VOL. XIX. No.7 JULY 1934

MECCANO MAGAZINE

AN AIRCRAFT CARRIER AT SEA
(see page 522)

6D.

MECCANO

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CONSTRUCTOR OUTFITS

MECCAUTO 538189

No. 1 Motor Car Constructor Outfit

No. 2 Motor Car Constructor Outfit

One of the most fascinating of all boys hobbies, either indoor or outdoor, is model car operation with cars built from Meccano Motor Car Constructor Outfits. Perfect miniature reproductions of many different types of car can be built with these splendid Outfits, including sports four-seaters, speed cars, sports coupés and others.

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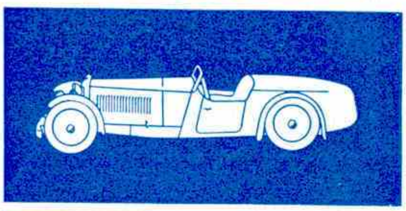

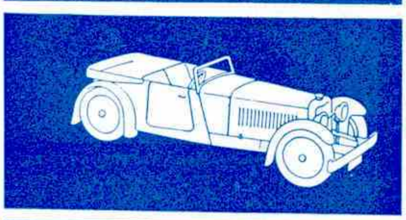

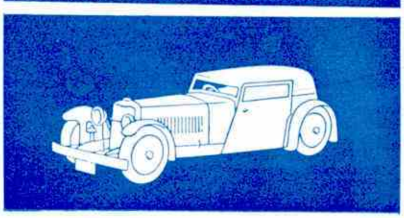

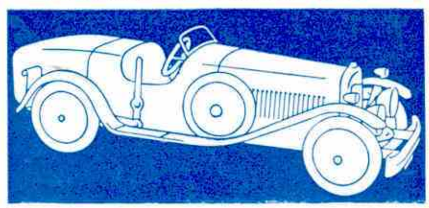

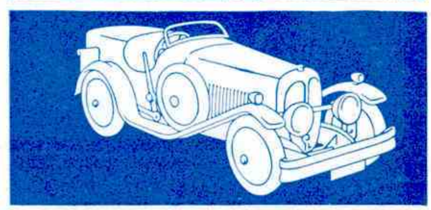

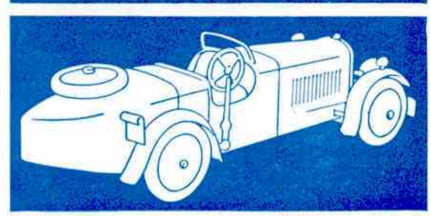

Motor Car Lighting Set

This Lighting Set enables the headlamps of Motor Car models built with the 1933/4 No. 2 Motor Car Outfit to be electrically lighted. Price **2/6**

PRODUCT of MECCANO LIMITED LIVERPOOL

Motor Car Garage

The Meccano Motor Car Garage provides accommodation for any Meccano model motor car or other car of suitable size. It is strongly built, with imitation rough-cast finish. Inside dimensions: Height 5 in., Length 13 in., Width 7¾ in. Price **7/-**

NEXT MONTH: "THE WORLD'S LARGEST DAM." PUBLISHING DATE: 1st AUGUST

MECCANO MAGAZINE

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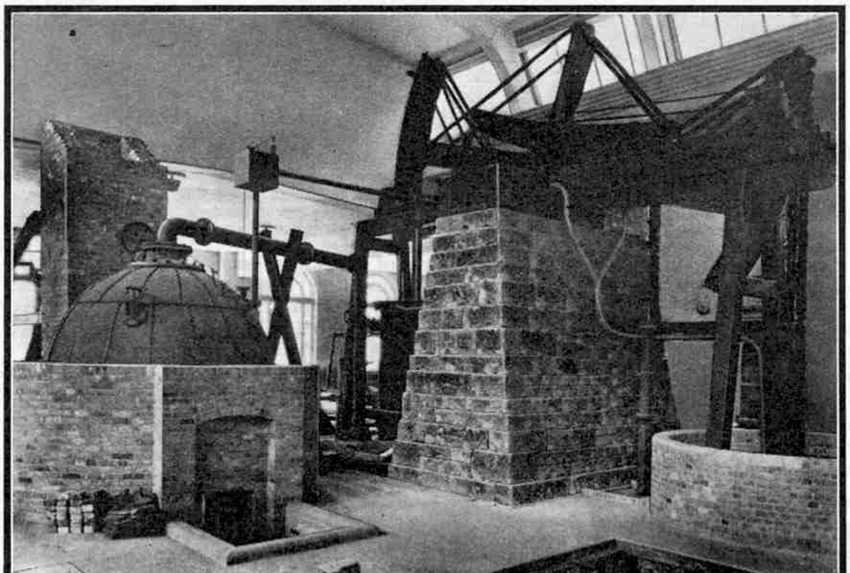
With the Editor

A Newcomen Engine in America

The curious mechanism illustrated on this page is an interesting reminder of the early days of the steam engine. It is a Newcomen engine that was used more than 100 years ago for pumping water from the Cannel Mine at Fairbottom, near Ashton-under-Lyne. A photograph showing this engine, dilapidated but still defying time, in the position it occupied when at work, was reproduced on page 445 of the "*M.M.*" for June, 1930. Mr. Henry Ford purchased the old engine and took it across the Atlantic to be restored and re-erected in his famous museum at Detroit, where as one of its companions it has a replica of George Stephenson's "*Rocket.*"

This type of engine was invented in 1765 by Thomas Newcomen of Dartmouth, of whom little is known beyond the fact that he was an ironmonger or blacksmith, or both. He appears to have had little education, but he certainly had remarkable mechanical ingenuity and skill. He does not seem to have made much money at any time from his engines, and he is believed to have died in poverty at Dartmouth.



A famous Newcomen engine, now in Mr. Henry Ford's Museum at Detroit, U.S.A. This engine was formerly employed in pumping water from a mine near Ashton-under-Lyne, where it remained in a dilapidated condition for a century after ending its useful career. Photograph by J. F. Stirling, M.Sc., Cornwall.

The cylinder of the Ashton engine can be seen behind the massive brick pillar in the centre of the photograph. Steam from the boiler on the left passed into the cylinder and raised the piston to a certain height, and the entry of a jet of cold water then condensed the steam and so created a vacuum. The upper end of the cylinder was open, and therefore the pressure of the atmosphere forced down the piston and the cycle of operations was repeated. The piston was connected by a chain to one end of an immense beam that oscillated see-saw fashion on an axis set on the brickwork pillar; and from the other end of the beam hung a long weight attached to a pump rod that descended a shaft into the mine. The motion of the beam was assisted and steadied by a balance weight. In the illustration the shaft is represented by the circular brickwork structure on the right.

At one time there were many Newcomen engines at work in various collieries, and more particularly in the tin mines of Cornwall. Trevithick, Watt, and other pioneers of the steam engine were accustomed to them, and there is no doubt that they paved the way for the subsequent inventions of these men, and thus played an important part in the development of the engines of to-day. For this reason it is gratifying to know that the Ashton engine is preserved for all time, but one cannot help regretting that it should be in the United States instead of in the country of its origin.

St. Swithin's Day

Old beliefs have a habit of clinging to life with the utmost tenacity, and this is certainly the case with the belief that rain on St. Swithin's Day means rain on the following 40 days. Even people who scoff at all superstitions take a mild interest in this day, and feel rather glad if it passes off without rain. In view of the present shortage of water, one imagines that harassed water engineers up and down the country will be interested this year in St. Swithin's Day, even if they never were before!

As a matter of fact the St. Swithin's legend is an imposter. This saint's day is celebrated on 15th July, but actually the date should be the 26th of the month. The reason for this is that 15th July in the old style automatically became 26th July during the 18th century, when 11 days were missed out of the calendar in order to bring it into line with the movements of the Sun. Even if the legend originally had any basis of fact, this discrepancy of 11 days upsets it completely.

There are many different accounts of the origin of the legend. According to one of them, St. Swithin, who was Bishop of Winchester nearly 1,000 years ago, expressed a wish to be buried, not in the chancel of his minster according to custom, but out in the open churchyard where the rains of heaven could wet his grave. His wish was gratified, but later the monks of Winchester became worried at the thought of so great an ecclesiastic being buried in a common churchyard. They therefore determined to re-inter the good Bishop inside the building, and planned to do this on 15th July, but were miraculously prevented from doing so by torrential rain, which continued throughout the following 40 days. Unfortunately neither this nor any other explanation of the legend seems to be at all satisfactory.

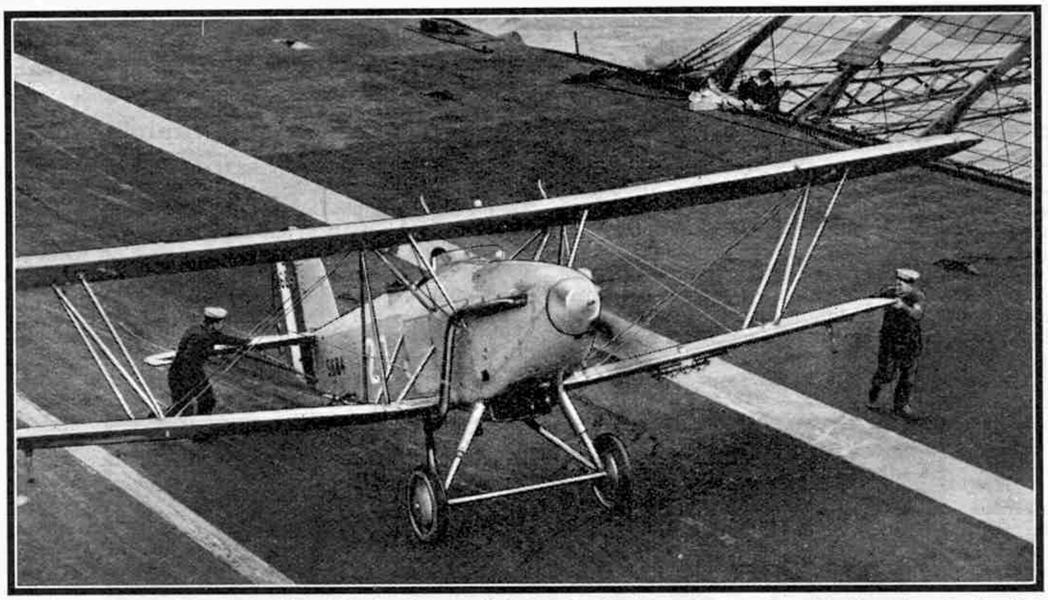
Fascinating Footplate Trips

When travelling by rail practically every reader of the "*M.M.*" would eagerly exchange the comfort of the most luxurious passenger coach for the footplate of the locomotive at the head of his train. The fascination of a footplate trip is strikingly shown in the story of a thrilling journey of this kind on the L.M.S.R. 4-6-2 locomotive "*The Princess Royal*" that appears on page 548 of this issue. Next month I hope to include an equally attractive description of a run on the footplate of "*Cock o' the North,*" the new streamlined L.N.E.R. locomotive that is described and illustrated on page 546 of the present issue.

Wings of the Navy

Floating Aerodromes that Carry Landplanes to Sea

THE calling of an officer of the Fleet Air Arm is one that demands the highest degree of skill and courage, for although the scouting and other duties involved must be performed at sea, and the pilots often are out of sight of land or ship, practically all the work is carried out in landplanes operating from aircraft carriers, which are gigantic floating aerodromes. There are no landmarks in the open sea, and the navigator of one of these aeroplanes has to calculate his course exactly and to know precisely at any instant where his machine is. This is particularly important in the case of a machine flying alone, for any carelessness or mistake in navigation may result in an aeroplane being unable to find its way back to the parent ship. This may lead to the death of the crew, for although machines operating from aircraft carriers are fitted with flotation bags, and therefore can remain afloat for a considerable time, a single aeroplane is so small that it is easily overlooked during a search, and in bad weather rescue almost certainly would be impossible.



Members of the handling party seizing a Hawker "Osprey" that has just landed on the deck of an aircraft carrier. On the right is a section of the palisade that prevents aeroplanes from falling into the sea if they run off the deck. Palisades are fitted on all British aircraft carriers except the "Eagle." Photograph by courtesy of "Flight."

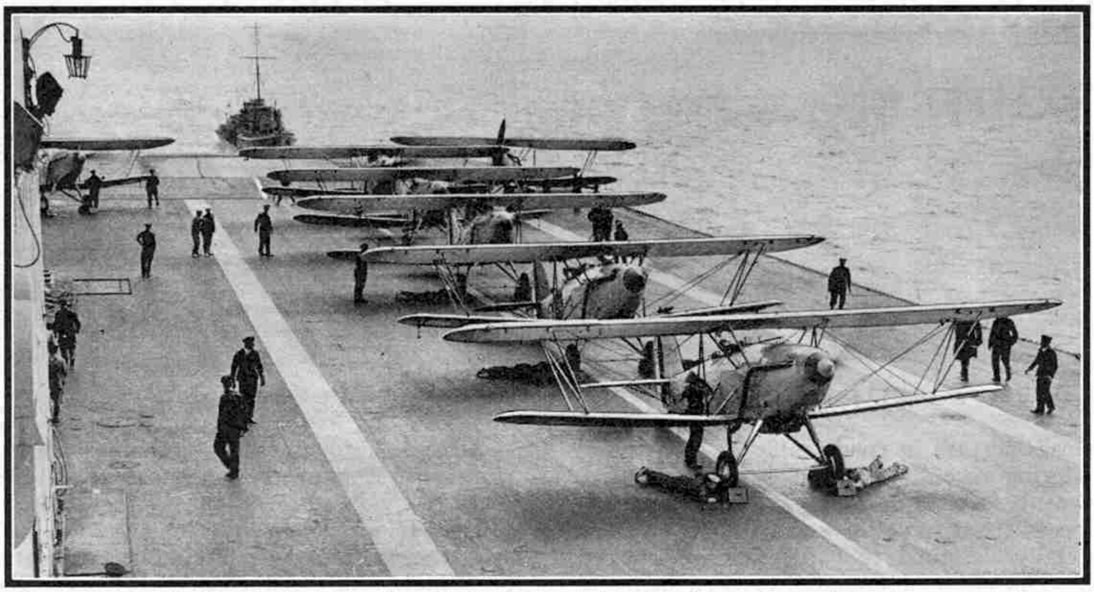
Officers of the Fleet Air Arm may be either R.A.F. officers or Naval officers who have been attached to the Arm to undergo a special course of training that includes navigation and deck landing, which is totally different from alighting on an aerodrome. The art of landing an aeroplane on the deck of a ship has only been brought to a state of perfection during recent years, although the first flight from a ship's deck was made as long ago as 10th January, 1912, when Lt. C. R. Samson flew a Short biplane from a staging erected on board H.M.S "*Africa*," then lying in Sheerness Bay. The first vessel built solely for carrying aeroplanes was the "*Hermes*," which was commissioned in 1913 and was torpedoed in the English Channel in November 1914. Aft several merchant ships had been fitted with platforms from whic landplanes could be launched, H.M.S. "*Furious*" was evolved, an trials carrie out with th vessel event ually prove that aeroplan could land o the deck as well as take off from it.

A two-seater Hawker "Osprey" taking off from H.M.S. "Eagle." The direction of the jet of steam shows that the carrier is steaming dead into the wind. Photograph by courtesy of "The Aeroplane."

At first various forms of arresting gear were used to prevent machines from being flung into the water after landing when the ship was rolling and pitching during rough weather. One form of such gear consisted of wire ropes stretched fore and aft along the flying deck. Hooks fixed to the undercarriages of machines engaged with these wires, and thus prevented the machine from turning sideways; while an additional hook lowered by the pilot became entangled in other ropes attached to sandbags that acted as brakes and arrested the progress of the aeroplane. It was soon found that arresting gear, of whatever form, strained the aeroplane too much, and its use was discontinued. An aeroplane fitted with modern wheel brakes can be pulled up and manœuvred on the deck of a vessel in perfect safety.

At present there are six aircraft carriers in the British fleet. These are the "*Furious*," "*Argus*," "*Glorious*," "*Courageous*," "*Eagle*" and "*Hermes*." The first four were built as cruisers, and afterwards converted to their present use; the "*Eagle*" was originally designed as a battleship for the Chilean Navy, and was bought by the British Government in 1917, and converted into a carrier. The "*Hermes*," launched in 1919, is the only British aircraft carrier that was specially constructed for the purpose. She is a lightly-protected vessel with a wide radius of action. On the starboard edge of her flying deck is a high and narrow superstructure, or "island" as it is called, surmounted by an oval funnel and a tripod mast that carries a control top and range-finder platform.

The "*Eagle*" has a starboard island and two funnels. She is the largest of the carriers, having a tonnage of 22,790; but the "*Furious*," with a tonnage of only 19,100, is 789 ft. in length, or 128 ft. longer than the "*Eagle*." The "*Furious*" is the most remarkable in appearance of the six carriers, for she has no funnels, the smoke being discharged through vents in the stern, so that the flying deck is quite unobstructed. This vessel is stated to have cost more than £6,000,000 to date owing to the many experiments made on it.

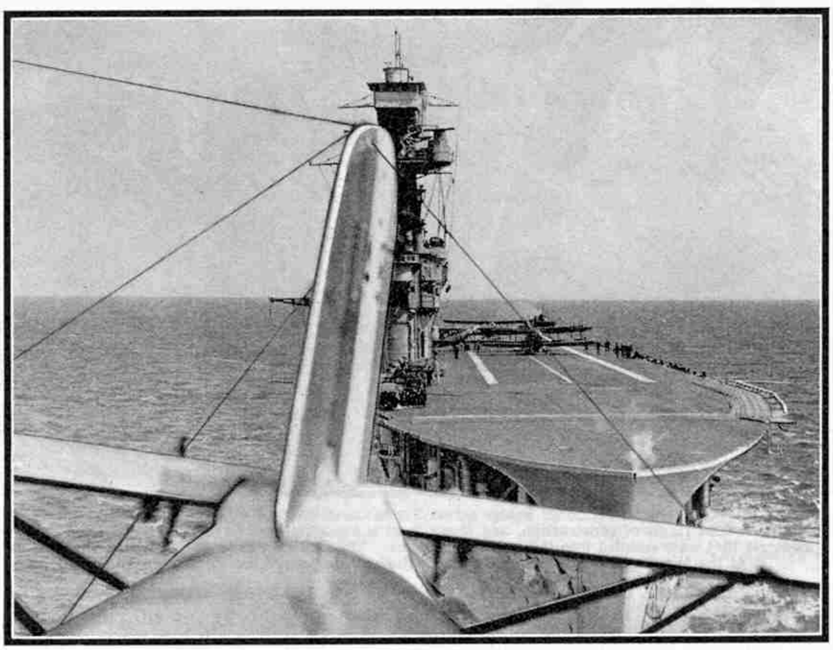


"Ospreys" ready to fly off an aircraft carrier, with naval ratings lying under the wings of the machines ready to pull away the chocks when the take-off signal is given. One of the attendant destroyers can be seen behind the carrier ready to go to the assistance of any machine forced to alight in the sea. The photographs on this page are reproduced by courtesy of "The Aeroplane."

The "*Hermes*" and the "*Eagle*" are the only two vessels that have a continuous flying deck from bow to stern, and the "*Eagle's*" flying deck, which is 100 ft. across, is the widest. All the carriers, except the "*Eagle*," are provided with special palisades consisting of wires carried on bars stretched out from the side of the ship so that if an aeroplane runs off the deck it does not fall into the water.

The internal arrangements of the carriers differ, as their dimensions are not the same. An enormous hangar that extends the whole length of the flying deck is provided in some of them, while in others there are separate smaller hangars. The vessels are magnificently equipped for carrying out all kinds of repairs to aeroplanes and aero engines, and communication with the flying deck is provided by means of electric lifts at the forward and aft ends of the vessel.

The number of men on board an aircraft carrier varies, but the normal crew of the "*Eagle*" is 750 naval officers and men, in addition to 250 officers and men of the Fleet Air Arm. Flying deck operations are under the control of an R.A.F. Deck Control Officer, who is subordinate to the Senior R.A.F. Officer, who in turn is responsible to the Captain of the vessel. Usually about 24 machines are on board.



The "Eagle" seen from the air. The photograph was taken from the rear cockpit of a Fairey 111F immediately after taking off, and shows the white guiding lines on the deck of the carrier.

Operations on board an aircraft carrier are very interesting to watch. The most important factor of course is speed, for no time must be lost if the machines are to be brought up out of the hangar, flown off the deck, and then manœuvred into formation before setting off on duty. When a squadron is about to take off, each aeroplane in turn is brought on deck by means of a lift and the engines are then warmed up. While this is being done, screens to break the wind are raised at the forward end of the deck in order to prevent the aeroplanes from being blown into the sea, and each machine is held steady by means of two pairs of chocks, one chock in front and one behind each wheel. When it is time to "fly-off," the wind-breaking screens are lowered, and two mechanics lying underneath the wings of the first machine pull away the front chocks as the Deck Control Officer signals the machine away by means of a green flag. A red signal flag is displayed when it is necessary to hold back an aeroplane.

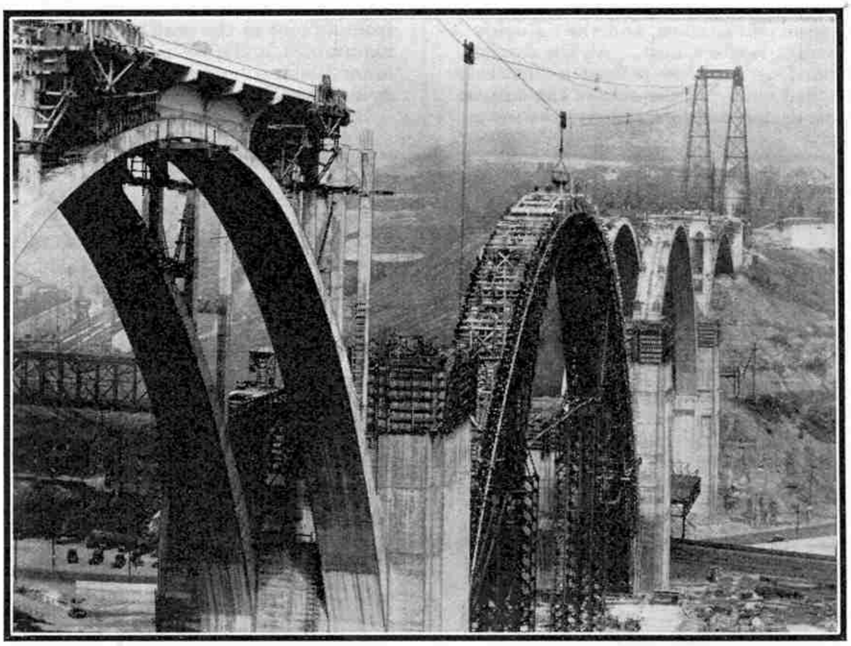
Immediately one machine has left the deck, the four chocks are pulled to the sides and the entire procedure is repeated with the next one. Meanwhile the aircraft carrier steams into the wind, and a thin jet of steam emitted from a point in the nose shows whether the correct course is being maintained, and gives pilots the exact direction of the wind. In the lower illustration on the opposite page an aeroplane can be seen flying over this jet immediately after having taken off.

Speedy work is required also for "landing-on," and operations then are more complicated than in "flying-off." When a squadron approaches the carrier, its recognition flag is flown from a special mast on the ship to indicate that machines may alight on its deck. Each aeroplane has an individual signal flag, and cannot be landed until this is flown underneath the squadron flag. When the necessary signals are given, the aeroplane indicated is flown into position behind the carrier, which of course is again steaming into the wind, and flies on to the deck. The ideal line of descent crosses the stern at a height of about 20 ft., for if the pilot goes lower than this a sudden gust of wind is liable to cause him to lose height rapidly and "wash out" the aeroplane's undercarriage by collision with the stern of the vessel. A pilot cannot switch off his engine and glide in as he could when landing at an aerodrome, for the carrier is travelling ahead rapidly and the aeroplane would be left behind if speed were lost.

Immediately the machine touches the deck, the men of the special handling party assigned to it catch hold of it and push it on to one of the lifts, usually the forward one. The chocks are then put in place, the wings are folded, and the aeroplane is whisked down below into the hangar. Signals allowing another machine to alight are not flown until the elevator is back again on (*Continued on page 584*)

THE WESTINGHOUSE MEMORIAL BRIDGE

THE immense increase in road traffic in the United States during recent years has led to extensive developments in road construction, and enormous sums have been spent on the construction of new highways specially designed to carry fast and heavy motor traffic. The construction of a modern highway is costly, even where the route is straightforward; and the cost is greatly increased if there are involved such matters as the negotiation of a railway, the construction of a tunnel, or the bridging of a river. Even the diversion of part of an existing highway to meet modern traffic requirements may involve serious engineering problems, and an instance of this occurred in the diversion of a section of the Lincoln Highway to a new route across the Turtle Creek Valley at East Pittsburgh. The Lincoln Highway is a national road extending across the country from coast to coast.



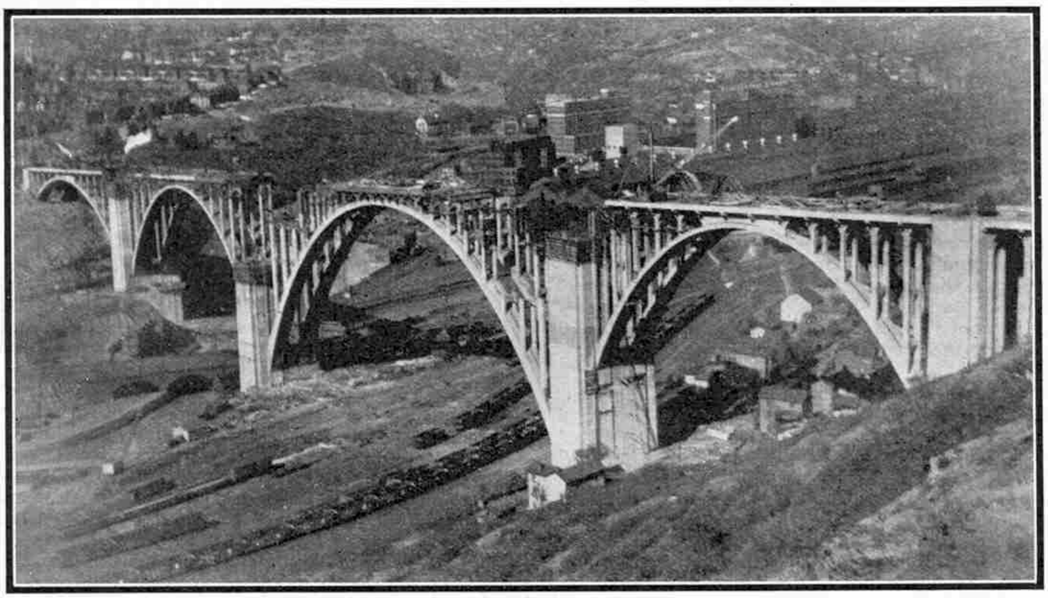
Building the Westinghouse Memorial Bridge across Turtle Creek Valley, East Pittsburgh. The arches are shown in various stages of construction, and above them is the aerial ropeway that conveyed the buckets of concrete that were emptied into the moulds, or forms. The illustrations to this article are by courtesy of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, U.S.A.

The Pennsylvania State Highway Department originally planned to start the new section at an East Pittsburgh thoroughfare leading to the plant of the Westinghouse Electric and Manufacturing Company in the heart of the valley, to carry it over the works by some type of bridge, and to continue it at a high level to Turtle Creek Hill, where it would rejoin the old highway. The Westinghouse Company objected to this scheme, however, on the ground that it would damage their property and be a menace to the operation of their plant; and the Secretary of Highways agreed to consider any alternative site that the company might suggest.

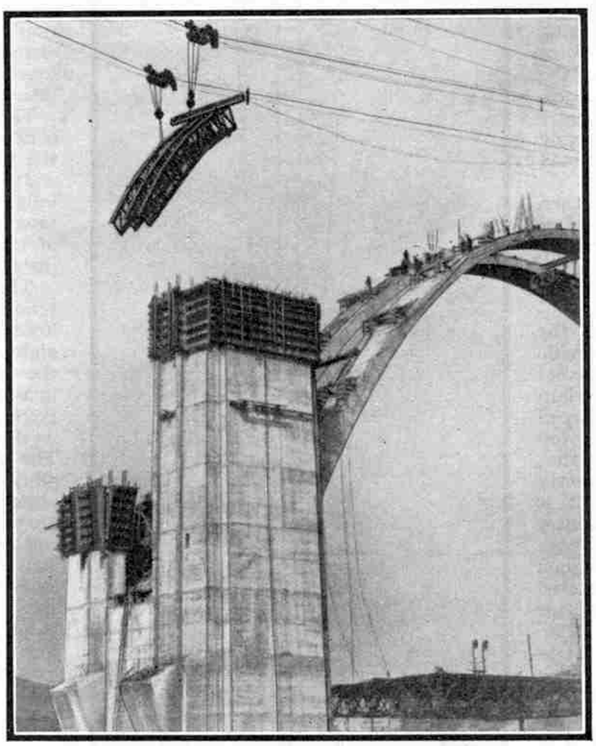
After a thorough study of the problems involved, the company recommended an alternative route that would cross the valley at a point south of the Westinghouse plant. It was proposed that the new highway should span the valley from one hilltop to the other by means of a high reinforced concrete bridge. This plan was accepted, surveys were made, and detailed plans were prepared. The total length of the new highway was $5\frac{1}{3}$ miles, and this was divided into four sections, the construction of these being entrusted to different companies.

In this article we are concerned only with the second or bridge section of the highway. The bridge is 1,510 ft. long from face to face of the abutments, and is the largest structure of its kind in the United States. It has five spans, consisting of two abutment spans 196 ft. 4 in. long, two intermediate spans of 295 ft., and a central span of 460 ft., which is the longest reinforced concrete arch in the country. This great arch spans the four main line tracks of the Pennsylvania Railroad along the bottom of the valley, and gives a clearance of 200 ft. A better idea of its height can be gained from the fact that an 18-storey building could be placed under the bridge at this point.

The abutments and piers of the bridge are all built on sandstone rock, with the exception of the first pier at the eastern end, which is founded on hard shale. Little excavation was necessary for the abutments, but in the case of the intermediate piers it was continued to depths of 35 ft. and 50 ft. respectively before the rock was reached. Reinforced concrete caissons were sunk at the sites of the two piers for the centre arch to depths of 55 ft. and 90 ft. respectively. Powerful pumps drew off the water encountered during this work, and kept the caissons dry for the pouring in of the concrete.


The bridge nearer completion. The arch ribs have been finished and the building up of the concrete columns to carry the roadway and the cantilevered sidewalks is well advanced.

Cranes and stiff-leg derricks were used to take away the excavated material, and also for pouring the concrete into the pier moulds or forms up to a height of 30 ft. above ground level. The forms were of timber and were assembled on the site, all cracks in them being carefully sealed to prevent any leakage of the concrete, and to ensure its surface being free from pores. The bolts used in assembling the forms were of ⅜ in. high tensile steel, and were encased in metal sleeves, so that when the concrete poured into the forms had set, the bolts could be withdrawn without difficulty. The holes vacated by the bolts were then closed up.


The aerial ropeway being utilised to dismantle the falsework, or centring, after the concrete of the arch rib has set.

The continuation of the piers up to their designed height was effected by means of an aerial ropeway, the erection of which had been commenced when the piers were only a few feet above the ground. This ropeway was carried by two lofty steel towers. The western or head tower was built on level ground behind the west abutment and was 150 ft. high, its top being 126 ft. above the bridge deck level at that abutment. The other tower was erected behind the east abutment of the bridge and was 110 ft. high, its top being 113 ft. above the bridge deck level at the abutment. The ropeway had three lines, two of which passed over the north ribs of the arches and one over the south ribs. It had a span of 1,650 ft., and the natural sag of the cables was about 75 ft. The concrete for the part of the piers above 30 ft., and for the arches, was conveyed along this ropeway in special buckets and poured into the forms.

The first arches to be constructed were those of the abutment spans, and these were followed by the two intermediate arches and finally the great centre arch. Each arch consisted of two large semi-circular "ribs" spaced 32 ft. apart, centre to centre, and each 14 ft. wide. The forms for the ribs were erected on special falsework or centring consisting of light steel trusses that were hoisted into position and joined together. In a case of the centre arch a trussed flat roof was erected beneath it to protect the railway from the danger of falling objects during the construction of the arch. An additional set of centring, consisting of three heavier steel trusses, was necessary for the intermediate arches, and in addition extra trusses had to be brought into use for the centre arch. The centring for this arch was supported on two structural steel towers 163 ft. apart, and each tower was built on a concrete base. The total weight of steel centring used in this arch was 710 tons. In every case the centring was erected under the north rib, and when the concrete of this rib had set the centring was moved into position for building up the south rib.

The forms erected on the ribs to receive the concrete were divided into long sections by leakproof partitions, and spaces called key positions were left between the sections. This was done in order to allow for changes in volume during the hardening of the concrete in the adjacent sections. The key positions were of course filled up after the concrete in those sections had set. The size and type of the bridge necessitated at least three key positions in each of the 10 arch ribs. In order that these spaces when filled in should be as rigid as the rest of the rib they were made as small as possible, and the ends of the sections were made uneven.

The roadway is 42 ft. wide between curbs, and accommodates four lanes of traffic.

We are indebted to the courtesy of the Westinghouse Electric and Manufacturing Company for our information regarding this structure, which is known as the Westinghouse Memorial Bridge.

The World's Tallest Tower

Budapest Wireless Aerial 1,030 ft. in Height

By F. E. Sharp

IN November, 1933, the construction of the highest tower in the world was completed at Budapest, Hungary. This tower is built of steel, and the tip of the steel flag pole that completes the structure, and forms an essential part of it, is 1,030 ft. above the ground. Its extreme point, therefore, is nearly 50 ft. higher than the top of the Eiffel Tower, and more than twice as high as Blackpool Tower, the tallest structure in Great Britain. The only structure in the world that reaches a greater height is the Empire State Building, New York, which rises to 1,248 ft.

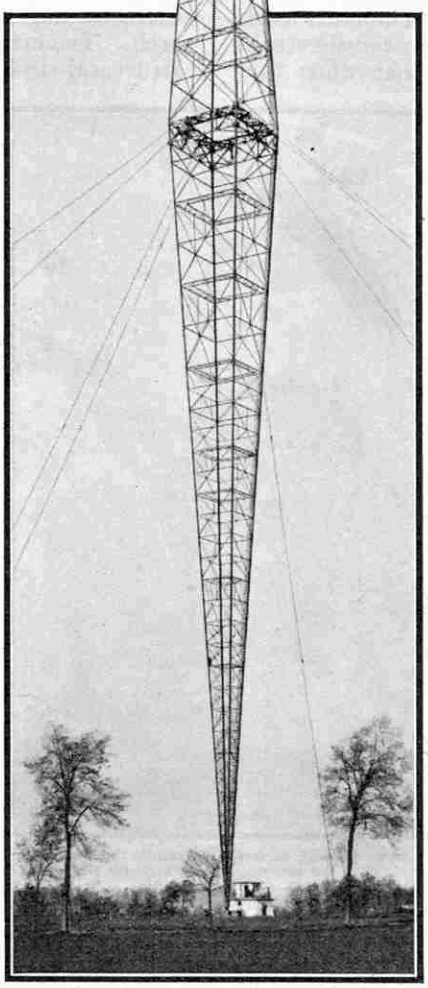
This remarkable tower forms the aerial of the new broadcasting station at Budapest. With a vertical radiator of this kind more powerful signals are obtained in receivers tuned to its wavelength than with an aerial of the usual type suspended between two towers, and the distance at which signal strength is affected by fading is increased.

The total weight of steel in the tower is 230 tons. Each of the eight guy ropes that hold it in position imposes a load of 32 tons, and therefore the insulating base on which the tower is built has to withstand a total crushing load of nearly 500 tons. The tower is climbed by means of a ladder erected inside it, and the time required for the ascent is about 50 minutes.

The foundations of the tower are of reinforced concrete. There are nine of them in all, one being the centre pier on which the tower stands, and the other eight the anchor blocks to which are attached the guy ropes that support the structure. The anchor blocks are placed at points equidistant from each other on the circumference of a circle having a radius of 585 ft. from the centre point of the tower foundations. Work on the blocks was started towards the end of April, 1932, and the construction of the centre pier was begun a little later, the pouring of the necessary concrete being completed by the end of May.

A steel base plate 2 in. thick was then placed in position on four holding-down bolts on the centre pier, and carefully levelled; and on it was placed the base insulator that supports the whole of the structure. The construction of this important member is shown in one of the accompanying photographs. It is made in two parts. The lower portion consists of a steel base on which is a hollow porcelain cone surmounted by a steel cap shaped like an inverted saucer, and on the top of the cap is a spigot 3 in. in diameter. The upper half of the insulator is exactly the same as the lower, except that it is inverted, and its steel cap has in its centre a hole into which fits the spigot of the bottom cap. This forms a rocker joint designed to take up any movement in the completed structure. The total height of the insulator is 5 ft., and its largest diameter is 42 in.

The erection of the tower itself was commenced at the beginning of July. The lower portion of the structure, 36 ft. in length, was riveted together in the workshops, and on arrival at the site was lifted in one piece and lowered gently on to the base insulator, to which it was joined by means of four connecting bolts. Eight temporary guy ropes were then attached and carried out to "dead men" about 175 ft. from the centre foundation. Two points were fixed about 450 ft. from the centre of the tower foundation, and there instruments were fixed for use in checking the alignment of the steelwork during erection. This was necessary, for the porcelain of the base insulator would not withstand the loads that would have been imposed upon it by excessive movements of the tower, which could not be allowed to deviate more than 20 min. from the vertical at any time during erection.



The vertical radiator or aerial of the new broadcasting station at Budapest, Hungary. This is 1,030 ft. in height and is the highest tower in the world.

Further constructional work was then carried out in position. A pole was suspended inside the structure and the steelwork to be erected was lifted by means of ropes attached to a winch on the ground and passed over a pulley block at the top of the pole. The corner leg sections were placed in position first and the joints made, after which the necessary horizontal and diagonal members were lifted. Each of the four faces of the tower was completed in turn. All members were bolted in position and the bolts were riveted over after tightening. As much riveting as possible was done in the shops, but the necessity for transporting and lifting the parts into position limited the extent to which this plan could be followed. The stiffening angles for use at the corners and certain other parts were riveted together in the shops.

An electric crane to fit inside the tower had been designed for use during its construction, and when a height of 165 ft. had been reached there was sufficient width to allow this crane to be put into position. It weighed 5 tons, and had to be taken up in pieces and assembled inside the tower, where it was suspended by means of four blocks attached to the corner legs of the structure itself. The end ropes of these blocks were attached to ratchet winches on the crane platform so that when necessary the crane could be wound up to a new position; and a telephone was provided to enable the crane man to keep in constant touch with those on the ground level while lifting operations were in progress.

The electric crane was used during the construction of the rest of the tower, except the top section, where there was insufficient width to accommodate it. There the plan followed in erecting the lower portion of the tower was again adopted, but the winch of the crane was used as a means of lifting instead of the winch on the ground.

The tower was stayed by means of 16 temporary guys during the erection of the lower half. These guys were in two sets of eight, each set in turn being moved up above the other as the height of the structure was increased. The half-way mark was reached before the end of August, and then came the work of attaching the eight permanent guys. The middle part of the tower has a width of 49 ft. and is built up as a strong girder in order to withstand the pull of the guys, which are connected to it and to the ring of guy anchor foundations already referred to. It had been calculated that in the most unfavourable conditions the tension on each guy could amount to 70 tons. This tension would not be distributed evenly along the guy rope, the stresses at the point where it is attached to the tower being greater than those at the union with the anchor foundations.

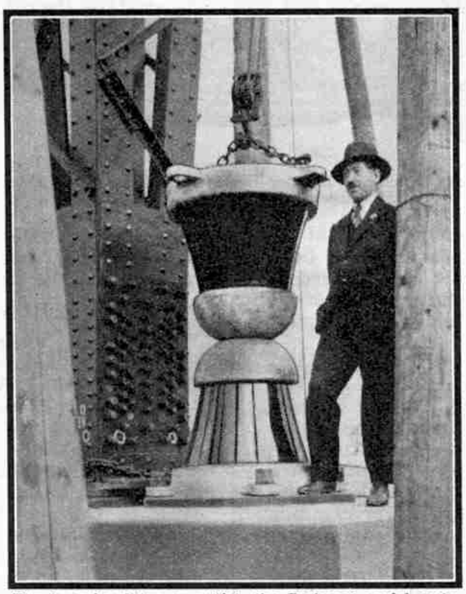
The guys have a diameter of $2\frac{1}{4}$ in. and are made of galvanised wire. Each guy consists of three lengths of 200 ft. and one of 105 ft., making a total length of 705 ft. This division is necessary to allow for the attachment of the five insulators employed to prevent electrical leakage from the tower to earth, for three of these are placed at intervals along the guy itself, the other two being at the point where the guy is connected to the tower. The guys actually were manufactured in lengths of about 1,410 ft. Thus two complete guy ropes were produced in one operation, and the single length produced was then cut into six sections 200 ft. long and two 105 ft. long.

