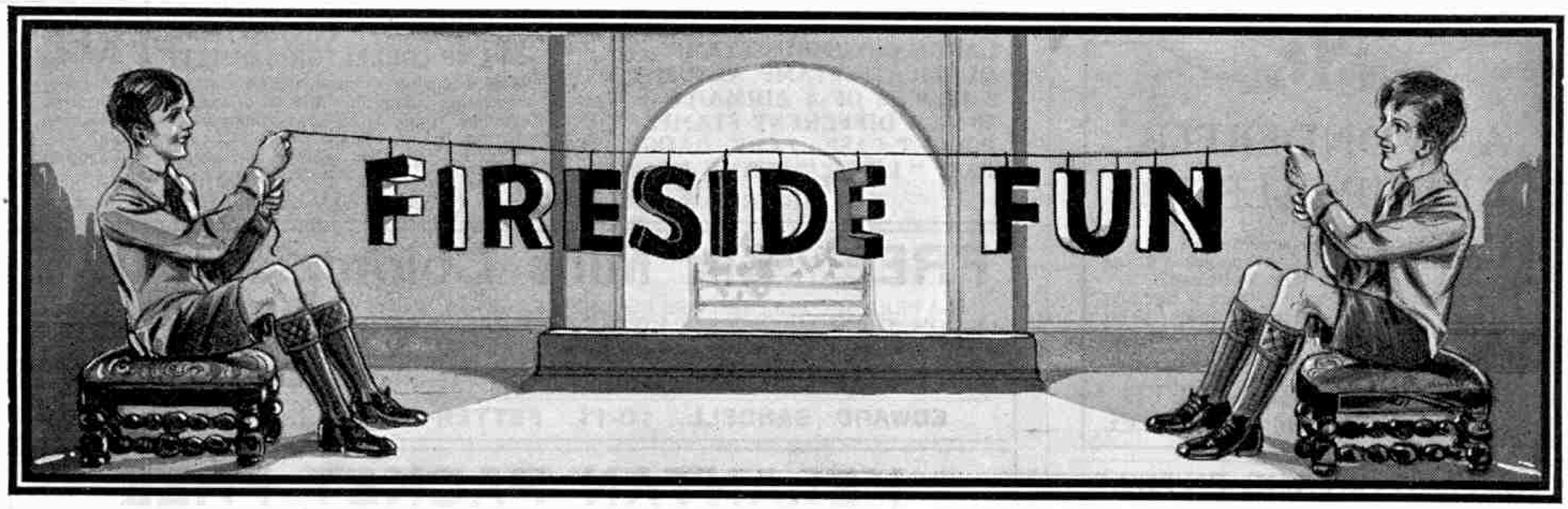


A VINEGARY RETORT

Teacher: "Can anyone tell me what happened after Cæsar mustered his army?"

Brown: "Yes. He peppered the enemy, and took the citadel by assault."

Teacher (annoyed): "Sit down. I'll take no sauce from you."

* * * *

The motor coach from Mudville-on-Sea was touring London and the guide was giving a commentary on all the sights.

"We are now passing through Mayfair, the home of London Society," he shouted.

The members of the party were deeply impressed.

"Ain't it wunnerful!" gasped one. She looked round in order to get a better view, and observed a steeplejack at work on a high building.

"And will yond be one o' they social climbers?" she inquired eagerly.

* * * *

Mrs. Smith was wakened in the early hours of the morning, by a suspicious sound in the drawing room.

"Timothy," she whispered to her husband, "I believe there's somebody downstairs. Go down and see who it is."

Mr. Smith gave a nervous start but made no effort to get out of bed.

"Timothy," his wife persisted, "did you hear what I said? Are you afraid of facing a burglar?"

"Afraid? Certainly not!" came the mumbled reply from under the clothes. "But you know, dear, how I hate meeting strangers."

* * * *

"How many bones have you in your body, Jones?" asked the teacher during a lesson on physiology.

"Two hundred and eight, sir," replied Jones without hesitation.

"I told you only five minutes ago that there were exactly two hundred and seven in the human body," said the teacher angrily. "Weren't you listening to me?"

"Yes, sir," said Jones meekly, "but I swallowed a fish bone at breakfast, this morning."

* * * *

Nervous Dentist: "Could you please open your mouth wider?"

Impatient Patient: "Certainly, if you'll move your ceiling up a few feet."

* * * *

SHIRKING ITS DUTIES

The fisherman had not had a catch although he had tried hard for several hours. At length he was joined by a friend who had had a successful morning's sport.

"How are you getting on?" asked the friend.

"Not very well," was the reply, "and what's more, I don't believe my worm's trying."

* * * *

"Mother, didn't you tell cook always to lock the pantry door?"

"Yes, dear. Why?"

"Well I found it unlocked just now, and to give her a lesson I ate all the tarts I could find there."

A BETTER ARGUMENT

There had been a bad crash. The victim opened his eyes at long last.

"I had the right-of-way, hadn't I?" he asked painfully.

"Yes," said a bystander, "but the other fellow had an eight-wheeled lorry."

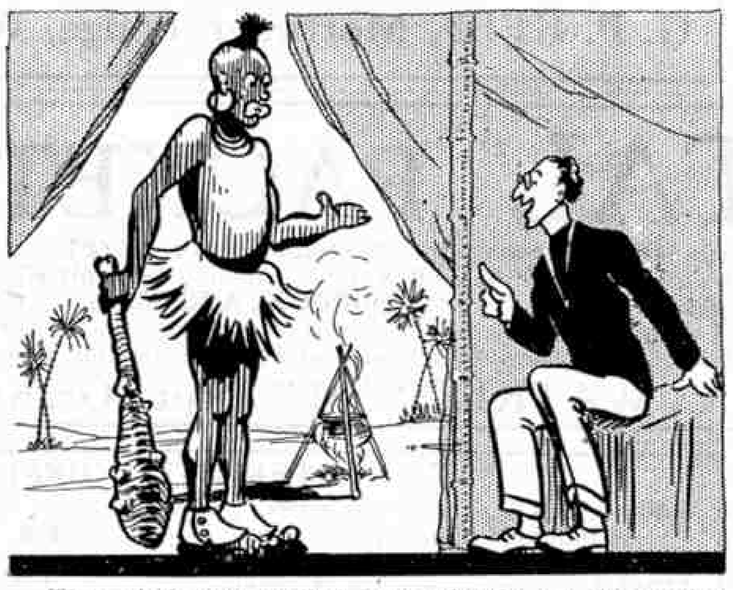
* * * *

Club Bore (reading from newspaper): "They say here that a person who speaks loudly is usually very ignorant."

Bored Listener: "Don't shout so. I'm not deaf."

* * * *

AN EARLY LESSON



The missionary smiled benevolently on the native tribe around him.

"I will cure them of all cannibalism," he thought hopefully, as he retired to his hut. There he was shortly joined by a native.

"The king has sent me to dress you for dinner," said the man.

"Ah," smiled the missionary, "How thoughtful of him! You are the Royal Valet, I suppose?"

"No," replied the native, "I am the Royal Cook."

* * * *

The new maid was being "broken in."

"I am a woman of few words," announced her haughty mistress. "If I beckon with my finger, that means 'Come.'"

"Suits me, mum," replied the girl. "I'm a woman of few words myself. If I shake my head, that means I ain't comin'."

* * * *

Pompous old man: "And now my man, tell me what you will do with that sixpence?"

Beggar: "Well, sir-er-I don't think I could do better than invest it in Government funds."

* * * *

Wife (of patient): "Will the operation be at all dangerous, doctor?"

Doctor: "Good gracious no! You can't expect a dangerous operation for eight guineas."

* * * *

Hotel Garage Mechanic (to owner of small baby car who has been giving him very minute instructions): "Awlright, awlright—I'll see it's refilled, and washed, and polished, and, if yer like, I'll 'ave it left outside yer bedroom door with yer boots in the mornin'."

* * * *

Teacher: "Willie, if you gave your little brother nine apples and then took away seven, what would that make?"

Willie (from experience): "It would make him yell."

* * * *

A burly dog fancier was taking his big Alsatian for a run when he met a man with a very small puppy at the end of a leash.

"Hi, guv'nor!" shouted the burly one. "Hold that dog of yours tight. I think mine's going to sneeze!"

ANOTHER "HOLIDAY" ANTICIPATED?

A convict in a county gaol had been kept in prison a week longer than his sentence owing to faulty book-keeping. The Governor sent for him in order to explain matters.

"I am very sorry," he said. "It's too bad that you had to stay here longer than was necessary."

"Don't worry," replied the man cheerfully. "I don't mind so long as you knock it off next time."

* * * *

A woman who was extremely wealthy but also extremely mean went into her garden one day and was amazed to find a tramp on all fours nibbling the grass on the lawn.

"Whatever are you doing there?" she gasped in surprise.

"Madam," replied the tramp, "I'm starving; it's over three days since I touched any food."

"Oh, my poor man!" she murmured in sympathy. "Go round to the back garden, the grass is longer there."

* * * *

"Now Smith," said the teacher, "if your father can do a piece of work in an hour, and your mother also can do it in one hour, how long would it take both of them to do it?"

"Three hours," answered Smith, "counting the time they would waste in arguing."

* * * *

The enraged man was uttering shrieks of pain. "Confound it, madam!" he cried. "Do you realise that your dog has bitten my leg badly?"

"You naughty Fido," said the dog's mistress, picking up her pet and looking at it severely. "You shall be punished for that! I shall take this pretty piece of ribbon off your collar for a whole week."

* * * *

"Carry your bag, sir?" said a small boy to a man hurrying toward the station.

"No!" snapped the man without stopping.

"Carry it all the way for twopence, sir," continued the boy.

"I don't want it carried," said the man becoming annoyed.

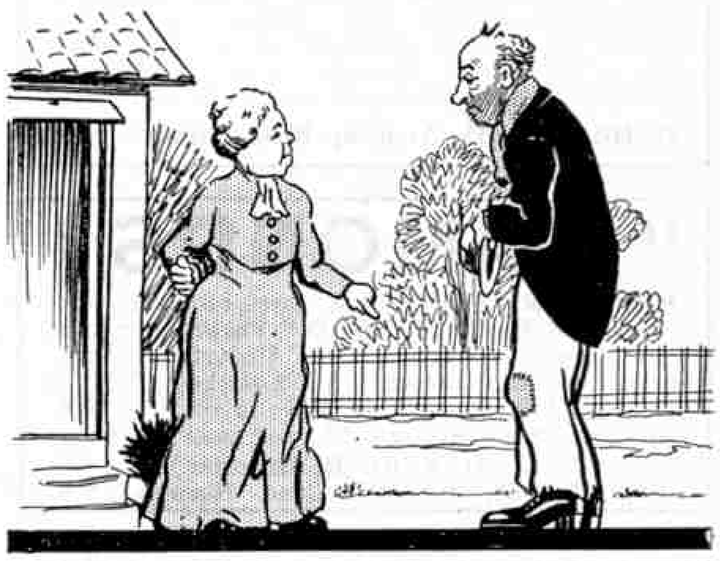
"Don't you?"