It was necessary to make each complete guy 4 in. longer than the direct distance between the points that it connected, in order to allow for permanent lengthening owing to the stretching necessary before placing in position, the length of the insulators and possible slight draw at their connection points, and the sag due to the weight of the guy rope itself and of the insulators. The guys were stretched before being placed in position in order to eliminate all irregularities due to manufacture, a special machine built for this purpose subjecting them to a load of 150 tons. This load was produced by means of a hydraulic cylinder fed by an electrically driven pump, the ram of the pump being provided with a head designed to take a cone fitted to the end of the guy. This machinery was installed on one of two concrete foundations laid down about 212 ft. apart and designed to withstand a pull of 170 tons without showing any signs of movement. On the second of these concrete foundations was fitted a threaded spindle that would allow for an adjustment in length of 3 ft., and a head was fitted at the end of this spindle to take the opposite end of the guy undergoing stretching.

Fitting together the parts of one of the giant insulators in the steel guy ropes that hold the tower in position.

After being submitted to the stretching load of 150 tons, each length of guy was retained in the machine and a load of exactly 32 tons was applied to it, representing the initial tension required for each guy when in its permanent position. While it remained under this load, two soft metal pieces were cast on the rope about 15 ft. apart, and a measuring rod exactly 15 ft. long, and made of the same material as the guy itself, was laid on the metal pieces while lines were marked on them to coincide with its ends. When the guys later were being placed in position, they were tensioned until the marks on the pieces cast on them again coincided with those on the measuring rod. By this method it was possible to ensure that the required initial tension of 32 tons was given to each guy.

The guy insulators are designed so that the porcelain sections are in compression, although the ropes themselves are in tension. The main bodies of the insulators are of chrome-nickel steel having an ultimate strength of 90,000 lb. per sq. in., and the socket bolts are of chrome-nickel-molybdenum steel with an ultimate strength of 120,000 lb. per sq. in. The insulating porcelains were cemented to the metal bodies by means of high grade Portland cement, and after assembly each insulator was tested to a load of 170 tons. A spare insulator was subjected to a load of 250 tons without showing any signs of breaking or of disturbance of the cement. These tests were carried out on the stretching machine already described and with the use of a rope specially constructed for the purpose.



The base insulator on which the Budapest aerial rests. On the left is the lowest section of the tower itself, ready for lifting into position on the insulator.

The guys were too heavy to be lifted when being installed, and therefore were built up in sections. In assembling one of them, two insulators were attached to the appropriate point at the middle of the tower, and the first length of guy was lifted and connected to them. This section already had an insulator at its lower end, and the next portion was then lifted up and attached to it, the process being repeated until the guy was complete. The guys were then tightened by means of bolts attached to the pins of the connection points. These bolts passed through slots in the castings attached to the lowest sections of the guy ropes, which were gradually pulled down to their final positions, and given their correct tension by means of ratchet spanners. Four of the guys were first dealt with, care being taken to keep the tower vertical during the operation; and the remaining guys were tensioned in a similar manner when the first set had been brought practically to their permanent positions. This difficult operation was safely carried out and completed by the end of August.

The erection of the upper part of the tower was then undertaken. This was carried out in exactly the same manner as that of the lower part of the structure, but proceeded more quickly because it was not now necessary to make use of temporary guys. The upper part of the tower tapers to a width of 5 ft. at the top, the height of which is 932 ft., and the last piece of steel in the tower was placed in position at this height on 28th October. All that then remained to be done was to put into position the flag pole that completes the structure. This pole, which has a length of 118 ft. and weighs nearly 2 tons, was manufactured in two pieces, for it was impossible to pass such a long piece of metal through the members of the framework into the interior of the tower. The two parts were lifted to the top and the necessary joint actually was made at a height of 900 ft. No difficulty was encountered in completing this operation, and the upper end of the pole was then pushed out at the top of the tower until it projected vertically to a distance of 98 ft., making a total height of 1,030 ft.

This giant flag pole is not a mere ornament, for it forms part of the radiator and can be moved up and down in order to adjust the height of the tower to suit the wavelength in use.

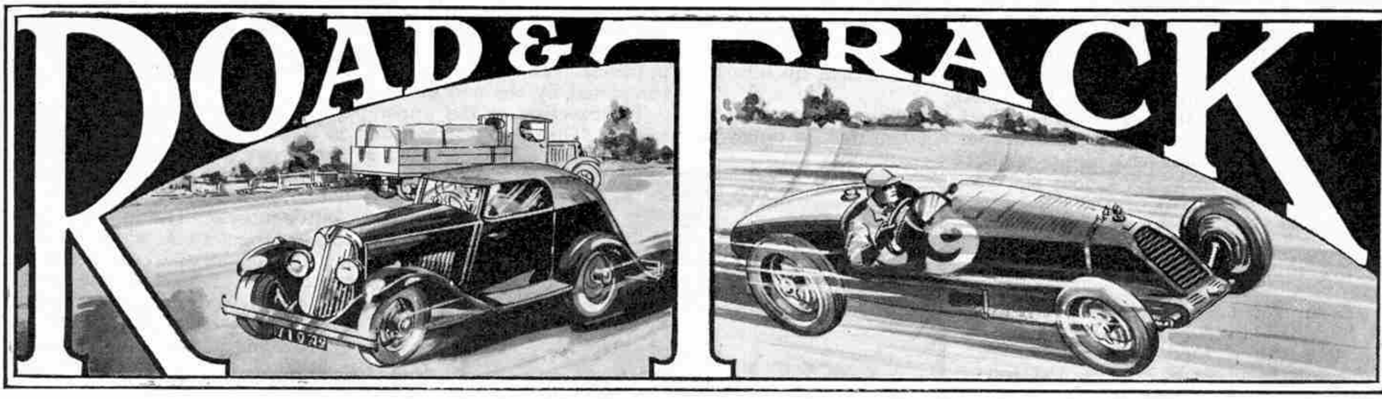
The entire tower is electrically energised when in action as an aerial. The radio feed comes from a coupling house built near the tower, and is connected to a copper band about 3 ft. above the base insulator. This band in turn is connected to four threaded copper cables clipped to the corner legs of the tower, and at the top of the structure the ends of the four cables are connected to the flag pole by means of an aluminium clamp. Thus the mast is electrically continuous throughout.

The manner in which the flag pole is fitted so that it can readily be raised or lowered is interesting. A square structure built up of angle pieces is fitted to the base of the pole, and there is a similar structure 15 ft. higher. Four guide angle posts have been erected inside the top of the tower itself, and the two square structures can slide up and down between them, thus allowing the pole to be raised or lowered by means of chain blocks when necessary. Holes have been punched in various positions on the guide angles in order that the pole can be fixed at any required height between its limits of movement. Normally the lower 20 ft. of the pole are inside the steelwork of the tower.

Naturally the existence of a tall steel structure of the magnitude of the novel radiator of the Budapest Station involves the giving of special warnings to pilots of aircraft, who in the absence of any indications of this kind might easily come into disastrous collision with it when flying at night. For this reason a special lighting system was installed. This takes the form of three pairs of red lights that have been placed on the upper part of the tower in suitable positions to enable their warning signals to be seen by the occupants of aircraft approaching from any direction.

A giant tower reaching so far into the sky of course is liable to be struck by lightning. In order to avoid damage from this cause conducting tubes are fixed to the steel base on which the porcelain insulator rests and to the steel top of the upper insulator. These tubes end in balls that are brought near each other by bending the lower one upward, and thus a safety spark gap is provided.

The erection of the tower was completed on 4th November, 1933, and the electrical engineers then commenced their first test transmission.

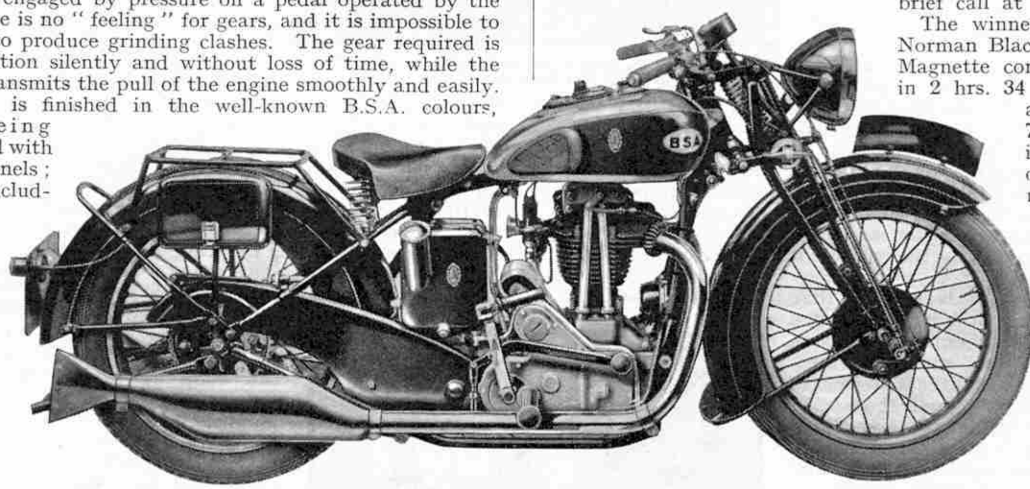


The B.S.A. Fluid Flywheel Motor Cycle

Further details are now available of the B.S.A. motor cycle fitted with the fluid flywheel and pre-selector gear-box mentioned in "*Our Busy Inventors*" of the "*M.M.*" for January last. The model that has been selected for the provision of these wonderful mechanisms is the 5 h.p., 499 c.c. overhead valve model, and as the illustration on this page shows, the new machine has a handsome and well-balanced appearance. Special attention has been given to mechanical details in order to ensure easy running, an example of this being the provision of a spring tensioner for the primary chain, which runs in an oil bath case. Lubrication is on the dry sump system with a separate oil tank mounted under the saddle.

The pre-selector lever is mounted on the left handlebar, and the gear selected is engaged by pressure on a pedal operated by the right toe. There is no "feeling" for gears, and it is impossible to miss a gear or to produce grinding clashes. The gear required is brought into action silently and without loss of time, while the fluid flywheel transmits the pull of the engine smoothly and easily.

The machine is finished in the well-known B.S.A. colours, the tank being chromium plated with green side panels; and its price, including full electrical equipment, is £79. This is very moderate in view of its revolutionary character and the ease and simplicity of control.



The B.S.A. 4.99 h.p. o.h.v. motor cycle fitted with Daimler fluid flywheel transmission and a pre-selector gear-box. Photograph by courtesy of the B.S.A. Co. Ltd.

I mentioned recently that dirt track race meetings for motor cars were to be held in this country as the result of the lifting of the ban on such meetings by the Royal Automobile Club. A body known as the Autodrome Racing Club has now been formed to govern and generally to regulate the sport, and several meetings have already been held in the South of England under the auspices of the new club.

It is interesting to recall that a motor car dirt track race meeting was organised as long ago as 1928 by the Junior Car Club. This was held on the old Trotting Track at Greenford, Middlesex, which also was the scene of the first meeting held by the Autodrome Racing Club. It was obvious at the more recent meeting that great strides have been made in the sport in the intervening six years. In 1928 the record speed for the lap was 44.12 m.p.h., while this year it was 59.28 m.p.h.; and average speeds of well over 50 m.p.h. were attained even when there were as many as six competitors taking part in an event.

The cars used at the recent Greenford meeting included a huge supercharged Mercedes, a Singer Nine, an M.G. Midget, a 3-litre Bugatti, a Lea-Francis and several Ulster-type Austin Sevens. The event was very popular, and the interest shown in it and in other meetings of this kind promises well for the future of the new sport which may well become a serious rival to motor cycle racing.

"Round the Houses" in the Isle of Man

As usual, intense interest was taken in the Mannin Beg and Mannin Moar run on 30th May and 1st June respectively in the Isle of Man, and the popularity of these events shows that there is an excellent field for motor car racing in Great Britain. The Isle of Man course runs through the streets of Douglas, to which sandbags and stout barriers give an unfamiliar appearance as the time for the race approaches, while the roar of exhausts during early morning practices leaves the visitor in no doubt as to the nature of the events themselves.

The Mannin Beg, for cars with engine capacity up to 1,500 c.c., at one time seemed to be at the mercy of F. W. Dixon, whose spectacular achievements in the T.T. Motor Cycle Races have made him a great favourite in the island. When only two miles remained to be covered he had a lead of nearly three minutes, but to the general concern it was then announced that he was proceeding slowly, and finally he stopped for lack of petrol. He would almost certainly have been first past the winning post if he had paid a brief call at the pits.

The winner of the race was Norman Black, who in an M.G. Magnette completed the course in 2 hrs. 34 min. 37 sec. His average speed was 70.99 m.p.h., which is a great advance on last year's winning speed of 54.41 m.p.h., set up by F. W. Dixon. The race was a great triumph for the M.G. Magnettes, which occupied the first five places, and also the seventh. C. J. P. Dodson, who, like Dixon, is a famous racing motor cyclist, was second with a speed of 70.2 m.p.h., and G. E. T. Eyston, the holder of many motoring records, was third, his average speed round the course being 69.3 m.p.h.

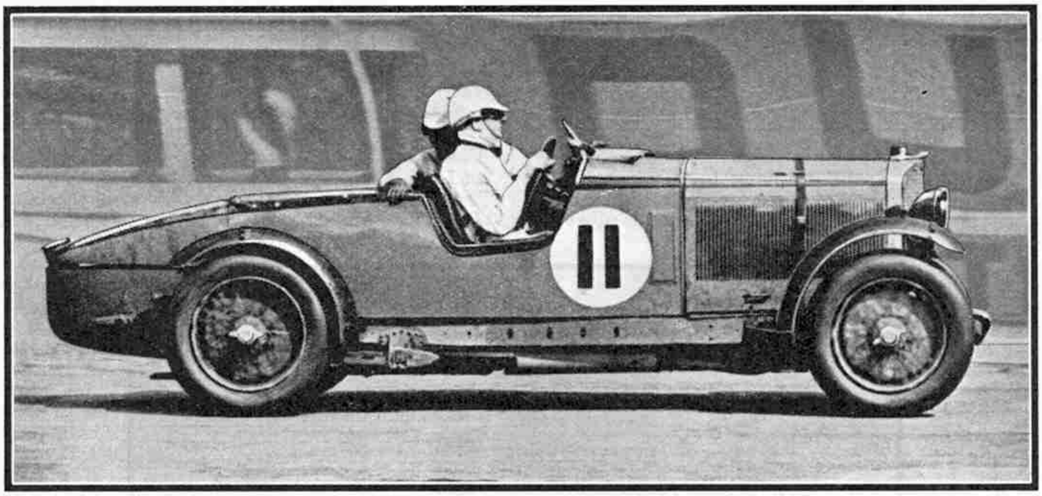
Thrills of a Big Car Race

The Mannin Moar, the race for big cars, was a very thrilling spectacle, the sensational cornering and the high speeds fascinating the spectators. F. W. Dixon in a Riley again attracted attention. At the start he found himself shut in behind a group of other cars, and for several laps was unable to pass them. He ran out of the course at a sharp corner after one desperate effort to do so, but returning quickly, he soon made up lost time, and eventually found a way through the cars in front of him. He drove furiously in an effort to overtake the leader, the Hon. Brian Lewis, in an Alfa-Romeo, but after a great struggle to get on even terms his engine failed, and he could not get it going again, although he sent to the pits for tools and worked desperately on it for half-an-hour.

In the meantime Lewis went on to win the race, covering the course in 2 hrs. 25 min. 41 sec., his average speed being 75.34 m.p.h. The pace was so terrific that only three competitors finished out of 12 starters. The second was C. J. P. Dodson, who in an Alfa-Romeo maintained an average speed of 71 m.p.h. and thus repeated his success in the Mannin Beg. The only other car to survive the exacting contest was a Riley, driven into third place by C. Paul, whose average speed was 69.83 m.p.h.

Dixon and Lewis were the outstanding personalities of the week's racing in the Island, the latter because of his clear-cut victory in the Mannin Moar, in which he completed the course without a stop, and the former because of his gallant efforts in both races. Dixon is not merely a racing driver, but also is a skilled mechanic with a deep interest in motor cars. He is familiar with every nut and bolt on the cars he drives, and was hard at work tuning up his entry in the Mannin Moar only a short time before the race itself.

The car driven by Lewis in the Mannin Moar was the Alfa-Romeo Monoposto. This is a mystery racing car that originally was intended for the use of selected Italian drivers, and only three of the type actually were constructed. Lewis secured one as a special favour, and mechanics travelled from Italy to the Isle of Man with the car and carefully guarded its secrets.



T. Rose Richards, the well-known British racing motorist, driving a Talbot past the stands at Brooklands. Our photograph is published by courtesy of Clement Talbot Ltd.

New Driver's Brilliant Victories

It was no surprise when Lewis's Alfa-Romeo took the lead from the mass start of the Mannin Moar and retained it to the end of the race. Gruelling contests do not always end in this way, however, as was shown in the Monaco Grand Prix, which resembles the Mannin Beg and the Mannin Moar in being run over a course of the "round the houses" type. Readers will remember that this event is known as "the race of a thousand corners," and this year it was won by Guy Moll, a comparatively unknown driver. It is a tribute to the winner's skill that in spite of his lack of experience he should be the victor in one of the most difficult tests imaginable, and with the world's most famous racing motorists as his competitors. Moll drove an Alfa-Romeo, and completed the tortuous course at an average speed of 56.04 m.p.h. He has since shown himself to be the equal of the greatest of contemporary racing motorists by a spectacular triumph in a race on the Avus Track, Berlin, again driving an Alfa-Romeo. His average speed over the 15 laps of the race, a distance of 183 miles, was 127.5 m.p.h.

Starting a competitor in the Shelsley Walsh hill climbs organised by the Midland Automobile Club. The contact wire of the timing apparatus is in front of the off-side front wheel of the car. Another electrical contact is situated on the finishing line. Photograph by courtesy of the M.G. Car Co. Ltd.

Motoring Across the Sahara Desert

Many stirring stories have been told of adventurous journeys by motor car in wild and desolate places, and in spite of the great triumphs already achieved wonderful opportunities yet remain for those who enjoy the sensation of pioneer work of this kind. Proof of this is supplied by the feat of Miss E. F. Smith and Mrs. Dabell, who recently completed a 6,000-mile tour in North Africa, and afterwards set out to complete a circuit of the Mediterranean Sea.

The starting point of this remarkable journey was Tangiers, and Morocco and Algeria were explored in its early stages. Then followed a plunge southward across the Sahara Desert, and before the motorists reached Tunis after turning northward they had covered 1,000 miles of difficult country in parts of which motor cars are unknown or very rarely seen. Still keen for adventure, and making light of all difficulties, the travellers then set out across Tripoli for Egypt. This was an exceptionally arduous undertaking, for heavy rains often turned the track into a morass, and on many occasions it was necessary to remain all night in the car out in the desert. Even these experiences failed to quench their enthusiasm, however, and after a short stay in Egypt they proceeded to Syria with the intention of returning home through Asia Minor, Greece and Central Europe.

Descending Mountain Passes with Sealed Brakes

The scene of an equally adventurous motor car journey of a different type was the Lake District, where Miss Marjorie Cottle, the well-known competition motor cyclist, recently crossed five of the most difficult mountain passes in a 10 h.p. B.S.A. saloon with the brakes sealed in order to prevent her from making use of them. The test was made under the observation of an official representative of the Royal Automobile Club, and the climbs included the Kirkstone, Wrynose and Hardknott Passes, Newlands Hause and Honister Pass, which in parts has a gradient of 1 in 3½.

The chief purpose of the journey was to demonstrate the capabilities of the fluid flywheel and pre-selector gear-box with which the 10 h.p. B.S.A. car is fitted. Passes were descended in first gear with the pre-selector lever in the reverse position in order to enable reverse gear to be engaged without delay. When it was necessary to reduce speed in order to take difficult hairpin bends, or to enable gates to be opened, a touch on the gear-changing pedal brought the reverse into action, and the car then remained under perfect control with the accelerator slightly open. No difficulty was experienced throughout the journey, in spite of the heavy gradients encountered. The car was actually held on one steep incline while the passenger opened a gate.

The Highest Road in Europe

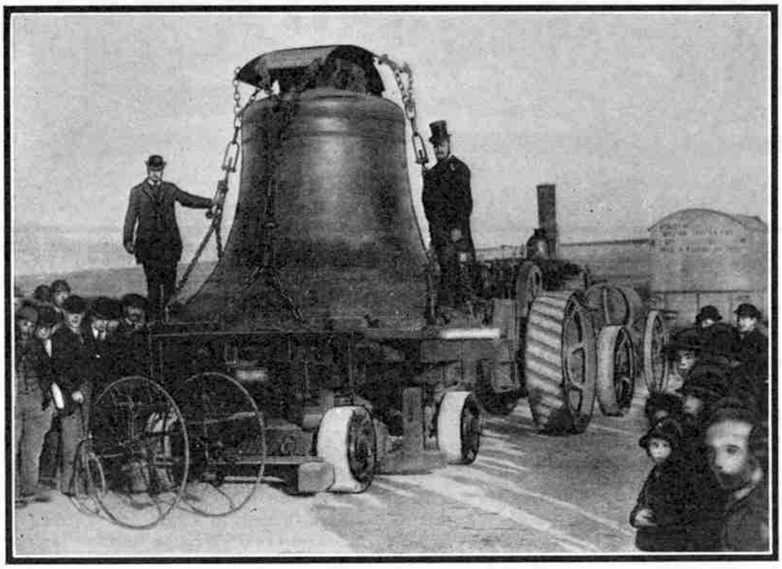
While adventure awaits the motorist in many remote quarters of the world, the engineer is striving to give him opportunities for remarkable climbing feats in mountainous districts within easy reach of populous centres. The most remarkable effort of this kind now in progress is the construction of a road over the Col de l'Iseran in the Savoy Alps, France. This road will be the highest in Europe, for it is to reach an altitude of 9,085 ft.

England's Great Bells

How the Bronze Monsters are Cast and Tuned

By Ernest Morris, F.R.H.S.

GREAT bells probably were first cast in England about 940, and the earliest bell founders seem to have been monks and priests. Later the numbers of bells required increased rapidly, and great bells appear to have been common from mediæval times, though perhaps not to the same extent as in many other countries. In Norman times we hear of Prior Wybert adding a tenor bell to the great ring of five bells already at Canterbury. This bell required 32 men to ring it, and the ringing was not done by pulling ropes, which is the usual practice in this country, but by pressing with the feet alternately on the opposite ends of planks fastened to the headstock of the bell, and projecting on both sides of it. Large bells on the Continent are still rung in this manner.



"Great Paul," the largest bell in England, on its way to St. Paul's, London, from the foundry at Loughborough in which it was cast in 1881. This photograph and the lower one on the opposite page are reproduced by courtesy of Messrs. J. Taylor and Co., Loughborough.

Many English abbeys and cathedrals have had and still have bells weighing a ton or more. A great bell cast in 1316 for installation in Canterbury Cathedral in memory of St. Thomas, better known as Thomas a'Becket, weighed over 3½ tons. It was broken by a fall of the campanile, or bell tower, and was replaced in 1459 by a slightly heavier bell dedicated to the memory of St. Dunstan. This bell was recast in 1762 by Lester and Pack of London, and still hangs in the South-West Tower of the Cathedral. Bury St. Edmunds had four great bells weighing 23 cwt., 50 cwt., 140 cwt. and 180 cwt. respectively in 1538, and there were also four at Ely Cathedral that weighed 18 cwt., 21 cwt., 27 cwt. and 37 cwt., and were cast in 1346. Shrewsbury Abbey had two rings of five bells, and a similar peal existed at King's College, Cambridge.

All these old bells had names, which in some cases were those of their donors. The two great bells of Exeter Cathedral furnish excellent instances of this. The tenor bell was called "*Grandison*" after the Bishop by whom it was given in 1360. Its successor, cast in 1902 by Messrs. John Taylor and Co., of Loughborough, weighs 72½ cwt. The second bell, known as "*Great Peter*" of Exeter, hangs in the North Tower, and was the gift of Bishop Peter Courtenay in 1484. This bell has twice been recast, and in its present form, dating from 1676, is the work of Thomas Purdue. It now weighs about four tons.

"*Great Peter*" of Exeter has two namesakes. One of these is "*Great Peter*" of Gloucester, which weighs 2 tons 18 cwt. This is actually the original bell, no re-casting having been necessary, and is the only mediæval great bell we now possess. The third "*Great Peter*" is that of York Minster, which is a modern bell weighing 10¾ tons.

From "*Great Peters*" we pass to "*Great Toms*." Of these there are two famous examples, one at Lincoln and the other at Oxford. The Lincoln "*Great Tom*" hangs in the central tower of the Cathedral. It was cast by Oldfield of Nottingham and Newcombe of Leicester, and weighed four tons eight cwt. After a time it was "clocked" instead of "rung," that is the bell was fixed and the clapper swung against it by means of a rope; and a contemporary writer then complained that "he has been chained down, so that instead of the full mouthful he hath been used to send forth, he is enjoined in future merely to wag his tongue." "Clocking" is a dangerous practice, except with bells equipped with chiming hammers designed for the purpose, for the clapper is sometimes kept on the bell after striking, and the stoppage of its vibrations that follows will in time ruin the strongest bell. This happened in the case of the Lincoln "*Great Tom*," which cracked in 1827 and had to be recast. The work was carried out by Messrs. Mears of Whitechapel, London, and the bell now weighs five tons eight cwt.

"*Great Tom*" of Oxford came from the Abbey of Oseney, in Oxfordshire, when the monasteries of England were despoiled by Henry VIII, and hangs in the gateway tower of Christchurch, which is therefore known as Tom Tower. It was unsuccessfully recast three times between 1612 and 1680, and in its present form is the work of Christopher Hodson of London. It is still rung nightly at nine o'clock.

Another historic bell is "*Great John*" of Beverley Minster, which weighs 7 tons. This survived mediæval times, but was recast in 1902. The great bell of Tong in Shropshire, originally given by Sir Harry Vernon in 1518 to be tolled when a Vernon came to Tong, was recast in 1729 and again in 1892. It now weighs 2¾ tons.

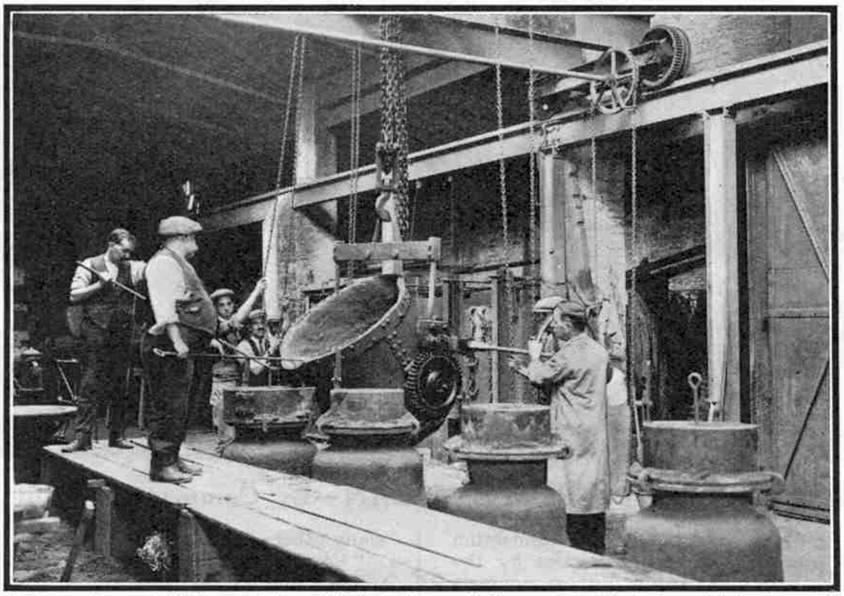
	Date	tons	cwts.	qrs.	lbs.
London, St. Paul's (Great Paul) ...	1881	16	14	2	19
Westminster (Big Ben)	1858	13	10	3	15
York (Great Peter)	1927	10	16	2	22
Nottingham (Little John)	1928	10	7	0	0
Bristol (Great George)	1925	9	11	2	0
Manchester Town Hall (Hour bell)	1882	8	2	3	3
Beverley (Great John)	1901	7	0	3	1
Birmingham University	1908	6	1	0	0
Oxford (Mighty Tom)	1680	6	0	0	0
Newcastle (Major)	1891	5	18	0	0
Lincoln (Great Tom)	1834	5	8	0	0
Downside Abbey	1900	5	6	3	0
London, St. Paul's (Big Tom) ...	1716	5	4	0	0
Manchester Town Hall (2nd bell) ...	1882	5	0	2	0
Preston Town Hall	1878	4	16	0	0
Bradford Town Hall	1873	4	7	0	0
Worcester Cathedral	1868	4	2	3	24
Bolton Town Hall	1872	4	2	0	0
Leeds Town Hall	1859	4	1	0	0
Exeter (Great Peter)	1676	4	0	0	0
Portsmouth Town Hall	1889	4	0	0	0

There are several remarkable great bells in London, prominent among them being "*Great Paul*," of St. Paul's Cathedral, the largest bell in England, weighing nearly 16¾ tons. This bell was cast in 1881 by Messrs. John Taylor and Co., Loughborough, and is a masterpiece of founding. It hangs in the South-West Tower of the Cathedral and is rung for a few minutes before Sunday services and at certain other times.

"*Big Tom*," the hour bell of St. Paul's, which also hangs in the South-West Tower, has had a long history. It began its career in Westminster Hall and was the gift of Edward I. It was removed to St. Paul's in 1708, but on its way it fell from the trolley while passing Temple Bar and was cracked. Recasting was carried out by Philip Wightman, but this was not successful; and Richard Phelps, of Whitechapel Foundry, again recast it in 1716. The bell bears the inscription "*Richard Phelps made me 1716*." It weighs five tons four cwt., and its note is now broadcast daily as a substitute for that of "*Big Ben*" during the overhaul of the clock at Westminster for which this world-famous bell strikes the hours.

In the other tower of St. Paul's hangs the heavy ring of 12 bells, the largest of which weighs 62 cwt. These bells are rung regularly every week by the Ancient Society of College Youths.

"*Big Ben*" of the Westminster Clock Tower in the Houses of Parliament was designed by the late Lord Grimthorpe, then Mr. Denison, and was originally cast by Messrs. Warner, but cracked when sounded for public amusement, by means of a hammer, while in the Palace Yard, before being hung. In 1858 a new and slightly smaller bell was cast by Messrs. Mears, of Whitechapel. Shortly after casting this gave way, but after special treatment could still be used for striking the hours, which it does to this day. Since the introduction of wireless the sound of "*Big Ben*" has become familiar to listeners in all parts of the world, but its tone is anything but satisfactory.



Pouring molten metal into one of the moulds in which great bells are cast. The ladle containing the metal is tilted by means of a hand wheel. Photograph by courtesy of Gillet and Johnston Ltd., Croydon.

More modern productions from the Taylor foundry at Loughborough include the now famous "*Little John*" of Nottingham City Exchange, weighing 10 tons 7 cwt.; "*Great George*" of Bristol University, weighing 9½ tons; and the Birmingham University bell, weighing over 6 tons.

The making of bells has occupied the close attention of engineers, scientists and musicians of many nations for centuries. It is only comparatively recently, however, that bell founding reached a satisfactory standard, although huge bells weighing many tons were cast in China thousands of years before the Christian era, and some of them exist to this day.

In order to avoid breakage from friction by the clapper, and also to ensure musical tone, a special alloy of tin and copper is used for bell casting. The proportions of these metals are varied according to the size and tone required, the alloy usually employed consisting of 13 parts of copper to four parts of tin. The shape of the bell also is of the greatest importance, for this largely determines whether the bell has harmonic tones in accord, or in other words is in tune with itself. A good bell when sounding the strike note on the sound-bow, or part near the lip where the clapper strikes it, will give out correctly a minor third, a perfect fifth, and an octave above when struck higher up, while the "hum" note is an octave below the strike note.

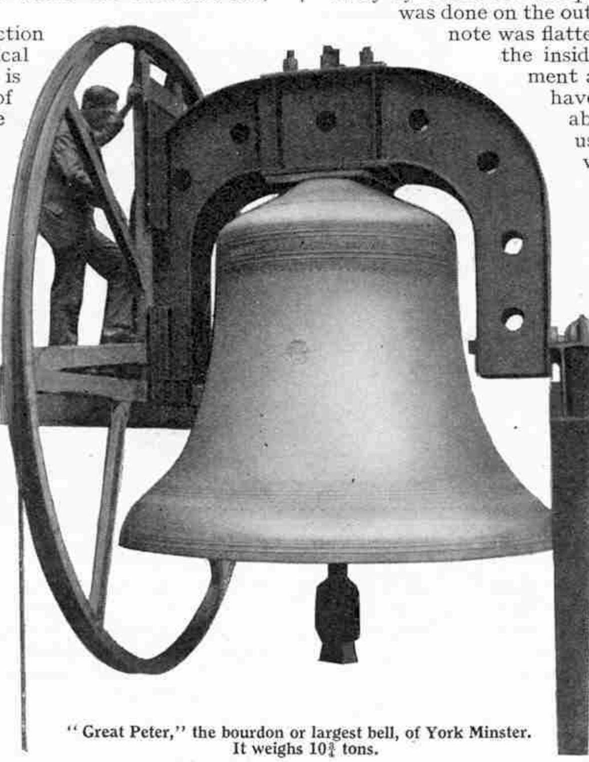
When a bell is to be cast, the necessary mould is made in two parts, the outer and the inner moulds. The outer mould, known as the "cope," is built up of cast iron sections and has the shape of the bell, but is slightly larger than the actual casting. Its inner surface is coated with soft loam, an adhesive mixture of sand and other ingredients, which is plastered on by means of a metal template, the edge of which has the exact form of the bell. The template revolves on a vertical pivot in the centre of the mould and smooths out the soft loam to the outward shape the bell is to take.

The inner mould is called the "core" and shapes out the interior of the bell. It consists of a central base of brickwork, built up on a cast iron plate, and coated with loam shaped to the inner surface of the bell by means of a template similar to that employed in forming the cope, or outer mould.

The moulds are thoroughly dried by heating them in large ovens, a process that may take several days in the case of large bells, and a second coating of a finer mixture of loam is then given, after which the moulds are again thoroughly dried. Finally the surfaces that will be in contact with the molten metal are sleeked in order that the casting may come out clear and smooth. At this stage the inscription and any decoration included in the design are impressed on the lining of the outer mould. The core is then placed in a convenient position for casting operations, the cope or outer mould is fitted over it, and the two are securely clamped together. When very large bells are being cast, the moulds are assembled in earthen pits.

In the meantime the metal for the bell has been prepared. The copper is melted first and the tin is then added to it, and the molten metal is conveyed to the mould in a huge ladle suspended from a travelling overhead crane. There the ladle is slowly tipped over so that the glowing liquid flows downward through an aperture in the top of the mould. The casting is left to cool off for a time varying from one to four or five days, according to the size of the bell. The outer case is then taken off and the inner core broken away to reveal the bell itself.

The bell is sandblasted in order to clean it of all rough sand and loam clinging to it. Then it is "tuned." Formerly this was done in a very crude manner, certain portions of the casting being chipped away by means of a sharp-pointed hammer or chisel. The chipping was done on the outside of the rim to sharpen the bell, and its note was flattened by a similar operation carried out on the inside of the sound-bow. This crude treatment accounts for the fact that many old bells have the appearance of having been knocked about. To-day, more scientific methods are used. The bell is bolted to the table of a vertical lathe with its mouth upward, and metal is skimmed off the inside of the lip to flatten the tone, or off the inside waist if sharpening is necessary. When the bell is safely cast and tuned, it is ready to receive the necessary fittings by which it is to be swung in its tower.



"Great Peter," the bourdon or largest bell, of York Minster. It weighs 10¾ tons.

In the old days a great bell was hung in a wooden frame or cage on plain bearings and with crude fittings. To-day it is fixed in an iron or steel frame and swung on ball bearings, so that the task of the ringers is greatly lightened and the strain on the towers caused by vibration is much less than was formerly the case. The headstock, which carries the bell, is usually made of cast iron and bolted on, and the clapper is fixed on a pivot bolted through the bell and headstock. On one side of the bell is a grooved wheel over which passes the rope by which it is moved, and on the other side is a stay to prevent it from turning completely over when it is in full swing. Bearings running in ball-races are attached on each side of the headstock, and these in turn are bolted to the frame, which is specially designed to fit the bell-tower. Careful design is particularly important when a complete ring of bells is installed, for the frame must be so made that the weight is equally distributed when all the bells are in full swing. England is often referred to as "the Ringing Isle" from the manner in which its bells are rung.

A THRILLING TRIP FROM DURBAN—By Commander Attilio Gatti

IT seems quite strange to think of whale-hunting in connection with South Africa, but not only are there whales by the hundreds in the Indian Ocean, but the capture of these monsters is the daily, prosperous work of a little colony of very blonde Norwegians.

One of the oldest and most experienced of the hunters is Captain Karpisson, commander of the "*Whytok*." Aboard his little 60-ft. whaling ship, with its small bridge not more than 3 ft. above the water, he stood smiling at us more with his blue eyes than with his cool, taciturn mouth. He was smiling and nodding his head, evidently much amused at my request. The Captain had spent 18 years commanding whale ships and in his life had captured more than 1,000 whales. He was a man accustomed to long cruises on frozen seas, and he never spoke except when it was really necessary, then saying only the indispensable words in a syncopated, very Scandinavian English with his mouth nearly closed, firing out the words like a small machine gun.

"You really want that? All right, you can come," he said, all his animation concentrated in his sparkling little eyes. "But you will be sick, very sick. Everybody is sick when they come on the whale ship."

"But you know, Captain, we are quite good sailors, all of us."

"I know, and I hope so, but the ship is small and very fast, and the sea is very big and very fast too. This year two ships have sunk. The last one only two days ago."

"But we are all full of good luck," I insisted, absolutely determined to be accepted on board.

"All right," he smiled again quite sarcastically: "but I am sorry to tell you that there are no cabins on board, and if you are ill you won't have any shelter at all."

"What about food? Must we bring some?" I asked him, just to try to end that business of the sea sickness.

"Oh no, on board there is plenty of food, and very good food, because we must eat a great deal;" and his blue glance probed my eyes ironically. Certainly he was seeing us already begging for mercy and imploring him to bring us back to shore, as so many others had done before us.

"Captain Karpisson," I concluded, with much dignity, "you will see that we will give you no trouble."

His eyes twinkled, not believing a word I said; but they were such nice eyes that it was impossible to be cross with them.

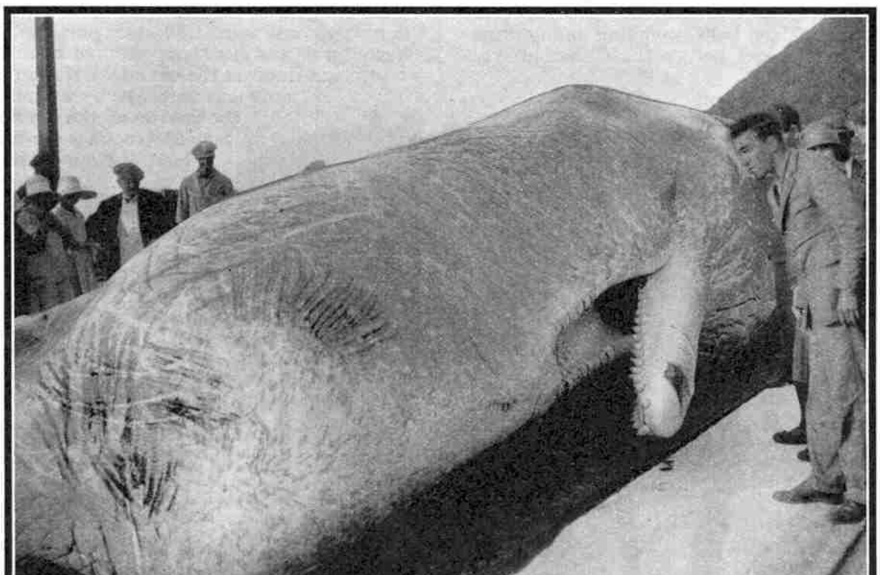
"All right, come on board at midnight," the machine gun answered with a last barrage, "At two o'clock we will leave."

The whaling fleet at Durban consisted normally of 16 ships, but the recent catastrophe had reduced the number to 14. The ocean, bothered by these noisy monsters not created by himself, which had the impudence to cross him in every direction every day, had devoured two of them in a few weeks, but the crews had been rescued by the companion ships.

At two o'clock in the morning, puffing and panting and snorting, the little steamers started off one by one, without an order or a whistle blowing, like nice animals perfectly trained; a little old and asthmatic, but knowing well every small detail of their daily work, even better than their masters, who seemed still a little sleepy. The last to start was the "*Whytok*," on which I had been waiting since midnight with the Professor and Bomba. In his tiny cabin under the bridge Captain Karpisson was sleeping, not having to begin his watch until eight o'clock. The mate proved to be another man not fond of words. He had suggested that we should stay in the mess until daybreak and rest, but the mess was a small room a yard or so square, very hot, and full of bugs of every possible kind. Much better we found the sparkling air of the bridge and the starry sky, with Durban in her marvellous nightly toilet embroidered with lights, searching with anxious eyes the fantastic submarine towns that the phosphorescence of the Indian Ocean always seems to reveal.

The whalers, as soon as they had left the ample bay, spread out fanlike, each one anxious to make the best kill.