"No, I don't."

"Then what are you carrying it for?" said the boy.

* * * *

BAD FOR TRADE



Beggar: "Please ma'am have you got a pair of very old shoes you could let me have?"

Lady: "But there is nothing wrong with the ones you are wearing."

Beggar: "That's it, ma'am. They're ruining my business."

* * * *

Owner of Street Stall (to small boy): "Now then, what do you want?"

Boy: "Oh, nothin'—I'm just looking at what I would have had if I hadn't lost my penny."

A WONDERFUL STAMP ALBUM

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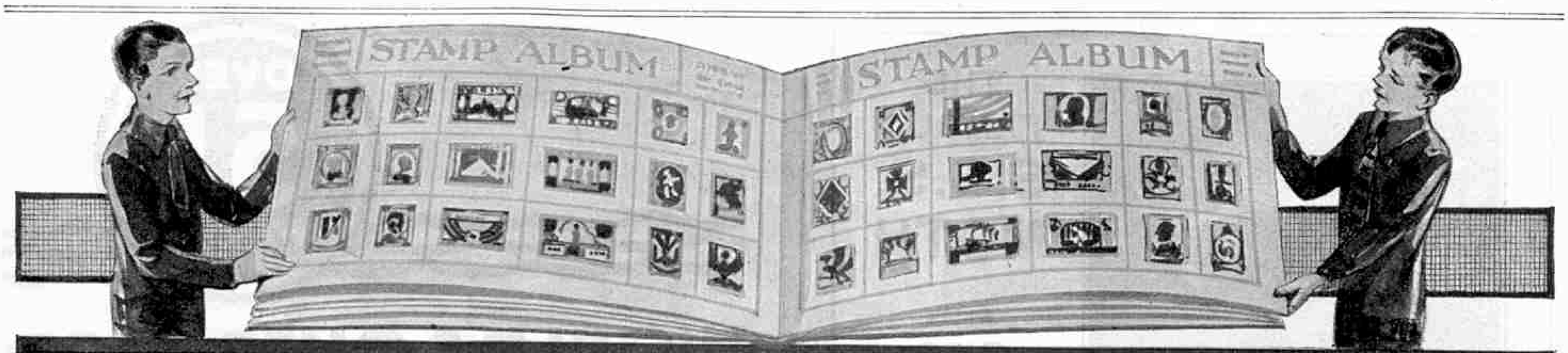


STAMP COLLECTING

INDIA'S FIRST COMMEMORATIVE ISSUE

THE most interesting philatelic event of 1931 to date has been the appearance of India's first commemorative stamp issue to celebrate the official inauguration of New Delhi, the great new capital of India. The series comprises the six stamps illustrated in this article, and was available for all postal uses for one month only, from 9th February.

It is but a month or two more than twenty years ago since H.M. King George V, King Emperor of India, announced at the great Coronation Durbar at Delhi that, in consultation with the Government, he had decided upon the transfer of the seat of the Government of India from Calcutta to the ancient Indian capital, Delhi. Less than a dozen persons were aware beforehand of the impending change, and when, three days after the first announcement, Their Majesties laid the foundation stones of the new Imperial capital, the stones had to be laid on the ground at a spot near the Royal Camp. The actual site of the city had not then been chosen. To-day there stands a beautiful city dominated by the splendid buildings that are featured on the stamp designs, where twenty years ago there was a barren rocky plain!

Few architects are given the opportunity to start with a clean sheet of paper and to bring into being a great modern city as one unified whole. Australia's capital, Canberra, Washington in the United States, and St. Petersburg—now known as Leningrad—in Russia, probably are the only parallel cases since early Roman days. Nevertheless, such was the remarkable opportunity that came to Sir Edwin Lutyens.

Naturally, the selection of a suitable site adjacent to the old city was a task calling for careful consideration. Fortunately a ridge running North and South offered an ideal position. From it there is a spur flung eastward for a mile over ground sloping gently in the same direction, to the river three miles away. On this spur it was decided to place the central group of buildings. These were to include the twin Secretariat or Government Office buildings, one of which is illustrated on the 3A stamp, and the Viceroy's House, seen on the 2A stamp.

A very interesting feature of New Delhi is that its layout breaks completely away from modern ideas. Instead of the rectangles formed by a series of streets intersecting at right angles, the site has been divided by roads into a number of triangles, the chief avenues radiating from a point midway between the Secretariat Buildings. The arrangement seems puzzling at first, but it gives more direct point to point communication than the method so largely followed in America. The rotary traffic system has been introduced at main intersecting points, and in view of the general spaciousness of the design, it is scarcely likely that there will ever be a traffic problem in New Delhi.

A great boulevard, known as King's Way, running almost directly East and West, forms what may be termed the backbone of the layout. Its Eastern terminal is the ancient Purana Qila, a fort now in ruins of course, which lies close to the road leading back to the old city. This old fort was the centre of a city built some five hundred years ago by King Humayun, and tradition maintains that it was built on the site of the first City of Delhi. It is illustrated on the ½A stamp.

The full magnificence of King's Way is not revealed until the Purana Qila has been left a half mile in the rear and the great circular area known as Princes Place is reached. Here stands India's memorial to those who died in the Great European War. This mighty arch, which is illustrated on the ½A stamp, is flung 75 ft. clear above the roadway. The dome rises to a height of 140 ft. and from it a pillar of smoke is to ascend on special occasions in memory of the dead.

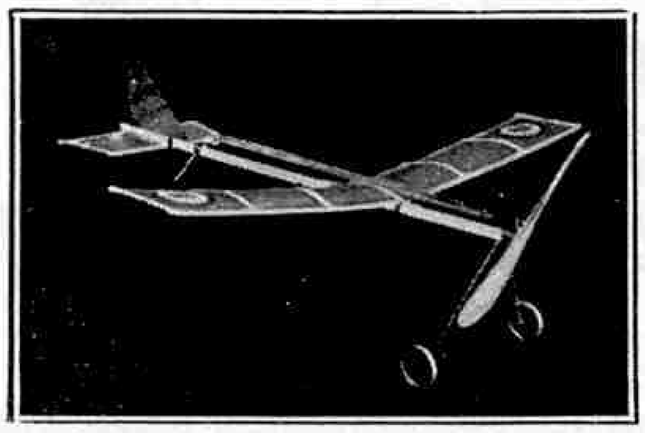
King's Way attains its full width of 1,200 ft. beyond the War Memorial. It continues a further 1½ miles to its Western terminal, the Great Place, the forecourt of the great buildings on the summit of the hill, and for most of the way it is lined with avenues of trees, and bordered by narrow sparkling lakes. It is difficult to give any definite impression of the magnificent scale of the layout here, but readers who know London will get some idea from the fact that if the site of Buckingham Palace were occupied by the Viceroy's House, the foot of the Great Place would be at the Admiralty Arch!

The Council House, the meeting place of the Indian Parliament, lies on a triangular plot a little to the North East of the Great Place, and is excellently depicted on the 1A stamp. It was designed by Sir Herbert Baker, who was called to collaborate with Sir Edwin Lutyens when it was realised how appallingly heavy was the task Sir Edwin had taken upon himself, and in many respects is the most noteworthy of all the buildings of New Delhi. It is circular in plan with an outside diameter of 570 ft. It covers a total area of more than 5 acres, and more than 2½ million cubic ft. of brickwork went into its construction! The colonnaded veranda that runs around the outside contains no fewer than 144 columns, and is a third of a mile in length.

The twin Secretariat buildings are also the work of Sir Herbert Baker. One stands to the North and the other to the South of Government Court, the Western continuation of King's Way. Built of red and white stone, they are a striking example of the adaptation of Western art to Eastern needs. Their long classically composed facades are broken up with porticos and reunified each with a central dome and a tower. Within these two buildings—each a quarter mile in length and three storeys in height—is housed the whole of the Indian Government services.

Outside, in Government Court, surrounded by grass

(*Continued on page 435*)



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Hornby Train enthusiasts will be greatly interested in a sample set of wooden ready-to-build parts, intended specially for farm buildings to be placed at the side of a model railway track, that reached us recently from our advertisers, Messrs. W. Gosling & Sons Ltd., of Birmingham. We found it quite entertaining, and remarkably easy, to put the structures together, and soon found that they could readily be adapted for actual railway service.

The wood of the outfit is supplied ready, cut to shape and planed, and all necessary accessories, such as nails, screws and hinges, are included. The tool kit required to put the parts together is simple, a hammer, a screwdriver, a fretsaw, a tube of Seccotine and a box of paints being the only needs.

We understand that Messrs. Gosling intend extending the range of their outfits shortly. Full details will probably appear in our advertising columns, but readers who are interested may also send enquiries to the firm at 110, Northwood Road, Birmingham. Mention of the "*M.M.*" will ensure immediate attention.

1,000 PACKET A WONDERFUL OFFER The "**1,000** Packet" contains **500** excellently assorted Stamps, a COMPLETE SHEET of **100** UNUSED (very useful for exchange purposes) ; a neat **12-page** booklet for holding duplicates ; **25** British Colonials, usually sold at ½d. to 1d. each, including new and obsolete issues ; **375** Magic "Strip" Mounts, and my price list of stamp bargains. Price **4½d.**, postage **2½d.** extra, abroad **6d.** extra. In addition, free sets will be sent to those who send names of stamps collecting friends. *Ask for my famous approvals.*—**H. C. WATKINS, M. Dept., Granville Road, BARNET**

Stamp Collecting—(*Continued from page 433*)

and flower beds and sparkling pools, there stand the four red monolith columns that were the gifts of the British Dominions overseas. The 1 rupee stamp shows a portrait of The King Emperor, flanked by two of these columns, and supported by a distant view of one of the Secretariats.

Spanning the quarter mile immediately to the West of the Secretariats is the Viceroy's Court. This is flanked by roads leading to the Viceroy's House, the crowning feature of New Delhi's architectural symphony. As the illustration on the 2A stamp shows, Sir Edwin Lutyens, the architect, has welded Eastern and Western ideas into perfect harmony. The outstanding features of the building are the white Doric columns and the massive

dome. The dome is indeed one of the finest in the whole world, and completely dominates the entire city. Interesting features of the design are the great fountains on the roof of the palace, the immense white stone basins of which can be seen plainly in the stamp illustration.

The new city of Delhi has been planned on a magnificent scale, and in a short article it is impossible to deal fully with this vast enterprise. Even to give statistics of the materials used in the construction of the chief buildings is of little help in conveying an adequate idea of the enormous scale of the operations, for the numbers involved are so large that it is difficult to comprehend their meaning. For example, more than 700 million locally made bricks and 100,000 cubic ft. of Indian marbles of different colours have been used in the central buildings! Over six million cubic ft. of red and white stone, weighing over 400,000 tons have been quarried and transported by rail over a distance of 200 miles. The dressing of this stone has provided continuous work for between 2,000 and 2,500 stonemasons, practically every one of whom has had to be trained specially for the work. The stoneyard in which these men worked was 22 acres in extent, or very nearly the size of Waterloo Station!

Few commemorative stamp issues can claim so overwhelming a justification of their issue, and it is certain that India's first issue will go down in stamp history as one of the most popular commemoratives of all time.

At the moment of writing we have no details available to show the quantity printed, but the popularity of the stamps is so great that those readers who buy with an eye to the investment value of their stamps, may safely purchase this commemorative set at its present price of 3/– for the six stamps.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Stamp Gossip

and Notes on New Issues

A Stamp Comedy

An interesting feature of life in the United States of America is the remarkable degree of patriotic fervour that pervades the many groups of different nationalities that make up the population of the States. Many amusing incidents have arisen from this retained love of Mother Country, and a typical example occurred recently in connection with the U.S. War of Independence stamp commemoratives.

A year ago, as our readers will recall, the Prussian General von Steuben was featured in this series, and the German portion of the population were quietly pleased by the honour conferred upon their race. The Polish element felt aggrieved, however. They had a General who also had played an important part in that historic struggle. What about him?

Thus it comes about that the services of General Pulaski are commemorated by a stamp that appeared on 16th January last, the 152nd anniversary of his death. The Poles, in fact, have scored heavily, for the number of Pulaski stamps issued is twice as many as for the Von Steuben issue, and, above all, the design incorporates the Polish flag, the first time a foreign flag has appeared upon a U.S. stamp! Incidentally, the design is one of the best of this commemorative series.

Further Canadian Designs

We illustrate on this page the designs of the new 12c. and 50c. Canadian issues to which brief reference was made in our last issue.

The design of the 12c. stamp gives a view of the old citadel of Quebec and the famous Heights of Abraham. The view point is from the River St. Lawrence and gives a splendid impression of the difficulties that faced General Wolfe when he scaled these cliffs to conquer Quebec.

The 50c. stamp shows the little church at Grand Pré, Nova Scotia, immortalised by the poet Longfellow in his poem "*Evangeline.*" In the foreground can be seen the statue which was erected in 1920 in front of the church to commemorate Evangeline, and in the background are the willow trees under which she walked daily. It is understood that the land on which the willows stand has been purchased by the Canadian Pacific Railway for permanent preservation, but of the forests concerning which the poet wrote, nothing remains.

It is interesting to observe that in this issue, as in former pictorial issues, inspiration for the designs has again been drawn from representative parts of the Dominion, to give each its share of prominence.

Saar Charity Issues

The principal industry in the Saar Valley, as most of our readers know, is coalmining, and it is natural that collieries should figure largely in the industrial designs used on the Saar charity issues. An interesting departure from the usual pit-head scene in colliery designs appears in the 1930 Christmas charity issue, however. As our illustration shows, the design on this occasion features an obviously conscientious safety man conducting a test for firedamp.

This design is used for the three lowest values of the seven stamps in the series, the 40c. + 15c., the 60c. + 20c., and the 1 fr. + 50c. A design illustrating the parable of the Good Samaritan appears on the 1 fr. + 75c., 2 fr. + 1 fr. and 3 fr. + 2 fr. stamps, while a very striking picture of a mother and her children, gazing anxiously through a window, is used for the 10 fr. + 10 fr. stamp.

A Really Royal Issue

One wonders what sum would be offered for its purchase were there to come on the market one of the special blocks of Bulgarian royal wedding stamps!

Readers will recall that late in 1930, Bulgaria issued a special commemorative series of stamps in celebration of the marriage of King Boris to the Princess Giovanna of Italy. There were four stamps in the series and 300,000 sets were issued. Subsequently a special printing of this series was made in the form of blocks of four, comprised of one stamp of each denomination. Only 55 blocks were issued, and these were distributed among the Bulgarian, Italian and British Royal Families and the various Foreign Legations in Sofia.

Royal wedding issues are becoming very common, by the way. Belgium, Italy and Bulgaria have issued them in recent years and now it is rumoured that Johore, in the Straits Settlement, contemplates celebrating the Sultan's recent marriage.

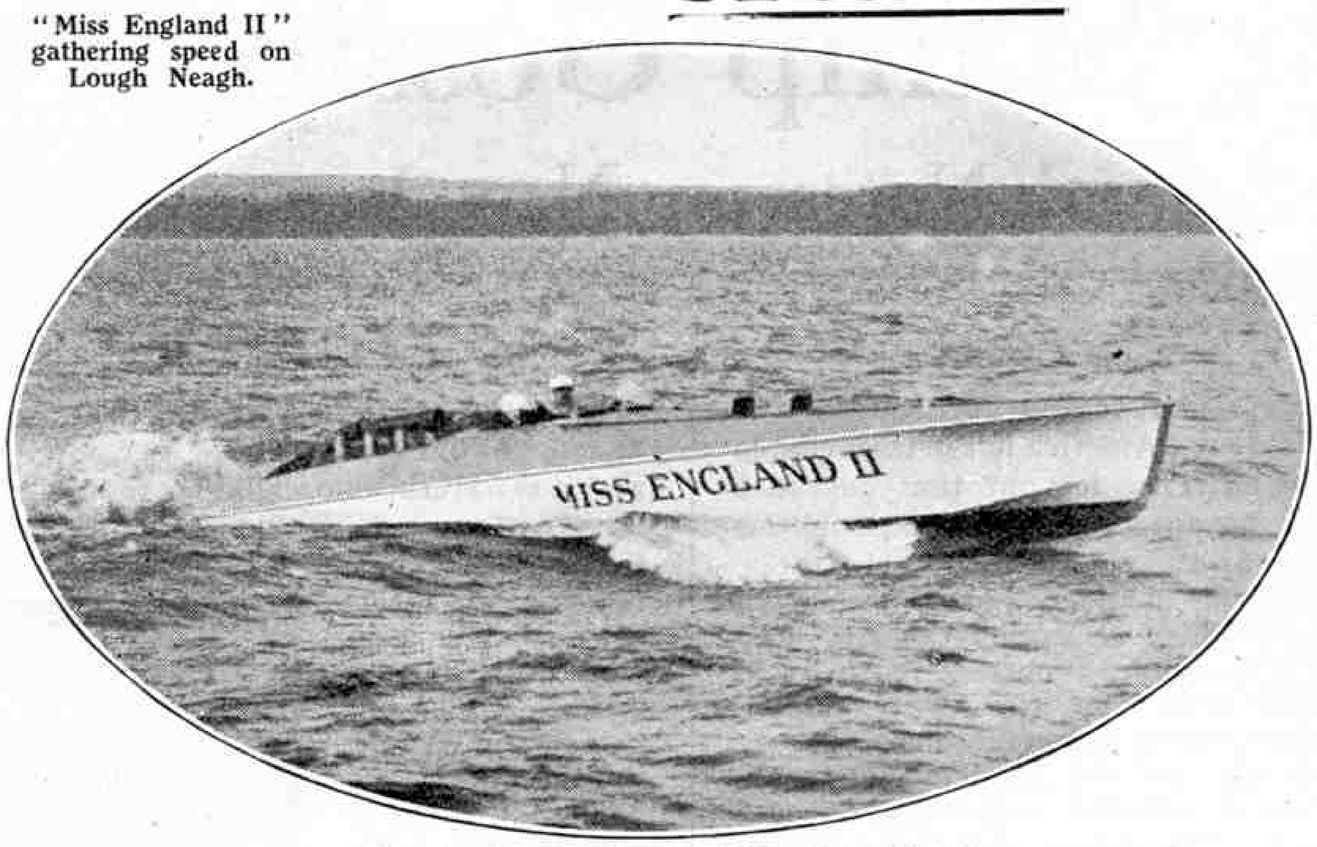
* * * *

It is understood that Siam will issue a special series of stamps to celebrate the forthcoming 150th anniversary of the foundation of Bangkok, the capital.

Probably the most interesting feature of the issue will be the fact that the designs approved by the King are the work of Prince Narisara.

SPEED AND STRENGTH!

"Miss England II" gathering speed on Lough Neagh.



Reproduced by courtesy of "The Motor Boat."

These qualities are characteristic of "Miss England II"—the most famous speedboat in the world—and they are also the qualities to which most consideration has been given in the design and construction of the new range of Sutcliffe Steel Speedboats.

Steel for Strength

It is interesting to know that steel has been used to strengthen "Miss England II", because Sutcliffe Speedboats are made almost entirely of pressed steel in order to give extra strength and reliability. Further, every model is fitted with a very powerful clockwork mechanism which enables the boat to go "all out" at full racing speed.

These new models are jolly fine. When you handle one you can tell what strength there is and when you switch over the starting lever—Phew!—the roar of the motor makes you jump.

Prices of Sutcliffe Steel Speedboats with powerful clockwork motors are 6/6, 10/6, 15/–, and 25/–. Ask your dealer to show them to you.

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"Miss England II" is Britain's best and beats the world—so do the new Sutcliffe Steel Speedboats.

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For full details of the famous double-power 'Snipe' in the photograph and its sister ships 'Seahawk,' 'Eagle' and 'Swallow' (priced 42/-, 32/- and 17/6 respectively), write for our **FREE ILLUSTRATED FOLDER.** This folder also shows the clockwork launches and gives illustrations and specifications of the latest and one of the most successful Bowman inventions—the new, ultra-fast Aeroboat (see announcement on page 440 of this magazine).

WRITE FOR *YOUR* COPY OF THIS INTERESTING BOAT FOLDER TO-DAY.

Bowman models can be inspected at all Halfords and Hobbies Branches and good shops everywhere.

BOWMAN models

BOWMAN MODELS (DEPT. MM3), DEREHAM, NORFOLK

The "Autogiro"—(*Continued from page 363*)

possible for the "Autogiro" to be operated in regions that are unsuitable for ordinary aeroplanes. It is ideal also for deck landing purposes and for use with ships in general.

"Autogiros" have not only been constructed as landplanes, but a seaplane version also has been produced; and work is now being carried out by Short Bros. Ltd. on an "Autogiro" flying boat. The principle has attracted a great deal of attention in America, and recently the American branch of the Cierva Autogiro Company received a contract for supplying a machine to the Chief Fire Warden of the State of New Jersey. The Fire Warden intends to experiment with the machine to determine whether it is suitable for aerial fire-fighting purposes. The United States Navy have purchased an American-built "Autogiro" for experimental work in co-operation with sea-going vessels not fitted with launching and landing apparatus. The French Government authorities also are interested in the machine, and in England an "Autogiro Puss Moth" constructed by the de Havilland Aircraft Co. Ltd., is shortly to make its appearance.