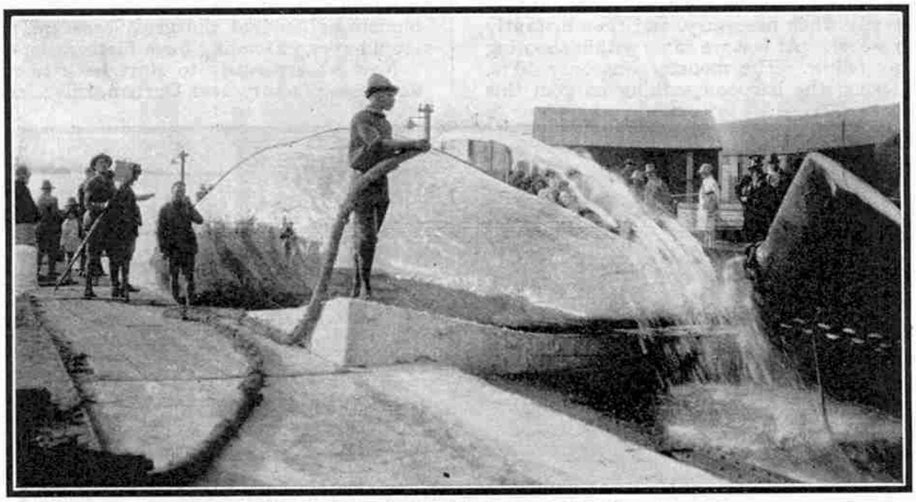
The mate was at the wheel, but every now and then he left it completely alone and went away to do a lot of other little businesses, perfectly sure that his good steed would follow its



The heading photograph shows, in silhouette, Captain Karpisson at the whaling gun of his ship "Whytok." In the lower photograph a huge sperm whale is shown landed on the slipway at the whaling factory near Durban.

course by itself. A little later, from the bridge, all we could see of the other whalers were 13 white lights, the lamps on the mast, and a few red and green, the sidelights, always moving farther and farther from us, the white and green and red reflections trembling on the water. All the rest had disappeared amid the waves.

The dance of the ship was beginning. Huge waves crashed up to the bridge, splashing our faces, which were instantly dried by the furious wind. I found the scene a real enchantment. The courageous little "*Whytok*" was devouring her good 12 miles an hour, climbing easily the thousand hills of the waves, which in the darkness looked like actual solid hills. One quick descent, and then up again, panting on the top of the cliff, then down once more. Now and then she would make a mistake, and instead of clearing a wave in one jump would plunge into it, and the hill would fall upon her in a foaming fury that hid the bridge beneath its white boiling froth. Then it would seem for a moment that the bridge was floating like a lost cask, followed by a mast that careened back and forth crazily, almost touching the surface of the sea at times. On the top of the mast in the look-out a young boy was smoking an enormous pipe. Tossed back and forth, here and there, he was as undisturbed and placid as though he were sitting at home reading a book.



Washing a captured whale before cutting it up.

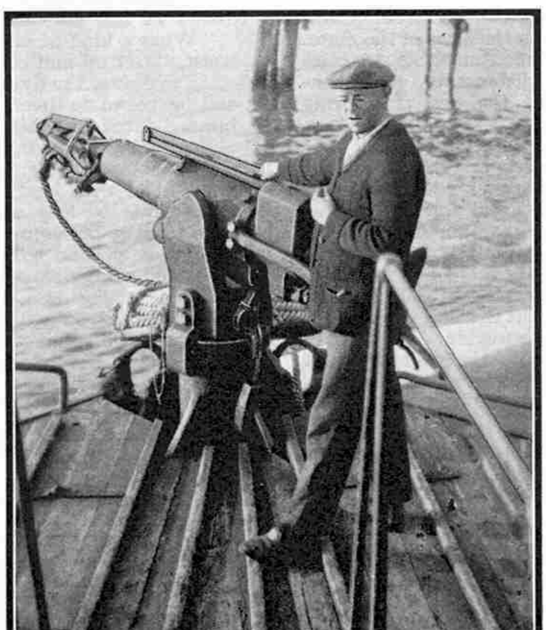
We looked at each other, very proud of ourselves.

"Is this all there is to it, this famous heavy sea?" asked the Professor.

"What a kind of sailors we are," said Bomba, extremely haughty, but with a pale face, drawn and sad. And the mate looked at him and smiled, just as the Captain had done, as though to say await a moment and we will see what happens.

We saw no one else on board. How six o'clock and sunrise came I don't know. The hours had flown away. The shore had been invisible for a long time, and the whaler continued to attack watery hills, up and down, up and down. Then suddenly the enormous flaming ball of the sun climbed up above the horizon, seemingly flattened at both poles, as always happens in that latitude by some strange phenomenon of refraction. Presently it emerged completely round in a glory of light, a riot of colour. The mate shouted a gutteral cry. The young boy on the mast replied in the same way, calmly lighting his pipe, scrutinising with greater care the endless range of waves, and continuing to swing above our heads, here and there, forward and back.

Another hour passed, and then the boy of the pipe, without even looking down, shouted something that must have been a word. The mate stamped on the floor of the bridge and looked in the direction towards which the boy was pointing. We too, were eagerly searching the waves, but we could see nothing. From below came a grunt from the Captain.



Captain Karpisson at the gun of the "Whytok," after the hunt described in this article.

The mate made a heroic effort to be gracious, and said to us: "Whales."

"Oh really," we answered, but we saw nothing at all.

Captain Karpisson arrived on the bridge, dressed and shaved, fresh and smiling, greatly astonished to see us still in good condition.

"The camera man had better go in my cabin," he said, "there is a big porthole from which he can take his movies without the camera being splashed with water."

I took Bomba down to the cabin, installed him, and gave him a thousand recommendations to do some good work, get all the possible pictures, and to call me if he needed anything. Then, quite excited, I went on deck again. The hunt had begun. The boy from the look-out was giving the directions with a gesture of his hand. The mate at the wheel followed the whales, trying to cut across their path, and continuously shouting orders down the speaking tube to the engine room.

"Full speed—three-quarter—half—stop," and so on, always with the fewest possible words. The Captain stood on a little platform at the end of the prow near the small whaling gun, sometimes giving a silent order by a nod or wave of his hand—slower—a little bit to the right, etc. All three of them had enormous pipes in their mouths and were placidly smoking, their eyes intent on the whales. No one else appeared on board.

The small ship jumped and fluttered, tossing from one side to the other. Clinging to the rail with both hands we had the greatest difficulty in keeping on our feet. The Captain on the platform, with nothing to hold to, stood at ease, one hand in his pocket, with the most natural air in the world. He looked like a statue riveted to the platform, and I was filled with astonishment at his remarkable poise.

At last we could see the two whales that we were pursuing. Closer and closer we followed their movements. A round dome, dark and shining, would appear above the surface of the water, rotating like a huge black rubber ball in a fountain, until the blow-hole, the nostril of the whale, would emerge. Then a jet of compressed steam some 10 ft. high would leap into the air with the noise of a distant cannon shot, the breath of a cyclone. The whale would slowly submerge, to reappear again 200 or 300 yards distant, and repeat the performance. The stream of steam condensed into water, and blown by the wind fell heavily and reluctantly to the sea, leaving a sheet of oil on the surface of the water, the spoor of the monster. The "*Whytok*" panted and quivered in the effort, but gained a 100 ft. or so on the whales. But they had taken a good provision of air, and for about 15 minutes were not visible.

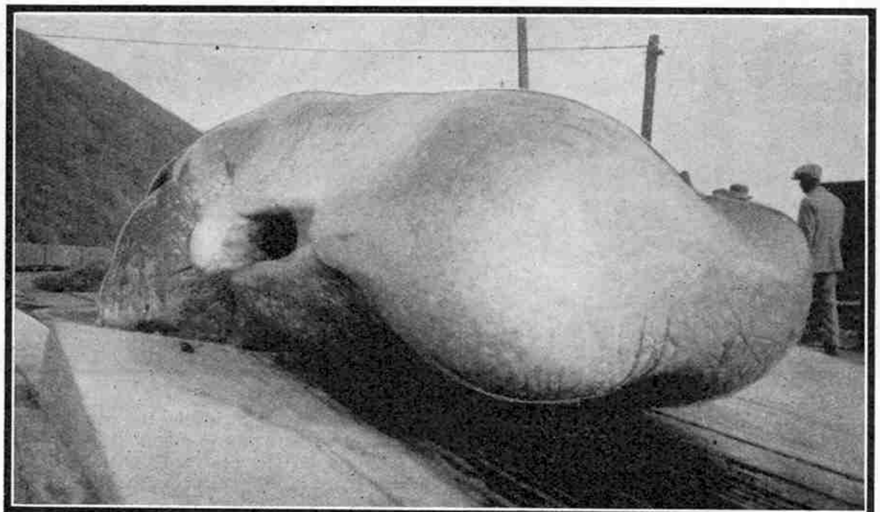
"Full speed," yelled the mate, and he followed the direction that he thought, from his long experience, the whales would take.

"Stop!" We were in suspense. The whales could suddenly emerge half a mile away or within shooting distance, or they might be tactless enough to come up directly beneath the steamer. We followed the eyes of the Captain as he made a quiet gesture. He had detected the whales, glimpsing their dark bodies just below the surface of the water, and had calculated the spot where they would emerge. Our small craft leaped forward. Too late. The monsters had already disappeared, leaving another huge oily spoor. Again we followed. Again and again, for two hours we trailed our prey, never getting close enough to take a shot at them.

Finally, after an exceptionally long immersion, one of the whales came up at about 30 ft. from us. A shot, and a big cloud of white smoke. We saw the harpoon rebound from the back of the whale and fly in the air. The enormous animal disappeared at once, its companion emerging just at that moment and precipitously plunging back into the sea. It seemed that something in his immense head realised that this was not the ideal moment to take the air !

Just then three men appeared from the maw of the ship and set to work to haul in the rope, showing the harpoon to the Captain, who made a gesture of impatience. We understood that the point of the harpoon was defective, and had broken instead of penetrating the whale. The hunt continued, while the small cannon was recharged with a new harpoon.

Another hour of the chase ensued. It seemed that the monsters understood the trick and played a game with us. They would swim like mad, emerging only when necessary, and then instantly changing directions under water. At last we came within shooting distance, 50 ft., of one big fellow. The monster was only 40 ft. away when the cannon spoke, the harpoon making its goal this time and burying itself in the head of the whale. The cable unwound rapidly, pulled by the infuriated animal thrashing about in the water. When the deep smoke of the black powder was dissipated we saw that the sea was red with blood for yards and yards in every direction.



Another view of a captured sperm whale, showing the massive head and exceedingly small mouth.

The whale emerged almost completely and instantly plunged head downward, but the mate had rapidly judged it to be 90 ft. long, and 60 tons in weight. It went down, down, struggling to release itself from the harpoon. The cable attached to the harpoon passes through a fairlead, climbs to a pulley attached to the top of the mast with a powerful spring, descends to the deck, and goes down to powerful winches in the keelson. If it were not for this arrangement the violent movements of a whale would carry away the harpoon line. The cable is marked with red paint every 50 ft. and is 900 ft. in length.

Suddenly a terrible shock made the ship groan and tremble and plunged the prow in the water, throwing us in the arms of the mate. The cable had reached the end. The whale continued its struggles at a depth of 900 ft., but in spite of that distance the prow continued to receive formidable shocks while the powerful spring on the mast worked like a piston.

Meanwhile, from every point of the horizon, which until that moment had been quite deserted, the profiteers arrived. Black sea gulls by hundreds, and dozens of immense albatross, all energetically hunting for clots of blood or pieces of flesh, fishes and polyps, live little Jonahs that had been cast out of the great wound in the whale.

The Professor and I had completely forgotten the danger of sea sickness, so engrossed were we in watching the scene and trying to keep our balance. The shocks were growing less severe and came less often. The engine was going at full speed, but the ship moved very slowly because of the enormous mass she was towing. The winches in the bottom of the ship began slowly to rewind the cable. For half an hour the battle continued, the strength of the whale gradually ebbing. At last all the cable was drawn in and the monster appeared at the surface of the water, reddening the sea in every direction. A last tremor, which made the whaler strain and quiver, and the brute was dead.

The body of the whale looked like the keel of an upturned craft, and was so huge that it remained immobile in the churning waves. Everyone was working frantically now in order to tie the whale to the left side of the ship. A loop around the tail fastened it to the prow. The rope from the harpoon, which cannot be extracted unless the whale is cut to pieces, is secured to the stern of the ship, the monstrous head of the great creature, with its ridiculous, small, stupid eyes, extending for a further distance of some 20 ft.

Now we are ready to start back to port. To-morrow, in the flourishing factory near Durban, this whale and all the others captured to-day by the rest of the fleet, will be cut in pieces by a huge electric saw. Oil, grease, fertiliser, whalebones, will be taken out with remarkable speed by a company of ridiculously garbed natives. Everything will be cooked at once amid a fiendish smell, with a boiling of Cyclopean pots, deafening noise, clouds of smoke, in a small strange corner of the earth where everything seems on a colossal scale, particularly the odours. But the profit, too, is vast, 2,000 or 3,000 dollars net profit from a whale, and an average of more than 2,000 captured every year by this one fleet alone.

I suddenly remembered poor Bomba, and shouted to him that his work was over and he could join us. No answer at all. I ran down to the cabin. The movie camera was on the ground with its three legs in the air like a dead bug. Stretched on the bunk lay Bomba, his face green, gasping like a fish out of water. Evidently he had not taken a foot of film.

" What a kind of sailor you are," I said, remembering his proud boast, " Get up and come up in the air."

" I'm dying, I'm dying," he moaned, " I'm terribly sick—sick " ; and he began to demonstrate his illness in such a fashion that I jumped out of the cabin because I didn't want to follow his example.

Now the Captain invited us to sit down for lunch with himself and the mate. " Plenty of food, very good food," but in that tiny mess, filled with heat, bugs and smells of every description, we were afraid to lose completely our prestige as old sailors, and considered it better to declare with indifference that we were not hungry at all, and to stay up on the bridge in the fresh air until we would arrive at port a few hours later.

When we left him, Captain Karpisson gave us his best compliments, and offered to take us with him another time. But his eyes were smiling, and saying, " I know you, my dear. On board I shall never see you again."

And he was right.

Great Ports of the World—*(Cont. from p. 537)*

port. The 12-mile Belfast Lough provides one of the safest and most accessible harbours in the world. The port owes a good deal also to the fact that the maximum difference between high and low water is only 9½ ft. Dock gates are therefore unnecessary, and ships can proceed direct to and from their berths at all times.

The port is well equipped with modern facilities for the reception and shipment of all classes of goods. Seven miles of quayage provide berths for ships up to 32 ft. draught, and there is a special deep water wharf 500 ft. long reserved for oil tankers. The many large and well-lighted sheds have a total floor space of 19 acres.

The numerous cranes range in capacity from two to 10 tons for ordinary loading and discharging, and there are three large cranes, for heavy lifts, of 25, 120 and 150 tons capacity respectively.

There are excellent drydocking facilities at the port. In addition to the Hamilton and Alexandra graving docks already mentioned, there is the Thompson graving dock, 887 ft. long. This dock has been used by many well-known ships, including the White Star motor liners "*Britannic*" and "*Georgic*," and the Pacific Steam Navigation Company's motor vessel "*Reina del Pacifico*."

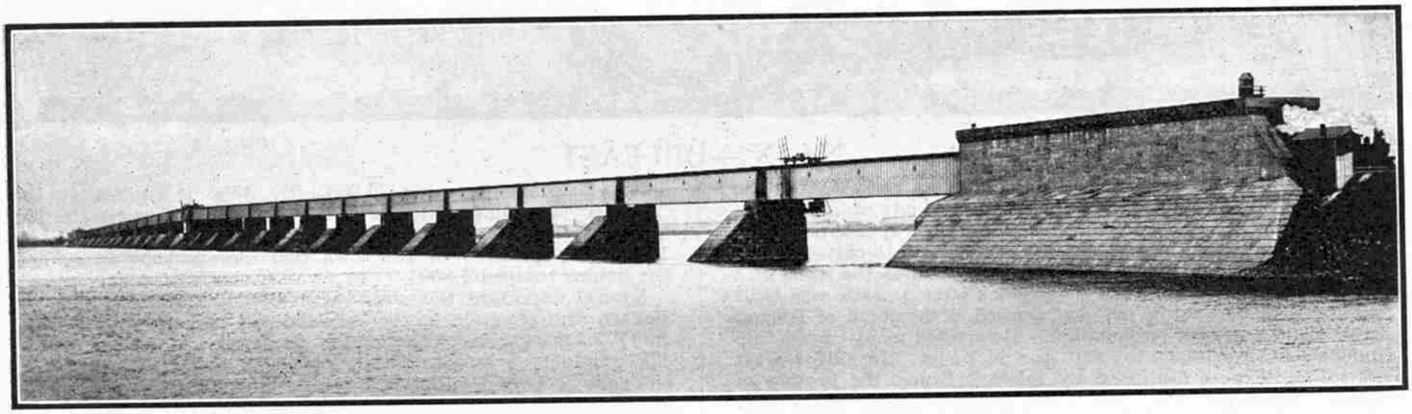
The trade of the port is considerable and very varied, and 3,005,459 tons of goods were imported and exported during 1933. Coal is the chief import, and 1,206,104 tons were received last year. Many thousands of tons of maize are imported annually, and other commodities brought to Belfast in large quantities are timber, oil and cement ; iron and steel bars, castings, etc. ; flax and hemp. The most important exports are cattle, sheep, pigs and horses, and during 1933 the huge total of 264,488 head were shipped from the port. The textile industries in Northern Ireland also contribute considerably to the trade of the port, and 49,000 tons of linen and cotton goods were shipped from it in 1933. Other commodities exported in large quantities are potatoes, wheat, eggs, grass seed, and manufactured tobacco.

Belfast is also an important passenger port, and a jetty with two special buildings equipped with waiting rooms and accommodation for Customs examinations is provided to meet the requirements of the shipping companies engaged in the transatlantic passenger trade.

We are indebted to the courtesy of the Belfast Harbour Commissioners for much of the information contained in this article.

A Former Montreal Bridge

Robert Stephenson's Tubular Structure



THE designing and building of the Britannia Tubular Bridge across the Menai Strait, and the similar bridge across the Conway River, provided Robert Stephenson, the famous engineer, with experience that proved of great value to him when he was called upon in 1852 to design a similar structure to span the St. Lawrence River at Montreal. At that time passengers and freight had to be ferried across the river in summer and conveyed across by sleighs in winter; and twice a year there was a complete stoppage of traffic, lasting for from one to three weeks, during the spring and autumn periods when the river was impassable.

As the population of Montreal steadily increased, the need of better means of cross-river transport became more and more serious, and in 1846 the local press strongly advocated the construction of a bridge to connect the city directly with the proposed Atlantic and St. Lawrence railway. A survey was carried out, and the scheme was reported to be practicable, but no further progress was made until 1852 when the Grand Trunk Railway Company began their operations. In that year the Canadian Government requested an English firm of contractors to report on the possibility of building a bridge, and Mr. A. N. Ross, who had superintended under Stephenson the construction of the Conway Tubular Bridge, visited Canada to examine the conditions. He recommended bridging the river just above Montreal, and advised a tubular structure on similar lines to the Conway and Britannia bridges. He returned to England to confer with Stephenson, and the result was the Victoria Bridge, of which Stephenson was the designer and Ross the joint and resident engineer.

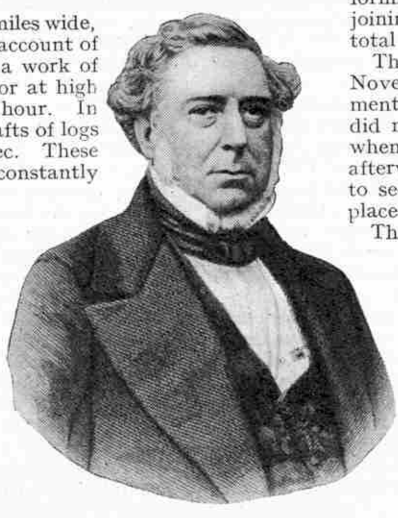
The upper photograph shows Stephenson's Tubular Bridge across the St. Lawrence River at Montreal. This bridge was opened in 1860 and did good service for 40 years, when it was entirely rebuilt, trusses replacing the tubes. Photograph by courtesy of the Canadian National Railways. Below is a portrait of Robert Stephenson.

At the point chosen for the bridge the river is $1\frac{3}{4}$ miles wide, so that the task of bridging it was considerable on account of the length alone. The building of the piers was a work of great difficulty on account of the swift current, for at high water the river runs as fast as eight or nine miles an hour. In summer the difficulty was increased by the huge rafts of logs floated down the river to the sawmills at Quebec. These rafts were a source of great anxiety, for they were constantly colliding with the partly-finished piers.

The greatest danger of all, however, was experienced in spring. At this time, after the long winter, the ice from higher up the river, from its tributaries and from the Great Lakes, begins to be driven downstream towards the sea, and the pressure from behind is so great that the ice piles itself up against any obstacle, often reaching a height of from 30 to 40 ft. The strain placed upon the piers by these piled-up masses is tremendous, and the anxiety of the engineers during the constructional work may be imagined.

An instance of the danger from this source occurred early in April 1858, by which time 14 of the 24 piers and the abutments and approaches to the bridge had been completed. A general movement of the ice began on 31st March and lasted an hour, during which time the river rose rapidly. The movement was resumed at noon next day, the water rising about 4 ft. in two minutes and reaching the level of many of the streets of Montreal; while at the same time the fields of ice were suddenly raised to an abnormal height. The jammed ice destroyed several portions of the quay wall, and subjected the embanked approaches and the piers of the bridge to tremendous pressure. The river subsided, and was clear of ice by 5th April, when an examination of the piers showed that they had successfully resisted the ice and, with the exception of one or two heavy stone blocks that were still unfinished, had escaped injury. One of these blocks, weighing many tons, had been torn out of its place and carried a considerable distance.

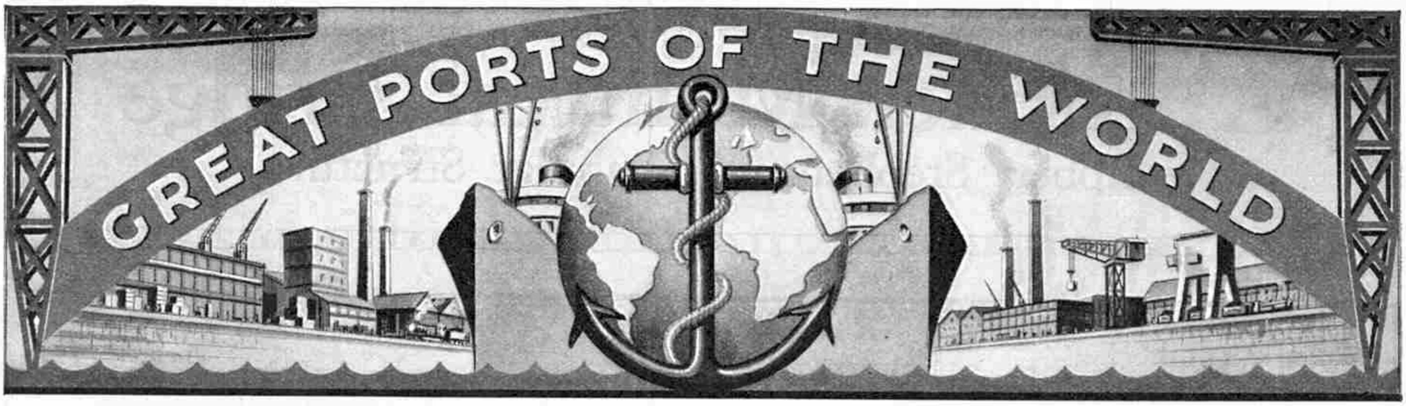
The first stone of the bridge was laid on 22nd Apr l 1854. The menace of ice jams made it essential that the piers should be of very massive construction, and their foundation s were laid in the solid rock beneath the river. The upriver side of each pier was reinforced with a "cutwater," or inclined buttres built up of great stone blocks, each weighing from seven to 10 tons, to arrest and break the ice when it was forced against the piers. The blocks forming this buttress were firmly clamped together with iron rivets. The two piers supporting the long centre span were 18 ft. wide, and the other 22 piers 15 ft. wide, all being high enough to give a clearance of 60 ft. above the river. The erection of the bridge deck was a formidable task, consisting of placing in position and joining together 25 great iron tubes that contained a total weight of 9,044 tons of iron.



The first crossing of the bridge took place on 24th November 1859, nearly $5\frac{1}{2}$ years after the commencement of the work. The official opening of the bridge did not take place until 25th August 1860, however, when the last rivet was driven by the Prince of Wales, afterwards King Edward VII. Stephenson did not live to see the bridge completed, his death having taken place in the previous year.

The bridge cost about £1,300,000 to build, and, including the approaches, was nearly two miles in length. It was 16 ft. wide, and carried a single railway track, that of the Grand Trunk Railway.

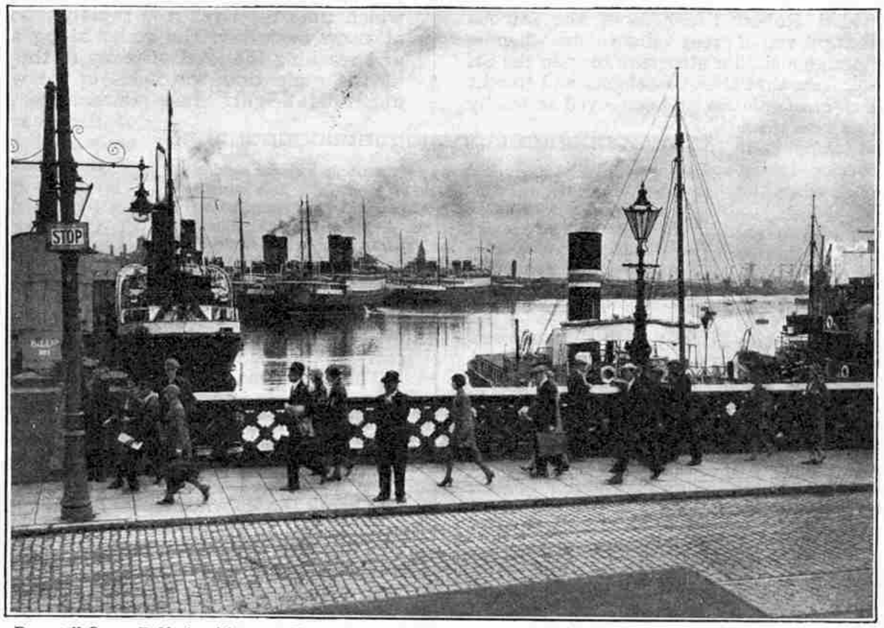
The Victoria Tubular Bridge did good service for 40 years, after which it was completely rebuilt. The piers were lengthened, and Stephenson's great tubes were replaced by steel trusses. Carriageways and footways were provided, and the single line was replaced by the double track of the Canadian National Railways. The new bridge, which was named the Victoria Jubilee Bridge, is 66 ft. 8 in. wide, and weighs 22,000 tons.



No. X.—BELFAST

THE origin of Belfast is very obscure, and its history up to the 16th century is scanty and vague. The city stands at the mouth of the River Lagan, a winding waterway that flows into a lough, or natural inlet of the sea, on the north-east coast of Ireland. Under the name of "Bel-Feirste" it was the scene of a battle in 680 A.D., and nearly 600 years later a castle was built there by John de Courcy, who had arrived in the north of Ireland with a small army six years earlier. He erected many castles and churches, and was made the first Earl of Ulster. In 1316 Belfast and its castle were destroyed by Edward Bruce, the brother of Robert, king of Scotland. Bruce had invaded Ireland the previous year with an army of 6,000 men.

At the beginning of the 16th century Belfast is described as a "town and fortress," but actually it was only a fishing village. It was then possessed by a sept, or subdivision, of the tribe of O'Neill, who had been great warriors in Ireland for many centuries and were opposed to the English. Eventually it fell into the hands of Sir Thomas Smith, a favourite of Queen Elizabeth, but later it was forfeited by him to Sir Arthur Chichester, the Lord-Deputy, who in 1611 rebuilt the castle. The next year he was created Baron Chichester of Belfast. At that time the town consisted of about 120 houses, mostly built of mud and covered with thatch, and the castle was a two-storey structure with a shingle roof. In 1613 James I granted a charter to the town constituting it a corporation with a chief magistrate and 12 burgesses.



Donegall Quay, Belfast, with cross-Channel steamers alongside. The illustrations to this article are reproduced by courtesy of the Belfast Harbour Commissioners.

The appointment in 1632 of Earl Stafford as first Lord-Deputy of Ireland brought better times to the country, and Belfast shared in the benefits of his enlightened policy. Troublous times returned with the rebellion of 1641, however, and two years later a rampart was raised round the town, with four gateways on the landward side. An old map dated 1662 shows that in that year there were only 150 houses within the wall, forming five streets and five lanes; and the surrounding uplands were still dense forest.

The religious unrest in Ireland at that time caused an interesting incident during 1636 that provides the earliest record of shipbuilding at Belfast. A group of Presbyterians in the town resolved to seek a more peaceful life in the New World, as America was then called, and they built a vessel named "*The Eagle's Wing*," of 150 tons, to convey them across the Atlantic. Their courageous adventure failed, however, as adverse winds drove their ship back, and her disappointed passengers were obliged to land in Scotland.

During the later years of the 17th century Belfast progressed more rapidly than most Irish towns, and became a prosperous port. In 1686 its merchants owned 40 ships, and the Customs' duties collected totalled nearly £20,000. By 1750 it ranked as the "greatest town for trade in the north of Ireland." The growth that accompanied this rising prosperity is shown by the fact that by 1757 the population of the town had increased to 8,549, and the houses totalled 1,800.

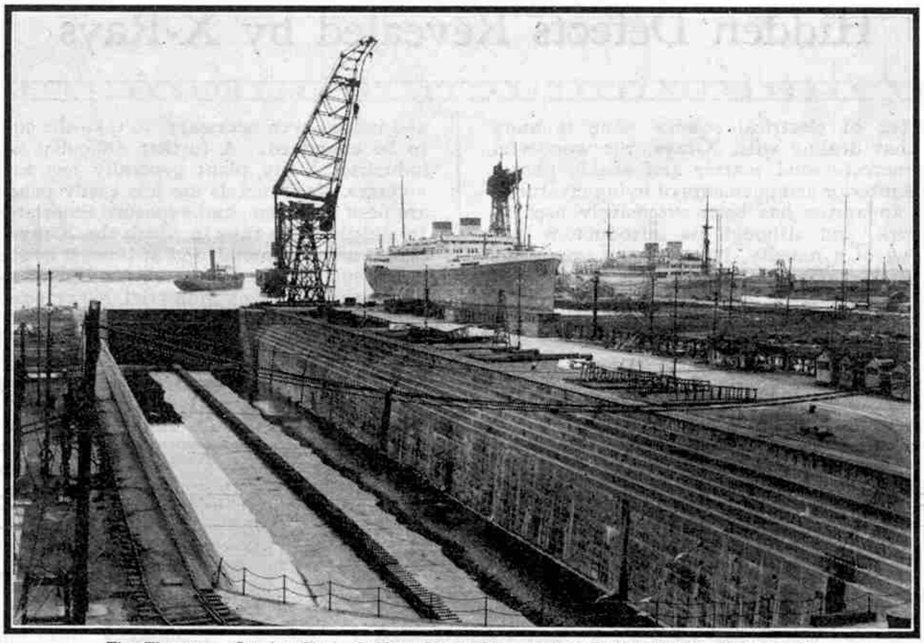
Several important industries were already well established in Belfast, the chief being the manufacture of rope and canvas. In 1777 the manufacture of cotton goods was introduced, and in 1791 shipbuilding on a large scale was begun by William Ritchie, an energetic Scotsman. Ritchie visited Belfast in March of that year, and was so impressed with its possibilities as a shipbuilding centre that he closed down his shipyard at Saltcoats, in Scotland. He returned to Belfast in July, taking with him 10 skilled men, together with the necessary plant and materials, and established a successful shipyard there, at which he later built the first steamship in Ireland.

The development of Belfast as a port was hindered by the bad state of the roads and the steep hills between the town and Newry, which made communication with other important towns very difficult and slow. A stage coach service between Belfast and Dublin by way of Newry began in 1752, and the journey took three days. During the winter months, however, the coach could not go further than Newry, owing to the wretched conditions of the road; and regular communication by stage coach between these important towns was not established until 1789.

Until about a century ago the port possessed only a wharf, where the small ships that visited it were left high and dry at low water. The wharf was reached by navigating a long, winding and shallow channel, and the larger ships did not venture so far inland. They received and discharged their cargoes at Garmoyle Pool, where the channel was deeper, the cargoes being conveyed to and from the wharf by lighters, which was a slow and expensive business.

The first steps to develop the port were taken in 1830, when it was decided to provide a long, straight deep-water channel leading direct to the sea, by constructing two cuts across bends of the River Lagan between Belfast and Garmoyle. The first of these cuts was not begun until nine years later, but it was completed in two years at a cost of £42,352, including the purchase of land. The work was carried out under the direction of an engineer named William Dargan, and the excavated material was dumped on the County Down side of the river where it formed an island that became known as "Dargan's Island." The construction of the second cut was commenced shortly afterwards, but the work was stopped before completion. In the meantime the facilities of the port had been increased by the purchase of several local quays and private shipbuilding yards at a cost of about £144,000. These included certain quays and land on the County Down side, and the Donegall quay, Cunningham quay, Dunbar Dock, and Chichester and Merchants' quays.

The passing of the Belfast Harbour Act in 1847 placed the maintenance and development of the port in the hands of a Public Trust, known as the Belfast Harbour Commissioners, and the modern history of the port dates from this important event. At first the new Port Authority totalled 18 members, but in 1883 the number was increased to 21, with the Mayor of Belfast as an ex officio member. The Commissioners entered enthusiastically into the big task of developing the port, and during the first five years of their administration many great improvements were effected. The construction of the second cut was resumed and was completed by 1849, and the full length of the straight deep-water channel was then ready for use. The channel was named the Victoria Channel in honour of Queen Victoria, who visited Belfast in that year. To further commemorate the visit Dargan's Island was renamed "Queen's Island."



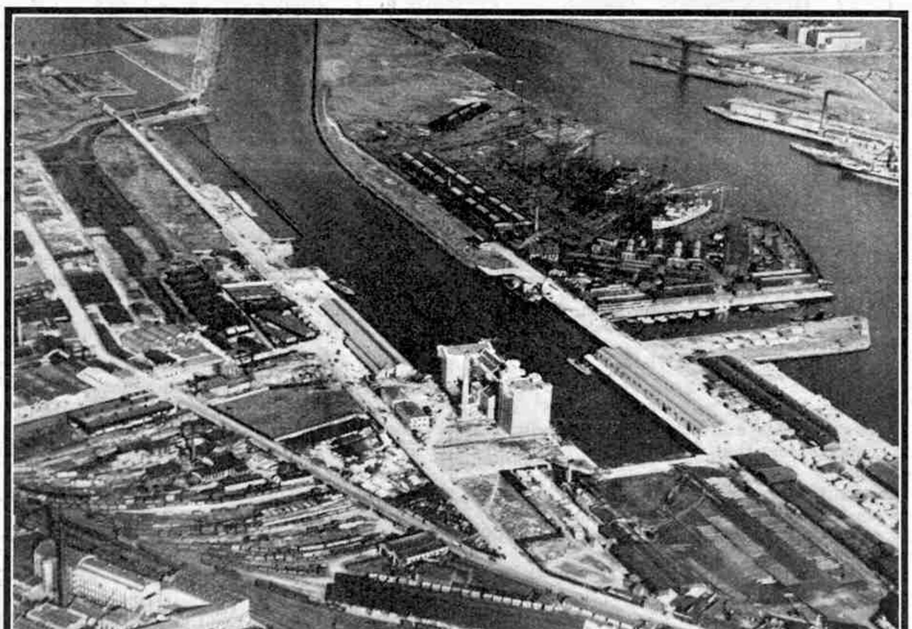
The Thompson Graving Dock, Belfast, 887 ft. long, and deep-water fitting-out wharves.

Other early work carried out by the Commissioners included the filling up of old creeks known as "Town Dock," "Ritchie's Dock" and "Limekiln Dock," the rebuilding of Donegall Quay (1849), and the construction of Clarendon tidal Dock (1851). In 1854 they obtained possession of foreshore on the County Down side of the river, including Queen's Island, now the site of great shipbuilding yards and other engineering works. On the same side of the river they constructed the Abercorn Basin and the Hamilton Graving Dock, which were opened in 1867, and the Queen's Quay in 1877. Developments proceeded simultaneously on the County Antrim side of the river, where the Dufferin and Spencer Docks (since much improved) and the Milwater Basin were opened in 1872. The Albert Quay, which is a continuation of the line of Donegall Quay, was opened in 1874.

In common with other great ports, Belfast had to enlarge its dock accommodation and navigation channel to cope with the rapid growth in the size of ships during the later years of the 19th century. Many improvements and extensions were effected, including the reconstruction of the Queen's and Donegall quays. The Victoria Channel also was widened and deepened, and extended in a straight line to the deep water of the lough. Since then it has several times been deepened to enable the increasingly large ships to reach the docks, and it is now 23 ft. deep at ordinary low water. The total length of the channel is $4\frac{1}{2}$ nautical miles and the width 300 ft. at its full depth. A larger graving dock became necessary, and the Alexandra Graving Dock was built on the County Down side of the river. It was completed in 1889 and is 800 ft. long and 31 ft. deep. The first ship to enter the dock was the White Star liner "*Teutonic*," immediately after she was launched from the great shipbuilding yard of Harland and Wolff Ltd., at Queen's Island.

The trade of the port continued to increase more rapidly than the dock accommodation, and a new deep-water dock, opening from the Spencer basin, was completed in 1894. Three years later the York Dock was opened, and shortly afterwards an extension was completed that joined the dock to the Prince's Dock, which was then renamed the York Branch Dock. Even these improved facilities could not keep pace with traffic requirements, and during the next 10 years more docks and quays were constructed. One of these quays is 1,300 ft. long and the depth of water alongside is 30 ft. at low water.

Important extensions on the County Antrim side of the river were put in hand in 1930 and were completed last year at a cost of £400,000. This work included the construction of an approach channel $1\frac{1}{4}$ miles long and 23 ft. deep at ordinary low water, which opens out of the Victoria Channel. It is lighted by means of electric flashing lights on both sides. A turning basin 10 acres in extent, of the same depth as the approach channel, and providing 1,880 ft. of quayage, was also part of the scheme. The basin leads to a new dock, called the Pollock Dock, 620 ft. long, and 30 ft. deep at ordinary low water. The water area comprised in the new channel, basin and dock was formed by dredging an area of 76 acres, partly land and partly shallow and obsolete timber ponds. Over 5,000,000 tons of material was raised by the Commissioner's dredging plant during this work. The material was deposited on the foreshore near Sydenham, and added about 150 acres to the land area of the harbour. The quays of the dock and turning basin, except two on the west side of the dock, were built of Columbian pine and decked with concrete. The two exceptions adjoin the flour mill of Joseph Rank Ltd., and were built entirely of concrete at the company's expense, but they will eventually become the property of the Commission.



Aerial view of the recently completed Herdman Channel and the Pollock Dock and Basin.

Belfast is fortunate in its geographical situation, which enables it to combine the advantages of an ideal ocean terminal and distributing centre with those of an inland (*Continued on page 534*)

Watch Dogs of Industry

Hidden Defects Revealed by X-Rays

OF the many branches of electrical science none is more fascinating than that dealing with X-rays, the wonderful radiations that penetrate solid matter and enable photographs to be taken of the interior arrangements of living creatures. For many years X-ray apparatus has been extensively used in medical and surgical work, and although its introduction into industry is still something of a novelty, it is now an important part of the equipment of the research departments of all large industrial concerns.

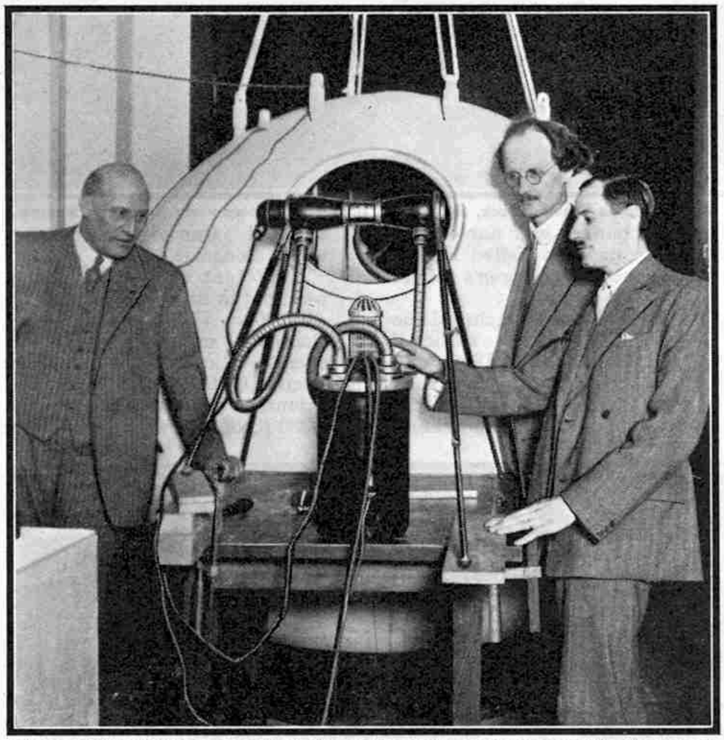
The rays are generated in tubes from which the air has been almost completely pumped out. Sealed into these tubes are two electrodes, and a high voltage discharge is passed between them. The cathode or negative electrode then emits a stream of electrons, or tiny negatively charged particles of electricity. These flash across the tube to the anode, or positive electrode, and their sudden arrest on reaching it gives rise to the radiations that we call X-rays. The end of the anode is placed at an angle to a line joining the two electrodes in order that the X-rays shall be emitted at one side of the tube instead of being radiated in all directions.