Discussions have taken place recently between the Cierva Autogiro Company and the British railway authorities with regard to the possibility of constructing flat roofs over railway stations, from which "Autogiros" could operate. Nothing definite has yet been decided, but the scheme is full of interest, for it would enable travellers to make journeys between cities and their airports much more quickly than is at present possible.

It seems probable that the "Autogiro" is the machine of the future. Its safety and ease of operation will make flying possible for many people who are unable to develop the necessary skill to pilot an ordinary aeroplane. A beginner is able to take complete charge of an "Autogiro" after only a short period of dual tuition, for there is no danger of his getting into difficulties owing to loss of flying speed, or to a forced landing. The short space necessary for the "Autogiro" to take off is another feature of great value, for it means that the machine may be operated from a space no bigger than a good sized lawn.

Flying Boats—(*Continued from page 373*)

the Blackburn "Nile" and a six-engined monoplane which is taking shape at the Supermarine Aviation Works. The "Nile" is really the civilian counterpart of the Blackburn "Sydney." It has seats for fourteen passengers and will be fitted with three Bristol "Jupiter" engines developing a total normal power of 1,470 b.h.p. The machine will have a wing span of 100 ft., while its overall length will be 65 ft. 6 in. It will weigh 15,258 lb. empty, and 23,492 lb. when fully loaded. When near the ground its maximum speed will be about 125 m.p.h. while the cruising and stalling speeds will be 103 and 60 m.p.h. respectively. The duration of the machine will range from 4.5 to 8 hours.

The Supermarine six-engined flying boat will create a British record, for it will be the largest machine of the kind ever constructed in this country. It will not be so large as the Dornier "Do.X," the giant flying boat described fully on page 922 of the "*M.M.*" for December, 1929, but it will be capable of carrying 40 passengers in addition to a crew of seven, and sleeping accommodation for twenty passengers will be provided. The span of this machine is expected to be about 160 ft., or over 50 yards. The frames of the hull and the under water part will be planked with stainless steel. Six Rolls Royce "Buzzard" engines will be fitted, and at cruising speed the machine will have a designed endurance of about 12 hours.

The Supermarine Aviation Works also have produced the Supermarine "Sea Hawk Mark II," which is a civilian version of the "Southampton Mark X" already described. This machine has twelve seats and, like its prototype, is equipped with three Armstrong Siddeley "Panther" engines. It has a wing span of 78 ft. and an overall length of 60 ft. The empty and loaded weights are 11,290 lb. and 19,558 lb. respectively. The cabins and the mail and luggage accommodation have been designed in accordance with the requirements of air line companies.

FAMOUS TRAINS

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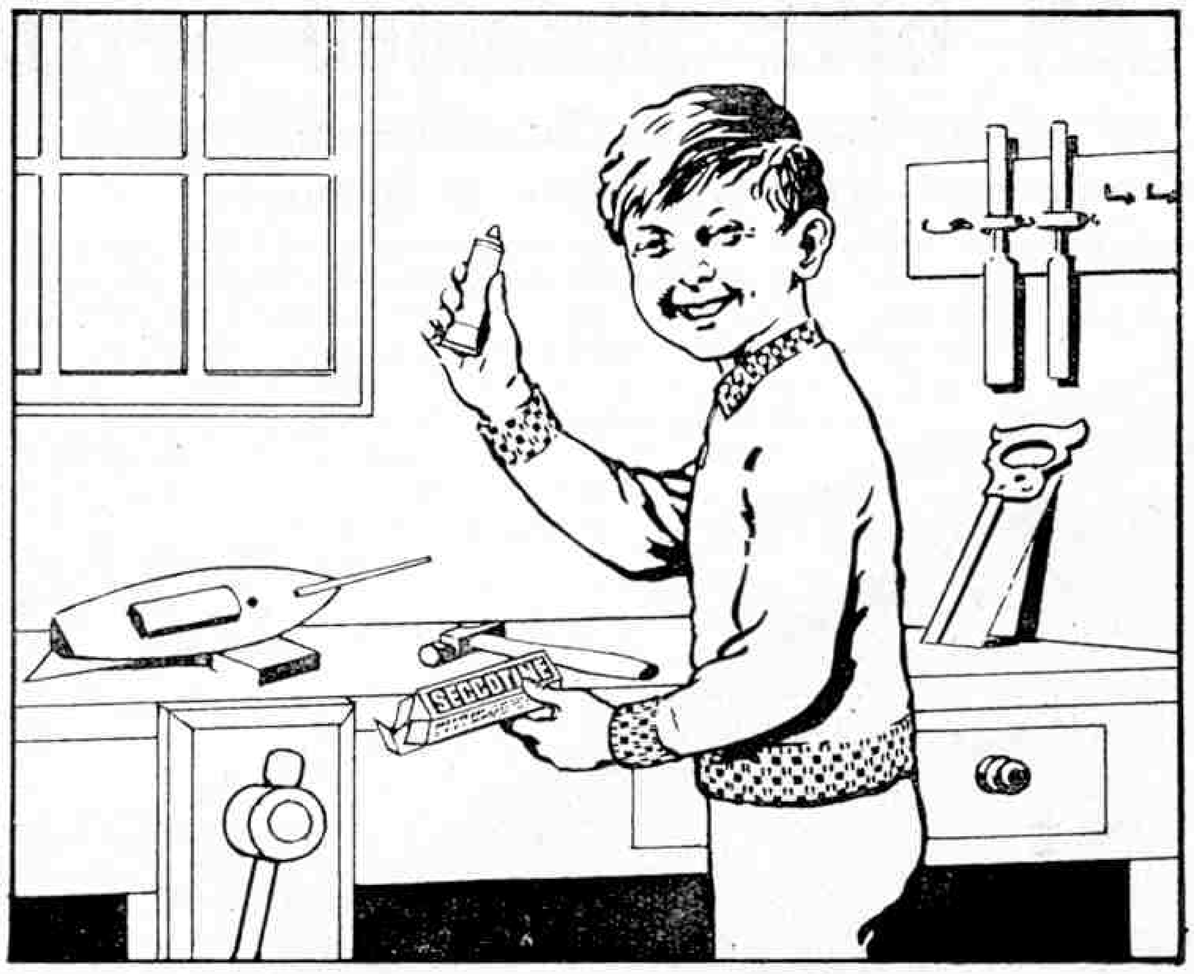

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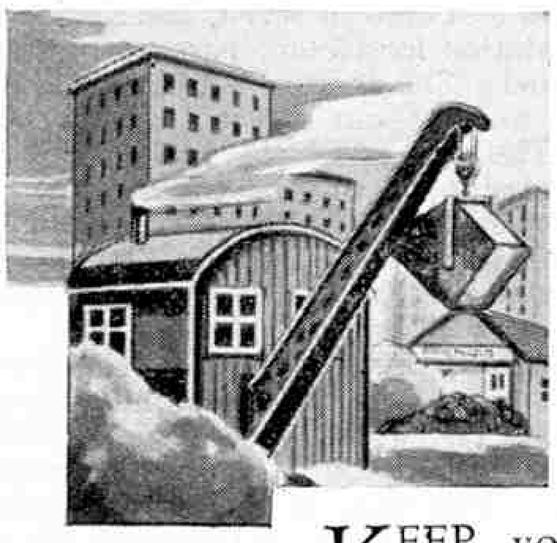

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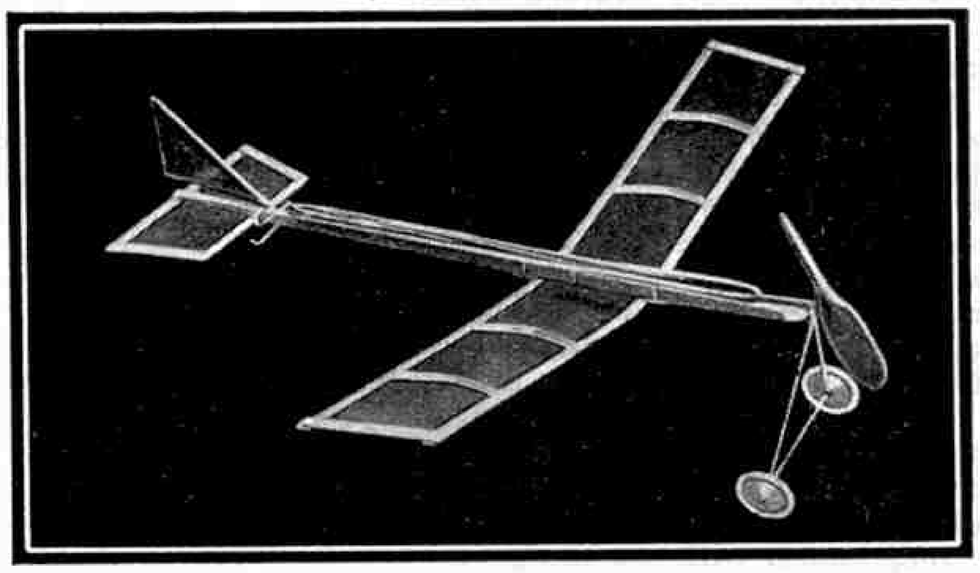

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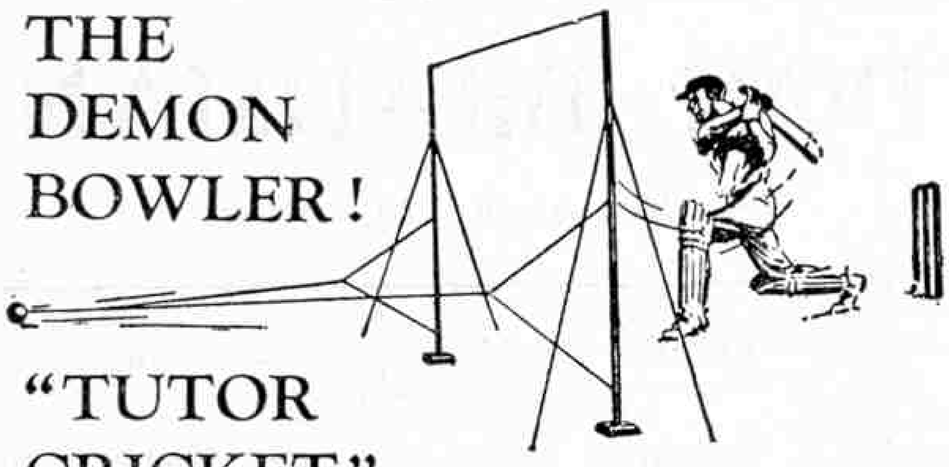

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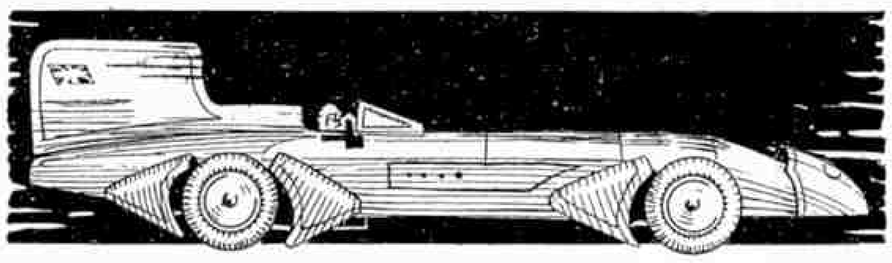

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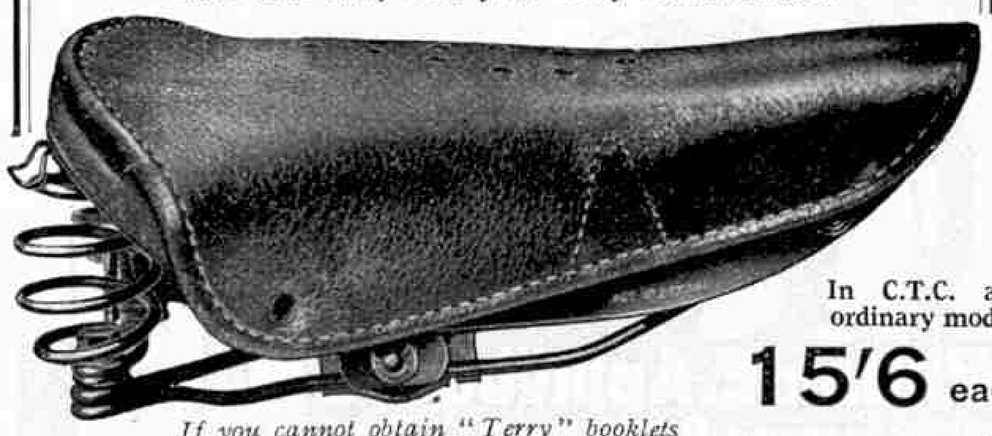

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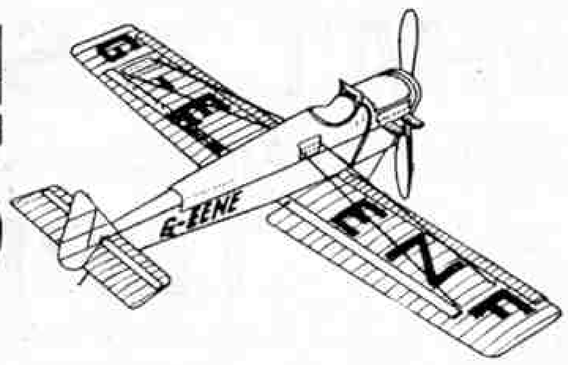

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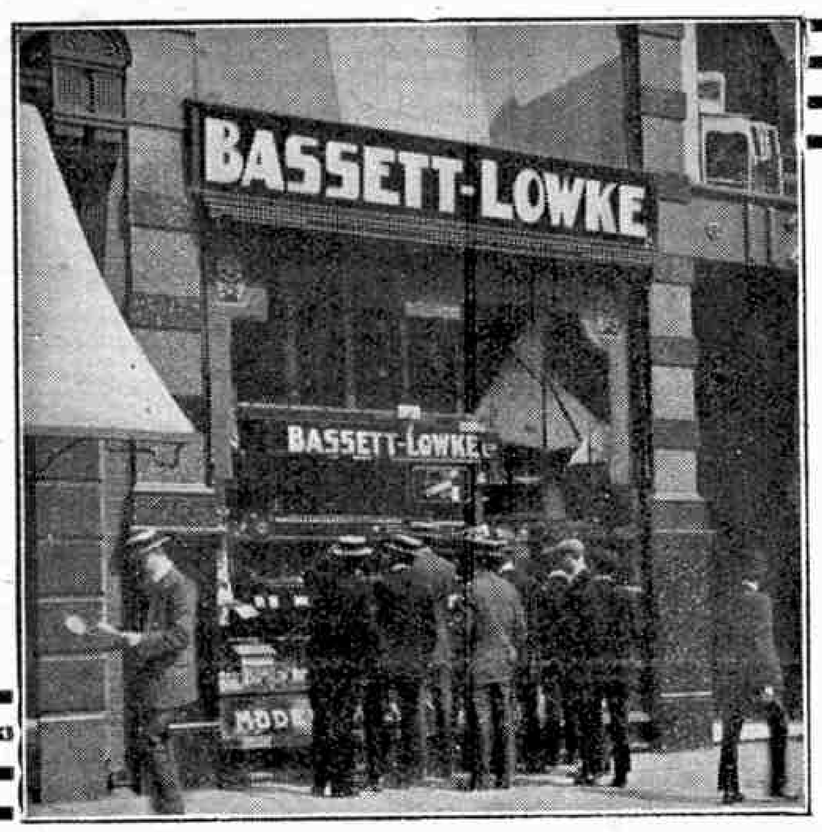

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180

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FOR USE WITH

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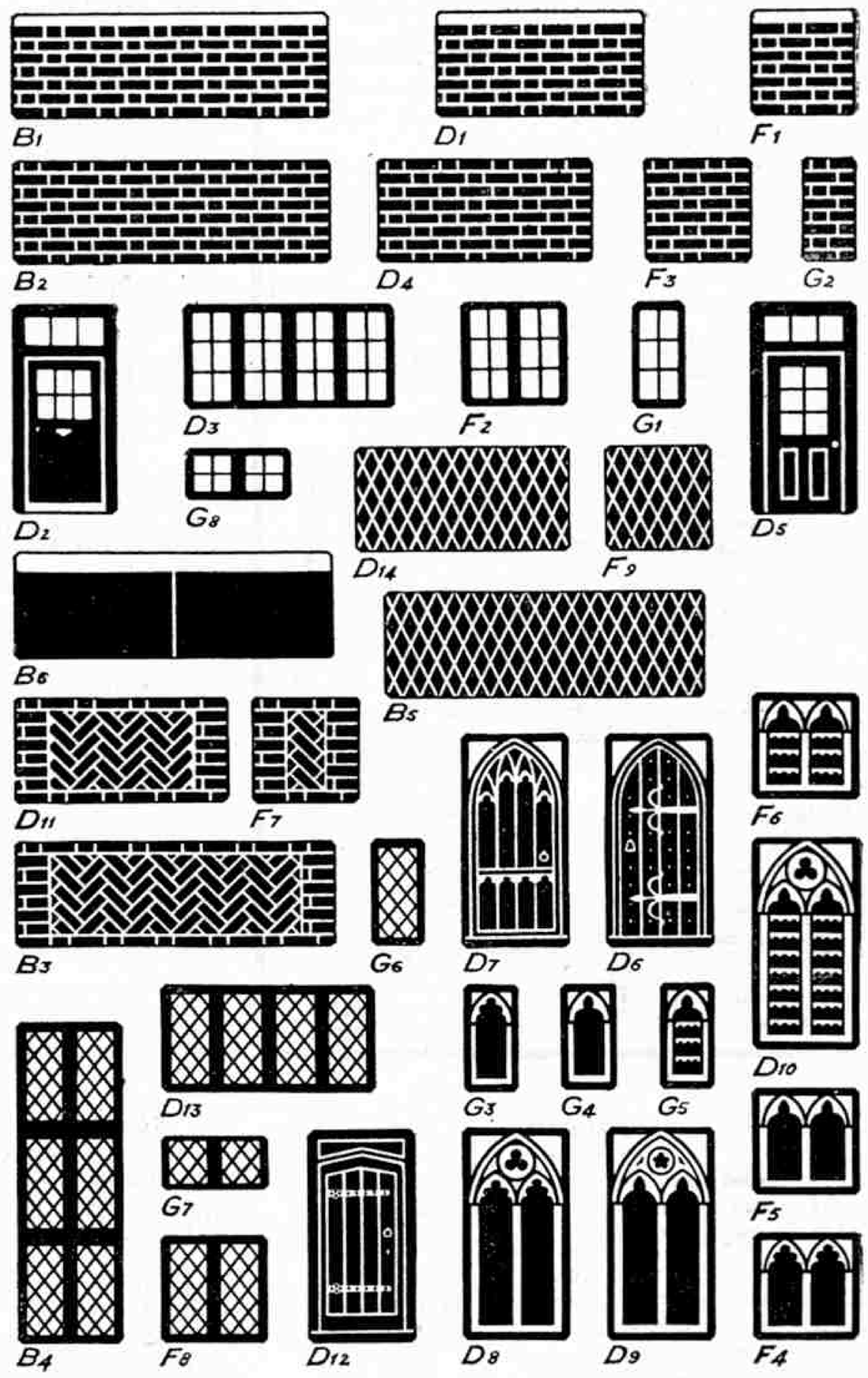