The rays themselves are similar to light rays, but have a very much shorter wavelength. They are best detected by means of a photographic plate, the emulsion of which is affected in the same way as when exposed to light, and X-ray photographs are made by placing the object to be examined between the X-ray tube itself and a photographic plate which, of course, is protected from the action of ordinary light.

The X-ray tube used in industrial work is similar in type to the simple tube we have described. It is larger, however, and the cathode that yields the stream of electrons takes the form of a metallic filament heated by the passage of an electric current. Very high voltages are used to drive the electrons across to the anode, which in effect is a target bombarded by the tiny particles. The speed of the particles increases with the voltage applied to the tube, and is of the order of many thousands of miles per second. The greater their speed, the more penetrative are the X-rays produced when they strike the anode, and no less than 200,000 V. are applied to some industrial X-ray tubes.

In view of the great penetrating powers of the radiation produced, and the high voltages employed, every precaution is taken to protect the operator of modern X-ray equipment from ill effects due to the rays themselves and from electric shock. This was not very difficult in designing stationary equipment, such as that used in hospitals; and effective ray-proof measures form a constructional feature of the "Metalix" X-ray tubes made by Philips Industrial for work of this kind. It is a much more difficult matter to make industrial equipment ray-proof and shock-proof, however, for in many instances it is preferable, and indeed even necessary, to take the equipment to the structure to be examined. A further difficulty arises from the fact that industrial X-ray plant generally has to be operated on higher voltages, since metals are less easily penetrated by the rays than are flesh and bone, and exposure times are correspondingly longer. In addition, the tube in which the X-rays are generated has to be placed near the metal, and at times it is necessary to put it actually inside such structures as the fire-box of a boiler.

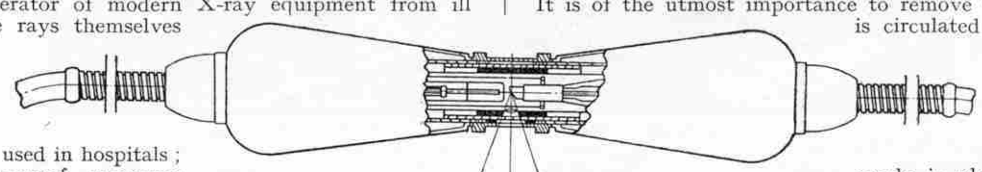
For these reasons industrial X-ray equipment had to be made definitely shoc -proof without reducing its mobility or efficiency; and the extent to which this task has been accomplished can be realised from examination of the Philips Industrial X-ray equipment shown in use in the photographs accompanying this article. Any part of the equipment, including even the X-ray tube itself, can be touched with impunity when it is in use, and the high-voltage transformers, condensers, and other accessories have been so designed that the entire plant is compact in form and can be wheeled to any desired place. Assembly in readiness for exposures takes only a few minutes, and thus large boilers, castings, and other objects can be examined without inconvenience, and with practically no necessity for dismantling industrial plant already in use to which X-ray tests are to be applied.



The gondola in which Professor Piccard made his second ascent into the stratosphere about to be tested by means of the Philips "Metalix" X-ray tube. Professor Piccard is seen on the right near the gondola. The X-ray tube used in the test was of the type shown in the diagram below.

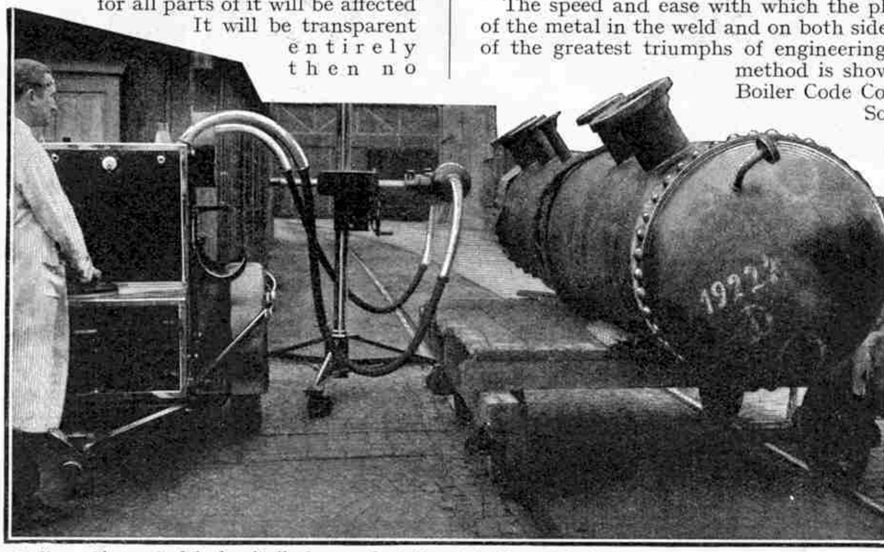
The lower illustration on this page shows the design of the Philips "Metalix" X-ray tube used for industrial work. It is almost completely encased in a metal shield, and the dimensions and form of this, and of the insulating material employed, have been carefully designed to withstand high electrical stresses. These measures serve to render the tube shock-proof, since the shield is earthed.

The X-ray tube itself is of glass, in which the two electrodes are sealed to chrome iron. A sleeve of special insulating material called "Philite" fits over the tube, and the insulating powers of this are so great that a comparatively small thickness provides ample protection, and the metal shield therefore is kept within reasonable dimensions. In the diagram the ends of the electrodes can be seen in the discharge chamber in the centre of the tube. The part of the anode that is bombarded by electrons is made of a tungsten disc embedded in copper, and copper is used for the body of the anode, because this metal readily conducts away the heat developed in the tungsten target by bombardment. It is of the utmost importance to remove this heat, and water is circulated at the back of the anode by means of a pump in order to carry it away as quickly as possible.



The end of the anode is placed at an angle to the stream of electrons bombarding it in order to direct the X-rays downward, as indicated by the lines radiating from it. The discharge chamber is protected by a sleeve of lead, in which is a hole for the passage of the direct useful beam of X-rays, any radiation not forming part of this beam being absorbed by the lead.

X-rays are largely employed in the testing of wood and metals, and the photographic method is extensively used. When a beam of X-rays is directed through a piece of any material on to a photographic plate, this when developed will show to what extent the radiation has been absorbed. The film on the plate will be uniformly black if the radiation passes clean through the material, for all parts of it will be affected equally by the rays. It will be transparent when the radiation is entirely absorbed, however, for then no X-rays emerge to act upon the sensitive emulsion on the photographic plate.



Radiographing part of the longitudinal seam of a boiler. The X-ray tube is supported on a stand in front of the boiler and the photographic plate is below the part of the seam undergoing examination.

It will now be seen how blow holes and slag inclusions in metal castings can be detected by studying X-ray photographs, or radiographs as they are called. A blow hole reduces the effective thickness of the casting locally, and slag inclusions have a similar effect, because they are impurities having less power of absorbing the X-rays than the surrounding metal. A film exposed to radiation passing through a casting with a blow hole in it therefore will show a dark spot in a position corresponding to that of the defect, since the rays in that region have less material to penetrate. Similarly the existence and position of a slag inclusion is shown by the presence on the film of a dark area, and this will be lighter in shade than a spot revealing a blow hole or any other cavity. Many flaws of this kind naturally escaped detection before X-rays were available, for practically the only method of testing then available was to cut sections across selected specimens, which were of no further value whether they proved to be perfect or defective. Now defects are readily discovered, and an entire batch can be thoroughly examined, without destroying a single specimen.

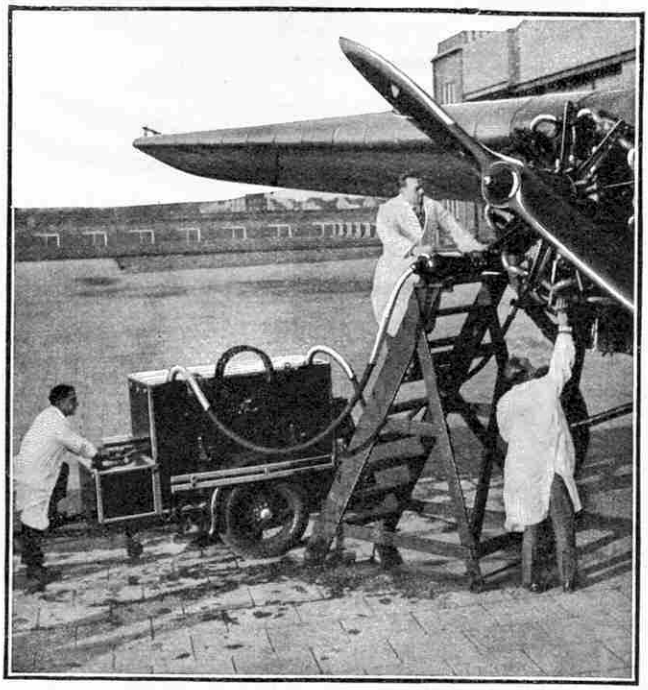
The actual taking of X-ray photographs is comparatively simple with the Philips "Metalix" equipment, since this is shock-proof and can be wheeled up to the object to be radiographed. It is best illustrated by means of an example. For instance, suppose that the longitudinal seam of a boiler has been welded, and that the efficiency with which this task has been carried out is to be tested by means of the rays. Such a seam usually is several yards in length and has to be photographed in instalments. Successive areas that can be radiographed in single exposures are marked off by means of chalk, and the X-ray tube is so placed that the beam of radiation penetrates the centre of one of these regions. The film is fixed to the inside of the boiler below the weld by means of some adhesive substance, or by any other convenient method; and the exposure time is determined from a knowledge of the thickness of metal to be penetrated and other factors. The controls are then set and the current is switched on. There is no sparking or flashing, even when a tension of 200,000 V. is used, a slight noise from the water-cooling system being the only evidence that the tube is in action.

When this exposure has been completed, the apparatus is moved to the next region, a new plate is fixed inside the boiler, and a second photograph is taken. This procedure is repeated until the entire seam has been radiographed, and the exposed plates are developed. Each is left for the same time in a developing solution of standard strength that is kept at a constant temperature throughout the operation, and thus uniformity of density is secured on the series of photographs. Inspection of the plates by the engineer in charge then reveals at once the presence of any flaws in the weld, and indicates their extent as well as their position.

The speed and ease with which the photographs of the interior of the metal in the weld and on both sides of it can be taken is one of the greatest triumphs of engineering. The value of the new method is shown by the decision of the Boiler Code Committee of the American Society of Mechanical Engineers to specify X-ray inspection of all joints of a welded boiler.

A great variety of objects can be tested by means of the rays. The examination of the fuses used for firing charges of explosive is a particularly interesting example. These fuses must be uniformly filled with powder, for any irregularities will affect the speed with which they burn, and alter the interval between the lighting of a fuse and the resulting explosion when the charge is ignited, perhaps with disastrous or even fatal results to the men in charge.

Formerly a length of fuse was tested by means of needles, with which it was prodded in order to ascertain that the core was satisfactory. To-day, X-rays actually look inside it, and examine its entire length in a surprisingly rapid and simple manner. No photographs are taken; instead, the X-rays passing through the fuse are allowed to fall on a screen on which is a layer of certain crystals that glow or become fluorescent when exposed to the radiations. A shadow is cast on the screen by any material that absorbs the rays, and the crystals on it glow where the rays are allowed to pass through. The picture seen on the screen therefore corresponds to the image that would be produced on a photographic plate if a radiograph were taken. In practice the length of fuse under test is run between the X-ray tube and the screen, and its filling therefore can be accurately checked without interrupting the manufacturing process.



Philips "Metalix" X-ray equipment in use for testing part of an aero engine without removing it from the air liner in which it is fitted.

It is impossible in a short article to give a full account of the many uses for the rays that have been discovered in industry. X-ray tests are now largely employed in practically every branch of engineering for the detection of cracks and flaws in castings of all kinds, in plates and girders and in the cylinders, pistons, valves and other components of engines and machines. A radiograph of a piece of coal gives an indication of the proportion of ash contained in it, for this is more easily penetrated by the rays than is the coal itself. Porcelain insulators for electrical purposes, especially those that are subjected to tensile strain as well as electrical stresses, are tested by means of X-rays, which reveal also hidden knots in timber, and look below the surface of built-up woodwork in order to show up faulty joints that would escape attention under ordinary tests. The detection of forged banknotes, and the scrutiny of old oil paintings are among other uses that have been found for the radiations.

We are indebted to the courtesy of Philips Lamps Ltd., for the illustrations to this article and valuable assistance in its preparation.

Huge ew Fleet for American Air Line

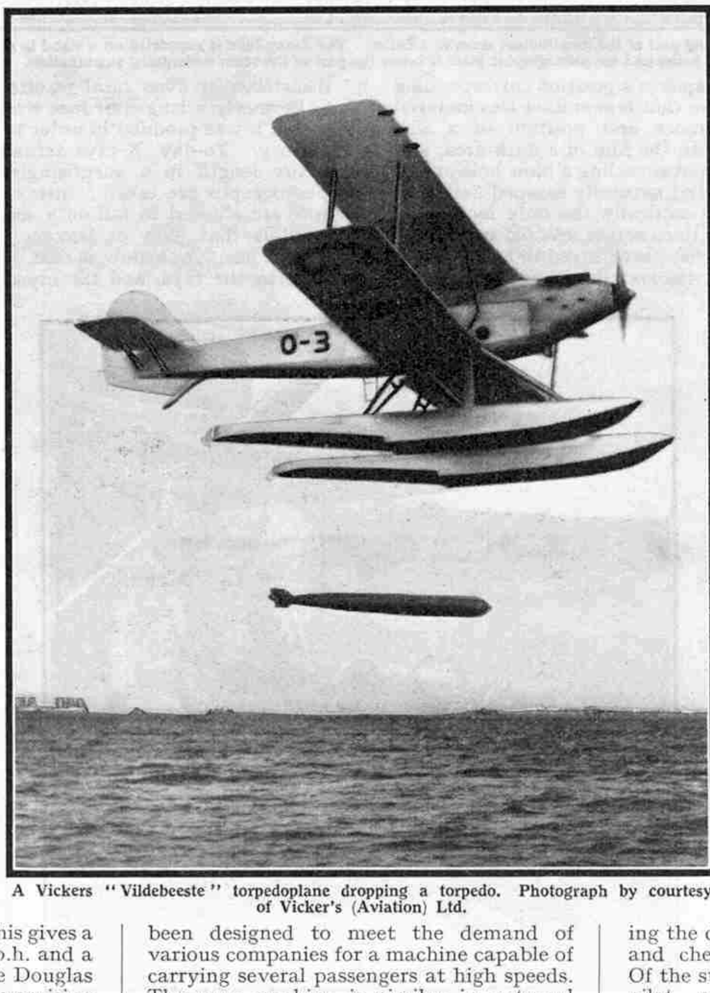
In order to speed up their services, Pan-American Airways, one of the biggest aircraft operating companies in the United States, have ordered a new fleet of 24 aeroplanes that will cost a total of about £689,000. The aeroplanes consist of six Douglas D.C.2 landplanes, six Fairchild amphibians, six Lockheed "Electra" cabin monoplanes, and six Sikorsky and Martin "Transatlantic" flying boats.

These machines vary greatly in performance and passenger-carrying ability, but the slowest of them has a top speed of about 180 m.p.h. The biggest is the Sikorsky and Martin "Transatlantic," which is intended to operate the existing passenger and mail service between North and South America, and is capable also of operating a transoceanic service for the transport of mails if such a project should be attempted. Full details of the machine are not available, but it is stated to be capable of cruising at 150 m.p.h. and of attaining a top speed of about 182 m.p.h. when carrying 32 passengers. It is 114 ft. 2 in. in wing span and is equipped with four Pratt and Whitney "Hornet" engines. With a full load on board it has an all-up weight of 38,000 lb., or about 34 tons.

The Fairchild amphibian is a single-engined cantilever monoplane in which the wing-tip floats are retractable in addition to the land undercarriage. Eight passengers and two pilots are carried, and the machine is provided with an outboard marine engine that can be lowered into the water to propel it in crowded harbours and in emergency at sea. A single supercharged Pratt and Whitney "Hornet" engine developing 645 h.p. is fitted, and this gives a maximum speed of about 180 m.p.h. and a cruising speed of 155 m.p.h. The Douglas landplane carries 18 passengers at a cruising speed of 190 m.p.h. and is powered with two Wright "Cyclone" engines. The Lockheed "Electra" also employs two engines. These are of the Pratt and Whitney "Wasp Junior" type, and they make the aeroplane the fastest of the four types, the cruising speed being 203 m.p.h. when carrying ten passengers.

A Faster "Dragon"

The De Havilland "Dragon" has been one of the important factors in making possible the establishment of the numerous internal air line services that are now being operated in this country, as it made available a comparatively cheap multi-engined aeroplane that is very economical in operation. An improved version has now been designed to meet the demand of various companies for a machine capable of carrying several passengers at high speeds. The new machine is similar in external design to the older type, but the wings have been tapered, and special cowlings have been provided to streamline the wheels and the undercarriage struts. These improvements have given the machine a top speed of about 140 m.p.h. Two D.H. "Gipsy Six" engines are employed, and accommodation is provided for up to eight passengers.



A Vickers "Vildebeeste" torpedoplane dropping a torpedo. Photograph by courtesy of Vicker's (Aviation) Ltd.

Navigating Aeroplanes by Radio

Radio communication, and in particular radio direction-finding, to-day forms an essential part of the operation of a commercial air line, because without a reliable radio service regular journeys can only be made in fair weather. By the use of radio, however, an aeroplane flying above clouds or under conditions of poor visibility can be given bearings by an aerodrome direction-finding station without any special apparatus or skill on the part of the crew of the aeroplane being required. There is obviously a limit to the number of converging aeroplanes that can be dealt with by a single aerodrome station, however, and it is therefore probable that eventually the occupants of the aeroplane will themselves be made responsible for ascertaining their whereabouts. The school of Air Service Training Ltd., of Hamble, Southampton, have anticipated this state of affairs by installing a rotating loop direction-finder in an Avro 5 monoplane, and making available instruction in its use.

As direction-finding equipment of the type installed in the Avro machine requires very high amplification, a Marconi AD35 receiver set is used in conjunction with it. The frame aerial employed has been designed by the technical staff of Air Service Training Ltd., and with the aid of these two pieces of apparatus it is possible for accurate bearings to be taken on any identifiable station. So far ranges up to 200 miles have been attained.

The machine carries the normal navigational equipment and is arranged to accommodate an instructor and four students, the instructor acting as first pilot and directing the duties of the remainder of the crew and checking the results of their work. Of the students, one is employed as second pilot, one as radio operator and the remaining two as navigators. Comparatively long-distance cross-country flights are carried out in the machine, but the cost of a course is surprisingly low as the cost of the flying time of the machine is shared by the four pupils. Sufficient flights must be made for pupils to get experience in all the duties.

A New World Height Record

The flight of Commendatore Rinato Donati from the aerodrome at Montecelio, Italy, on 11th April, when he created a world altitude record for aeroplanes by attaining a height of 14,433 m., or approximately 47,350 ft., was a fresh triumph for the Bristol "Pegasus" engine. The height attained surpasses the previous record, established by the French pilot Lemoine, by 772 metres.

The aeroplane used by Commendatore Donati was a special Caproni biplane and was powered with a single British-built Bristol "Pegasus" supercharged aero engine capable, if run at full throttle at ground level, of developing up to 1,100 h.p. Thus the world height record returned after a brief absence to the engine that formerly held it, for it was the record of 43,976 ft. set up in September 1932 by Flt. Lt. C. F. Uwins, chief test pilot of the Bristol Aeroplane Company, with a Bristol "Pegasus" engine in a Vickers biplane, that was surpassed after many attempts by M. Lemoine only a few months ago.

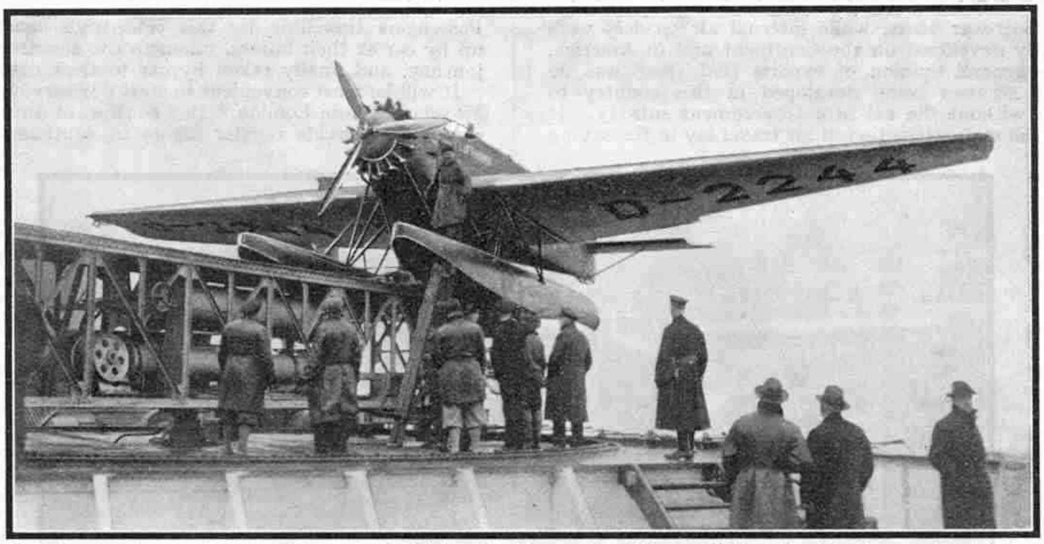
It is interesting to remember that an earlier type of Bristol engine, a supercharged "Jupiter," also achieved a world height record when, in May 1929, Herr Neuenhofer flew a German monoplane fitted with this engine to a height of 41,790 ft.

The engine used during the record-breaking Italian flight was exactly similar to that used by Flt. Lt. Uwins, and engines of the same type also provided power in the two British aeroplanes that flew over Mount Everest last year. In all but minor details the engines in these aircraft are similar to the standard "Pegasus" engine. This develops a maximum of 650 h.p. at 2,300 r.p.m.

The Comfort of Air Travel

Air transport is rapidly becoming a popular method of travel, but there are still large numbers of people who would like to fly but refrain from doing so on account of various fears. Almost all such fears are based on misapprehensions. The most common of these is that a passenger who has no head for height will feel giddy while travelling in the air. This is a natural idea, but it is quite wrong. When a person is looking down from a cliff or a tall building there is a direct link between him and the ground below, which emphasises the fact that he is at a height, and often produces a feeling of giddiness. When one is flying in an aeroplane there is no such connecting link with the ground below, and therefore the sensation of height is not produced, and there is no giddiness.

Another popular misapprehension is that the cabin of an aeroplane is unusually uncomfortable and cold. The modern air liner has saloons as large and luxurious as those of a Pullman coach. The engines are mounted out on the wings, and sound-reducing devices are employed that make it unnecessary to raise the voice even when the machine is flying at high speed. The cabins are heated to any required temperature in winter, and are kept cool in summer by a special system of ventilation. In the latest machines passengers are able personally to control the conditions in their immediate vicinity. It is not necessary for a passenger to wear any more clothes than would be necessary for a journey in a saloon motor car, while airsickness is very rarely experienced, even by those who are always ill when travelling in a ship.



A Junkers seaplane on the catapult apparatus installed on the German liner "Bremen." By catapulting the aeroplane into the air while the vessel is still at sea, the delivery of urgent mails is considerably speeded up.

The Curtiss "Hawk" P-1B pursuit aeroplane. Official photograph, U.S. Army Air Corps.

Transatlantic Zeppelin Service

The transatlantic airship service between Germany and South America that was operated last year is again being flown this summer by the *"Graf Zeppelin."* This year's first journey was made from Friedrichshafen on 26th May. The service is being operated fortnightly throughout the summer, departures being timed to leave Friedrichshafen on alternate Saturdays and Rio de Janeiro on alternate Thursdays. Fares have been reduced this year, the cost of a return journey now being about £180. Passengers from this country who wish to travel in the airship can leave by the aeroplane from Croydon at 8.45 hrs. every morning, as this is due at Friedrichshafen at 17.15 hrs. which gives them plenty of time to catch the airship.

Work on the new Zeppelin that is to be used on this service, has proceeded very rapidly and it is expected that the vessel will be launched this year. Readers will remember that the LZ129, as the vessel is called, will have a capacity of 6,720,000 cu. ft. and will be capable of travelling at a speed of nearly 85 m.p.h. In its construction the Zeppelin Aircraft Works have departed from their previous practice and have followed ideas that were first tried out in the British airships R.100 and R.101. The most noteworthy of these is the increase in width compared with the overall length.

Landing on Rubber Balls

Experimental flights have been carried out in Germany with an aeroplane provided with a very unusual type of amphibian undercarriage consisting of two large inflated balls of rubber mounted in place of the wheels. The machine has alighted on land and water several times with perfect safety and comfort, but it does not handle very well in the air.

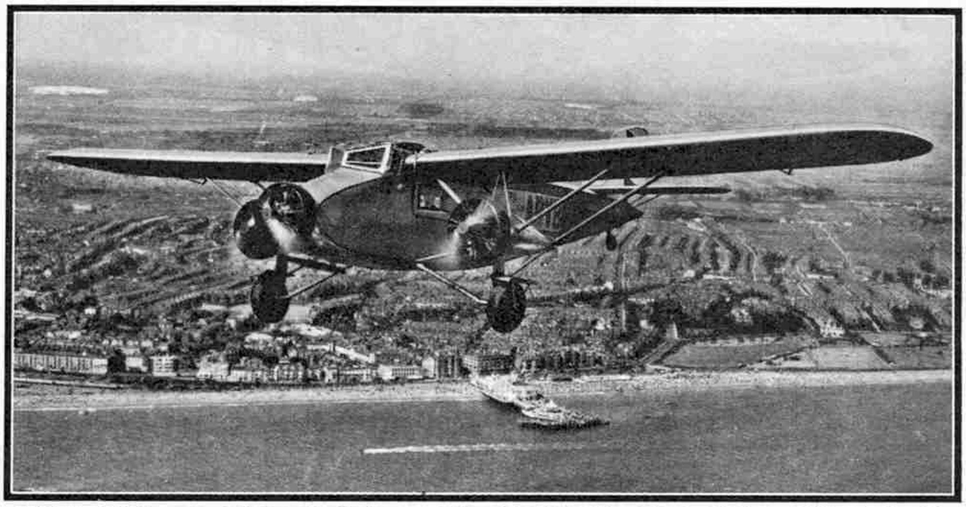
Flying 1,000,000 Miles

Capt. O. P. Jones, one of the veteran pilots of Imperial Airways, recently finished his 10,000th hour in the air. He has now flown over 1,000,000 miles and more than 4,500 times across the Channel.

Travelling by Air in Great Britain

Development of Internal Air Services

DURING the post-war years, while internal air services were being rapidly developed on the Continent and in America, it was the general opinion of experts that there was no prospect of such services being developed in this country to any great extent without the aid of a Government subsidy. It was argued that the main attraction of air travel lay in the saving of time, and that as the distances in this country were so small the saving would not be sufficient to attract passengers. Another and more important argument was that the operating cost of any such services would be prohibitively high as compared with that of railway transport. During the past two years, however, it has been proved that British internal air transport is not only practicable, but has a promising future. The development of such high-speed machines as the Airspeed "Ferry," the Avro Ten, the D.H. "Dragon," and the Spartan "Cruiser" has made fast journeys possible with engines of low power and consequently small running cost. At the same time, the development of airmindedness in this country has resulted in a small but steadily growing public to whom air travel appeals, and who appreciate even comparatively small decreases in travel time.



A Westland "Wessex" of Portsmouth, Southsea and Isle of Wight Aviation Ltd., in flight over Spithead. For this photograph and the upper one on the opposite page, we are indebted to "The Aeroplane."

British internal air services are now being operated by a number of companies at fares that are equal to, or little more than, those of first-class railway travel. Although the numbers of passengers carried by these air lines is yet small, the railway companies have shown that they realise the possibility of keen competition in the future by forming a joint company to operate air services for themselves.

One of the great handicaps of air transport in this country is that in most cases the aerodromes are situated at considerable distances from the towns they serve, whereas the railways run into the very centres of the towns. Thus the time of transport between town and aerodrome at each end of an air journey has to be added to the flying time, and this reduces very seriously the advantage gained by the high speed of the aeroplane. Recognising this difficulty, most of the air lines provide free motor transport from the centres of towns to the airports, where the distance is at all large. One company with headquarters in London, Provincial Airways Ltd., make a special feature of "door-to-door" transport. Passengers travelling by this company's machines are picked up by car at their homes, taken to the aerodrome, flown on their journey, and finally taken by car to their destination.

It will be most convenient to start our survey of British internal air services from London. In a southward direction four separate companies provide regular flights to Southampton, Portsmouth, or the Isle of Wight. Portsmouth, Southsea and Isle of Wight Aviation Ltd. operate a service from London to the Isle of Wight six times daily in each direction. The London terminus is Heston Airport, and passengers are flown to the airports at either Ryde or Shanklin as desired. The flying time from Heston to Shanklin is usually about 1 hr. 10 min. Passengers are picked up by car at Victoria Coach Station, and conveyed to Heston free of charge, the "all in" time from Victoria to Shanklin being about 1½ hr. This service has been named *"The Island Air Express,"* and it connects at Heston with the services of the British Air Navigation Co. Ltd., to Le Touquet and Deauville. Through bookings can be made also from the Isle of Wight to Liverpool, the Isle of Man, Belfast, and Glasgow, in conjunction with the services of Midland and Scottish Air Ferries Ltd.

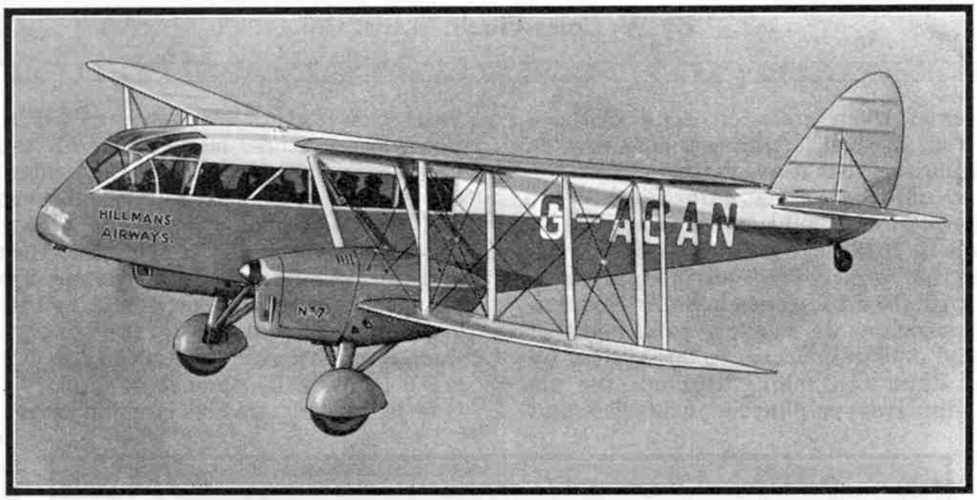
One of the two lines now operated by Railway Air Services Ltd. in conjunction with Spartan Air Lines Ltd., is also between London and the Isle of Wight, Croydon and Cowes Airports being the termini. At present four machines are flown in each direction every day on this service, 50 minutes being taken between Croydon Aerodrome and Somerton Aerodrome, the airport of Cowes. On the way a stop is made at Ryde, and, when returning, at Bembridge if requested, and there are vacant seats in the machine.

A Spartan "Cruiser" used on the lines operated jointly by Spartan Air Lines Ltd. and Railway Air Services Ltd. Photograph by courtesy of Spartan Air Lines Ltd.

Another service southward from Croydon, operated by Provincial Airways Ltd., is to Southampton or Portsmouth, and then on to Bournemouth, Weymouth, Haldon, Plymouth, and Hayle for Penzance in Cornwall. This service is flown three times a day in each direction and takes about 3 hours. One of the flights is from Croydon to Plymouth only, however, and this takes 1 hr. 45 min.

Jersey Airways Ltd. operate a service between London and St. Helier in Jersey. This is a particularly useful line, because it enables the journey between these two places to be made in 1 hr. 50 min., or about eight times quicker than by train and sea. The route followed is by way of Portsmouth and Southampton, and stops are made to pick up and set down passengers at the aerodromes at these places. At present two machines are flown in each direction every day, but during the latter half of September the service will be reduced to one machine each way per day. This service terminates on 30th September and recommences at the beginning of May.

Portsmouth, Southsea and Isle of Wight Aviation Ltd., operate also various short services along the South Coast. One of these, known as *"The Isle of Wight Air Ferry,"* connects Portsmouth, Ryde and Shanklin. The first machine on this service leaves Portsmouth at 9.10 every morning, and the service is continued throughout the day at half-hourly intervals up to 7.10 p.m., an equal number of return flights being made. Cheap day return tickets are issued, and they have proved very popular.



A D.H. "Dragon" belonging to Hillmans' Airways Ltd., who operate air services to the Continent. This machine has been one of the important factors in making internal air lines possible in this country.

Another service, operated in conjunction by Provincial Airways Ltd., Western Airways Ltd., and Southern Aircraft Ltd., provides transport between Brighton, Portsmouth and the Isle of Wight, and Penzance, Plymouth, Bristol and Cardiff. The through journey from Shoreham Aerodrome at Brighton to Cardiff takes 2 hr. 20 min., and is flown twice a day in each direction.

The only big air service northward from London is to Liverpool, Belfast and Renfrew, and is operated by Midland and Scottish Air Ferries Ltd. It is flown twice a day from Romford Aerodrome, about 40 minutes by car from London, where the Hillman's Airways services to Paris start. The journey to Renfrew, the airport of Glasgow, and the headquarters of Midland and Scottish Air Ferries Ltd., is by way of Speke Airport, Liverpool, and takes on the average about 4 hr. 40 min. Passengers for Renfrew and Belfast are carried on the same machine as far as Liverpool, where those going to Belfast change into another aeroplane and are flown to Belfast by way of Castletown Aerodrome in the south of the Isle of Man. The through journey from London to Belfast takes about $4\frac{1}{2}$ hours. In the opposite direction two flights are made every day from both Renfrew and Belfast.

Liverpool is rapidly becoming an important centre of air transport, and already several services to various parts of the country are operated from the city's municipal airport at Speke. Midland and Scottish Air Ferries Ltd., for instance, operate a twice-daily service to Blackpool, the scheduled time averaging between 15 minutes and 20 minutes. Another service operated by the same company in conjunction with the K.L.M. or Royal Dutch Air Lines is between Liverpool and Hull. This service enables a traveller to leave Liverpool at about noon, and arrive at Amsterdam at 3.40 p.m., or at Malmo in Sweden at 7.15 p.m., on the same day. A service between Liverpool and Plymouth, operated by Railway Services Ltd., makes it possible to travel between these cities in 3 hr. 10 min., whereas by rail 8 hr. are occupied. The service is flown twice a day in each direction, and calls are made at Birmingham, Cardiff and Teignmouth.

Blackpool and West Coast Air Services Ltd., operate a service between Liverpool, Blackpool and the Isle of Man. The journey from the Liverpool Airport at Speke to Squire's Gate Aerodrome at Blackpool is completed in 20 minutes, and the Isle of Man is reached in 1 hr. 25 min. after leaving Liverpool. The service is flown twice a day in both directions. At present the Isle of Man service is operated with a twin-engined eight-seater machine of the D.H. "Dragon" type, and two four-seater D.H. "Fox Moths" are used between Liverpool and Blackpool.

From Renfrew, the airport of Glasgow, Midland and Scottish Air Ferries Ltd., operate a twice-daily service to Campbeltown, on the peninsula of Kintyre, and Belfast. This journey occupies about two hours' flying time, and the centre of Belfast is reached in a little more than $2\frac{1}{2}$ hr. after leaving Glasgow. Another service from Glasgow is to Campbeltown and Islay, one of the islands in the Inner Hebrides. This takes $1\frac{3}{4}$ hr., and is operated three times a week. It is hoped shortly to open up a route as far as Stornoway in the Isle of Lewis, the most northerly isle of the Outer Hebrides, and if this is done calls will be made at various ports on the way.

An important feature of the work of Midland and Scottish Air Ferries Ltd., from the Glasgow airport is the carrying out of special charters to various ports in the western islands of Scotland, many of these charters being for the purpose of bringing ambulance cases to the mainland. These flights are a great boon to the inhabitants of the Outer Hebrides, as they bring them within a few hours of the hospitals of Glasgow, whereas by train, road and boat at least two days would be taken. Sometimes ambulance cases are carried by air to the mainland during storms that delay the boats for some days.

Other short internal services are in operation, but details of these have not been forthcoming, and therefore we are unable to give any description of them.

With the increase in the number of aerodromes available in this country, more internal air services will become possible. For instance, it is almost certain that the Midland and Scottish Air Ferries Ltd. service from Glasgow to Campbeltown and Belfast will be extended to Dublin, Waterford, Cork and Limerick, while at Dublin connection will be made with a service to Holyhead, Llandudno and Liverpool. Birmingham will become a great air centre with services radiating to Liverpool, various parts of Wales, and Bristol, Southampton, Brighton, Southend, London, Felixstowe, Yarmouth and Hull, among other places.

Municipal authorities are taking great interest in the development of airports, and many of them have either built aerodromes or reserved suitable sites. As previously mentioned, most aerodromes at present are far from the centres of the cities. This difficulty will probably be overcome eventually by using machines of the "Autogiro" type. When these have been fully developed, aerodromes will be built on the roofs of railway stations and passengers will be carried right into town by air.

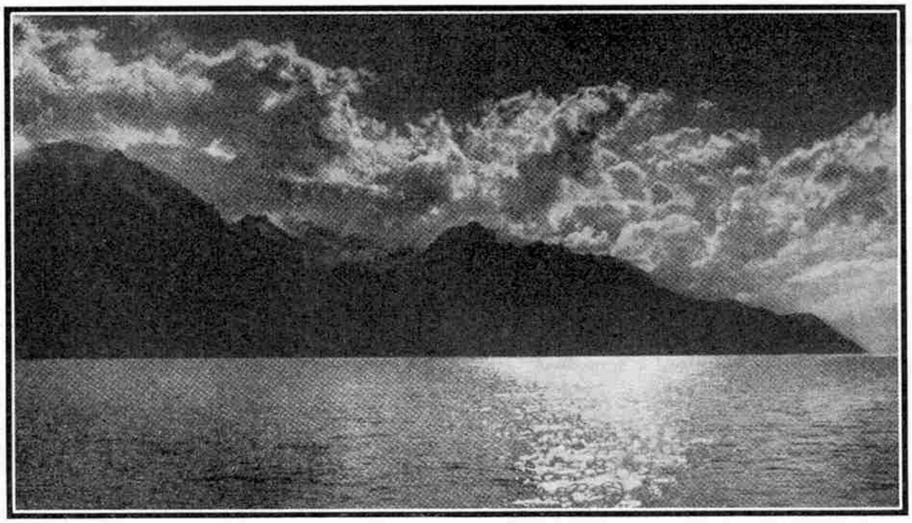
This map shows the most important British internal air services now operating. The dotted line from Islay to Stornoway shows the probable course of a service that Midland and Scottish Air Ferries Ltd. hope to inaugurate soon.

Rainfall and How it is Measured

Some Interesting Facts and Figures

By W. Coles Finch, M.Inst.C.E.

RAINWATER, even when collected at a distance of 25 miles from a town, contains a considerable amount of impurities that it has gathered from the atmosphere, and is unfitted in its natural state for human consumption. Half a pint of rainwater often condenses out of about 3,373 cu. ft. of air, and this is the quantity of air that a man breathes in eight days. Thus, in drinking a tumbler full of such water that has washed a dirty atmosphere, we swallow an amount of impurities that would only gain access to our system by breathing in eight days. In falling through the air near towns, rain dissolves sulphurous acid gas and ammonia. It also becomes charged with carbonic acid gas, so that it is enabled to absorb and hold in solution the carbonate of lime that it meets in its passage. It is thus greatly increased in "hardness," but is freed from other impurities in the process.



Celestial and terrestrial waters. Photograph reproduced by courtesy of Mrs. Aubrey le Blond.

Water falling in the form of snow becomes even more contaminated. The apparently pure, starry crystals, many hundreds of which go to form a snowflake, present a larger surface to the atmosphere, and this enables the flake to gather up a proportionately larger amount of impurities, to be brought to earth wrapped in its seemingly spotless mantle of whiteness.

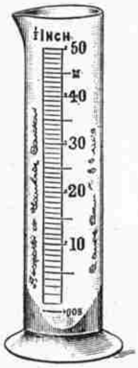
The amount of water that falls in the form of snow varies according to its condition. If the temperature is low and the flakes are light and feathery, some 11 in. in depth of the snow as it lies on the ground will equal only 1 in. of rainfall. If the snow is of the more dense kind, almost at the point of melting, it will lie closer on the ground, and then some 7 in. to 9 in. of it will yield the equivalent in water of 1 in. of rain.

Let us now consider what an inch of rainfall represents. Simple arithmetic tells us that, as one cubic inch of water weighs 252.458 grains, an inch of rain falling over an acre of land weighs 101 tons, and measures 22,624 gallons, or 3,630 cu. ft. A fall of 1 in. of rain over a square mile would provide nearly 40,000 gallons per day for a whole year.

It is principally to the rain and snow that falls in the cold, dull autumn and winter months that we look for the replenishing of our stores of water, for at this period of the year the loss through evaporation and vegetation is at its lowest point. Nearly all the summer fall is lost by these means. It will at once be apparent how necessary it is that, as the winter months pass by, the water engineer should mark and measure the rainfall daily, and compare it with the averages taken over a period of many years. The yield the rainfall produces, and the demand likely to be made upon it, are of vital importance to the engineer and to the community who look to him to safeguard the supply and ensure that there is no deficiency when the hot dry days of summer make heavy calls upon it.

It is difficult to give particulars of general interest in regard to the amount of rain falling in one year to the readers of a paper with such a wide circulation as the "*M.M.*," because the amount varies very considerably, from causes too numerous and abstruse to be detailed here. In England, the fall for London may be taken as 25 in.; at The Stye in Cumberland it is 171 in. In Wales, Snowdon has 176 in. and Rhyl 22 in. In Scotland, Glenquoich has 114 in. and Leith 22 in. In Ireland, the Gap of Dunlow registers 93 in. and Athlone 22 in. Going farther afield, we find at Cherra Punji, Assam, a fall of 610 in. Here in 1861 the fall amounted to 805 in., and on 12th June, 1876, no less than 40 in. fell in 24 hours. Even the word "torrential" fails to convey any idea of the nature of this downpour. The amount of rain and snow falling on the surface of the globe in one year would be sufficient to fill a lake 200,000 square miles in area—the size of France—and a mile deep.

This brings us naturally to the method by which rainfall is measured. For this purpose an instrument known as a rain gauge is used. The ideal rain gauge must collect only the water that falls upon the area of its own exposed surface or funnel, and must prevent any loss by "outsplashing," or by evaporation. These requirements are fulfilled in the simple and generally adopted form of instrument known as the "Snowdon" rain gauge. Fig. 1 shows both the gauge and the manner in which it is partly buried in the ground, the top being about one foot above the surface. With any less height there might be, on a hard surface, an "insplashing" of rain. A greater height would expose the gauge to wind eddies that would carry away the smaller drops that should



A rain gauge measure.

fall in the gauge. It is found that there is a loss of one per cent. for every foot the gauge is fixed above the ground. Some benefit also results from the sinking of the gauge into the ground, from the natural warmth of the earth in contact with the gauge.

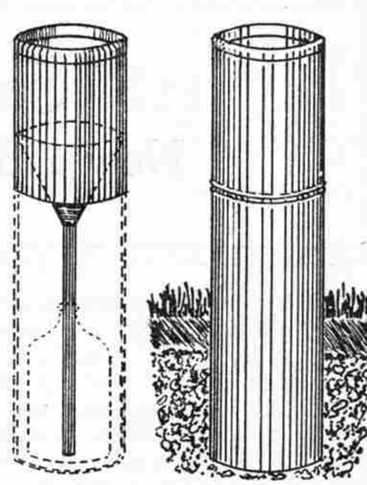
Fig. 2 shows the method of construction of the gauge. The upper section consists of a vertical copper cylinder, to the top of which is soldered an accurately turned brass ring 5 in. in diameter. Attached to this upper section is a copper funnel, securely brazed into it, the copper tube from which passes direct to the receiving bottle, conducting the water nearly to the bottom of it and thus preventing evaporation. This arrangement, with the further protection offered by the outer copper container, prevents the circulation of air in the gauge, and accurate results are thus obtained.

The measuring glass used with the 5 in. gauge is a tested and guaranteed tube, clearly defining each hundredth of an inch. In reading the measurement in the tube one notices that there is no single, definitely defined line showing the true surface level of the water in the tube, but a blurred double line. This effect is caused by capillary attraction of the tube, which raises the surface of the water in contact higher than the actual level. Hence it is safer to read the bottom line, and then any error will be of little importance. Thus the maker of the instrument relieves the observer of practically all worries in the way of calculations, and so far as rain is concerned, the measuring is reduced to a simple mechanical act.

In the case of snow some difficulties arise. With light falls, when the atmosphere is quiet, and the funnel is not full to the point of having lost some of the flakes, there is nothing to do but to bring the funnel and the containing bottle indoors, place it before a fire until the snow melts, then measure, record, and replace the gauge. If the fall is still in progress and there is no time to spare, a measured quantity of hot water is poured into the funnel, and the end of the tube is blocked with the finger until all is melted. Then the finger is removed and the water run off into the containing bottle. The added water is then extracted, and the remainder measured. With a heavy fall in boisterous weather, absolute accuracy is almost impossible. Flakes may fall into and blow out of the gauge, or the first fall may choke the funnel so that a great portion of the remaining fall will be unable to enter the gauge, and will thus be lost.


The observer and the rain gauge.

Reference to the catalogues of the principal scientific instrument makers will reveal beautiful, complicated and expensive instruments, some to melt the snow as it falls, others for use in positions such as on mountain heights, where the gauge is visited only at long intervals. Still others not only measure but record the reading on a revolving drum; while there is also an instrument that transmits the result to a distant station by means of an electric current.


Exterior and sectional views of "Snowdon" rain gauge.

The readings are generally taken each morning at 9 o'clock and, as an observer of over 30 years' standing, the writer can vouch for the interest one finds in the self-imposed task of becoming a member of the British Rainfall Organisation.

A fall of rain or snow is one of Nature's most interesting miracles, and an investigation of this phenomenon is rewarded by many fascinating and wonderful discoveries. In the first place, the rain that ministers to our wants has been drawn in the form of vapour from many sources, ranging from the surface of vast areas of snow and ice, to the surface of tropical seas, rivers, lakes and forests where evaporation is greatest. The moisture from these many sources ascends as water vapour and rises to great heights. The cooler temperature of the upper atmosphere causes the vapour to begin to condense, and eventually the moisture becomes visible to us as cloud, a middle stage between vapour and rain.

The minute globules of water that compose cloud are at first only about one three-thousandth of an inch in diameter, but as condensation increases the particles grow in size, as the result of the adhesion of other coatings of moisture. The larger particles sink down and absorb smaller particles, growing in size until they may be from one-twentieth to one-tenth of an inch in diameter. Finally the particles become too heavy to remain suspended in the atmosphere, and they fall to earth as rain, snow, or ice.

We may also recall the fact that water cannot be destroyed, no matter what purpose it may serve when it falls to earth, nor how long it may remain there before it is once more drawn up into the atmosphere. The molecules of water returned to the atmosphere may have been locked for ages in solid form in iceberg or mountain glacier, or built into the structure of some fruit or flower in our garden, or may have been used to quench our thirst. In any case the cycle of operations goes on, the water reverting to vapour, and from this back to cloud, giving us wonderful cloud pictures which, in addition to being things of beauty, are also evidence that the water is again about to perform some service for the creatures of the earth.

"Cock o' the North"

New 2-8-2 Express Locomotive for L.N.E.R.

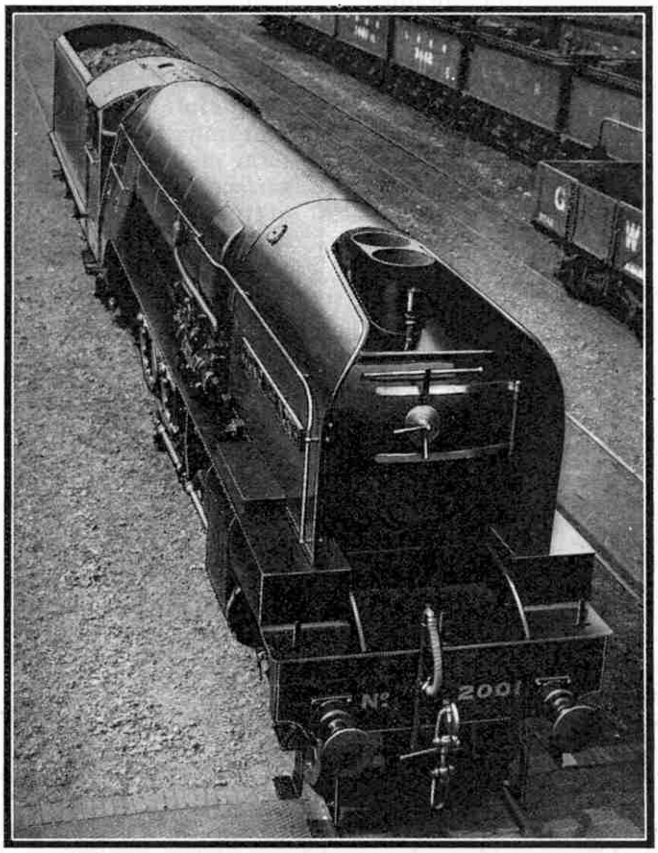
By "Observer"

THE advent of the first of Mr. H. N. Gresley's 2–8–2 "Mikado" express passenger engines for the L.N.E.R. will probably prove to be the most outstanding event of the year 1934 in British locomotive history, although possibly when Mr. W. A. Stanier's turbine-driven engine of the 4–6–2 class appears on the L.M.S.R., a rival claim to that distinction may arise. Certainly in the new L.N.E.R. engine British locomotive practice makes a decided advance.

When the news went round last year that Mr. Gresley was building an express locomotive with the 2–8–2 wheel arrangement, something exceptionally big and powerful was anticipated, and now that the engine has been completed and sent out from the works at Doncaster—bearing the number 2001 and the name "*Cock o' the North*"—it can be said with confidence that expectations have been more than fulfilled. Mr. Gresley, whose designs in the past have been remarkably successful, has undoubtedly scored again, and produced an engine that may be trusted to do all that is required of it—and more—when it is set to haul the heavy East Coast expresses over the steeply-graded lines between Edinburgh and Aberdeen, for which service it has been specially built.

In its dimensions the new locomotive approximates to the utmost limit that the British loading gauge will permit, and its tractive effort, computed on the usual formula at 85 per cent. boiler pressure, amounts to 43,462 lb. How great is the advance made will be realised when it is recalled that 10 years ago it could be claimed that the G.W.R. "*Caerphilly Castle,*" with a tractive effort of 31,625 lb., was the most powerful passenger locomotive in the British Isles. Since that time successive increases have been registered until both in the "Kings" of the G.W.R. and the 4–6–2 class of the L.M.S.R., a tractive effort of 40,300 has been reached. Yet compared with these locomotives "*Cock o' the North*" makes a further considerable advance.

In comparison with Mr. Gresley's "Pacifics," too, it shows a large increase, for their tractive effort is 32,909 lb. in the case of those fitted with 19 in. cylinders, and 36,465 lb. in those having 20 in. cylinders. It may be added that the increase is by no means merely theoretical, but is really effective, seeing that a boiler of very ample proportions has been provided. The barrel of the boiler is standard with that used on the L.N.E.R. "Pacific" type engines, but the fire-box has been lengthened to provide a grate area of 50 sq. ft. The total heating surface amounts to 3,349.5 sq. ft. The working pressure is 220 lb. per sq. in. Each of the three cylinders is of 21 in. diameter and 26 in. stroke, and all drive on to the second coupled axle. The eight coupled driving wheels are 6 ft. 2 in. in diameter.

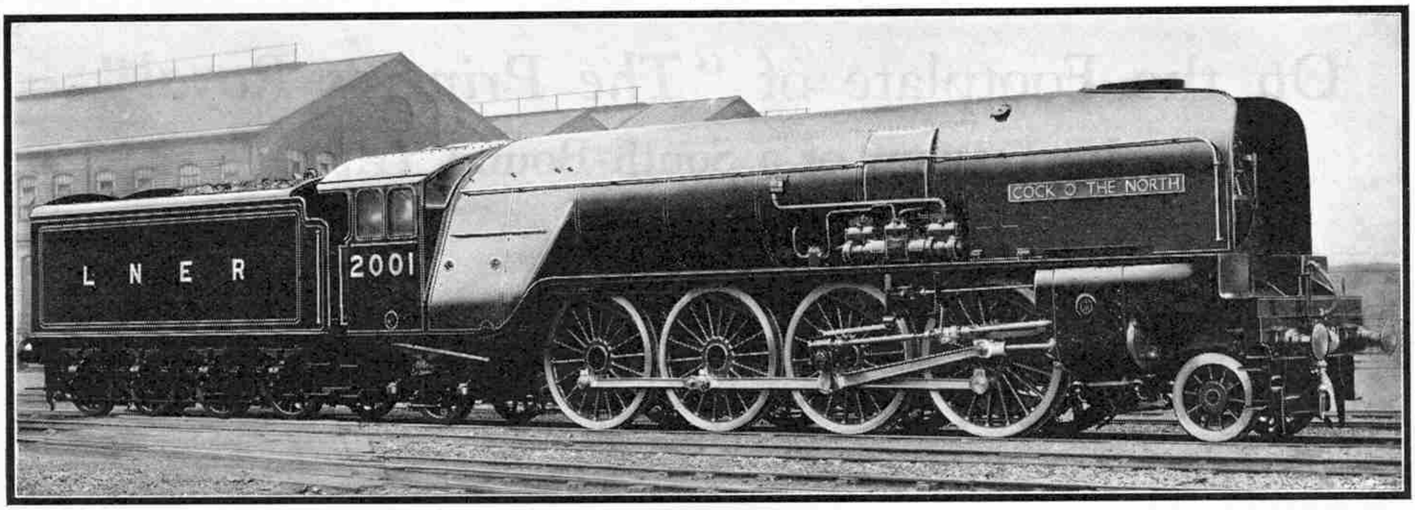


An interesting photograph of the new L.N.E.R. 2-8-2 express locomotive "Cock o' the North." This shows the arrangement of the smoke-deflecting front end and the double chimney. The illustrations to this article are reproduced by courtesy of the L.N.E.R.

Although it is so huge, No. 2001 is handsome and imposing, for Mr. Gresley has been at pains to secure neatness in its details and symmetry in its outline. It is, indeed, the most effectively streamlined locomotive so far built in Great Britain. The appearance of the engine, with its straight top line running right through from the smoke-box to the back of the cab, unbroken by the usual chimney, dome, safety valves, whistle and cab roof, is indicative of the care that has been taken to secure a design that would reduce wind resistance and avoid setting up eddy currents that would mar the efficiency of the smoke-lifting arrangements of the smoke-box sides and top.

I was privileged to attend a "private view" of the new locomotive at King's Cross Station on Friday, 1st June, and I availed myself of the opportunity to scrutinise every detail as closely as I could. I walked round the mighty engine and viewed it from every angle; I climbed on to the footplate and observed the convenience of the controls and other arrangements there; I sat in turn on the driver's and the fireman's leather-covered seats and noted the clear outlook afforded by the large windows on the sloping cab front; and as a result of my long and thorough inspection I was moved to enthusiastic admiration of the magnificent engine that Mr. Gresley and his able staff in the drawing office and works have produced.

Mr. Gresley was present at King's Cross and displayed a justifiable pride in his latest creation. He showed himself very genial and ready to impart information. I



had not noted the position of the whistle, and when I asked him where it was he at once pointed it out on the smoke-box in front of the chimney, and then had it sounded that I might hear its deep and musical note.

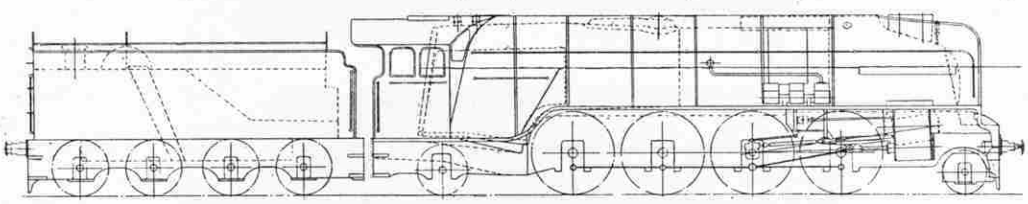
Another point about which I was curious was the manner in which the exhaust steam was divided between the two chimneys. Did the two outside cylinders exhaust into one chimney and the inside cylinder into the other? Or was there some device by which the puffs were made to alternate between the two chimneys? Mr. Gresley enlightened me and, making a rough drawing, showed that the exhaust steam from all three cylinders passes first into a common chamber and single pipe that afterwards divides into two, one going into each chimney. The principal benefits secured by this use of two chimneys are that larger exhaust passages can be used, and that the steam finally escapes through two blast pipes, each having a diameter of $5\frac{3}{16}$ in., thus reducing back-pressure and producing a uniform action on the fire.

In the "*M.M.*" for December last, in a paragraph announcing the building of this new 2–8–2 locomotive for the L.N.E.R., it was stated that the design had been influenced by the remarkably successful performances of some of the modern French eight-coupled locomotives. Mr. Gresley indeed has followed recent French practice and performance very closely, and he frankly admits his indebtedness to French locomotive engineers. The fitting of the double chimney is one of the chief features in which he has followed them, and another is in the use of rotary cam-operated poppet valves in place of the usual piston valves with Walschaerts gear. The poppet valves and gear fitted to No. 2001 are of the most improved type, and are remarkable in that they allow an infinitely variable cut-off.

Another feature that is used on Continental engines, but has been used only to a limited extent in England, is the provision of a feed-water heater of the A.C.F.I. type. In this arrangement the feed water from the tender is pumped into a chamber, placed under the lagging above the boiler at the forward end, in which the cold water mingles with a portion of the exhaust steam that is by-passed for this purpose. The temperature of the water is thereby raised to some 220°F., the heated water being then pumped into the boiler.

On the top of the barrel of the boiler is a steam collector that is integral with the dome and formed of a steel pressing riveted to the top of the boiler on the outside. Steam is admitted to the collector by means of a number of slots in the top of the boiler barrel. By this means steam is collected at the greatest height above water level and, owing to the large area through which the steam is taken, no water is carried over into the regulator.

The superheater also is of a new type, known as the Sine Wave from the shape of the element tubes; it has 43 elements, giving an exceptionally large superheating area, the object being to obtain a very high degree of superheat.



The photograph at the top of this page gives a general view of the locomotive, and shows how the boiler and fire-box casing is formed to present a continuous surface as far as possible, unbroken by the usual projections. The lower illustration shows a side elevation of the engine and tender in section.

The three cylinders and 12 valve boxes are cast in one piece. This monoblock, which weighs nearly 7 tons, was cast in the company's foundry at Gorton.

The tender is of the same design as that fitted to the latest "Pacific" type locomotives, and carries 8 tons of coal and 5,000 gallons of water. The tender tanks are electrically welded throughout, and by this means a saving of $2\frac{1}{2}$ tons in weight has been effected as compared with a similar tender built up in the usual manner with riveted joints.

The total weight of the engine in working order is 110 tons 5 cwt., of which 80 tons 12 cwt. are carried by the coupled wheels. Together with the loaded tender, the total weight is 165 tons 11 cwt. The length of the engine is 47 ft. $6\frac{1}{2}$ in., the coupled wheelbase being 19 ft. 6 in. The third pair of coupled wheels are fitted with thinner flanges to give a little play in rounding curves. The total length of engine and tender over buffers is 73 ft. $8\frac{3}{8}$ in.

In the trials so far made the new engine has behaved splendidly, steaming freely, running easily, accelerating rapidly, and cruising for considerable periods at 75 m.p.h.

The second engine of the class will be fitted with piston valves and Walschaerts gear to enable comparative tests to be made. At the time of writing the frames of this engine had not been laid down.

On the Footplate of "The Princess Royal"

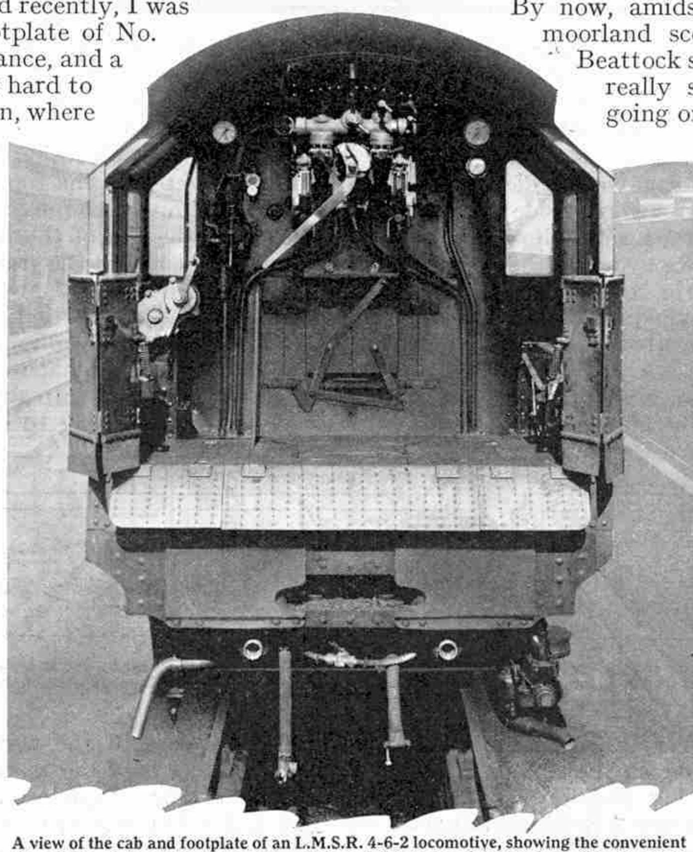
Impressions of a South-Bound Trip

By a Railway Engineer

THE regular daily duty of the two L.M.S.R. 4-6-2 locomotives, that of hauling "*The Royal Scot*" express throughout between London and Glasgow, is without much doubt the hardest continuous engine run that has yet been attempted in this country. These remarkable engines are doing the job with the greatest of ease, however, as the trip described here shows.

Coming south from Scotland recently, I was privileged to ride on the footplate of No. 6200 for nearly the whole distance, and a finer performance it would be hard to imagine. It was at Symington, where the Glasgow and Edinburgh portions are combined, that I joined the train. The Edinburgh part arrived first, in charge of a Caledonian 4-4-0 of the Pickersgill type. Not so many years ago this type were hauling the principal expresses on the Caledonian, and yet what small engines they seem now!

A few minutes later, in came "*The Princess Royal*" with the Glasgow portion, and I joined Driver W. Harrison and Fireman David Hill on the footplate. The cab is beautifully laid out. When the engine was being designed, a wooden model was made and all the various fittings were tried out beforehand so as to get the very best arrangement. In common with the practice of the old L. & N.W. and Caledonian Railways, the engine is driven from the left-hand side, so I was given the right-hand seat in the cab, from which there is a splendid look out ahead, in spite of the gigantic boiler and fire-box.



A view of the cab and footplate of an L.M.S.R. 4-6-2 locomotive, showing the convenient disposition of the various controls. This and the upper photograph on the next page are reproduced by courtesy of the L.M.S.R.

By now the Edinburgh portion was coupled on in rear and our total load was one of 15 coaches, 465 tons empty and 500 tons with passengers and luggage. On the stroke of time, 10.55 a.m., we got the "right away," and the great engine was soon into her stride. Two miles from the start the driver had "notched up" to such a degree that steam was being cut off in the cylinders as early as 15 per cent. of the stroke. In full forward gear these engines cut off at 75 per cent., so that she was being run very easily indeed.

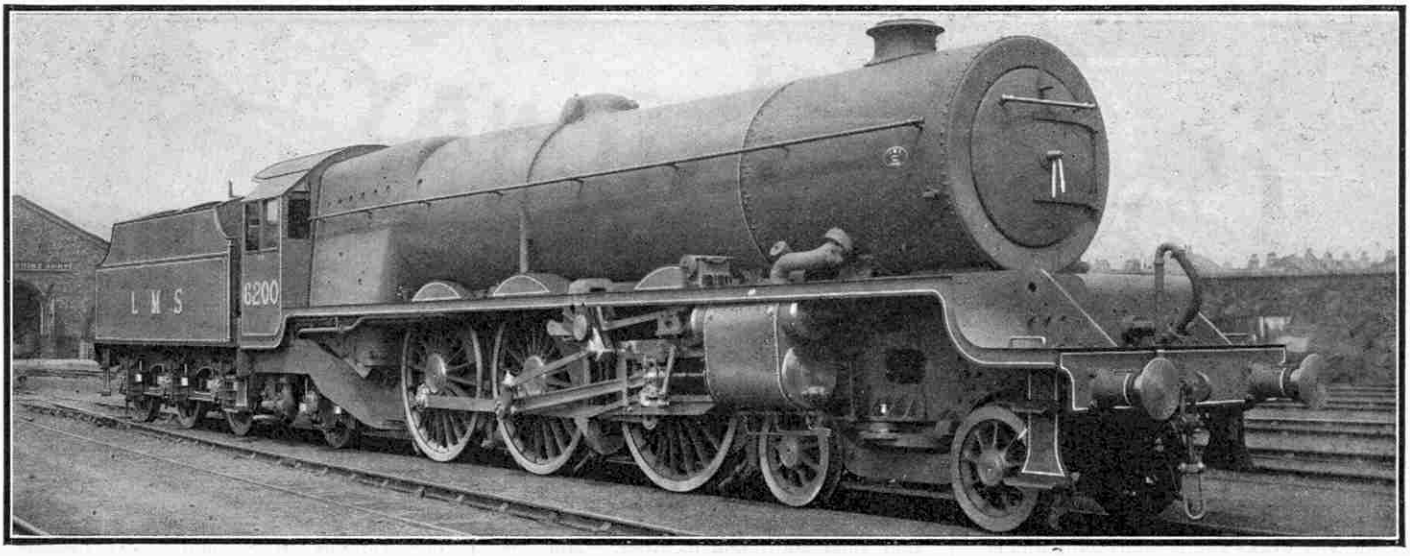
Speed rose rapidly. At Lamington viaduct, four miles from the start, we were doing 62 m.p.h. Now came the ascent to Beattock. On the steady rise past Abington and Crawford, where the gradient is 1 in 240, some really marvellous climbing was done. With the regulator full open, and only 20 per cent. cut off, the engine sustained 55 m.p.h. She was developing 2,650 h.p., and yet it was done so easily that I could hardly hear the exhaust even from the footplate. There was absolutely no sense of effort in spite of the work being done.

By now, amidst the wildest mountain and moorland scenery, we were approaching Beattock summit. The last 2½ miles are really steep, at 1 in 99; yet still going on 20 per cent. cut off we came over the summit at 35 m.p.h. The whole ascent of 13½ miles from Lamington had been climbed at an average speed of 52½ m.p.h., and we passed the summit, 17¼ miles from the start, in exactly 21 minutes—a minute early already!

The remaining 49¾ miles down to Carlisle were run under very easy steam. The highest speed reached was 70 m.p.h., and in spite of a check for permanent way repairs through Ecclefechan, we arrived half a minute early, having run the 67 miles from Symington in 70½ minutes.

At Carlisle, drivers and firemen are changed, and on this occasion the Glasgow men were relieved by Driver L. A. Earl and Fireman J. Lubnow of Camden shed. In the five minutes that we stood at Carlisle a great crowd gathered on the platform end to watch "*The Princess Royal*" start away. The engine was indeed the object of deep interest all along the route. Railwaymen of all grades paused in their duties to watch her pass, and we were "snapped" at a dozen different places by enthusiastic amateur photographers.

Now we set off on what is the longest non-stop run in the world, made all the year round, from Carlisle to Euston, 299¼ miles. The booked time of 334 minutes demands an average speed of nearly 54 m.p.h. Hard climbing begins at once, and continues almost without a break to Shap summit, 915 ft. above sea level. Once the train was well on the move, the cut off was brought back to 25 per cent., and remained so unchanged right up to Shap. Starting steeply with nearly five miles at 1 in 131, the gradients gradually become easier until



there is a welcome "breathing space," a level stretch of nearly three miles past Penrith. Here we got up to no less than 65 m.p.h.

As we swept round the S-curve, through Penrith and over Eamont Junction, there was just time for a delightful passing glimpse of the mountains grouped round the head of Ullswater, and then we came on to the worst part of the ascent. From the Lowther viaduct there are nearly nine miles, continuously, up at 1 in 125, and on this length speed fell to a minimum of 30 m.p.h., a notable figure under such easy working conditions. We had taken 28¼ minutes to pass Penrith, 17¾ miles from Carlisle, and we passed Shap summit, 31½ miles, in a shade under 49 minutes—exactly on time.

The upper photograph shows L.M.S.R. 4-6-2 locomotive No. 6200, "The Princess Royal." In the lower illustration is shown the second engine of this class to be constructed, No. 6201, "Princess Elizabeth," photographed on arrival at Euston. It bears the semaphore route indicator used on certain Scottish sections of the L.M.S.R.

No exceptionally high speeds were run on the long descent to Carnforth. Most of the way we were running at about 70 m.p.h., and the absolute maximum was 74. At this speed it was remarkable how smoothly the engine rode. There was no vibration, and even when passing round the numerous reverse curves that abound on this part of the route there was only the merest suspicion of a roll. One is always accustomed to a certain amount of bumping and hard riding on the footplate, but this engine rode almost as smoothly and as comfortably as a carriage.

A bad slack to 28 m.p.h. for permanent way repairs just below Milnthorpe caused some loss of time, but Carnforth, 63 miles, was passed in 81¼ minutes, and we got through Lancaster, 69 miles, in 87¾ minutes. Then, after mounting the steep mile at 1 in 98 beyond the last-named station at a minimum of 40 m.p.h., there came a magnificent speed exhibition on the level stretch to Preston. With the regulator full open and on 20 per cent. cut off, the engine worked up to a sustained 73½ m.p.h. The horse power being developed was nearly 3,000, and yet the impression on the footplate was one of effortless ease. It was perhaps the most striking part of the whole journey.

Approaching Preston we sighted signals at danger, but we were not seriously delayed, and passed that station, 90 miles from Carlisle, in 109¼ minutes, or about 105¾ minutes net, at the usual slow speed of about 15 m.p.h.

Up the steep rise out of the Ribble valley, 25 per cent. cut off was used at first, but at Euxton Junction Earl went back to 20 again. This easy working took us up the steep three miles to Coppull summit, where the gradient averages about 1 in 125, at the fine minimum speed of 43 m.p.h. Adverse signals checked us again on the descent to Wigan, but the engine recovered very quickly to make a lively sprint at 72 past the Vulcan Foundry Works at Newton-le-Willows. A careful slowing through Warrington followed, and then, up the gently rising grades across the Cheshire plain, a steady average of a mile a minute was maintained.

By now we were approaching Crewe and nearly half way to London. Earl eased up well before reaching the station, and we all took the opportunity of some "half-time" refreshment. With speed (Continued on page 552)

L.N.E.R. "Mikado" Express Locomotive

The first of the new three-cylinder 2–8–2 "Mikado" express locomotives has recently been completed at the Doncaster works and is undergoing numerous tests. It is numbered 2001 and has been given the name "*Cock o' the North.*" The driving wheels are 6 ft. 2 in. in diameter and each of the three cylinders has a diameter of 21 in. and a stroke of 26 in. The huge boiler has a heating surface of 3,349½ sq. ft. and the grate area amounts to 50 sq. ft. Six of the class are on order and they have been specially designed by Mr. H. N. Gresley for working the heavy expresses on the steeply graded sections of the L.N.E.R. between Aberdeen, Edinburgh and Carlisle. The new engine is fully described and illustrated in a special article on page 546 of this month's "*M.M.*"

The North British "Atlantic," No. 9903, was already called "*Cock o' the North,*" but has now been given instead the name "*Aberdonian,*" formerly carried by another "Atlantic," No. 9868, recently withdrawn for scrapping.

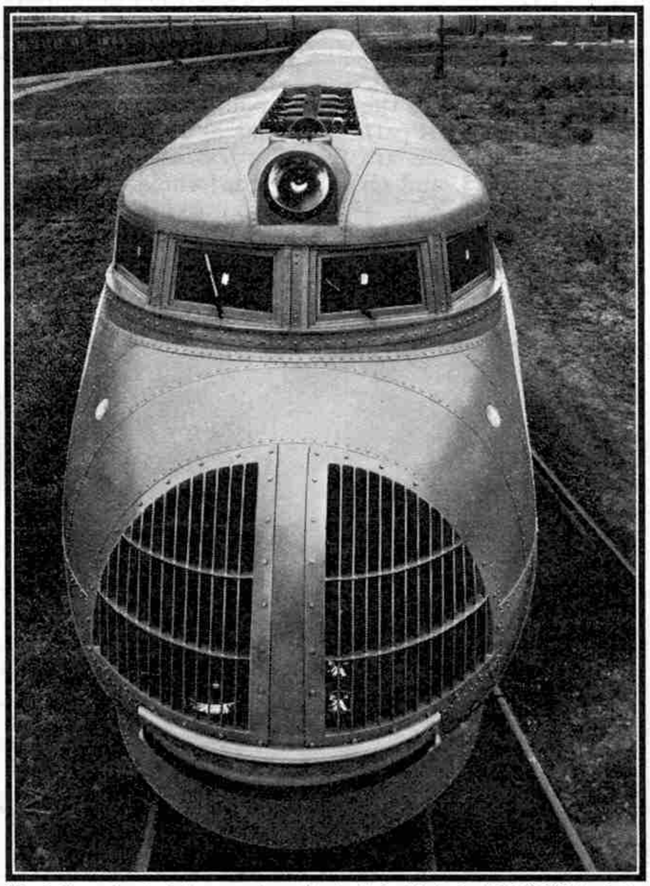
The new series of eight 2–8–0 freight locomotives of the "0.2" class are all out and at work on the heavy traffic between Whitemoor and Temple Mills. They are numbered 2430 to 2437. Work is now proceeding at Doncaster on nine new standard 4–6–2 "Pacific" express engines, while at Darlington further 4–4–0 engines of the "Shire" or "Hunt" class are building.

Average Age of Railway Engines

A census of railway engines of the Canadian National Railways shows that the combined ages of the 3,031 locomotives in operation give a total of 58,403 years. The average age is 19 years, and the greatest 52 years. Although engines are scrapped continually, and the railway boasts many monster locomotives of the latest type designed by its own engineers, experience has shown that there is certain work to be performed on every railway for which engines of the older types are better suited than those of modern design. This is particularly the case on remote lines and in yards and premises where constructional limits and weight restrictions prevent the use of modern engines.

Caravan Coaches on the L.M.S.R.

Following on the camping coaches of the L.N.E.R. and G.W.R., the L.M.S.R. have introduced a number of caravan coaches that offer additional facilities. Some of the older bogie corridor coaches have been used and the connection between the compartments, given by the corridor, is a distinct advantage. In addition to a large living room, luggage compartment and a well-equipped kitchen, three sleeping compartments are provided, each containing two single beds. The caravans are available at a reasonable charge per week and are situated at rural stations in the Lake District, Derbyshire dales, Yorkshire moors, North and Central Wales, and other attractive centres on the L.M.S.R. These should prove extremely popular.



The bulbous front of the new streamlined oil electric train "M.10,000" of the Union Pacific Railroad. A description of this train and of another streamlined train, the "Zephyr" of the Chicago, Burlington and Quincy Railroad, will appear next month. Photograph by courtesy of the Union Pacific Railroad.

"Southern" Electrification Extension

A first stage in the Southern Railway's electrification extension to Sevenoaks has been opened and electric trains are now running to St. Mary Cray instead of only to Bickley as before. In view of the rapid development of housing at St. Mary Cray and the popularity of the new lagoon swimming pool there, the S.R. have pressed forward the electrification of this section.

Record Run in Ireland

A non-stop run that constitutes a record for Irish railways was made recently on the Great Southern Railways when a special train consisting of three bogie coaches, weighing 95 tons, covered the distance of 165.3 miles from Cork to Dublin in 147 min., the average speed being 67.5 m.p.h. Near Maryborough a maximum speed of over 85 m.p.h. was reached. The locomotive responsible for this splendid run was No. 402, a 2-cylinder 4–6–0.

Repairing L.M.S.R. Viaduct by Arc Welding

After two years' work, necessitating the use of 140 tons of new steelwork, 22,000 linear feet of electric welding and 66,400 welding electrodes, repairs have been completed to the great Sharnbrook Viaduct carrying the main line of the L.M.S.R. over the River Ouse at Sharnbrook, near Bedford.

The viaduct, which was constructed in 1881, consists of 10 spans with a total length of 572 feet, and carries the two passenger tracks of the main line from St. Pancras to the Midlands and the North. Alongside it is another viaduct of nine spans carrying the goods train tracks, and the electric arc-welding methods used in the repair of the passenger viaduct have proved so successful that the goods viaduct is to be similarly repaired in the near future.

The repairs to the passenger viaduct consisted principally of providing a new steel floor and generally strengthening the wrought iron superstructure against the wear and tear caused by the passage over it of express trains travelling at high speeds. They were carried on with very little interference to railway traffic, and a full account of the interesting methods employed will be given in an article to be included in an early issue of the "*M.M.*"

Summer Train Services

British summer train services come into operation on the 9th of this month, a week earlier than usual, and will continue until 30th September, three weeks later than last year. An outstanding feature on all the lines is the great increase in express services at week-ends as a result of the unrestricted travel afforded by the popular "summer tickets."

The new timetable of the L.N.E.R. will include 400 accelerated trains shewing a total daily saving of 2,191 minutes as compared with the summer service of last year. The principal accelerations will be in the expresses to and from the Yorkshire and Lincolnshire coast resorts and in Scotland. "*The Flying Scotsman*" will again run non-stop in each direction between London and Edinburgh, covering the 392.7 miles in 7½ hours.

On the G.W.R. the most notable among many accelerations is the retiming of the 10.8 a.m. express from Oxford, due at Paddington at 11.18 a.m. From 9th July it will leave at 10.10 a.m. and, for the 63½ miles from Oxford to Paddington, be allowed exactly one hour! No alteration is made in the timing of the "*Cheltenham Flyer*" which will continue at its 71.3 m.p.h. schedule and there will be 14 other expresses timed at 60 m.p.h. or over. Altogether the G.W.R. are introducing 900 new services for the summer.

Both the L.M.S.R. and the S.R. made important additions on 1st June, with the promise of yet fuller services on 9th July. Chief among the accelerations on the L.M.S.R. were the day services between England, Scotland and Ireland, via Stranraer - Larne. Through carriages for Stranraer now run on the 10.0 a.m. "*Royal Scot*" from Euston, the arrival at Belfast by this service being 9.50 p.m., 20 min. earlier than last summer. In North Ireland itself a new buffet car train the "*North Atlantic Express*" runs between Portrush and Belfast.

The S.R. have greatly augmented their services to and from Portsmouth and the Isle of Wight.

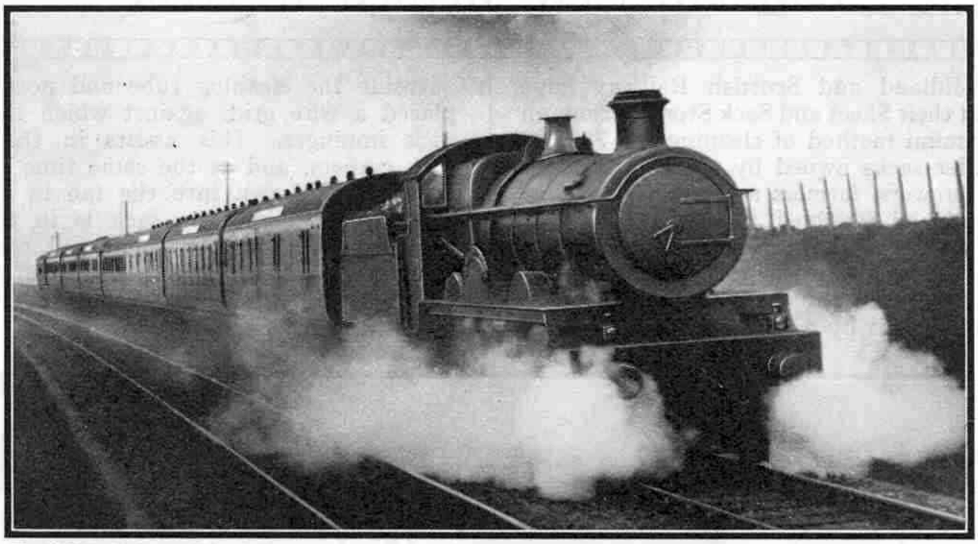
L.M.S.R. Locomotive News

Twelve of the new three-cylinder passenger tank engines have been completed at Derby works and are numbered 2500 to 2511. Several are working in the London area.

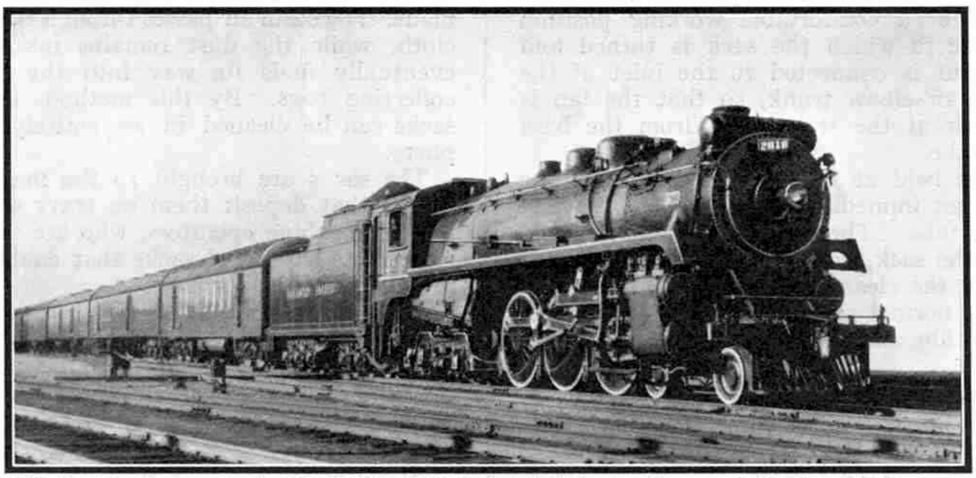
Trains on the short branch from Harrow to Stanmore are now being worked by engine No. 6408, a new 0–4–4 tank engine with a stove-pipe chimney. Loads are very light as the train usually consists of one eight-wheeled coach except during the morning and evening "rush" hours, when a second is added.