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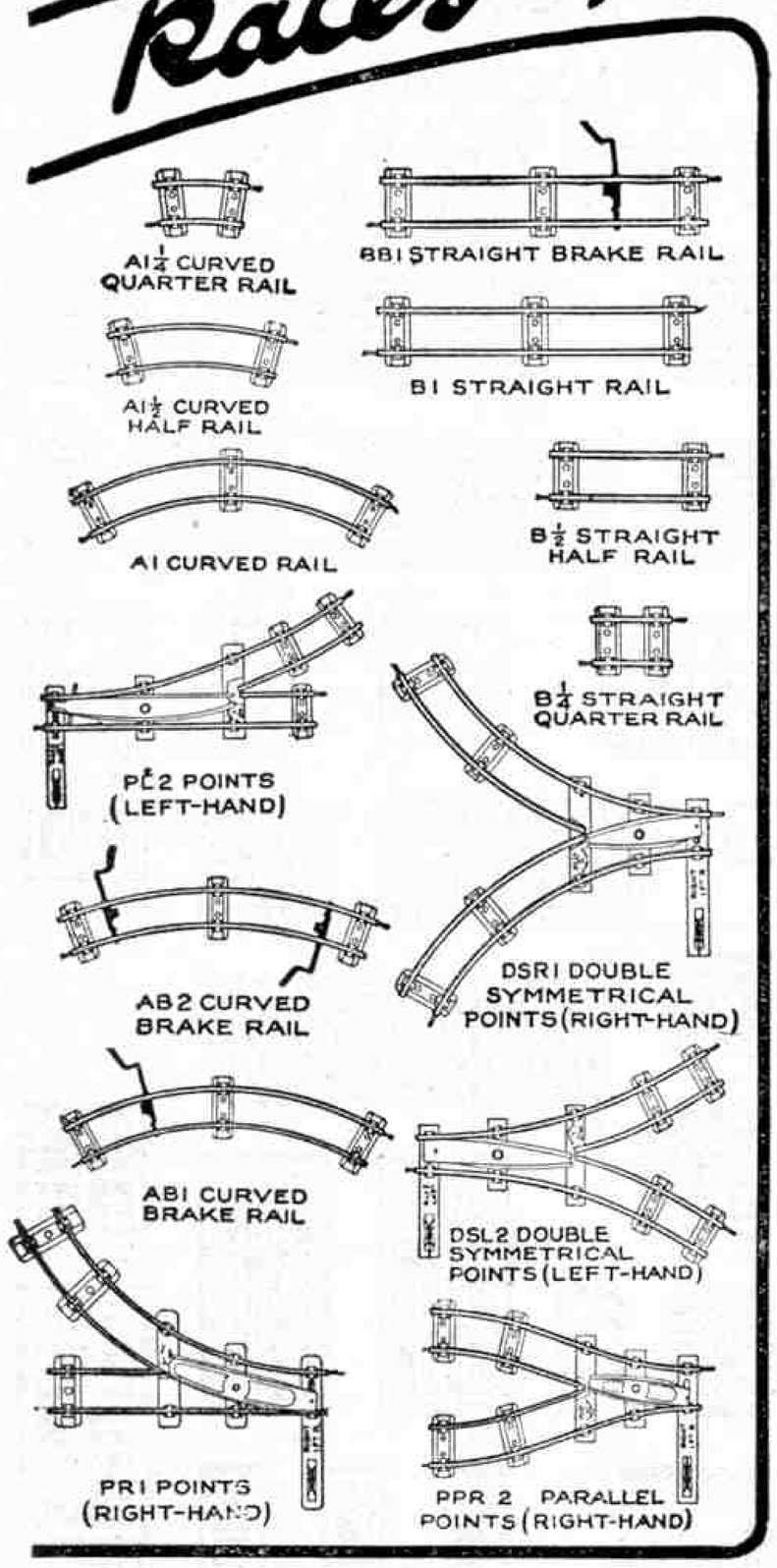

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A1¼	Curved quarter rails	"	3/-
AB1	Curved brake rails	each	6d.

2-ft. radius

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A2½	Curved half rails	"	3/6
A2¼	Curved quarter rails	"	3/-
AB2	Curved brake rails	each	6d.
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DSR1	Double symmetrical points, right	per pair	5/-
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PARALLEL POINTS

PPR2	Parallel points, right ...	per pair	5/-
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ML9	Left-hand points ...		

1-ft. radius

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2-ft. radius

PR2	Right-hand points ...	per pair	4/-
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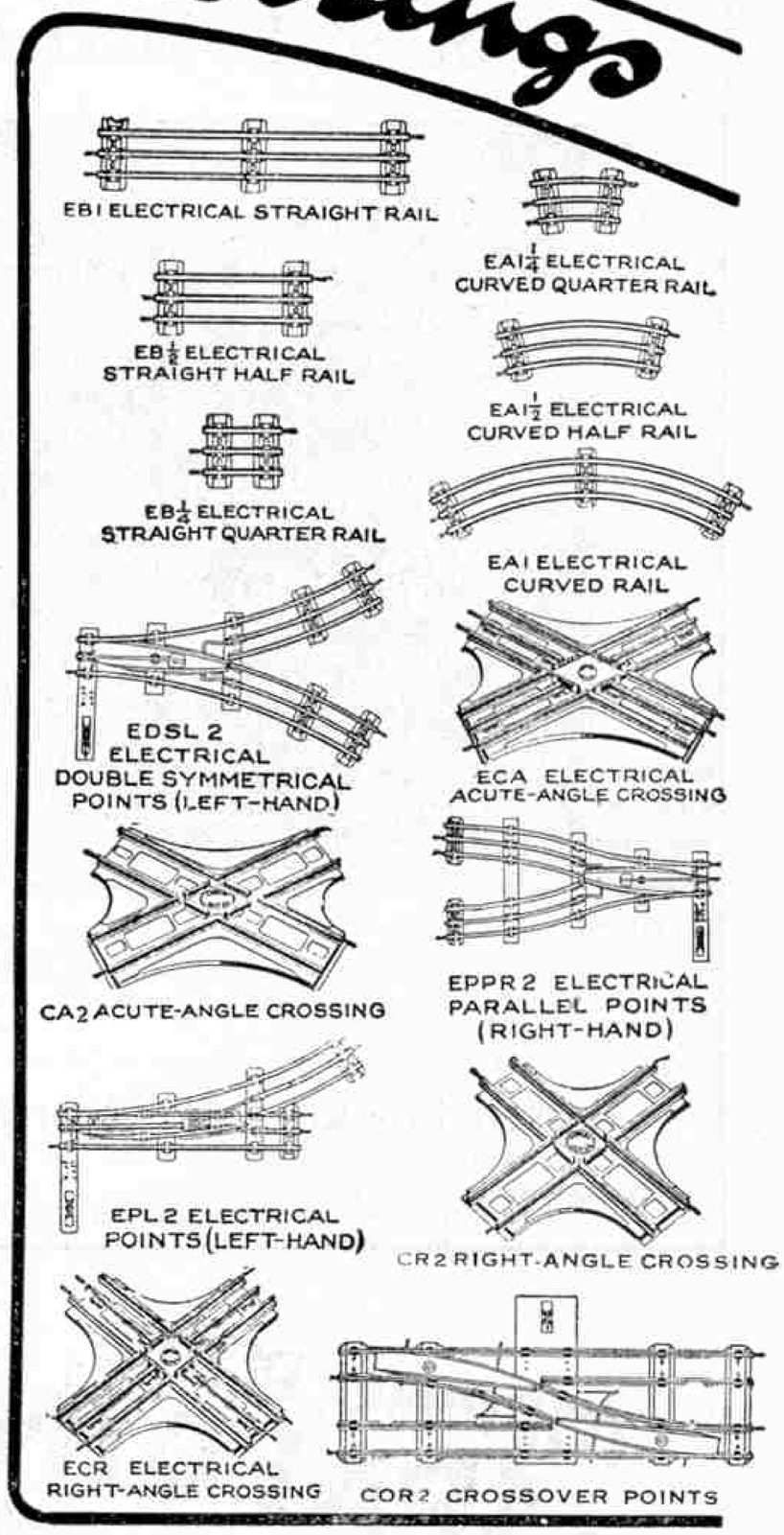

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EA2½	Curved half rails	"	4/6
EA2¼	Curved quarter rails	"	4/-
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CROSSINGS

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

POINTS

For 2-ft. radius curves

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

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

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

PARALLEL POINTS

For 2-ft. radius curves

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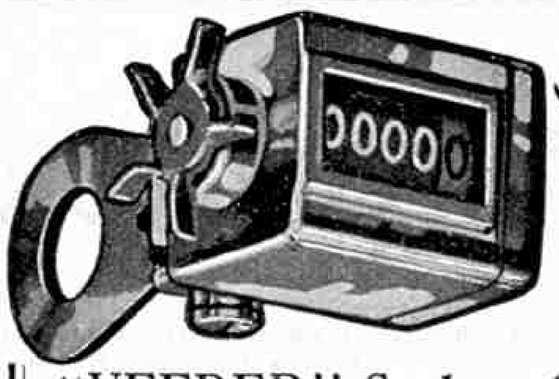

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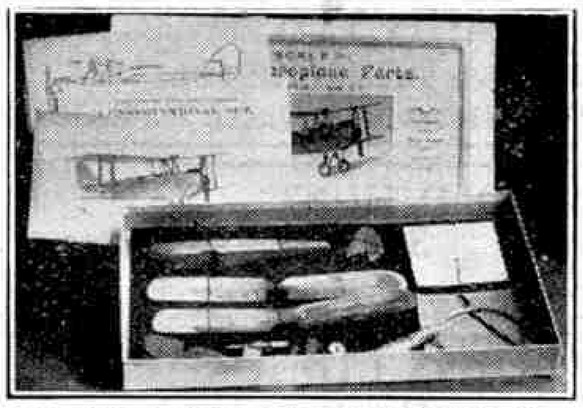

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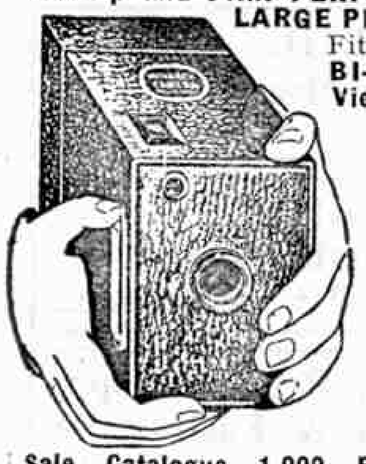

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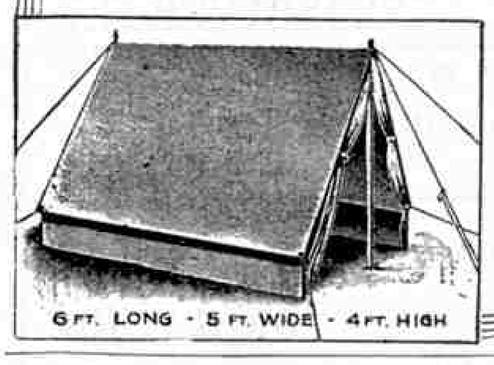

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What Shall I Be ?—(*Continued from page 387*)

A probationary term is usually served in London, and if the successful applicant is found satisfactory he is posted overseas, a first-class passage and an outfit allowance being granted. During the probationary period a salary of from £100 to £150 is usual. The scale is higher in overseas positions, and a recognised clerk has the prospect of eventually receiving a maximum salary of from £800 to £1,000 per year, or even as much as £2,000 per year.

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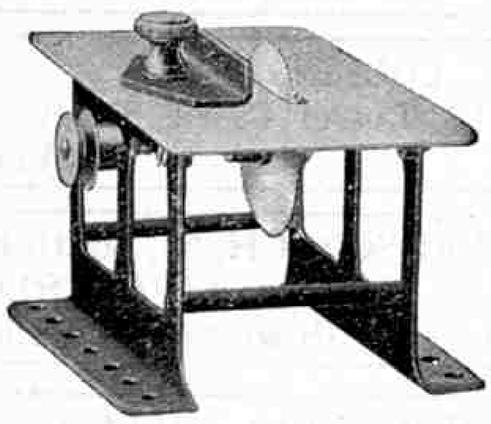
Binding cases for back numbers of the Magazine may be obtained from Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These are supplied in two sizes (1) for six copies price 3/6 and (2) for twelve copies price 5/3, post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown here. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding 6 or 12 copies. These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

MECCANO SAW BENCH



This model Saw Bench is suitable for use with an Electric or Clockwork Motor or Steam Engine. By means of the equidistant holes in the base it may be built into a Meccano Model Workshop. Beautifully finished in black enamel and nickel. Price 4/-.