Although some 4–6–0 engines of the "Prince of Wales" class have been scrapped, others are being reconditioned, and among the latest to be rebuilt with standard Belpaire boilers are Nos. 25788 and 25883. Two more "Claughtons," Nos. 5956 and 5995, have been withdrawn.

The current L.M.S.R. timetable contains an additional booking at a speed of all but 60 m.p.h. The Birmingham express that leaves Euston at 4.35 p.m., 5 min. later than formerly, has had a minute deducted from its schedule between Euston and Blisworth, so that only 63 min. are allowed for the 62.8 miles, giving an average speed of 59.8 m.p.h.



The G.W.R. "Channel Islands Boat Express" near Radipole, Weymouth, with the two-cylinder 4-6-0 express locomotive No. 2937, "Clevedon Court," at its head. This train runs between Paddington and Weymouth in connection with steamers for the Channel Islands. Photograph by R. B. Grice, Weymouth.



"The Dominion," a famous train of the Canadian Pacific Railway, that runs from Vancouver to Toronto. It is here seen leaving Calgary, hauled by No. 2818, an engine of the 4-6-4 or "Hudson" type first developed extensively for tender engines by the New York Central Lines. Photograph by Mr. Hendry, of Vancouver, British Columbia.

S.R. "Baltic" Tanks to be Rebuilt

Another 4–4–0 engine of the "Schools" class has been turned out from the works at Eastleigh and is now in service. Its number is 925 and its name "*Cheltenham.*" Further "Schools" are in course of construction at Eastleigh and the only other new locomotives at present building for the "Southern" are some class "W" three-cylinder 2–6–4 goods tank engines that are on order at Ashford works.

Preparations are in hand for some interesting reconstructions and in a month or two hence the seven "Baltic" express passenger tank engines of the former L.B. & S.C.R. will be rebuilt with separate tenders. This decision is consequent on the forthcoming electrification to Eastbourne, when there will no longer be any suitable service for the "Baltic" class, owing to their limited water-tank capacity. When rebuilt with separate tenders they will be somewhat similar to the famous "King Arthur" class.

When rebuilt all the engines will have names. No. 2333 will continue to carry its present name "*Remembrance,*" commemorating railwaymen of the L.B.S.C.R. who fell in the Great War. No. 2329 will again be named "*Stephenson,*" as it was when first built. The other five will be named after famous locomotive engineers. No. 2327 will be called "*Trevithick,*" after the "father of the steam locomotive"; No. 2328 will be "*Hackworth,*" in memory of Timothy Hackworth, a pioneer who did much to establish the success of the locomotive; while Nos. 2330, 2331 and 2332 will be named "*Cudworth,*" "*Beattie*" and "*Stroudley*" respectively, after the distinguished locomotive engineers of the former companies now comprised in the "Southern." These engineers were James Cudworth of the S.E.R.; Joseph Beattie of the L.S.W.R.; and William Stroudley of the L.B.S.C.R. The two first named played prominent parts in the introduction of coal in place of coke as locomotive fuel, and Mr. Stroudley was a pioneer of locomotive standardisation.

Cleaning a Million Sacks a Year

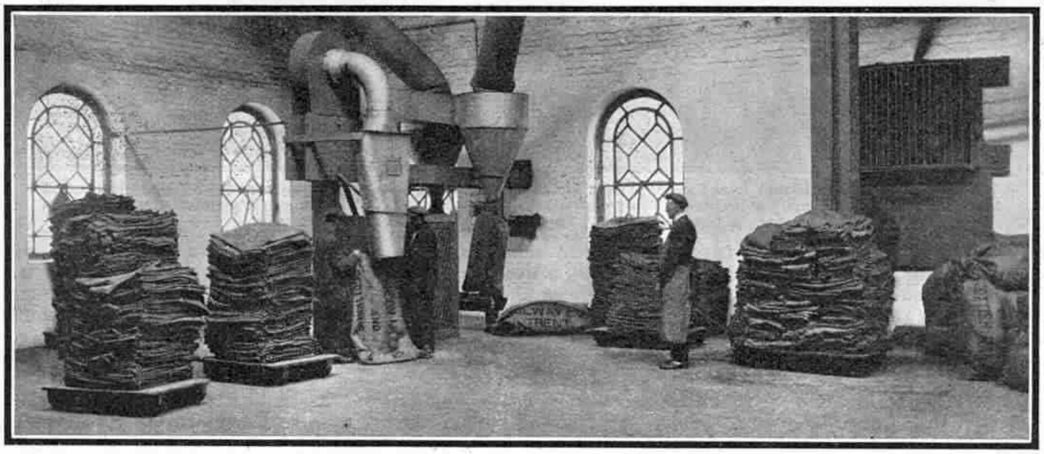
L.M.S.R. New Method at Trent

THE London Midland and Scottish Railway have introduced at their Sheet and Sack Stores, Trent, an electrical vacuum method of cleaning the 738,000 grain and provender sacks owned by the company for hiring to millers, brewers, farmers and others.

The previous method involved all the sacks being turned and shaken by hand, and the laborious nature of this task will be realised when it is stated that more than a million sacks are dealt with at Trent every year. The new process is carried out by a machine known as the "Eureka" (Herbst patent) sack cleaner, which not only cleans the sacks but also turns them automatically.

The necessary air current is produced by a fan which, when driven at a speed of approximately 2,000 r.p.m., creates an air displacement of about 3,000 cu. ft. of air per minute. The fan is mounted on a pillar at a sufficient height to permit of a comfortable working position of the actual tube in which the sack is turned and cleaned. The spout is connected to the inlet of the fan by means of an elbow trunk, so that the fan is actually pulling air at the stated rate from the base of the cleaning tube.

When a sack is held at the base of the tube, the strong current of air immediately takes hold of it and draws it into the tube. The operator retains his hold of the mouth of the sack, and thus the sack is sucked up inside-out. In the cleaning tube the sack assumes approximately its normal shape, but with its bottom at the top of the tube and its mouth still in the hands of the operator.



The electric vacuum sack cleaning process in operation at the L.M.S.R. Sheet and Sack Stores, Trent, where more than a million sacks are dealt with every year.

Inside the cleaning tube and near the top of it is placed a wire grid, against which the bottom of the sack impinges. This assists in the turning of the sack corners, and at the same time prevents the sack from being drawn into the fan in case the operator loses hold. While the sack is in the cleaning tube the air is searching through and round it, removing all dust and dirt. The sack is then pulled downward and out of the machine, and the operation is repeated to turn it to its original side out.

The outlet of the fan blows through a straight length of trunking into two cone-shaped cyclones that act as expansion chambers, the dirt falling into two collecting bags tied to the base of the cyclones. The air leaves the cyclones at the top by means of filter cloth tubes, and thus a final separation of dust from air is made. The clean air passes through the mesh of the filter cloth, while the dust remains inside the tubes and eventually finds its way into the cyclones and the collecting bags. By this method, for the first time, sacks can be cleaned in an entirely dust-free atmosphere.

The sac s are brought to the machine by elevated trucks that deposit them on trays or platforms ready for the machine operators, who are thus provided with an endless supply of sacks that enables them to clean more than 2,000 per day.

For our description of this interesting process, and for the accompanying illustration, we are indebted to Mr. W. K. Wallace, Chief Stores Superintendent, L.M.S.R.

On *"The Princess Royal"* —(*Con. from p. 549*)

reduced to 25 m.p.h. we passed Crewe in 167½ minutes from Carlisle, 141 miles. Up to now our average speed was 50½ m.p.h., but the worst part of the run was over. On the remainder of the journey we had to average nearly 57 m.p.h., but we were well on time and the engine was going splendidly. In readiness for Madeley bank cut off was advanced to 25 per cent., and the engine went up in great style. On the 1 in 177 grade we steadily maintained 44 m.p.h., but listening to her quiet, purposeful beat, I was conscious not so much of the great power being developed, but of the vastly greater power in reserve. What might she have done if given 30 or 35 per cent.?

At the top of the bank, back was brought the cut off to 20 per cent., and so it remained for the rest of the journey. We kept up a fine average right through the Midlands, covering the 75½ miles from Crewe to Rugby in 80½ minutes, inclusive of the usual severe slowing to 30 round the curve at Stafford, and a slack to 40 through the colliery district at Polesworth. The highest speed on this section was 74 m.p.h. at Hademore water troughs.

The engine had now been hard at work for over six hours and running non-stop for the last four hours; and yet, after Rugby, came the longest stretch of sustained high-speed running on the whole journey. The 73 miles from Welton to South Hampstead were covered in 65½ minutes, an average of 67 m.p.h. On this flying stretch speed twice rose to 77½, and the minimum rate on the six mile climb at 1 in 333 over the Chiltern Hills was 48 m.p.h. at Tring.

We came triumphantly through Willesden Junction five minutes early, and although we were checked by signal at Camden, we stopped in Euston 4½ minutes early in 329¾ minutes from Carlisle. It was a fitting climax to a magnificent run. Delays cost a total of 7½ minutes, so that the net time was only 322¼ minutes—nearly 12 minutes less than schedule. The net average speed was 55.7 m.p.h., while for 262 miles, from Shap summit to South Hampstead, the average was 60 m.p.h.

At the journey's end the engine was in first-rate order with all bearings beautifully cool. A word of congratulation is due to the enginemen, for throughout this long run she was driven and fired in most excellent fashion.

It was altogether a most impressive demonstration of the capabilities of Mr. Stanier's great engine. If she could make a superb run like this under such easy working conditions, the question naturally arises as to what electrifying feats she might perform if really "opened out"! An indication of the possibilities in this direction was given recently by the performance of the engine on the "*Liverpool Flyer*" when with a load of 380 tons an average speed of 68 m.p.h. was maintained between Crewe and Willesden, a distance of 152.7 miles, as recorded in the May "*M.M.*"

A Locomotive Coaling Plant in Meccano

Reproduction of a Doncaster Installation

THE accompanying illustration shows a Meccano working model of a modern high-speed locomotive coaling plant that was built recently by J. Willems, of Antwerp, as an entry for a model-building competition. The model is a reproduction of the fine plant installed at Doncaster, on the L.N.E.R., which was described and illustrated on page 264 of the "*M.M.*" for April, 1933. Comparison with that illustration will show how closely the main features of the original have been reproduced in the model.

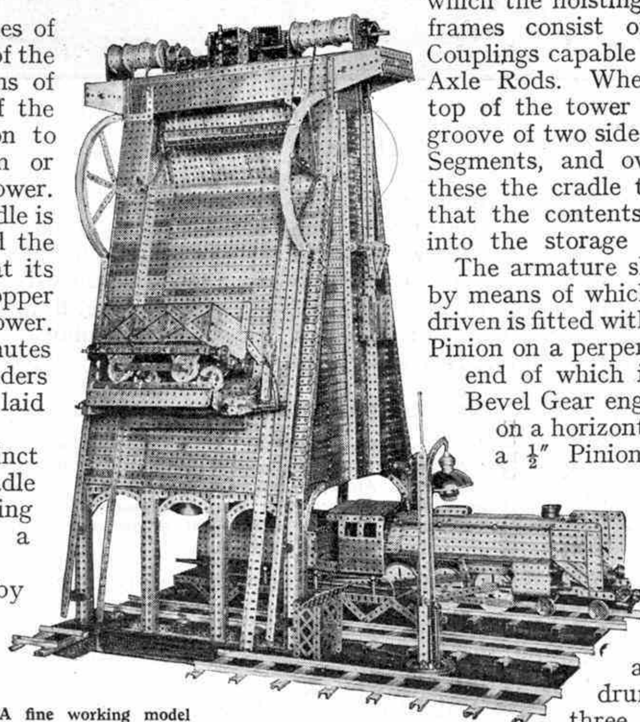
The actual plant straddles two lines of sidings, and the hoisting and tipping of the coal wagons is carried out by means of hoisting winches mounted on top of the tower. The loaded truck is run on to rails fixed on a movable platform or cradle at the foot of the hopper tower. When the truck is in position the cradle is hoisted to the top of the tower, and the wagon is automatically tilted so that its contents are tipped into a storage hopper inside the upper portion of the tower. From here the coal is fed down chutes fitted with trap-doors into the tenders of locomotives standing on a track laid beneath the chutes.

The model consists of three distinct parts—the hopper, the movable cradle and its set of rails, and the hoisting winches, which are operated by a Meccano Electric Motor.

The hopper tower is supported by eight pylons or legs, and is constructed in pyramid form, the corner members of the frame being 29 in. in length and made by bolting together a 12½″ and 18½″ Angle Girder, with an overlap of four holes. These members are connected at the top by 18½″ Angle Girders at back and front, and at the sides by means of 4½″ Angle Girders. The wall spaces are then filled in with Strips of various lengths, a space being left in the wall at the top of the hopper through which the coal is tipped into the bunker. Above the hopper is an extension 2½″ in height, constructed of Angle Girders and Strips. This has projections at each side consisting of Sector Plates and Strips, through which pass cables attached to counterweights, which balance the weight of the cradle and wagon and so reduce the power required to operate the plant.

The top of the tower takes the form of a platform and is made from 4½″ × 2½″ Flat Plates, on which are mounted two hoisting winches and an Electric Motor by which they are driven. The machinery is housed in a hut as in the original plant, but the hut was removed when photographing the model in order that the mechanism might be seen.

The cradle is 9½″ long and 4½″ wide, and is built from Angle Girders, Flat Girders and Plates. The rails are fixed on the upper side of the platform and are of sufficient length to accommodate one wagon. The cradle itself is supported by two "L" shaped arms, to the backs of which are fitted two ½″ Pulleys that are loose on their axles and are arranged to run on rails fitted to the side of the hopper. These rails serve as guides for the cradle during hoisting and lowering. The arms are joined by Angle Girders, and are pivoted between two frames to which the hoisting ropes are attached. The frames consist of 3½″ Strips, and carry Couplings capable of rotating freely on short Axle Rods. When the cradle reaches the top of the tower the Couplings engage the groove of two side rails composed of Channel Segments, and owing to the curvature of these the cradle tilts toward the tower, so that the contents of the truck are tipped into the storage hopper.

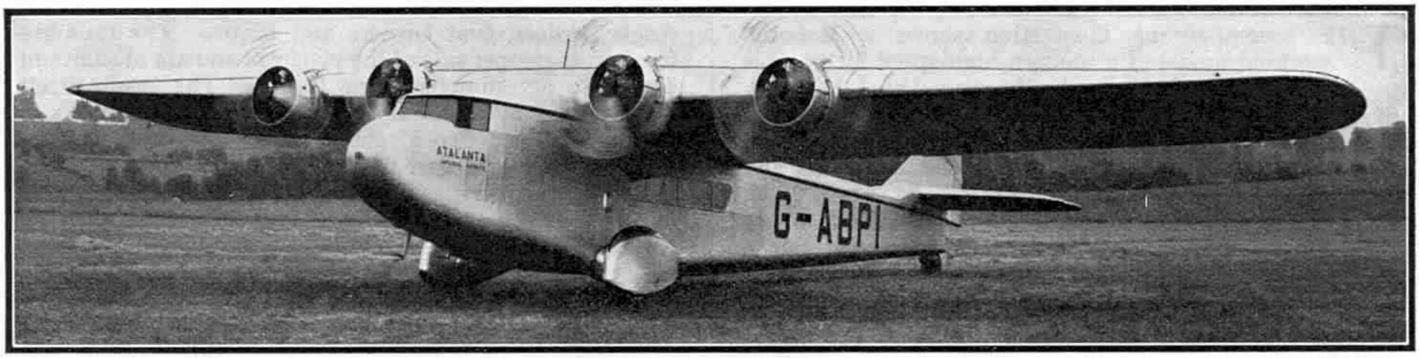


A fine working model coaling plant built by J. Willems of Antwerp. It is a reproduction of an actual coaler at Doncaster, on the L.N.E.R.

The armature shaft of the Electric Motor by means of which the hoisting winches are driven is fitted with a Worm that engages a ½″ Pinion on a perpendicular shaft, at the other end of which is a ⅞″ Bevel Gear. This Bevel Gear engages a second similar gear on a horizontal shaft that in turn drives a ½″ Pinion by means of a Worm. The final drive spindle rotates in bearings fixed behind the winding drums and is fitted at each end with a 50-teeth Gear Wheel that engages a 38-teeth Gear Wheel attached to the drums. The drums are each divided into three sections, two of which accommodate the cradle hoisting cables, while the third section is used for winding the cables of the counterweights. These counterweights are attached to travelling carriages that run on rails up and down the side of the tower, the counterweight ropes being wound on the drums in the opposite direction to the hoisting cables, so that when the cradle ascends the weights move downward.

In operating the model the loaded wagon is run on to the cradle and the Motor is set in motion. The cables first of all draw the two arms of the cradle upward, and the wagon tilts over toward the tower and is held securely in place against the back of the cradle. The cradle is then hauled upward, being guided in its travel by the rails laid up the front of the tower. When it reaches the curved rails at the top of the tower, the Couplings fixed to the side of the cradle run round the Channel Segments and the result is that the wagon is turned nearly upside down and comes to rest against the side of the hopper. A movable arm, operated automatically by counterweights inside the hopper, holds the truck in this position while the coal is emptied into the bunker.

Aviation in South Africa



SOUTH Africa has tackled the problem of aerial transport with characteristic enterprise. The most important factor in opening up the country by air has of course been the Imperial Airways air mail service that connects London and Capetown, one journey in each direction being made between these two places every week, and occupying ten days. In addition to these services, however, there are many "feeder" lines operated by local companies, which extend the benefits of the Imperial Airways services over areas of hundreds of miles. For instance, a coastal feeder route, operated by Wilson Airways, links up Dar-es-Salaam and other towns in Tanganyika Territory with the Imperial Airways route at Nairobi, connections being provided with both northward and southward Cairo–Capetown services. Another valuable air link extends for approximately 200 miles from Kisumu on the main trans-African line across the shores of Lake Victoria by way of Jinja, Torroro, and Eldoret to Entebbe.

Farther south along the main route is another feeder line, the purpose of which is to effect air connections with the Belgian Congo. This line operates between Broken Hill and Elizabethville, headquarters of the Katanga province, and it is proposed to extend a further link into the Central Congo at Luluabourg which, since the institution of the Benguella railway, has been the southern terminus of air services in the Congo.

More than 100 miles of auxiliary air lines, serving districts far removed from the main route, are represented by these Nairobi–Dar-Es-Salaam, Kisumu–Entebbe, and Broken Hill–Luluabourg services, and plans for other services that should prove equally valuable are now actually in hand.

In addition to regular services an interesting feature of aviation in Africa is the use of specially chartered aeroplanes for exploring and hunting, many big game hunters now employing aeroplanes as a means of transport when they wish to carry out expeditions to places hundreds of miles away. Another development that the use of aircraft has rendered possible is the establishment of new camps for hunting and wild life study in parts served by air stations such as Juba and Kampala. Communication between these camps and the air stations could be maintained regularly by aeroplane.

Ground facilities play a vital part in the development of African aviation. Reports now indicate that new landing grounds are available for use between Salisbury and the Zambesi, and that working parties have been busy on other flying ground and aerodrome improvements south of Bulawayo. This development work is being carried out under the Beit Trust scheme, by which £50,000 is being expended on improving air communication in Africa.

Our illustration shows an Armstrong Whitworth "Atalanta" Monoplane used on the African Section of Imperial Airways London-Capetown Route. The machine is equipped with four Armstrong Siddeley "Double Mongoose" engines that develop a total of 1,400 h.p.

In Rhodesia the provision of new landing grounds will, it is hoped, enable a scheme to be adopted whereby mails will be delivered by air to townships and villages not served by railway. Light aeroplanes will fly to and from these places from the main routes.

The spraying of crops and trees from the air for the extermination of pests is another important branch of aerial activity in Africa. Experimental work in this connection is being carried out by the South African Air Force in conjunction with the Department of Entomology and Forestry. Work was first commenced in 1925, when a gum plantation infested by the eucalyptus snout beetle was sprayed with calcium arsenate powder by S.A.A.F. machines, the results being very successful. Military machines are also used for survey work, particularly in desert regions, and for carrying diamonds from Alexander Bay to Capetown.

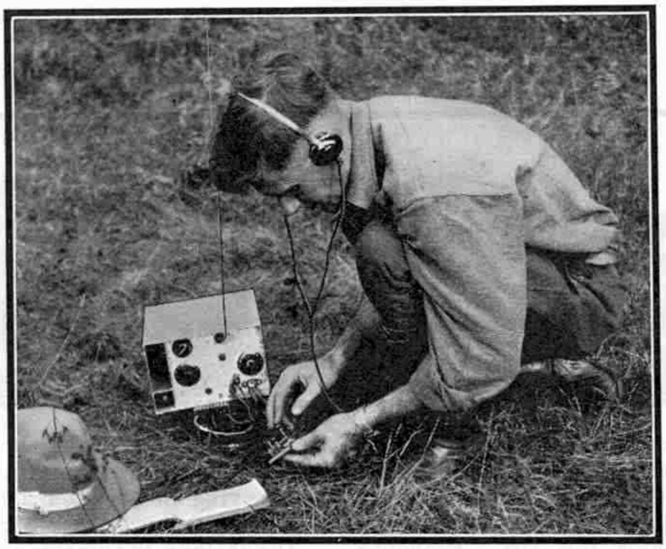
A great deal of good work in connection with the popularising of aviation in South Africa has been done by Sir Alan Cobham, who last year visited with his air circus more than 50 different aerodromes, in addition to many small places where an air display had never before been staged. One result of his visit was the construction of aerodromes in new centres, and the improvement of existing facilities in others. Over and above this important achievement Sir Alan made it possible for many people in outlying areas to enjoy for the first time the experience of a trip in an aeroplane. Most of these joy flights were made in a Handley Page "Heracles."

Radio Helps in Forest Fire Control

Interesting United States Experiments

THE development of special radio apparatus for use in the protection of the national forests from fire is one of the latest steps taken by the United States Forest Service, in their policy of bringing into play every possible resource of science and organisation with the object of keeping the "Red Demon" in check.

The Forest Service have been engaged since 1927 on the problem of adapting radio communication to forest fire control, and in 1930 their work reached the point of actual trial under field conditions in the Columbia National Forest, one of the big rugged forests of the Pacific Northwest. Although the Canadian Forest Service and one or two States had done some pioneer work with radio, the United States Forest Service were unable to find existing apparatus that would meet the rigorous and exacting tests of service in the national forests. It was therefore found necessary to design a set that would fulfil the special requirements, and a forest officer was assigned to experimental radio work.

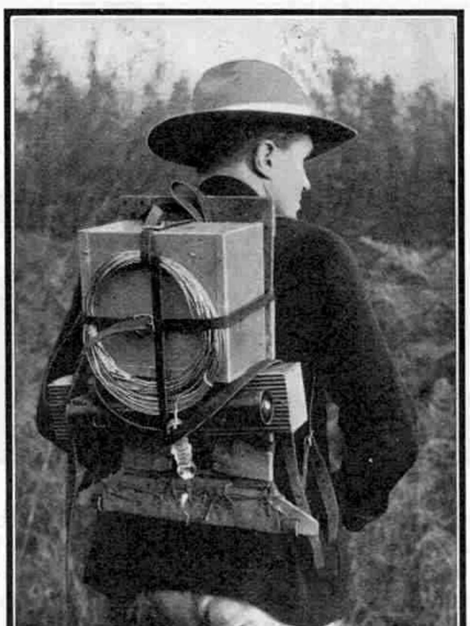


United States Forest Officer transmitting a message in code on the Forest Service portable field radio set.

An equipment was needed that would combine high efficiency with lightness and durability; and it had to be of very strong construction as it must often be transported by pack animals or on the backs of men. The power available for portable equipment was limited, because the weight and bulk must not be too great to be packed over steep narrow trails and through dense woods, and the problem of inefficient aerial systems, due to space limitations in heavy timber, had to be overcome. It was also necessary to determine whether the absorption of radio energy by green timber, and the "shadow" effects of mountains in the rough country found in most national forests, could be overcome. Still another difficulty was that few of the temporary men employed in fire crews, and the short-term fire guards of the national forests, had any knowledge of radio technique or of code.

The first Forest Service set designed weighed, with case, earphones, key, batteries, aerial wire, etc., about 70 lb., and it was given preliminary trial in actual field work in the Columbia National Forest in Washington. The results were encouraging, but further refinements and a further reduction in weight were found necessary. Recently a new "welter-weight" set, weighing complete, with varying battery power, from 45 lb. to 55 lb., has been developed by Forest Service officers. The outstanding feature of this set is that it receives and transmits by both voice and code, thus bringing to realisation the hope of the Service that it would be possible to transmit voice by these sets.

A "feather-weight" set, weighing complete about 12 lb., has also been designed. It is light enough for quick transportation, and substantial enough to be jogged over a mountain pass on the back of a mule without being damaged. This set receives voice, but transmits code only, and the safe radius of communication is given as 10 miles. In order to determine the practicability of the "feather-weight" set for field use by inexperienced operators, an average man taken from a road crew was tested. The demonstrator assembled the set and took it down again, showing the road man how to turn the knobs, etc., after which the road man experimented alone with the set for about an hour. He was then taken out into the brush and given a message written in dots and dashes and told to send it to a lookout station. He fixed up the set in 18 minutes and sent a code message calling for eight men and giving the location and nature of an imaginary fire. The station received it, transmitted it by telephone to the despatcher, who replied, and the station re-transmitted it to the road man, who then put away his outfit—all in 44 minutes.



The method of carrying the portable radio set. Photographs reproduced by courtesy of the United States Forest Service.

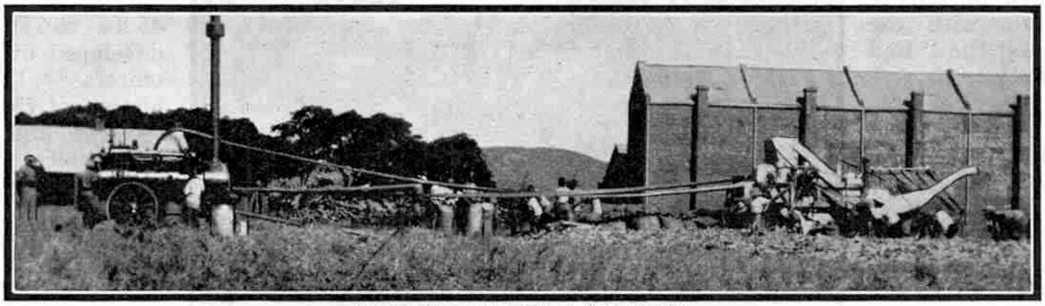
An important development is a scheme of using lookout men as central station men, thus avoiding the cost and complications attending an earlier plan of providing a special central station set and operator for a given forest. Under this plan a lookout man using a "welter-weight" set could talk to and receive code from any man working within, say, 10 miles of the lookout station.

Gathering the Maize Harvest

Scenes on a Rhodesian Estate

By Wilfrid Robertson

FEW people realise the important place that maize takes among the list of the world's cereals. Too often the name of the grain conjures up a vision of the yellow stuff that is sold in shops as chicken food; yet the amount used in that way, and of that variety of maize, is infinitesimal compared with the total vast quantity produced. In many countries maize is the staple food of the people, besides being used for feeding every kind of livestock; and from it also are made many things that few would connect with it. The world production of the grain is estimated at about 390,000,000 quarters, of 480 lb. each, a figure surpassed only by wheat and oats. Probably this estimate is well under the mark, for no official analysis can compute the amount grown by savage tribes for their own use, and figuring in no trade return.



Steam-driven maize shelling plant at work.

In Rhodesia and the adjacent African territories the round yellow maize is never seen. The grain grown is of the kind known as flat-white, of which there are several varieties. Each grain is roughly about the size of a sixpence, slightly tapered at one side, and about as thick as three of these useful coins. The maize is grown in rows 3 ft. apart, and the plants average about 7 ft. in height. The grain itself forms on a cob, covered with a paper-like sheath, that projects from the side of the stalk. Thus it differs from wheat and barley, which produce their corn at the apex of the plant.

Maize is harvested by hand, as machinery for the job has not yet been perfected. On my Rhodesian estate the method I employed was the one that is usual in the country. Taking two rows each, a long line of natives moved steadily through the field breaking off the cobs and dropping them into sacks slung from their shoulders. As the sacks were filled they were dumped in readiness for the wagons that were to follow later. The cobs were finally stacked in a huge mound at the side of the field, there to lie and dry out thoroughly until the arrival of the machine for separating the grain from the cores.

As it was done by hand labour, harvesting maize was a slow job, and I therefore employed big gangs. The heavier the crop the longer it took, of course. Good workers were able to average between half an acre and one acre per day, for which they were paid at the rate of from about 6d. to 8d. per day, receiving in addition a ration of maize meal and salt.

Before power-driven machinery was introduced for the shelling or thrashing of maize the work of harvesting in the field was slower, for the paper-like sheaths covering the grain had to be stripped off by hand as each was plucked from the stalk. In consequence nearly twice the length of time was needed to clear a given area, and when the slower process was finally completed there was another long period before the corn had all been passed through the little hand-power machine and had reached its destination in the finished sacks.

A close-up view of the power sheller.

The hand sheller was a small machine standing on four legs and driven by a perspiring native who turned the crank. At the top end were two apertures through which the corn cobs were inserted individually, and care had to be taken that these were not fed in too rapidly or the whole affair would jam. The cobs dropped into an arrangement of revolving toothed wheels, which stripped off the maize, and core and grain then fell further into a shaker fitted with sieves. The seeds dropped through the larger holes in the sieves and so on to the receptacle placed to catch them; but the cores, being too big to go through, passed on and were thrown out at the other end. The capacity of the machine was about 50 completed sacks of grain per day.

Thus, even with several shellers at work, it was a slow job to handle a dump that eventually would produce several thousand bags of finished grain.

The coming of the steam-driven sheller made a vast difference to the speed at which a crop could be worked through to its destination in the sacks. The machine itself is much of the same general appearance as the thrasher seen in England, though its internal arrangements are of a different type. When this machine was used there was no need for the sheaths to be removed—a big saving in harvesting time—and, with motive power supplied by a 12 h.p. portable steam engine, the output could be anything up to 1,000 bags a day. To keep pace with the hungry hum of the revolving drums and the steady stream of the outflowing grain, 50 or 60 natives were needed for feeding in the cobs, removing the rapidly-filled sacks, and sewing, stencilling and stacking.

Natives operating hand-driven sheller.

Running a power-sheller to its full capacity required a considerable amount of organisation, for one little delay anywhere along the line of workers meant an upset of the whole circle. The natives who weighed and stacked the finished sacks had to keep pace with the sewers; if those at the grain-chutes were slow, the men with the needles were hung up; and so on right through to the feeding end. As the near side of the dump from which the natives were feeding the machine became cleared away, reinforcements were needed, for the longer the carrying distance the harder it was to keep the entrance hopper filled.

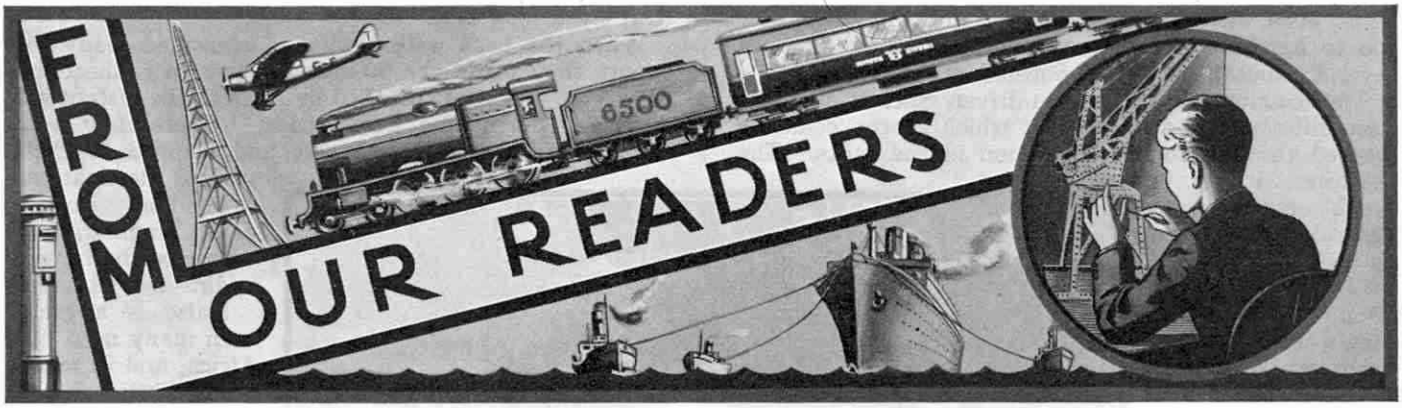
Grain bags sewn and stencilled, ready for export.

Flung into the intake-hopper, the cobs were caught up by an endless revolving belt and carried up to the top of the machine, where they vanished into its humming interior. At the other end the grain, sorted into two grades, poured in a steady stream from the exits, filling the sacks at the rate of more than one per minute. In the meantime the cores and the husks, caught up by a powerful fan, were blown out in another direction through a long curved funnel, to fall in an ever-growing mountain. On account of the inflammability of maize husks, the engine, fired with wood fuel cut in the surrounding forest, was placed as far away as possible from the sheller, and connected to it by a long belt.

When the bags were sewn and stencilled ready for export they made the 30-mile journey to railhead by ox-wagon, and then travelled by train to the distant sea at Beira, Portuguese East Africa. There they were loaded on to waiting steamers and shipped to their various destinations—London, Rotterdam, Hamburg, or wherever the buyers might be situated.

Maize is a grain with many uses. In Africa, and in many other parts of the world it is one of the main foods of the natives, and large quantities of the grain I grew were used for consumption on the estate. Exported grain is a big factor in the make-up of feeding stuffs for livestock, and much of it goes also to the makers of cornflower and similar products. In addition, it has many other destinations that are not so obvious. Among the biggest buyers of our maize were the manufacturers of starch, for the Rhodesian product is known to excel in its content of this substance. Distillers also are large consumers, and the makers of transparent paper wrappings are looking to the maize plant for much of their raw material. In addition to the grain the stalks of the maize plant also are utilised. They form a valuable cattle food, as they contain a large amount of sugar; and good household sugar could be made from them if ever cane and sugar beet were to fail. They contain alcohol also, and motor spirit has been experimentally made from them.

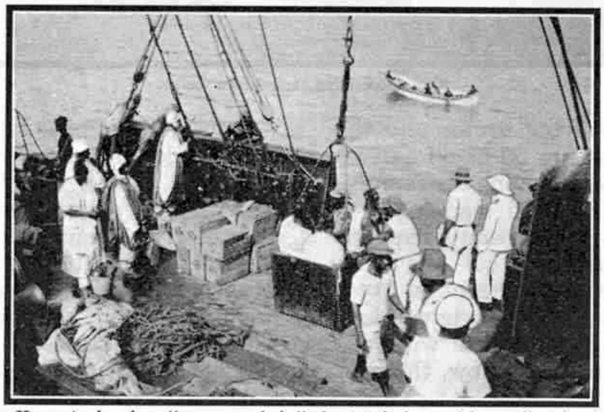
Maize meal is the main food of the natives, who eat it in the form of a stiff porridge. They look upon this maize porridge as "food"; and other things that they may have—meat, potatoes, or other vegetables—are known by the generic title of "flavourings." It has often amused me when in shooting camp in the wilds, where meat has been plentiful, to see natives get outside about 10 lb. of solid meat each, and then come and ask me for their regulation dinner ration of meal. They had not yet had their porridge, and therefore in their view they had not yet had anything to eat! Had they not had a vast quantity of meat? Oh yes, but that was just "flavourings"—a snack between meals, as a bar of chocolate or a biscuit might be to you or me!



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.

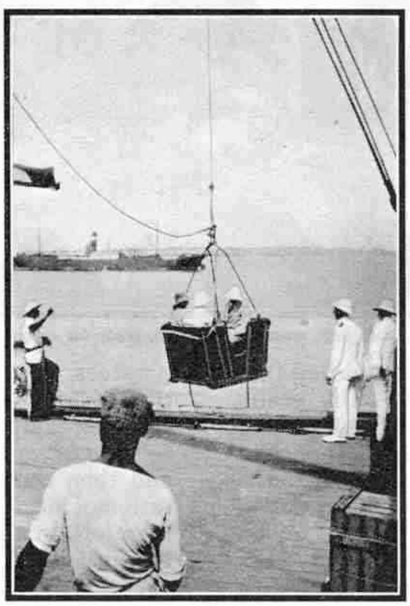
Landing at Accra by "Mammy-Chair"

The surf beats furiously on the shore of the west coast of Africa, and the only small vessels that can stand its battering are the shallow native canoes known as surf boats. Accra is one of the chief ports on this coast, and passengers in liners arriving there are lowered into surf boats by means of the "mammy-chair," which holds four persons and is raised and lowered by means of a crane.



Hausa traders in a "mammy-chair" about to be lowered from a liner into a surf boat at Accra, on the West Coast of Africa. The photographs on this page are by F. J. W., Cardiff.

The lower photograph on this page shows three Europeans disembarking in this manner. The experience is often thrilling, especially when there is a heavy swell, for then it is difficult to get the contrivance safely down into the surf boat as this pitches and tosses on the heaving water. Swinging into space is an ordeal in itself. The passengers sit in the lurching chair, and hang sickeningly over the sea while below them the tiny boat full of grinning blacks dances in and out of view. They hold on to the sides grimly and hope for the best, feeling as though the flying chairs of a fairground were preferable to this combination of lurching mammy-chair, heaving sky, rolling sea and dancing surf boat. They breath sighs of relief when they are at last in the boat, and the blacks then seize their paddles and set out vigorously for shore, the paddles flashing to the rhythm of their queer sing-song chant.



Swinging the "mammy-chair" over the side of a vessel at Accra.

The upper illustration shows a party of Hausa waiting to go ashore at Accra. The Hausa are mainly Mohammedans and are physically a fine race. They are the merchants and traders of West Africa, and in their long garments they resemble the Jews seen in biblical illustrations. Even the terrors of the mammy-chair do not seem to upset the natural poise of these tall and dignified people. The one seen on the left in our illustration has at his feet a bucket loaded with his possessions. In spite of a heavy swell and the erratic movements of the surf boat, which at times was yards away from the side of the ship, he reached the shore with one arm clasped tightly round his cumbrously loaded bucket, and not a saucepan or a drinking cup of its miscellaneous contents was lost in the treacherous sea.

F. J. W. (Cardiff).

Finding Herring in the North Sea

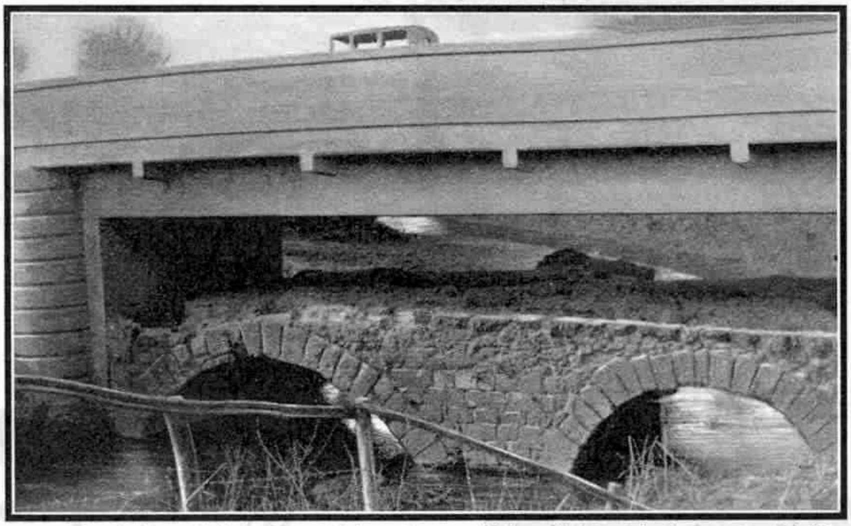
While I was staying in Hull a short time ago I made a trip in a herring trawler, for I am interested in zoology, and particularly in fishes. When we left for the North Sea the skipper told me that he knew exactly where to go to find the biggest shoals of herrings, and when I expressed surprise he explained that a comparatively new invention enabled the fish to be located. The herring-finding apparatus can be carried by any vessel, but is usually fitted to special ships that find the shoals.

On my return I was able to examine this apparatus closely. It consists of a framework carried in the wash of the ship below water level. On each side is a tank, and one of these contains a roll of special bolting silk of standard colour and mesh that passes over the framework of the tank on the other side. The silk moves at a steady speed from one tank to the other, and as the water strains through it the microscopic creature known collectively as "plankton" are caught in the fine meshes and pass on with the silk into the receiving tank. There special chemicals fix the plankton on to the silk, which is then rolled up with the tiny creatures on it. The silk is then examined for a yellow species of plankton that is the favourite food of the herring, and the positions where these were gathered are marked on special charts.

R. Horsham (Ramsgate).

A Buried Italian City

When I was driving with a friend over a modern bridge on the road from Rome to Ostia, he suddenly stopped the car and asked me to get out. He then made me climb over a fence and down a bank to the edge of the stream over which the road passed, and I then saw that there were actually two bridges, one above the other, as shown in the accompanying photograph.