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The Fokker "Safety 'Plane"—

(*Continued from page 365*)

3 ft. 5 in. in width, and 5 ft. 9 in. in height.

The undercarriage has a wheel-track of 20 ft. 8 in. and is made in two halves, each consisting of a chrome-nickel steel axle and a shock absorber strut with rubber rings stretched horizontally and running up to the outboard engine bed. The rubber rings may be easily removed or replaced. The struts are fitted with a streamlined cowling, and the wheels with ball-bearings. Wheel-brakes are also provided. The tail skid consists of a chrome-nickel steel tube with a steel ski sufficiently large to eliminate damage to aerodromes. The ski swivels on the tail skid, which is attached to the fuselage by means of rubber rings.

The Fokker F.XII has a span of 75 ft. 5 in., a length of 57 ft. 5 in., and a height of 14 ft. 1 in. The wing area is 893 sq. ft., and the track of the undercarriage is 20 ft. 8 in. The machine has a maximum speed of 137 m.p.h., a cruising speed of 112 m.p.h., and a stalling speed of 68 m.p.h. The climb to 3,280 ft. occupies 6 min.; while to 6,560 ft. and 9,840 ft. the figures are 14.5 min. and 28.5 min. respectively. The absolute ceiling of the machine with an all-up weight of 14,112 lb. is 16,728 ft.; and the service ceiling is 14,760 ft. The machine can also operate with an all-up weight of 15,986 lb., when the service ceiling is 11,152 ft. When only two engines are in operation, and the machine has an all-up weight of 14,112 lb., the service ceiling is 6,888 ft.; while with a load of 15,986 lb. it is 2,952 ft. The normal cruising range is 400 miles, but if desired this can be safely increased to 790 miles.

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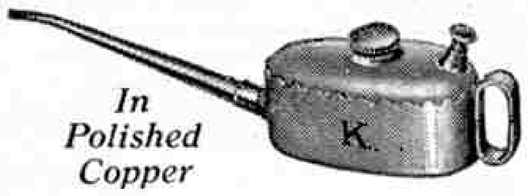

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Every Meccano and Hornby Train enthusiast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect.

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Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues of 1925 and 1926, and all the issues from 1927 to date are 8d. each.

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"Meccano Magazine," Binns Road, Old Swan, Liverpool.

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The Meccano Manuals are all beautifully printed and the illustrations are in half-tone throughout. Every Meccano boy should possess a copy of each of the 00-3 and 4-7 Manuals, in which a total number of 882 models is illustrated, and also a copy of the Standard Mechanisms Manual, in which a fine selection of real engineering movements that may be built with Meccano are reproduced. These Manuals may be purchased as separate units, or attractively bound in full cloth cover, lettered in gold.

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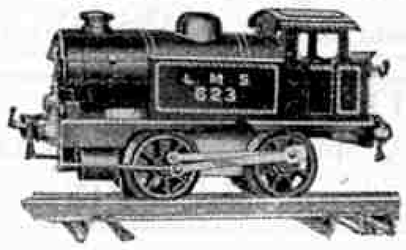
HORNBY TANK LOCOMOTIVES



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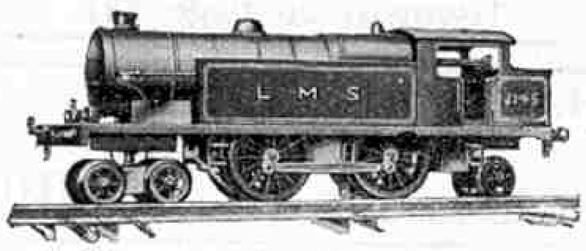

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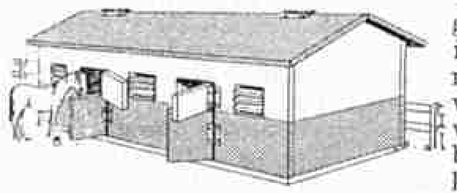

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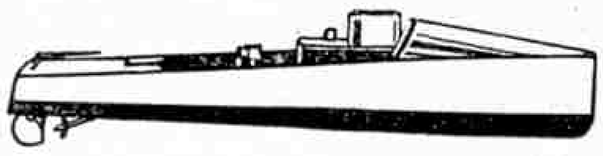

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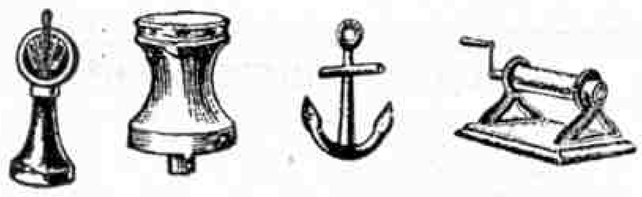

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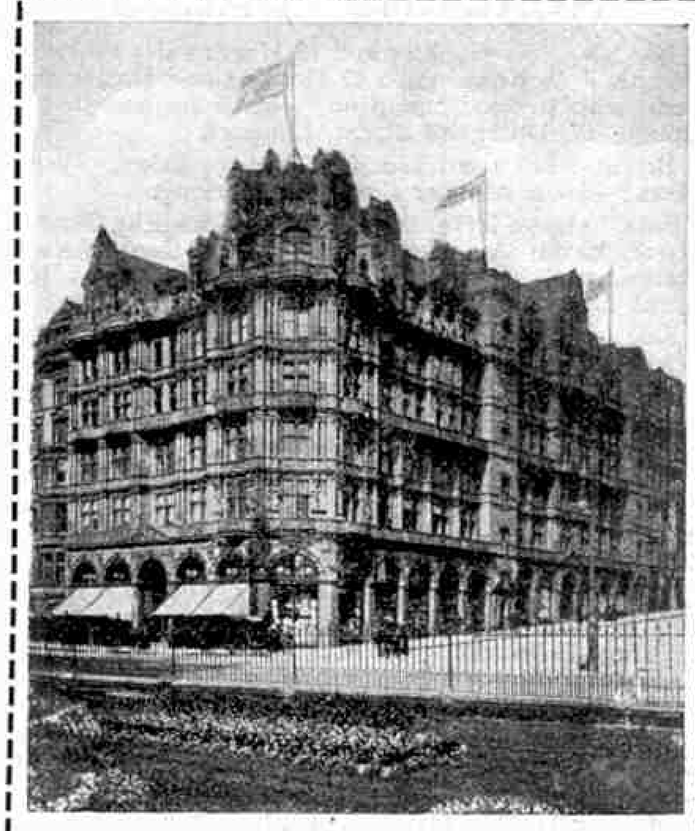

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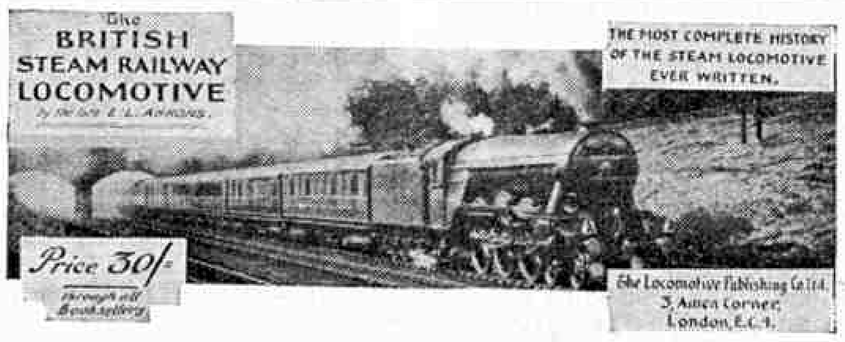

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Sale. Silkworm Eggs, 1/- per 100.—Quarmby. 165, Melfort Road, Thornton Heath, Surrey.

Stamp Collectors! Join the (New) Brithdir Stamp Exchange. No fees or subscription. Stamp for particulars.—17, Marlpit Lane, Coulsdon, Surrey.

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Sale. "Meccano Magazines," March 1926-April 1931. Two missing (60). Offer.—Davis, 133, Broomhill Drive, Glasgow.

Sale. 56 "Meccano Magazines," 1926-1930; 50 "Scouts," good condition. 18/- or nearest offer.—Harrison, Fitzburn, Langholm, Scotland.

Stamp Collection, over 500 British Colonials, Bargain, 6/-.—S. Riley, Uppercombs, Stowmarket, Suffolk.

Cheap Torch, Books. Write for particulars:—H. Cable, Red Lion, Ash Road, Aldershot.

Sale. "Meccano Magazines," 1925-31; Hornby Books of Trains; Brownie Camera. Lot or separate. Offers.—Sullivan, New Houses, Grey Friars, Chester.

21/- Bowman Tank Loco., 10/-; used five times. £5-5s. Electric Bassett-Lowke (L.M.S.) Loco., £3. 10/- Controller, 4/-, or offers. Excellent condition. Write—Bateman, 24, Parkfield Road, Cheadle Hulme, Cheshire.

Sale. "Mercury" Electric Motor Boat, as new; cost 35/-, accept 20/-, or near offer. Also Garden Coal-fired Loco. and Tender, 1" scale G.C. "Atlantic" Handyside Steel Boiler, 80 lbs., wants overhauling, £10.—Perrykeene, Alvechurch, Worcs.

"Meccano Magazines," 1921-26 inclusive, complete, also Spring Back Binder. What offers?—P. Fisher; 16, Stokewood Road, Bournemouth.

Sale. Hobbies Peggy Engine, perfect condition, 6/-.—Earle, 36, Harcourt Street, Birkenhead.

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Gauge 0 Clockwork Express Loco, Corridor Coaches, and odd Accessories. All brand new and by Bassett-Lowke. Cheap to clear.—R. C. Farnham, 175, Goldhurst Terrace, N.W.6.

"Meccano Magazines," January 1924 to August 1926, new condition. What offers?—Box 501.

For Sale. As new. Scale Model Railway Station, also twelve Model Railway Accessories, Gauge 0. All excellent condition. Sell together, or separately. Stamp for list.—K. J. Gardner, Sheepy, Atherstone.

Sale. Horizontal Piston-Valve Steam Engine, Starting Coach, Lever Safety Valve, Whistle. Cost 30/-. Accept 11/-. "M.M.'s," 1927, Bound Red with Gold Lettering, 6/6.—Temple, 61, Finnart Street, Greenock.

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Model Yacht, Length 3 ft. 8 in., Height 3 ft. 10 in. Complete with Stand. £2 or nearest offer. Apply—C. Chicken, Nara, Maxwelltown, Dumfries.