The remains of a Roman bridge on the road between Rome and Ostia. Photograph by R. Hoare, London, W.2.

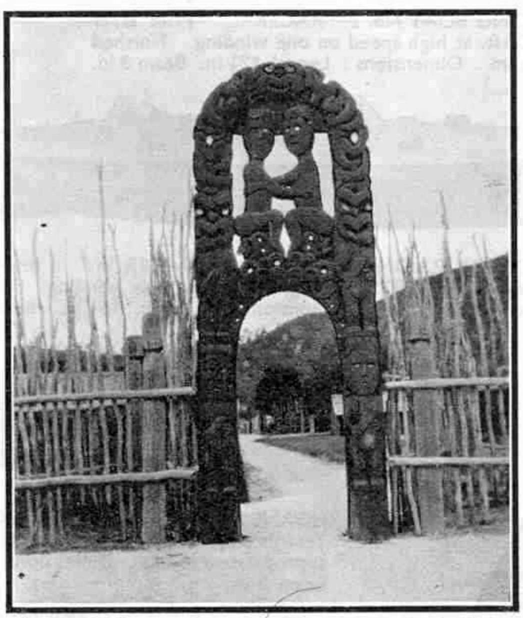
My friend told me that the lowest structure was built by the Romans in the days when Ostia was a great port. The harbour then silted up and gradually Ostia was deserted. Eventually it was covered with sand and earth, and for centuries the only sign of its existence was a certain unevenness on the surface. Many of the buildings of the ancient port have now been excavated, and in certain cases the remains of two floors of some of the houses have been found. One particularly interesting feature, unearthed in an excellent state of preservation, is a courtyard surrounded by what are believed to be the remains of shops, and paintings of fruit and vegetables may still be seen on the walls of a ruined wineshop in which many great wine and oil jars were discovered.

The site of ancient Ostia is now about two miles from the sea. A new town has been built on the present coast and this is a popular resort of the people of Rome, with which it is connected by an electric railway with a frequent service of trains.

R. HOARE (London, W.2).

Symbolic Maori Wood-Carvings

The first Europeans to reach New Zealand found the islands in the occupation of a fierce race calling themselves the "Tangata-Maori," or simply Maori, as they are known to-day. Along with a great love of fighting, and strangely out of keeping with it, the Maori possessed many fine qualities. One of these was appreciation of the beautiful in poetry and art, and their artistic ability is revealed in wonderful wood-carvings done long ago with the aid of stone chisels and other primitive tools.



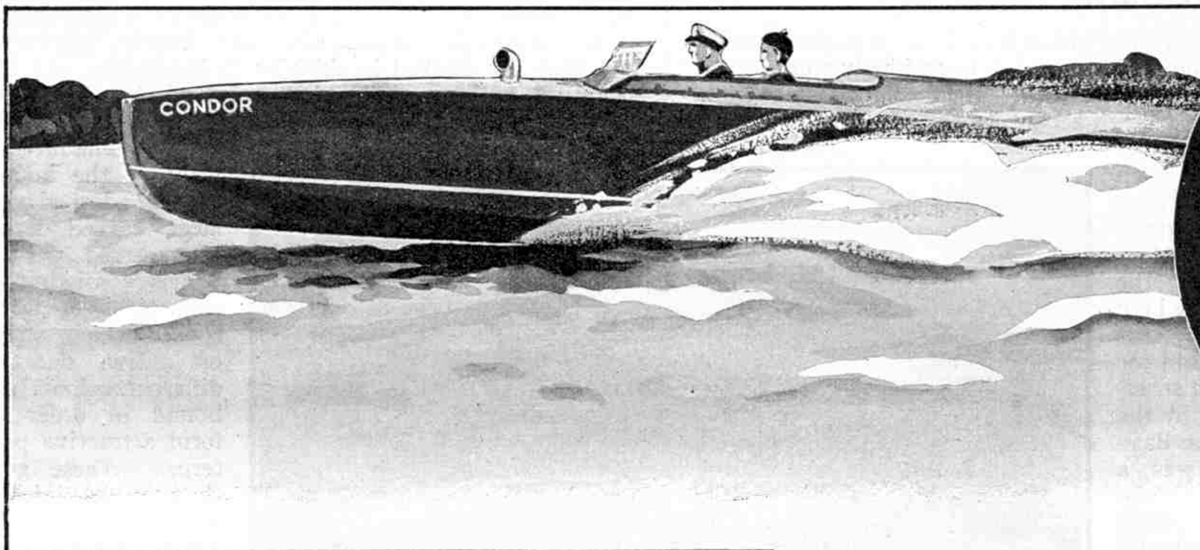
The beautifully carved wooden gateway of a Maori village. Photograph by J. M. McEwen, Palmerston North, New Zealand.

There is an almost complete lack of straight lines in Maori carving, and beautiful curves abound in the designs, which are exquisitely balanced although the artists were guided only by eye. The principal pattern is the spiral called "pitau," or "fern shoot," which is said to have originated in the spiral shoots of the common fern. Grotesque figures also are largely employed, but they are worked in skilfully to harmonise with the beautiful patterns. The doors and window lintels of Maori dwellings are often profusely and elaborately carved. The interior walls of the houses also are adorned with large carved slabs, interspersed with panels consisting of thin laths of wood round which strips of native flax of different colours are bound in order to form attractive patterns. These give the rooms a finished and comfortable appearance. Weapons, agricultural tools, children's toys, and even storehouses are adorned by carvings, and boxes in which feathers and trinkets are kept also are beautiful examples of Maori art.

Carving is still carried on, but not to a great extent. Every design has a mystical or historical meaning that could be interpreted by the "tohunga," or priests, but the significance of most of the work has now been lost, owing to the reticence of the old priests, and only its artistic value remains. The carved slabs already referred to represent incidents in tribal history or depict ancestors of present-day Maori. The figures on these slabs were not intended to be faithful portraits, and indeed were purposely made unlike the persons represented in order that uncomplimentary remarks about the carvings would not cause loss of sleep to the deceased ancestors who formed the subjects.

Most specimens of Maori carving are variations of conventional patterns, for the Maori believed it to be unlucky to make extensive changes in the patterns introduced by their ancestors. For instance, nearly all carved door lintels are ornamented with three figures separated by spirals or scroll patterns. The Maori never selfishly copied another man's work, however, and designs that are outwardly conventional invariably include something that is original and individual.

I am greatly interested in symbolic Maori wood-carvings, and spend most of my spare time trying to produce similar work. The results are certainly attractive in appearance and make excellent decorations, but of course my carvings have none of the mystic meanings attached to those of the Maori. J. M. McEWEN (Palmerston North, N.Z.)



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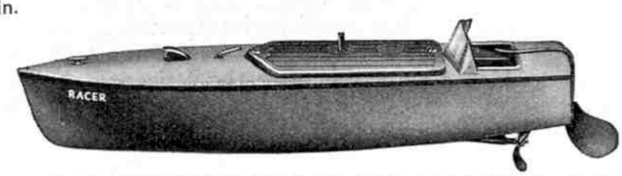

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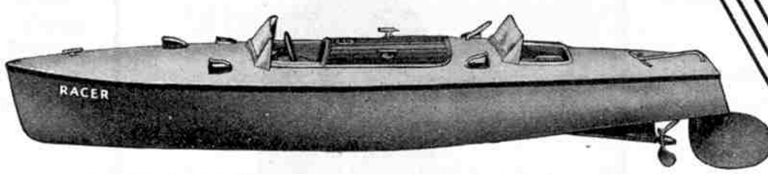

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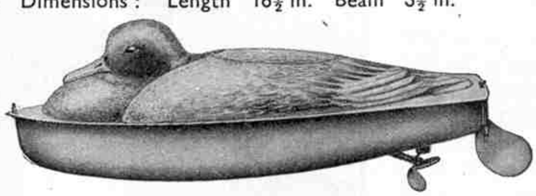

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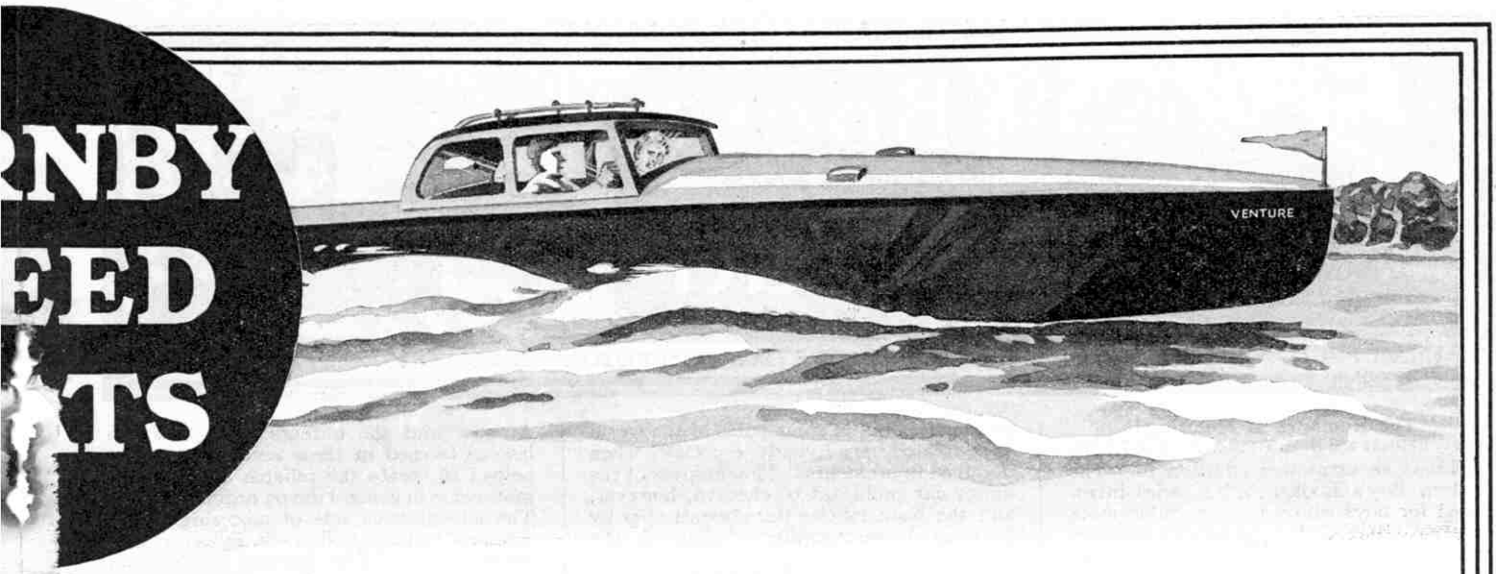
Every owner of a Hornby Speed Boat or Hornby Racing Boat should join the Hornby Speed Boat Club. This may be done by purchasing a special badge (illustrated here) from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Liverpool 13. Prices: United Kingdom, **6**d., New Zealand, **10**d., South Africa **9**d., Canada, **20** cents.

HORNBY SPEED BOAT CLUB

Manufactured by Meccano Ltd.,



IS IS
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e - Attractive Colours
le Efficiency

the new Water Toy are the finest examples of model
ormance, graceful lines and beautiful finish are the
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s and Hornby Racing Boats has been known before
rb ! Each model follows closely the design and
the world's famous speed boats.
, or send to us for a copy of the new price list.

SPEED BOATS

the Hornby Speed Boats are still going
e propeller and the unique methods
the hull give each model exceptional
line and every feature of the Hornby
cellent qualities, speed and reliability.
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ACING BOATS

Boats have been introduced to
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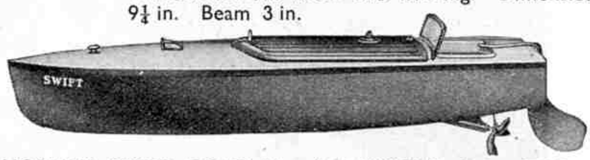
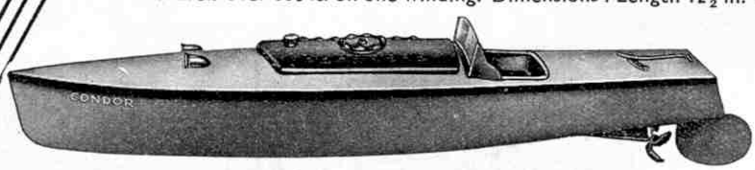
HORNBY SPEED BOAT No. 1 "HAWK." Price **2/11**
Travels over 100 ft. on one winding. Dimensions: Length 9¼ in. Beam 3 in.



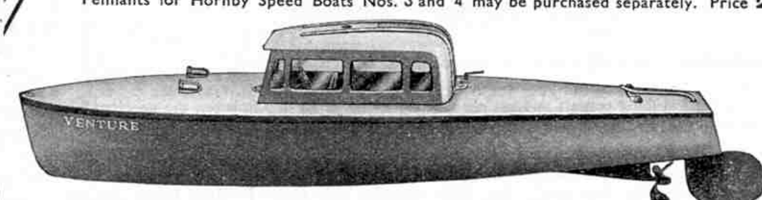
HORNBY SPEED BOAT No. 2 "SWIFT." Price **7/6**
Travels over 300 ft. on one winding. Dimensions: Length 12½ in. Beam 3 in.



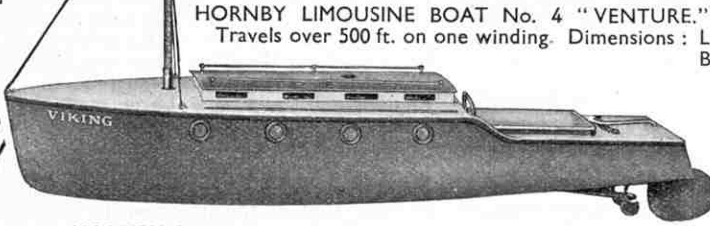
HORNBY SPEED BOAT No. 3 "CONDOR." Price **12/6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

PENNANTS

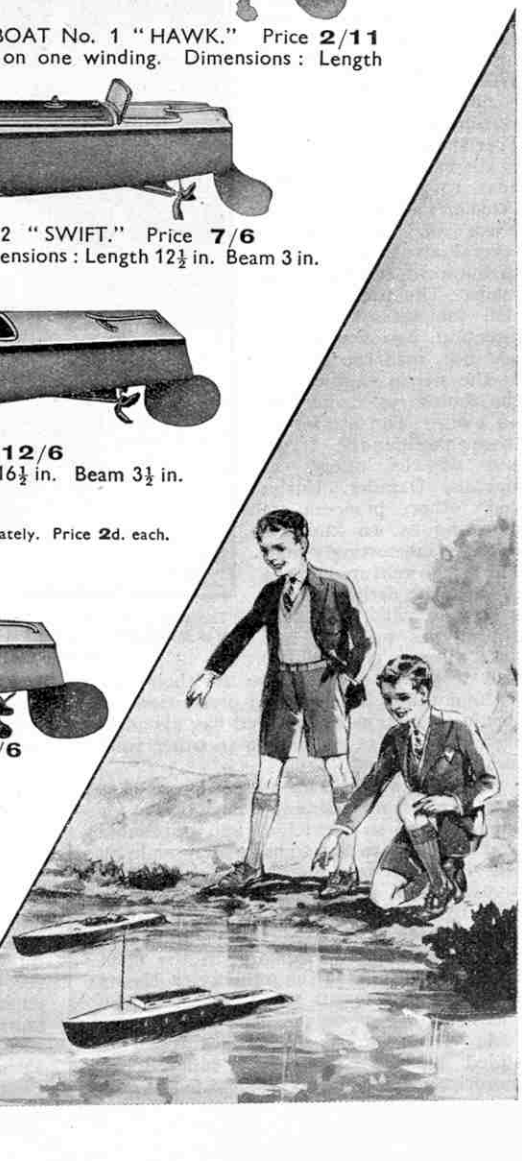
Pennants for Hornby Speed Boats Nos. 3 and 4 may be purchased separately. Price **2**d. each.



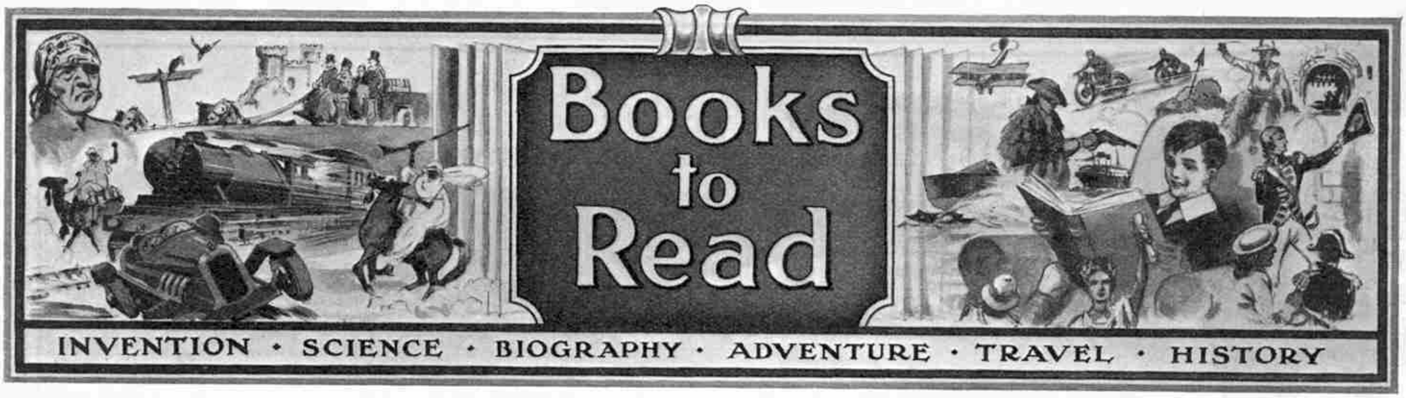
HORNBY LIMOUSINE BOAT No. 4 "VENTURE." Price **15/6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.



HORNBY CABIN CRUISER No. 5 "VIKING." Price **16/6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.



Binns Road, Liverpool 13



"The Romance of Motoring"
By J. C. Bridges and H. H. Tiltman (Harrap, 7/6 net)

This is an attractive addition to "The Modern Boy's Bookshelf," a series introduced for boys who want something more satisfying than fiction. Previous volumes in this series include the Editor's "*Romance of the Merchant Ship*," "*Book of Remarkable Machinery*," and "*Romance of Transport*"; and the present volume deals with the story of motoring from its earliest days.

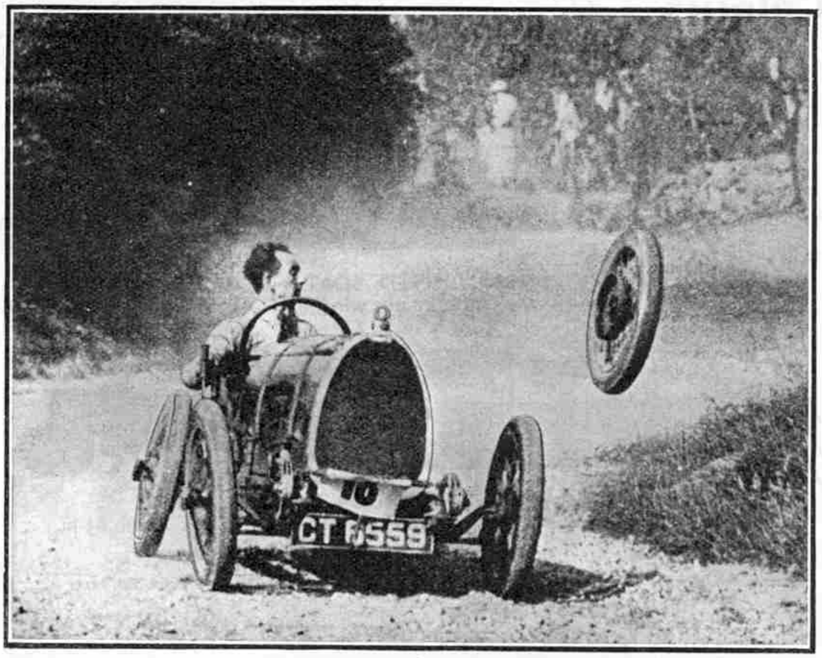
Readers who regard the motor car as a modern development may be surprised to learn that the romance of motoring began as long ago as 1769, when a French inventor named Cugnot built a successful steam carriage. This was followed by the road locomotive of William Murdock, which is now to be seen in the Birmingham Art Gallery. Trevithick, the "father" of the locomotive, was the next to produce a road vehicle, and in the early years of last century several steam cars made their appearance on British roads. The time was not ripe for success in this direction, however, and it was not until the coming of the petrol engine that the motor car came into its own. The stories of these preliminary trials, and of the efforts of Markus, Daimler, Butler and other pioneers of motoring as we know it to-day is interestingly told. Those who ventured on the road in the earliest petrol cars met with strenuous opposition, and it was only after a great battle that they won the right to use their cars without taking such absurd precautions as sending a man carrying a red flag ahead of them on foot as a warning to other road users.

Motoring was still an adventure when it was freed from irksome restrictions, for engines were so capricious and unreliable that fortunes are said to have been made by individuals living near steep hills who invested in a pair of stout horses to tow recalcitrant cars up the slopes! Roads were poor, tyres were short-lived, and spare wheels were unknown; and in the open bodies usually fitted the unlucky motorists were exposed to all the vagaries of the weather.

As speeds increased, police traps were added to the annoyances suffered by motorists, who came to be regarded almost as enemies, and in some parts of the world were treated very roughly, especially when involved in accidents. The progress of the motor car could not be checked, however, and the book follows its advance step by step as it successfully challenged the horse and the railway.

"Motoring for the Million" is the title of the chapter that brings the story of the development of the motor car to its present position. In it the contributions to modern motoring of Mr. Henry Ford, Sir Henry Royce, Sir William Morris, now Lord Nuffield, and Sir Herbert Austin are described, these pioneers having been selected because, in the words of the authors, they "stand out above all others as the men who dreamed of better, safer and cheaper motor cars, and who lived to see their dreams come true."

To many readers the most interesting section of the book will be that dealing with the achievements of the speed kings of the motor world, from the winner of the first great race in motor history, whose speed was 16.65 m.p.h., to Sir Henry Segrave, Sir Malcolm Campbell, and other modern record-breakers. Thrilling accounts of exciting races are given, in addition to stories of the creation of speed records on the track and on special courses such as the Pendine Sands in South Wales, Daytona Beach, Florida, and Verneuk Pan, South Africa; and the authors show how the lessons learned in these severe tests have helped to create the reliable and efficient motor cars in general use on ordinary roads. The adventurous side of motoring is not confined to the speed track, however, and details are given of amazing incidents in which death has been missed by inches. Most of these prove the truth of the statement that "hairbreadth escapes may break a driver's bones, but seldom break his nerve."



The rear wheel of a car bounding ahead after the back axle had broken. Mr. R. Mays, the driver, was taking part in a hill climbing contest and his car was travelling at 60 m.p.h. when the accident happened. (From "The Romance of Motoring" reviewed on this page.)

Several interesting chapters are devoted to the achievements of the motor car in many different fields. They tell the story of its use in the War, and of the amazing success of the tanks, which since have been wonderfully developed and now appear to be almost irresistible, for burning woods and trenches of extraordinary width and depth appear to be the only obstacles they cannot overcome. They describe also the adventures of the pioneers in motor transport across roadless wastes and in unknown lands; trace the rise of the motor bandit and explain the activities of the Flying Squad of Scotland Yard; and describe the growth of dirt track racing, a dangerous but fascinating sport.

Although technicalities find no place in the volume, which deals with the romance of motoring, one of its most interesting features is a description of a day's work in the Morris Motor Works at Cowley, Oxford, where a car is made every $3\frac{1}{2}$ minutes. This illustrates the remarkable amount of organisation that has been necessary in order to bring us to the Motor Car Age. It is pointed out that as yet this is a new era, for we are only 30 years from the days when the horse was supreme. The authors suggest that the next 30 years will bring even greater changes than those dealt with in the book, and in their final chapter they elaborate visions of the motor car of the future, and suggest a car that can move along the road, through the air, or on the water with equal ease, as the aim of motor engineers in their efforts to conquer the elements.

The book is attractively illustrated by means of 32 plates showing chiefly famous motorists and the motor cars with which their names are associated, and exciting moments on road and track.

"Man's Genius"

By E. BULLER BARWICK (Dent, 7/6 net)

There is a peculiar fascination about the history of famous inventions. Even in the many instances where there was nothing in the least exciting or unusual about an inventor's career, there is always something thrilling about the manner in which the great idea was first conceived, and in the slow development from crudeness to mechanical efficiency. In "*Man's Genius*" Mr. Barwick has collected together the stories of what might be called the basic inventions of modern civilisation. The first 23 chapters of the book deal with these inventions in chronological order, so that they give a good idea not only of each invention by itself, but also of its place in the steady stream of progress.

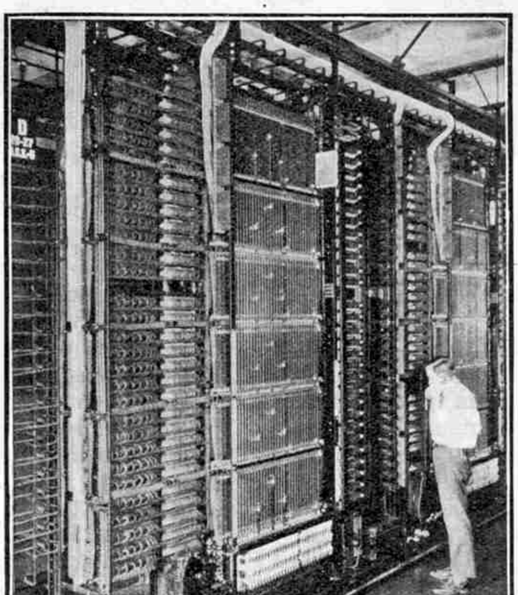
Commencing with Watt and his steam engine, the author goes on to show how this invention made possible astonishing developments in textile machinery. The inventions of Richard Arkwright and Edmund Cartwright in England and Joseph Jacquard in France are described, and we are shown how, in America, Eli Whitney revolutionised the cotton industry by his cotton gin. Whitney realised that the steadily-increasing demand for cotton could never be met so long as all cotton fibres had to be separated from the seed by hand; and that it was useless to raise large crops when the cotton could only be cleaned in small quantities and at great expense, although the work was done by slaves. Equally fascinating is the story of the application of Watt's engine to steam navigation, and we are given an interesting account of the epoch-making work of the American Robert Fulton.

The familiar stories of the invention of the printing press, the locomotive and the dynamo are retold briefly but well, and then we are taken into an entirely different sphere—that of the great cornlands of America. The reaper invented in 1831 by Cyrus Hall McCormick made it possible to harvest grain on millions of acres of land that had never before been under cultivation, thus making bread cheap all over the world. The essential soundness of McCormick's invention is shown by the fact that, although between the years 1826 and 1860 reaping machines innumerable were devised, his, with its many subsequent improvements, is the only one that has survived. To-day more than 2,000,000 reaping and harvesting machines based upon the McCormick patent are at work in the wheatfields of every continent.

Subsequent chapters deal with a variety of inventions, including the telegraph and the submarine cable, the sewing machine, the lift, and the various inventions that led to the production of cheap steel. Then there is the air brake of George Westinghouse, one of the most interesting and important inventions connected with railway working. When Westinghouse had completed drawings and models of his mechanism he took them to the great railway magnate Cornelius Vanderbilt. "Do you mean to tell me," said Vanderbilt, "that you can stop a railway train by wind?" "Well," replied Westinghouse, "inasmuch as air is wind, yes." "Nonsense," exclaimed Vanderbilt, "I have no time to waste on such a fool idea!" Nevertheless "wind" could stop railway trains, and has since done so in almost all parts of the world.

An interesting account is given of the development of the telephone and of the electric incandescent lamp. In this connection the author quotes Edison's famous declaration that "genius is two per cent. inspiration and ninety-eight per cent. perspiration." Typesetting machinery, the motor car, and wireless are considered in turn, and then we come to aviation, to which subject the remaining 20 chapters of the book are devoted. After describing the general development of aviation, the author gives brief accounts of all the most famous flights from Blériot's first crossing of the Channel in July, 1909, to the flight round the world in eight days made in 1931 by the American airmen Harold Gatty and Wiley Post.

Cyrus Hall McCormick's first Reaper, invented in 1831. (See below.)



The maze of mechanism in the central office of an automatic telephone system. (This and the top illustration are reproduced from "Man's Genius" reviewed on this page.)

The story of these flights is of intense interest as showing how the pioneer airmen, with wonderful skill and marvellous courage, were always ready to try out to the utmost each new development of the engineers. The spirit that animated these men is well illustrated by a story of Blériot. A few days before his pioneer cross-Channel flight he had been badly burned by a petrol explosion, and could only hobble about painfully on crutches. This did not deter him in the least, however. "I'll show them that I can fly if I cannot walk," he said, and in a few moments he was sailing through the air over the Channel.

The book is excellently illustrated by a large number of photographs of the inventors and of their inventions, with a few well-drawn diagrams to make clear various points mentioned in the text.

"The Sea Scout Badge Book"

(Brown, Son & Ferguson Ltd. 2/- net)

Every Sea Scout, and indeed every boy who is interested in ships and the sea, should possess a copy of this book. Its stated object is that of making the technical details of the tests usually undertaken by Sea Scouts more readily available for study, and this is achieved admirably. The book goes far beyond this, however, and compresses into its 210 pages an immense amount of interesting information on a variety of topics. The chapters devoted to boat sailing should be read by every boy who proposes to trust himself in a small boat. The details of different sailing ship rigs, fishing boat marks, and buoys and lights, are very full, and the instructions for learning signalling in semaphore and Morse are remarkably clear and practical. Other matters dealt with are the reading of charts, and the forecasting of the weather by instruments and by observing cloud formations and other atmospheric phenomena. The book is excellently illustrated, the colour plates of flags, code signals, and combinations of ships' lights being particularly good.

"Everybody's Book of Aeroplanes"

By R. BARNARD WAY
(Percival Marshall & Co. Ltd. 1/6 net)

Any boy with a thirst for knowledge regarding aeroplanes will find this book extremely useful. In its 100 pages it touches upon almost every aspect of aviation. After a short chapter in which the exploits of the early pioneers are dealt with, the author passes on to describe the parts of an aeroplane and how the machine flies, and discusses the old problem as to whether the biplane or the monoplane is the better. Gliding is given an interesting mention, which is followed by a general survey of different types of aircraft and their engines. This section contains brief but useful details of such unusual machines as the "Autogiro," the Pescara helicopter, the Westland-Hill "Pterodactyl," and the Focke-Wulf "Ente." Finally there is an interesting chapter on the identification of aeroplanes in flight. The book is illustrated with a number of original drawings by the author.

New Books

The undermentioned books, recently published, will be reviewed in a future issue.

EXPLORING THE UPPER ATMOSPHERE
by Dorothy M. Fisk (Faber & Faber Ltd., 6/-)

BROWN'S FLAGS AND FUNNELS
(Brown, Son & Ferguson, 7/6)

HOW TO SEE POND LIFE
by Eric Fitch Daglish (Dent & Sons, 2/6)

HOW TO SEE INSECTS
by Eric Fitch Daglish (Dent & Sons, 2/6)

British Marine Engine History in Meccano

V.—The Steam Turbine

As was shown in last month's article in this series, the triple-expansion engine has been brought to a remarkable pitch of perfection; but there is little doubt that it is capable of still further improvement in various directions. So long as this type of engine is considered suitable for marine work, engineers will continue their efforts to increase its efficiency. In recent years special attention has been given to valve gears, and extensive experimental work has shown that there are great possibilities of improvement in such mechanisms. Stephenson's valve gear, which has been universally adopted, is now being slowly but surely forced from its dominating position by more efficient and compact drop-valve gears. Two of the most successful gears of this type are the Beardmore "Caprotti" gear and the "Emew" gear, in each of which the valves are similar to those employed in motor cars. The operating camshaft, driven by gears from the crank-shaft, is situated either over or alongside the cylinder block, and carries three cams for each valve. Two inlet and two exhaust valves are usually employed for each cylinder, reversing being accomplished by sliding the entire camshaft and thus bringing into operation a separate set of cams.

We must now turn to the great rival of the reciprocating engine for marine propulsion—the steam turbine. In a very rudimentary form turbines were constructed centuries ago, but it was not until the late Sir Charles Parsons introduced the reaction turbine in 1894 that engineers took any serious notice of the possibilities of this type of engine. After an exhaustive series of experiments Parsons amazed everyone at the Diamond Jubilee Naval Review in 1897 with his 44½-ton vessel "*Turbinia*," which darted about among the lines of great warships at a speed of over 34 knots, and even outpaced with ease the fastest destroyer of that period.

The final propulsion machinery of this little vessel consisted of three separate pressure-compounded turbines, each driving a separate propeller. The high-pressure turbine was on the starboard shaft, the intermediate-pressure one on the port shaft, and the low-pressure one on the centre shaft. A separate turbine was fitted to the centre shaft for use in going astern. This was necessary on account of the inability of a turbine to reverse, which is one of the greatest disadvantages of this type of marine engine. Up to the present the disadvantage has been overcome successfully only by the provision of an extra turbine. The engines of the "*Turbinia*" are now preserved in the Science Museum at South Kensington, together with about 45 ft. of the after section of the vessel.

The demonstration given by the "*Turbinia*" at the Naval Review so impressed the authorities that they ordered two destroyers, the "*Viper*" and the "*Cobra*," to be fitted with the new form of marine engine. Unfortunately both these vessels were wrecked before exhaustive trials could be carried out, but the "*Viper*" had shown that she was capable of a remarkable speed, nearly 37 knots being registered on one occasion.

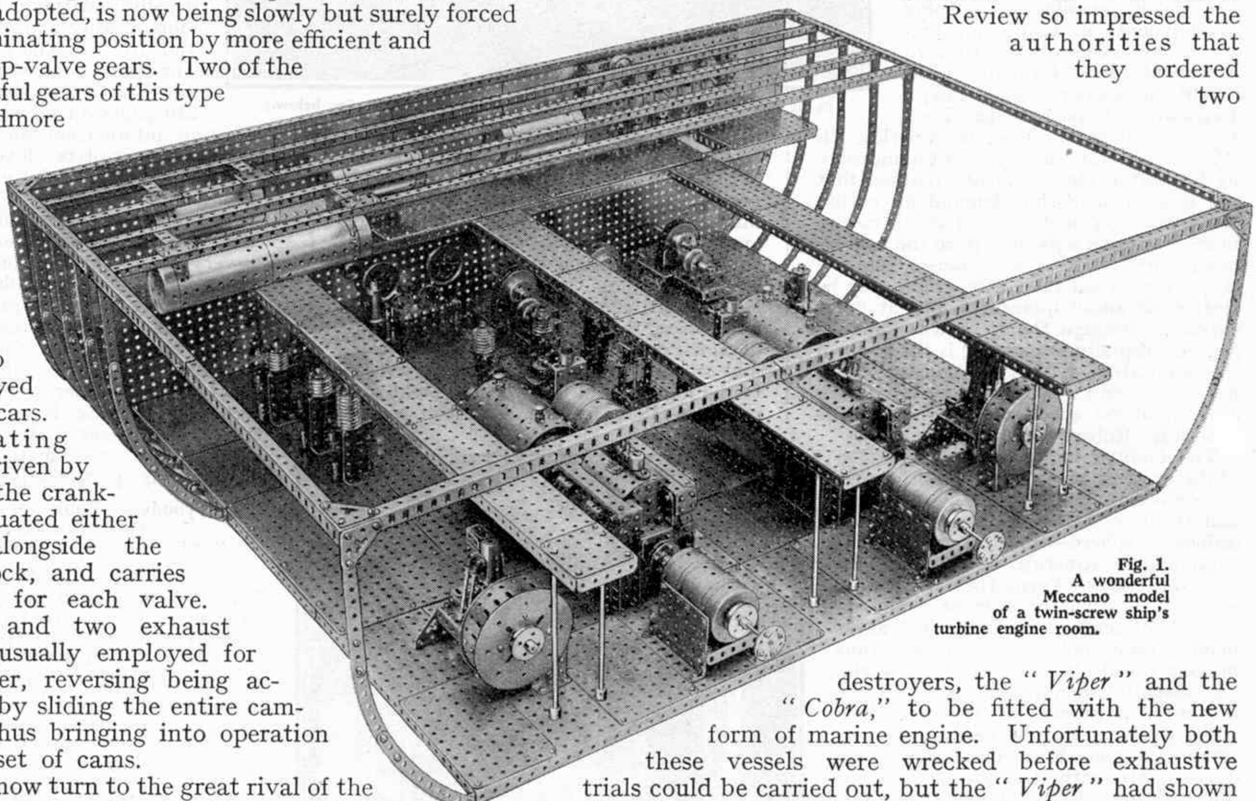


Fig. 1. A wonderful Meccano model of a twin-screw ship's turbine engine room.

The next step towards the successful adoption of the Parsons turbine came in 1901, when the Clyde passenger ship "*King Edward*" was built. This vessel was constructed to the order of a pioneer syndicate known as Turbine Steamers Ltd., which came into being as the result of the general opposition shown to the new method of propulsion by shipbuilders and shipowners alike. The "*King Edward*" was 250 ft. in length and attained a service speed of 20 knots, and it is interesting to note that she is still successfully engaged on her original service. She proved so economical and reliable in service that shipowners were forced to realise the possibilities of turbines, and within a few years almost every new fast vessel was being fitted with them.

In the mercantile marine the efficiency of the steam turbine was shown most strikingly in the struggle for speed supremacy in the Atlantic crossing. ne of the most successful and popular of these ocean greyhounds is the "*Mauretania*," which was launched in 1907, and for over 22 years outpaced all rivals. The engines of this vessel are representative of those fitted to almost all the turbine-equipped pre-war liners. Six turbines form the complete power unit, four being used for driving the vessel ahead and two for going astern; the total power output being about 80,000 S.H.P. The astern turbines rotate idly when the vessel is moving ahead, as do the ahead turbines when she is going astern.

On her early voyages the "*Mauretania*" did rather more than 24 knots, and she and her sister ship, the "*Lusitania*," were the fastest vessels on the Atlantic service. During the winter of 1909 the "*Mauretania*" was fitted with propellers of a new type that made a remarkable difference, an additional $3\frac{1}{2}$ knots being obtained. She then lowered the eastbound record with an average speed of 25.4 knots, which was increased later to 25.7 knots. As the years passed, this fine old ship, instead of decreasing in speed as might have been expected, continued to break her own records, until in 1929, when she lost the "Blue Riband" to the North German Lloyd liner "*Bremen*," she was actually running regularly at a speed of over 27 knots. This is an amazing record, and it shows in a striking manner the enormous advantages of turbines over reciprocating engines for high-speed use.

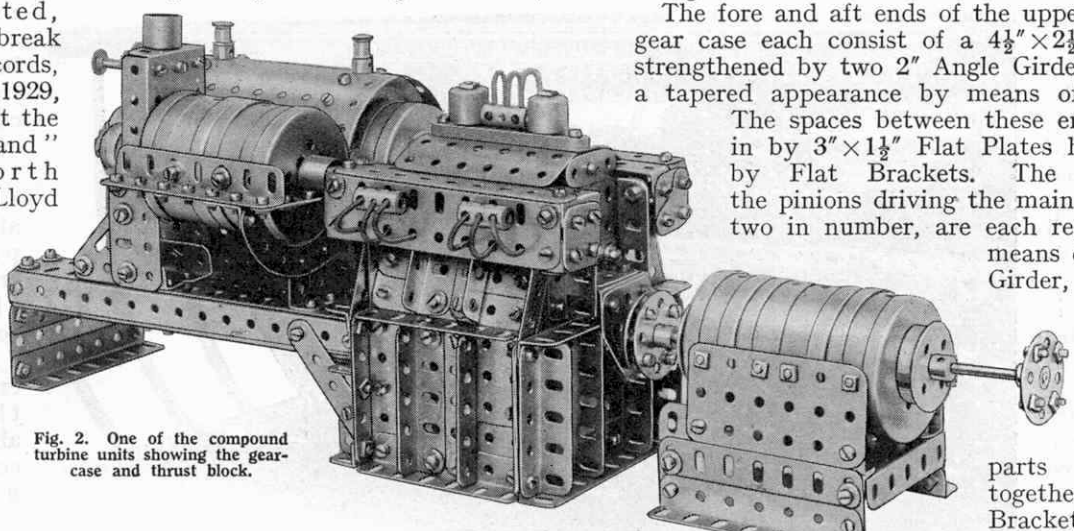


Fig. 2. One of the compound turbine units showing the gear-case and thrust block.

Up to about the year 1910 turbines were seriously handicapped in their application to slower vessels on account of their inefficiency when running at low speeds. Before this time they were always direct-coupled to the propeller shaft, and as they could not run at a speed suitable for the efficient operation of low-speed propellers, they were seldom fitted to vessels designed for a speed of less than 20 knots. In 1910, however, Parsons fitted to the steamer "*Vespasian*" a system of geared turbines that met with immediate success, and since has been used in practically every ship fitted with turbine engines. Even the fastest vessels, such as the "*Bremen*," "*Europa*" and "*Rex*," are all fitted with geared turbines, the reduction being carried out over one stage of gearing. Two stages of gearing have been tried, but the scheme was not entirely successful and has since been abandoned.