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Exploring the Antarctic (*Continued from page 376*)

been disappointed. The Pole itself was reached on Wednesday, 17th January, 1912. There they discovered a small tent erected by the Norwegians, and inside it found a record of Amundsen's arrival with four companions on 16th December, 1911, together with a letter for the King of Norway, which Amundsen requested Scott to bring back with him.

The five men stayed in the vicinity of the Pole for a sufficient length of time to take accurate observations of their position. They left a record of their visit in Amundsen's tent, and then began their homeward journey. They were rather late, and they made all haste northward. Misfortune followed them, however, for the conditions proved bad, and the heavy work they had performed began to tell on them. Evans was the first to show signs of this, and while descending the Beardmore Glacier he became ill. His wonderful exertions on the outward march had reduced his strength alarmingly, and the disappointment at not being the first to reach the Pole had affected him more than the others, for he was greatly attached to Scott. His companions helped him as much as possible, but he was badly frost-bitten, and two heavy falls gave rise to concussion. Finally he greatly alarmed Scott by not returning after being allowed to fall behind to adjust his footgear. Retracing their steps, the other men found that he had fallen and was in a dazed condition. They immediately encamped, and did all they could for him, but he never rallied, and he died the same evening.

Scott and his remaining companions continued their journey under the most dispiriting conditions. The leader felt that all was not well with the party, but his fighting spirit never quailed and he urged his companions forward. At last they reached the Barrier, only to encounter severe blizzards and temperatures that were undoubtedly far below the average. Slowly they grew weaker, and Oates in particular began to fail. His feet became badly frost-bitten, and he was unable to help in pulling the sledge. His comrades urged him forward, and restricted their own pace in order to keep him with them, although by doing so they made their own chances more remote.

Oates' case became more and more hopeless. He repeatedly asked the others if he had a chance to get through. Wilson, the doctor of the party, concealed the fact that he was too weak to make more than a few slow marches, and advised him to "slog on"; and Scott and Bowers joined in this cheery encouragement, although they knew well that Oates would never leave the icy Barrier, and that every hour spent with him made their own prospects worse. None of the three thought for one moment of saving himself, but Oates realised that he was a drag on them, and was ruining their chances. One night he left the tent in which they were seeking an uneasy rest after a terribly dreary march. "I am just going outside and I may be some time," he said. His companions knew that he was deliberately sacrificing himself in the hope of ensuring their safety, and tried to persuade him to remain; but he staggered out into the blizzard to die.

Scott, Wilson and Bowers continued to struggle northward, but they were weakened by their privations and depressed by the deaths of Oates and Evans, and Wilson had suffered terribly from his continued attention to the men who had died. A fierce blizzard brought them to a standstill when only eleven miles from a depot containing food, and fuel for their Primus lamp. They remained inside their tent, hoping each day that on the next the weather would have improved sufficiently to allow them to make the comparatively short journey. But the blizzard raged on, and the journey was never made. Day by day they grew weaker, and one by one they died of starvation and cold.

The details of Scott's desperate march homeward were not known until the following summer. The members of the expedition who had remained in the South for the second year were well aware that the five men who had last been seen marching towards the Pole must have perished. Several efforts to dash southward in search of them were made, but these all failed, and they were finally brought to an end by the coming of winter. Nothing more could be done until the following summer, and then a search party set out under Lieut. Atkinson, who was now in command of the expedition. They found the tent, and in it the bodies of Scott, Wilson and Bowers. Scott had

(*Continued at foot of next Column*)

written up his diary almost to the last.

The personal belongings of the dead explorers and the photographs taken at the Pole and on their march were removed, and a great cairn of ice and snow was erected over the tent. An effort was then made to find the body of Lieut. Oates, but the snow and ice had already given this hero fitting burial. A cross was erected as near the scene of his self-sacrifice as possible, and on this it was recorded that "Hereabouts died a very gallant gentleman."

The discovery of the fate of the men who had reached the Pole was the last episode of the expedition, and if Scott and his companions had succeeded in struggling to safety, the expedition could have been described as the most successful Antarctic effort made up to that time. It was at least the most memorable, for the heroism of Scott and his four companions has never been surpassed in either Arctic or Antarctic exploration.—*We are indebted to the courtesy of Lady Hilton Young (formerly Lady Scott) for the photograph of Captain R. F. Scott, R.N., reproduced on page 374.—THE EDITOR.*

MECCANO MAGAZINE

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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

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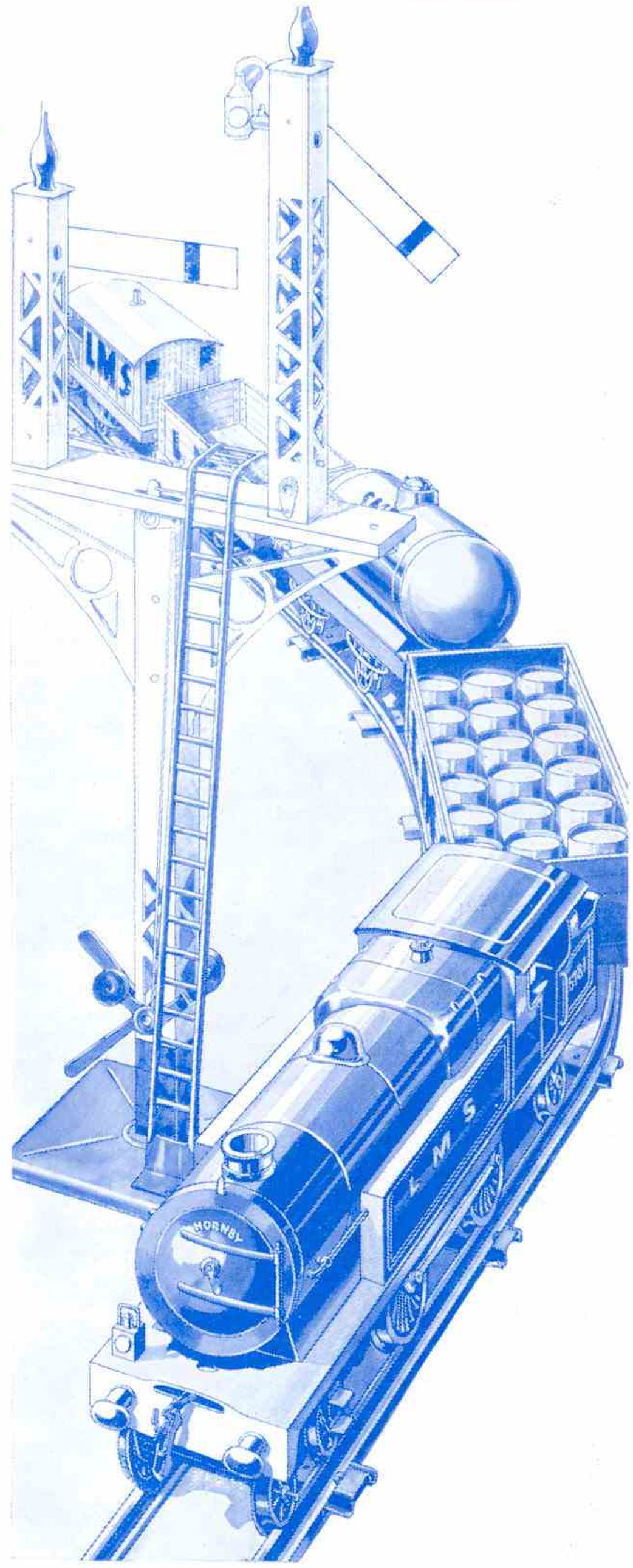

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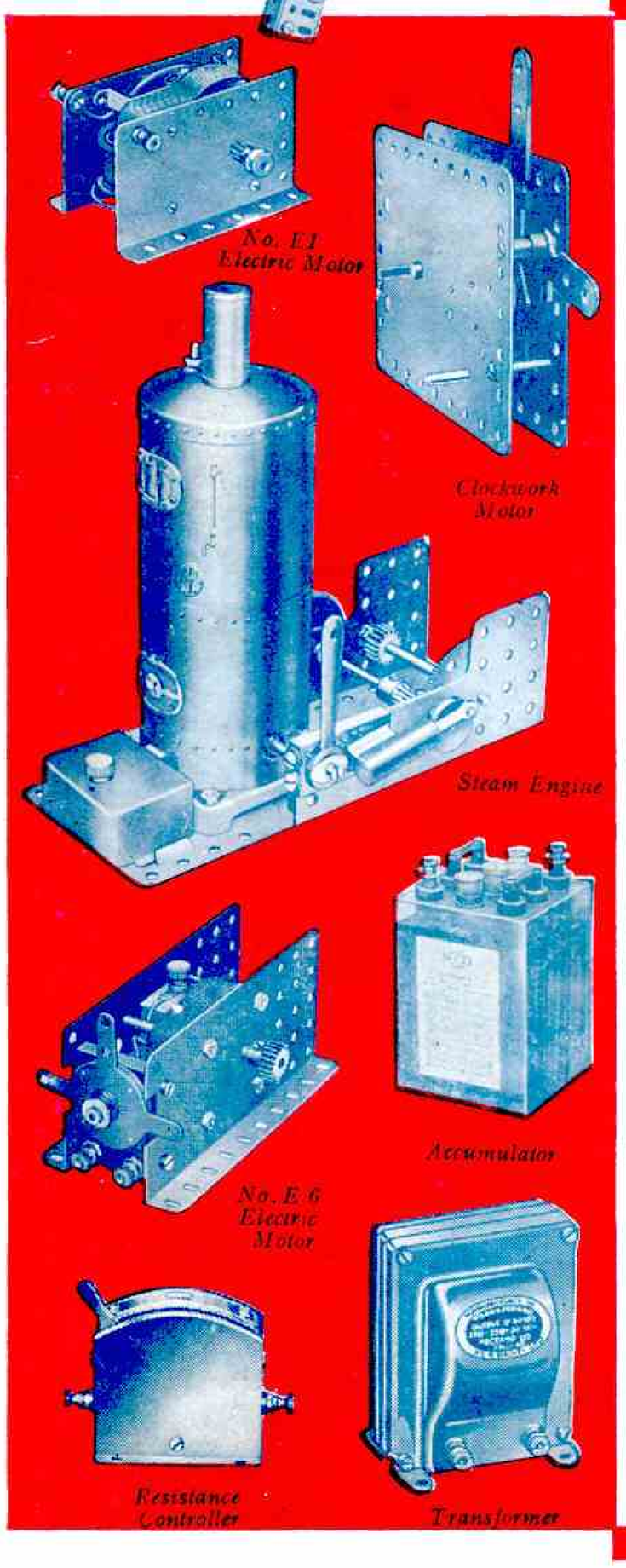

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