A fine Meccano model of a ship's engine room having two sets of compounded single-reduction geared turbines is shown in Fig. 1, with two sectional views in Figs. 2 and 3. It is built to an approximate scale of $\frac{3}{4}$ in. to 1 ft., and for the sake of simplicity all fittings such as ladders, gratings, steam pipes, etc., have been omitted, thus enabling the construction of the separate units to be seen more closely. It will be noticed also that a few frames and deck beams have been incorporated, these being necessary in order to support the two feed heaters shown on the left-hand side of the illustration.

One of the main propulsion motors, together with its thrust block, is shown separate from the complete model in Fig. 2. The lower half of the gear case is made in the form of a shallow box from $4\frac{1}{2}''\times2\frac{1}{2}''$ and $3''\times1\frac{1}{2}''$ Flat Plates held together by means of $2\frac{1}{2}''$ and $4\frac{1}{2}''$ Angle Girders. The forward end of the unit is fitted with an extra $4\frac{1}{2}''$ Angle Girder, and four vertical $1\frac{1}{2}''$ Angle Girders are used to act as supports below this. The $4\frac{1}{2}''$ Angle Girder carries the inner ends of four $7\frac{1}{2}''$ compound girders each of which is built up from two $7\frac{1}{2}''$ Angle Girders. The complete compound girders are then coupled together in pairs, as shown, by means of $7\frac{1}{2}''$ Flat Girders, and supported at their outer ends by a deep channel section girder formed from two $3\frac{1}{2}''$ Angle Girders and two $3''\times1\frac{1}{2}''$ Flat Plates. At the inner ends of the $7\frac{1}{2}''$ girders are $2''$ Strips acting as bracing members.

The fore and aft ends of the upper half of the gear case each consist of a $4\frac{1}{2}''\times2\frac{1}{2}''$ Flat Plate strengthened by two $2''$ Angle Girders and given a tapered appearance by means of $2\frac{1}{2}''$ Strips. The spaces between these ends are filled in by $3''\times1\frac{1}{2}''$ Flat Plates held in place by Flat Brackets. The casings for the pinions driving the main gear wheels, two in number, are each represented by means of a $4\frac{1}{2}''$ Flat Girder, two $4\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strips and a $4\frac{1}{2}''$ Angle Girder, these parts being held together by Angle Brackets and small Corner Brackets. Each complete casing is secured at each end to the main gear casing by a $1''\times1''$ Angle Bracket. The top of the gear casing is built up from two $3''\times1\frac{1}{2}''$ Flat Plates surmounted by six $3''$ Strips and two Chimney Adapters. Dummy lubricators are formed from Couplings, from each of which appear three lengths of Spring Cord representing feed pipes. Copper wire is passed down the centre of the Spring Cord to hold it in position.

The low-pressure and astern turbines, both of which are incorporated in one casing, are represented by two Boilers joined together round the periphery of two $3''$ Pulleys. The bearing at the after end of this unit is built up from Sleeve Pieces, Chimney Adapters, and $\frac{3}{4}''$ Flanged Wheels, and at the forward end from a Boiler End, two Wheel Flanges and a $1\frac{1}{8}''$ Flanged Wheel. The complete unit is then secured to the $7\frac{1}{2}''$ compound girders, mentioned earlier, by two $4\frac{1}{2}''\times2\frac{1}{2}''$ Flat Plates and four $4\frac{1}{2}''$ Angle Girders. A support for the after bearing is also built, consisting of $1\frac{1}{2}''$ Flat Girders and Angle Girders of similar length.

The construction of the high-pressure turbine is shown in Fig. 2 and needs no further comment. It is secured in place on the inside by a $\frac{3}{8}''$ Bolt passing into the low-pressure casing, and at the outside as shown, by a

3½" Angle Girder and two 2½" small radius Curved Strips held in place by Angle Brackets. The after end is supported by Flat Girders and Corner Brackets as shown.

The thrust block consists of a series of Wheel Flanges and Boiler Ends attached to two 3"×1½" Flat Plates as shown, the Bolts in each case first being locked to the Boiler Ends by means of Nuts. The base of the block is built up from 3½" and 2½" Angle Girders and 3½" Flat Girders. The propeller shaft is journalled inside the thrust block in the bosses of Bush Wheels, and 1⅛" Flanged Wheels secured in place on the propeller shaft hold the two end Wheel Flanges of the block in place. Flexible couplings are represented by Bush Wheels fitted with Nuts and Bolts.

At each outer side of the main turbine is a circulating pump for forcing water through the condensers, which in actual practice are situated below the main engines under the engine-room floor. Each of these pumps, which do not of course work in the model, is operated by a single cylinder vertical steam engine, the construction of which will be seen from Fig. 1.

At each inner forward corner of the main engines will be seen the extraction pumps, each of which is used for drawing up the fuel oil from the ship's double bottom where it is stored, and delivering it to the boilers. A little further forward are situated three vertical pumps. These are the forced-lubrication pumps, and in an actual vessel of this size two are always kept working when the main engines are in operation, with one always in reserve. Three similar pumps will be found on the port-hand side of the engine-room. The two forward ones are the sanitary and bilge pumps, while the other, that is fitted with an extra large cylinder, is the emergency bilge and ballast pump. Two further pumps also are incorporated, these being the main boiler feed pump and the fresh water pump. The first-named is shown in Fig. 3, and the other is situated on the starboard-hand side of that main engine.

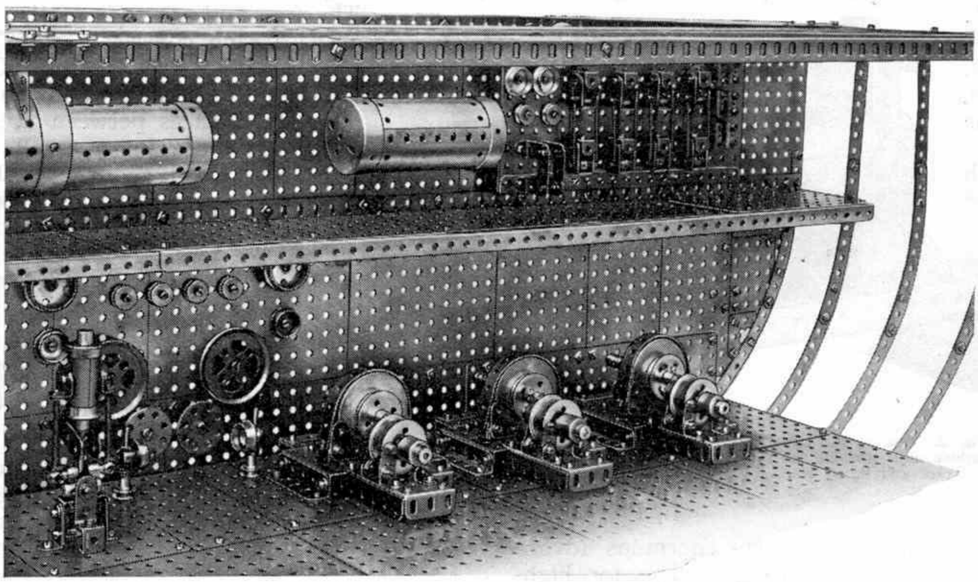


Fig. 3. The generating flat and control platform, the main switch-board being seen immediately above the dynamos.

The primary and secondary feed heaters are represented by Boilers as shown, and are suspended from the main-deck beams at the forward end of the model. Two further Boilers also are fitted, and are secured to the forward bulkhead. They represent the two oil-coolers through which the hot lubricating oil from the entire engine room passes in order to be reduced to a suitable working temperature before being re-delivered to the various working parts.

Fig. 3 shows the arrangement of the fitting at the forward bulkhead. The starting platform is seen on the left-hand side, the three turbo-generators are on the right, and above these is the main switchboard. Below the main switchboard a platform running the entire breadth of the ship is fitted and, as will be seen from Fig. 1, three others branch off from this. These are supported at their after ends by 6½" Rods and Rod Sockets.

From this model and the foregoing description some idea of the complication and magnitude of a modern ship's engine-room will be gained, but only an actual visit could possibly convey the idea of pent up energy so characteristic of the modern ship. In the model there appears to be considerable space between the various units, but in actual practice this is far from being the case, for almost every available square foot of floor and wall space is taken up by pumps, too small to show in this model, pipes, ladders, wires, lamps, tool racks and a hundred and one other items, all of which go to make a ship's engine room one of the marvels of modern engineering.

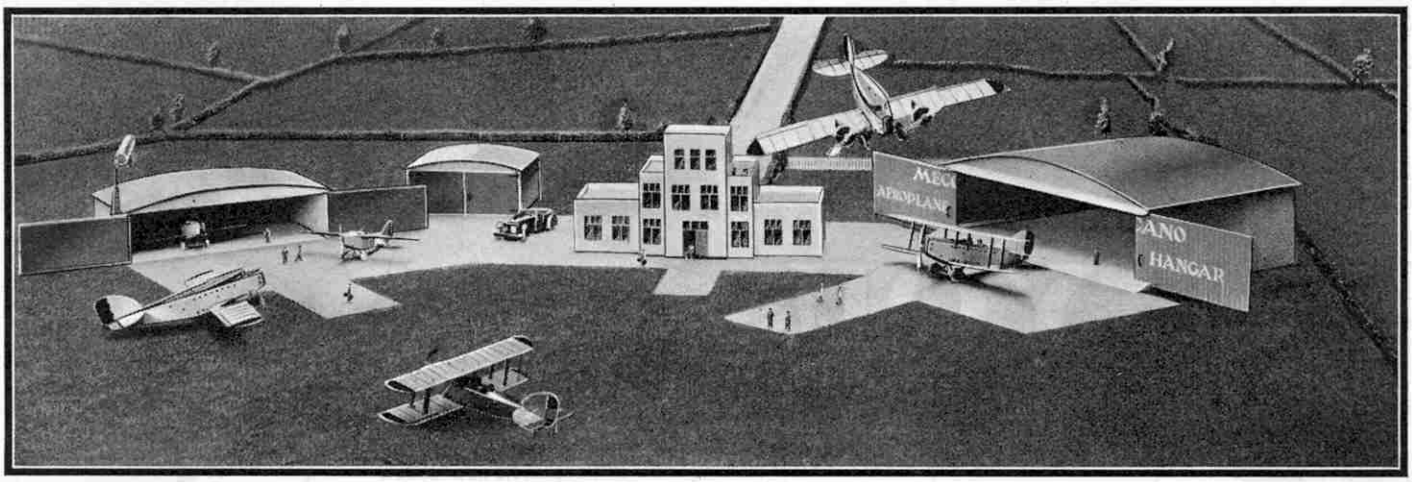
It is an interesting fact that the two rivals, the reciprocating engine and the steam turbine, can be used together. The usual arrangement consists of an exhaust steam turbine coupled in tandem with the main reciprocating engine. The turbine extracts almost the last particle of energy from the steam coming from the main engine, and thus brings about greater economy. It is necessary that the turbine should be designed so that its speed is practically identical with that of the main engine, for otherwise it would cause this engine to drag. In some cases the turbine is not placed in tandem with the main engine, but is arranged to drive an electric generator that in turn supplies the necessary current for operating a powerful motor placed between the main engine and the propeller. This arrangement is said to be very efficient, but the high initial cost of the necessary installation is a drawback to its widespread adoption.

A still more recent innovation is the turbo-electric system of marine propulsion, in which the turbines drive large electric generators, and the current from these operates powerful motors coupled direct to the propeller shafts and placed in the very stern of the ship so fitted. Remarkable ease in manœuvring is claimed for this method, and it also lends itself readily to considerable economy when running at low speeds. Although economical in operation, it is costly to install, and its use therefore is limited to the bigger class of ships.

Next month we shall complete this series of articles on marine engine history with a number of models of Diesel engines.

Outdoor Fun with Meccano Aeroplanes

How to Arrange a Model Aerodrome

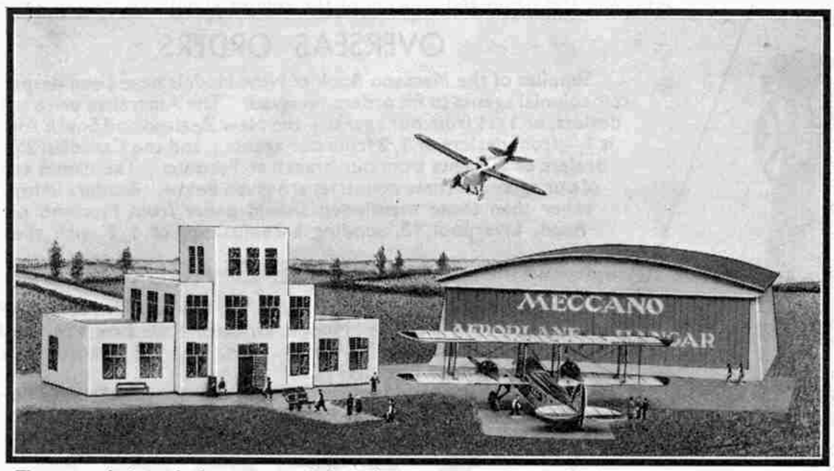


DURING the summer months Meccano enthusiasts naturally like to spend as much time as possible out of doors, and indoor model-building activities are mostly confined to wet days. In previous articles in the "*M.M.*" we have shown how a vast amount of pleasure can be obtained by laying out a Hornby railway in the garden for a few hours on really dry days, and this article will show how owners of Meccano Aeroplane Outfits can have a really good time out of doors with a miniature aerodrome layout.

The size of the aerodrome will depend on the space available and on the number of machines to be accommodated. The Meccano Aeroplane Hangars are splendid for housing the machines, and additional hangars can be easily made of cardboard or wood. The accompanying illustrations show a central control building made of stiff white cardboard to represent concrete. The upper illustration shows a complete aerodrome, which in this case consists of Aeroplane Hangars Nos. 1, 01 and 02. The control building is built in sections, which are fixed together on the base by means of Seccotine. The door and windows may be cut out or painted as preferred.

For laying out the fields, Hornby Hedges and Fencing are particularly useful. The Hedges are supplied in lengths fitted to wooden stands, and the Fencing is flanged and perforated. To prevent the Fencing from falling over, small wooden pegs may be used to fix it to the ground. Extra realism may be given by "planting" a few Meccano Trees here and there, care being taken not to place them in positions where they would be likely to be dangerous to aircraft.

Many small details and refinements may be added to the aerodrome, and the owner of a Meccano Outfit will find his parts very useful for building various accessories. For instance, the standard carrying the wind stocking on the left of the upper illustration is made from Meccano parts, the stocking itself consisting of a piece of paper round the rims of a 1½" and a 1" Pulley fixed on an Axle Rod. If preferred the stocking might be made of calico or similar material, so that it actually indicates the direction of the wind.

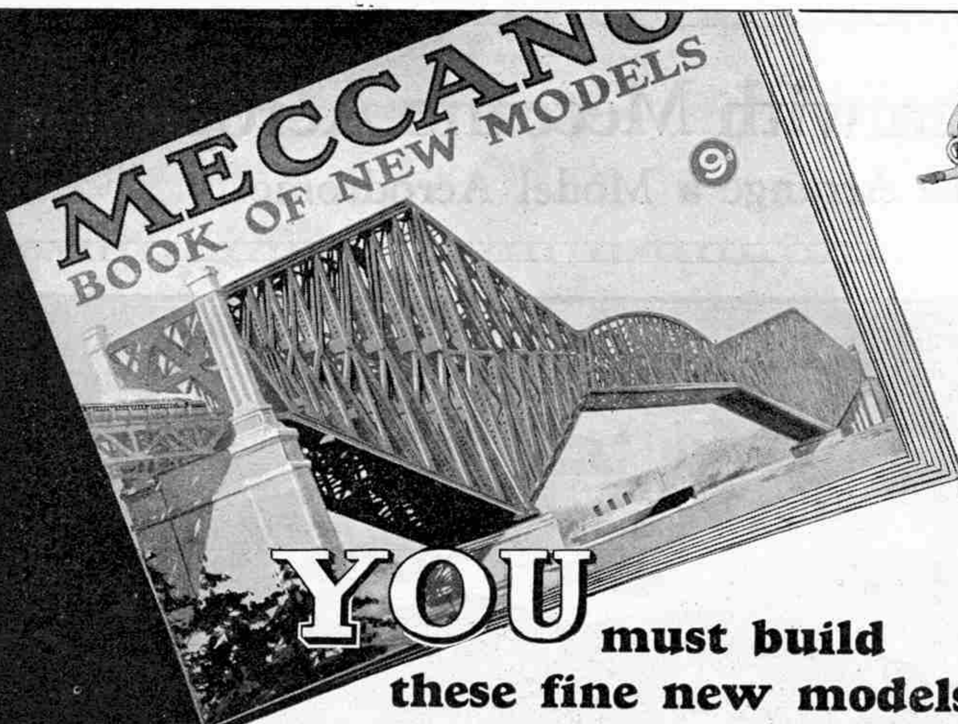


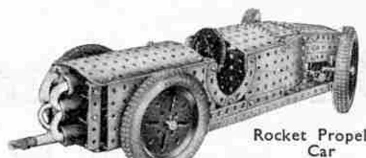
The upper photograph shows a general view of a Meccano aerodrome with hangars and control building. In the lower illustration, which depicts the arrival of an air liner, the miniature figures give the necessary suggestion of activity.

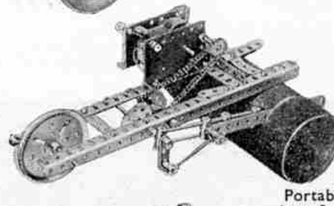
No aerodrome would be complete without its ground staff, and excellent figures for this purpose are included in the Hornby series of Dinky Toys. The figures included in the Set No. 1, Station Staff, and No. 4, Engineering Staff, add a life-like touch to the layout, as is shown in the illustrations; and the Passengers in Set No. 3, and the Hotel Porters in Set No. 5, are also very effective. The lower illustration shows an active scene after the landing of a large air liner. Passengers are making their way to the control building, while the porters dispose of the luggage, and other members of the ground staff attend to the machine and discuss the flight.

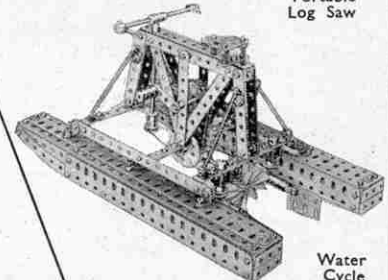
The making and operating of an aerodrome of this type is full of fascinating interest, but in addition it provides material for splendid photographs. The examples shown on this page give an idea of the great possibilities of this form of model photography. Perhaps the most realistic effects are obtained by placing the camera at ground level, so that the photograph is taken more or less from what might be imagined to be the point of view of one of the miniature figures. On the other hand, by placing the camera high up, effects may be secured suggesting that the photographs have been taken from an aeroplane flying over the landing ground.

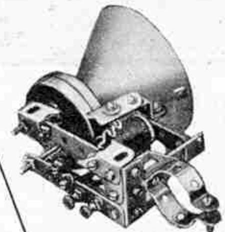
It will be noticed that the realism of the photographs on this page is greatly increased by the inclusion of machines "in flight." Such effects are produced by suspending a machine by lengths of Aero Cord, or white cotton, from a clothes prop or long pole extending across the layout, and resting on the backs of two chairs, one at each side. The prop must be placed at such a height that it is not included in the photograph. It is necessary to prevent the model from swinging, and this is done by means of lengths of white cotton tied near each wing tip, and at the tail, and attached to small pegs driven into the ground. Such cotton fastenings also make it possible to bank the aeroplane and set it at any angle to the ground as required. If dull lighting necessitates a time exposure, great care must be taken to prevent the aeroplanes from swinging.




Rocket Propelled Car


Portable Log Saw

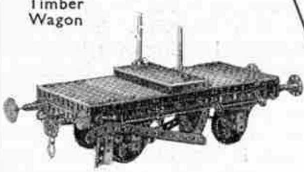

Water Cycle


Electric Horn

YOU must build these fine new models

The majority of Meccano boys have already had the 1934 Book of New Models, and have had the thrill of building some of the splendid new models that are featured in this magnificent edition. If you have not yet had your copy see your dealer about it to-day or write to us, as directed below.

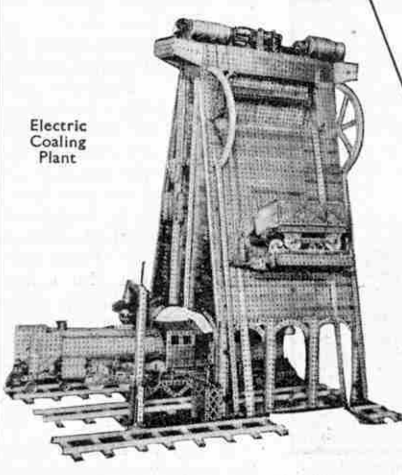
The principal object of this fine book is to keep Meccano model-builders in touch with the latest improvements and developments connected with their hobby. Illustrations and details of the best of the new models and new movements submitted in recent competitions, together with many others that have been designed by our own experts, are included. The models shown are of outstanding interest and variety.


Timber Wagon

HOW TO OBTAIN THE BOOK

The Meccano Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Binns Road, Liverpool 13, price 10½d. post free. In the latter case a postal order or stamps should be sent, and the name and address of the sender should be clearly written.

44 Pages

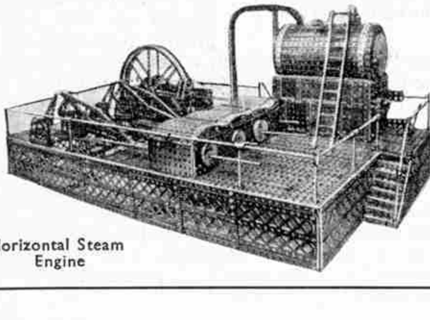

Electric Coaling Plant

OVERSEAS ORDERS

Supplies of the Meccano Book of New Models have been despatched to our colonial agents to fill orders received. The Australian price is 1/9 from dealers, or 1/11 from our agents ; the New Zealand and South African price is 1/- from dealers or 1/2 from our agents ; and the Canadian 25 cents from dealers or 30 cents from our branch at Toronto. The names and addresses of our agents in these countries are given below. Readers living in countries other than those mentioned should order from Meccano Limited, Binns Road, Liverpool 13, sending a remittance of 1/2 with their orders.

OVERSEAS AGENCIES

AUSTRALIA : E. G. Page & Co., 52, Clarence St., Sydney (P.O. Box 1832k).
NEW ZEALAND : Models Limited, P.O. Box 129, Auckland C1.
SOUTH AFRICA : Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).
CANADA : Meccano Ltd., 34, St. Patrick Street, Toronto.


Horizontal Steam Engine

MECCANO

BOOK OF NEW MODELS 9D

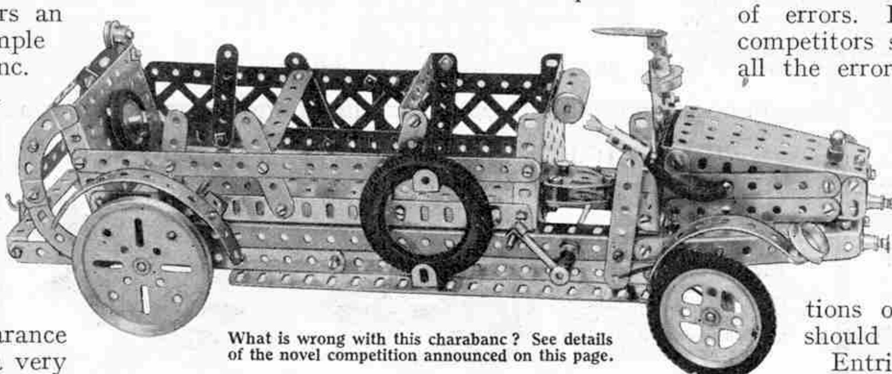
MECCANO LTD., BINNS ROAD, LIVERPOOL 13

Special Summer Competition

Novel "Errors" Contest

At this period of the year it is natural that everyone should want to spend as much time as possible out in the open air, and therefore there is little opportunity to participate in competitions that necessitate building models. We have therefore arranged a special competition that is particularly suitable for the summer months. To take part in it the only things required are a pencil, a sheet of paper, and a copy of this month's "*M.M.*," and competitors can prepare their entries just as easily by the seashore, or while resting during a country ramble, as at home. There is no model-building whatever to do, and there are no fees to pay or entry forms to fill in.

On this page appears an illustration of a simple Meccano model charabanc. It will be seen at a glance that the model is very crudely built, and a few minutes' study of the illustration will reveal numbers of really ridiculous mistakes that have been made. The model, in fact, has all the appearance of being the work of a very inexperienced model-builder, but actually it was built in our own model-building department, and the mistakes have been made deliberately. The model forms the subject of this month's competition, and competitors are required to make a list of as many of the mistakes as they can detect in it, and state briefly how each error should be corrected.



What is wrong with this charabanc? See details of the novel competition announced on this page.

It is not necessary to write a long essay. Any boy who spots a large number of errors, and explains clearly how he would remedy them, stands a good chance of winning one of the principal prizes.

Apart from the fascination of discovering all the mistakes in the model, this novel and pleasant summer competition provides boys with an excellent opportunity of winning valuable prizes of Meccano goods that will greatly enlarge the scope of their Outfits, so that when the dark winter evenings come again they will be able to build bigger and more exciting models than ever before.

Before commencing to write down the mistakes they discover, competitors are advised to study the model very carefully. It will then be seen that mistakes have been made not only in the design of the model, but also in the usage of the Meccano parts and in the construction. Most of the mistakes are obvious and will be readily apparent to any boy who has the slightest knowledge of the appearance of a modern charabanc; but some of them are more subtle, and will only be discovered by a keen pair of eyes combined with a knowledge of Meccano construction. It is to be assumed that the correct Meccano parts were available to the builder when he constructed the model.

Competitors should write their lists of errors in column form, and then against each item state briefly the way in which they think the fault may best be remedied. Some boys may try to deal with the problem by actually building the model, but it is not at all necessary to do this, for every mistake is shown plainly in the illustration.

If no competitor succeeds in pointing out every mistake in the model, the First Prize will be awarded to the competitor whose list contains the largest number of errors. If two or more competitors succeed in finding all the errors the judges will give preference to the entries that are the most neatly prepared, and contain the clearest and best descriptions of how the errors should be corrected.

Entries will be divided into two Sections as follows: Section A for competitors living in the British Isles; Section B for competitors living Overseas. The prizes to be awarded in each Section are listed in the panel on this page.

In preparing their entries competitors should write on one side of the paper only, and should take particular care to see that their name, age and address appear on the back of each sheet of paper submitted, together with the name of the contest (July "Errors" Contest) and the Section (A or B) for which the entry is eligible.

Envelopes containing entries should be addressed to July "Errors" Contest, Meccano Ltd., Binns Road, Liverpool 13.

Entries for Section A must be posted in time to reach Liverpool not later than 31st August, 1934. Overseas competitors entering in Section B must forward their entries to reach Liverpool by 31st October, 1934.

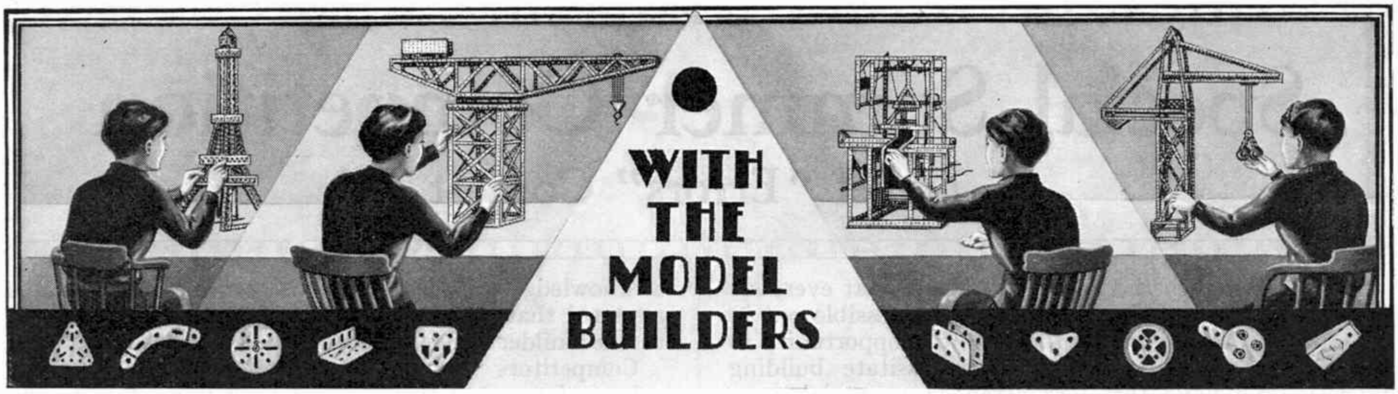
Successful competitors will be advised by post as soon as possible after the closing dates, and a full account of the Contest will be published later in the "*M.M.*" Prizewinners will be allowed to make their own selection of goods from Meccano and Hornby Train catalogues.

This Contest provides an opportunity for the competitor to exercise his knowledge of the correct design of a Meccano model, and at the same time it is great fun "spotting" the errors!

The Prizes

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

First Prize: Meccano or Hornby Goods value £2-2s.
Second Prize: Meccano or Hornby Goods value £1-1s.
Third Prize: Meccano or Hornby Goods value 10/6.
Ten Prizes: Meccano or Hornby Goods value 5/-.
Ten Prizes: Meccano or Hornby Goods value 2/6.
There will also be a number of consolation awards consisting of "How to Use Meccano Parts" Manuals.



SIMPLICITY AERO MODELS

Miniature Meccano models of an extremely simple nature have been illustrated in the "*M.M.*" from time to time, and have formed the subject of many model-building competitions. Those who have tried this branch of model-building know that the construction of a very small model is not so simple as it appears if a realistic reproduction of a definite prototype is to be obtained. A little extra time spent on designing and building a simplicity model is well repaid by the attractive results that can be obtained.

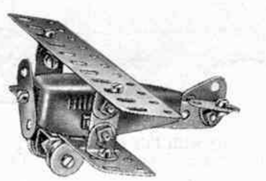
The building of simple aeroplane models can be just as fascinating as Meccano building, and in this connection Meccano parts come in very useful. There is plenty of scope for originality, and the four models illustrated on this page show that there need be no restrictions in the use of parts for new purposes. The examples illustrated have gained prizes in recent aeroplane competitions.

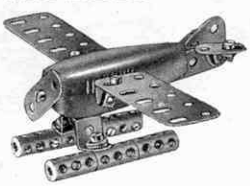
The three smaller models make use of the Base and Top for the Engine Casing (Parts Nos. P40 and P41) for the fuselage, the remaining construction being carried out with Meccano parts. A 1" Screwed Rod holds the two parts of the Engine Casing together and also secures the ends of two 3" Strips. The Strips extend beyond the rear of the Engine Casing, and are fitted with two Angle Brackets to which Flat Brackets are bolted to form the tailplanes. A 1" Triangular Plate is used for the fin. Flat Girders form the mainplanes, a 4½" Girder being used for the lower one in the biplane model and a 5½" Girder for the upper one, which is supported by Flat Brackets and Angle Brackets. Two ½" loose Pulleys serve as landing wheels and are carried on ⅜" Bolts attached to a Double Bracket that is spaced from the lower wing by two Washers.

A similar method of construction is adopted for the low wing monoplane model, except that a 5½" Flat Girder is used for the mainplane, the upper plane being omitted. The wings of the seaplane model are attached by Angle Brackets, and a Double Bent Strip secures the floats. Each float consists of three Couplings fixed on a 1½" Axle Rod.

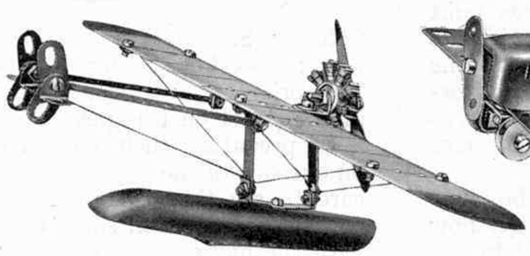
The larger model follows the lines of the Sikorsky amphibian aircraft, the notable feature of which is the method of mounting the tail unit on an outrigger. Small Mainplanes are used, and carry a single Seaplane Float suspended from two Centre Section Struts. Two Tie Rods form the outrigger that is braced by a Wing Stay, and Flat Brackets and Angle Brackets form the tail unit.

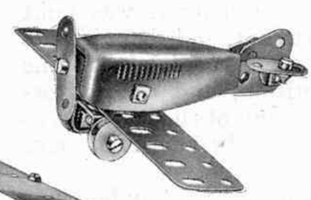
SIMPLICITY AEROPLANE MODELS





Three interesting examples of simple models using the Engine Casing for the fuselage. (Top left.) Light biplane. (Top right.) High wing monoplane seaplane. (Centre.) Low wing monoplane.





(Left.) A different type of simplicity model, of the Sikorsky Amphibian.

PRIZE FOR SIMPLICITY MODEL

The examples illustrated show the possibilities of simple aeroplane models, and we offer a prize of half-a-guinea for the best model of this type. The model may be built entirely from Aeroplane Parts or may be a combination of Meccano and Aero Parts. Simplicity and originality will be the chief points that will be given preference by the judges. Entries should be marked "Simplicity Aero Contest" and must reach this office not later than 29th September.

WIRE GRID CONSTRUCTION

Engineering models such as ships' engine rooms, or large steam engines, generally require some form of wire grid representing the platform which, in actual practice, enables the engineers to inspect and adjust certain parts of the machine that are above ground level. Usually steel ladders give access to these grids.

A realistic grid can be made in Meccano from Spring Cord stretched between Axle Rods. Screwed Rods may be used instead of Axle Rods if preferred, and in certain cases these will be found better on account of the method of fixing. Two Rods should be spaced apart the width required for the grid, and Spring Cord stretched between each and passed to and fro from side to side. At each loop the Spring Cord is stretched and twisted round the Rod. The finished grid made in this manner is much neater than one made up of Strips and Axle Rods. Spring Cord is useful also for making handrails in models of this type, and may even be used for the rungs of the steel ladders, the sides of which may consist of Strips, Axle Rods or Screwed Rods, according to circumstances.

FLEXIBLE PIPE

It is a simple matter to make steel piping with Meccano parts, and for this purpose Couplings, Sleeve Pieces, Boilers or even Strips can be used, according to the size of the pipe required. With such pipes it is generally necessary to make all bends angular, as it is not possible to curve the parts to the radius required. If Sleeve Pieces are used for the pipe, however, a curve of any radius can be made from Chimney Adapters. The Adapters are threaded together on a length of Spring Cord that keeps the parts close together but allows flexibility. This method of construction enables bends of large or small radii to be made in the pipe.

A NEW CAM PART

Cams of various shapes can be made from standard Meccano parts to produce many different movements. A simple and compact cam can be formed from the Universal Stand Clamp, Kemex Part No. K31. This resembles a large bush with a hole that just admits a Collar or Wheel Boss. The part is provided with a tapped hole into which a Grub Screw can be fitted for securing the boss, and when mounted in position the Rod is off centre in the Clamp. This arrangement is very satisfactory for producing uniform reciprocating motion, and can be used in some cases instead of an Eccentric, to get neater results.

SUBJECTS FOR NEW MODELS

There are times when even experienced model-builders run out of ideas for new models, yet the field of subjects available for modelling is unlimited. In fact there are so many subjects from which to choose that, instead of being short of a subject, one would expect the model-builder to find greatest difficulty in deciding what to build.

The enthusiast whose ideas are temporarily exhausted would do well to choose an entirely different subject from those he generally favours. Most boys have a favourite prototype, such as ship subjects, railways, or motor cars, and in these three branches alone will be found an unlimited field for constructional work. A change of subject increases the interest of model-building, however, and the builder will find fascination in overcoming the new problems and difficulties that occur.

An outdoor walk with a notebook should prove a profitable source for ideas, and the constructor will be surprised at the large number of possible subjects he sees. Even in the household there are numerous articles of equipment that can be built in Meccano to produce very interesting models, and those boys who have not already thought of the possibilities of such models should investigate when next seeking a subject.

Another method of finding subjects for modelling is to refer to illustrated books on engineering. In fact the books need not even be of an engineering nature, for if the enthusiast is really keen he is sure to find a subject in a very short time. A book on animals or birds would seem to be the last place to look for ideas for a Meccano model, yet we have previously illustrated such models in the "*M.M.*," and shown that unusual subjects can be most interesting.

The model-builder who is also a Hornby Train or Aeroplane enthusiast will find a pleasant diversion from the usual model-building by making accessories for his Hornby railway or Aeroplane "base." We describe elsewhere in this issue how an aerodrome can be laid out, and this should give many ideas for Meccano constructional work.

HOLLOW AXLE RODS.—This is an ingenious idea for lubricating models, the Axle Rods being drilled longitudinally through the centre and provided with transverse holes at intervals. Oil would be contained between two ¾" Contrate Wheels butted together so that the space between them covers one of the transverse holes in the Rod. The oil would flow through the centre hole of the Rod and out through the other borings to lubricate the bearings.

Although the idea is distinctly novel, it is scarcely practicable for Meccano. The Rods would be weakened considerably by the borings, and the cost of production would necessarily be high, so that it is doubtful if the introduction would be popular. Disadvantages are likely to arise owing to the limitations of available positions for the transverse bores, as it is obvious that these must occur only where bearings are required, otherwise the oil will be distributed where it is not wanted. (*Reply to a London reader, W.7.*)

COMBINED OIL CUP AND SHAFT BEARING.—The proposed part consists of a small cup provided with a threaded shank and shaped to take the end of a pointed Rod. The cup is of larger diameter than the Rod and contains oil so that the bearing is kept constantly lubricated.

This idea is applicable to the lower bearing of vertical shafts only, and a substitute can be formed from the present Grease Cups. These can be fixed to Strips or Plates and pointed Rods journalled in the outer end. By screwing down the cap grease is supplied to the bearing. Pointed rods can be made by filing the ends of Axle Rods. (*Reply to E. F. Small, Peckham, S.E.15.*)

Model-Building Contest Results

By Frank Hornby

"Winter" Competition (Home Sections)

THE lists of principal prizewinners in the Home Sections of the "Winter" Model-building Competition are as follows:—

Section A (competitors over 14).
First Prize, Meccano or Hornby Goods value £3-3s.: J. Matthews, Fillongley, Nr. Coventry. Second Prize, Goods value £2-2s.: R. Lawford, Bexleyheath, Kent. Third Prize, Goods value £1-1s.: L. Stiles, Chippenham, Wilts.

Editor's Special Prize of Meccano or Hornby Goods value £1-1s.: Mr. G. Harper, Uckfield, Sussex.

Five Prizes of Goods value 10/6: R. Atter, Birmingham; H. Fisher and J. Johnston, Leith (joint entry); R. Grant, Aberdeen; D. Holloway, Squirrels Heath, Essex; A. Slater, Sandal, Nr. Wakefield.

Five Prizes of Goods value 5/-: F. Byron, Liverpool 13; E. Deakin, Coalville, Leicestershire; A. Durrant, London, N.W.10; S. Reid, Aberdeen; H. Stephenson, Huyton, Liverpool.

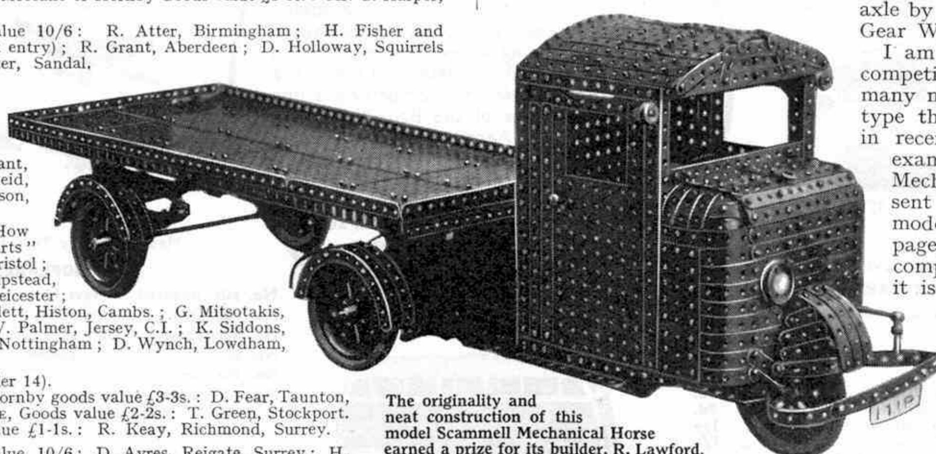
Consolation Prizes of "How to Use Meccano Parts" Manuals: R. Adams, Bristol; J. Ford, Steeple Bumpstead, Haverhill; K. Hart, Leicester; N. Jones, Ilford; T. Mallett, Histon, Cambs.; G. Mitsotakis, Kingston Hill, Surrey; V. Palmer, Jersey, C.I.; K. Siddons, Woodbridge; T. Smith, Nottingham; D. Wynch, Lowdham, Notts.

Section B (competitors under 14).
First Prize, Meccano or Hornby goods value £3-3s.: D. Fear, Taunton, Somerset. Second Prize, Goods value £2-2s.: T. Green, Stockport. Third Prize, Goods value £1-1s.: R. Keay, Richmond, Surrey.

Five Prizes of Goods value 10/6: D. Ayres, Reigate, Surrey; H. England, Exeter; H. Chapman, Egham Hill, Surrey; P. Siddons, Northants.; R. Walford, Newton Abbot, Devon.

Five Prizes of Goods value 5/-: J. Benson, Hull; A. Dick, Brighton; W. Harling, London, S.E.23; E. Sharp, London, N.1; J. Tottle, Taunton, Somerset.

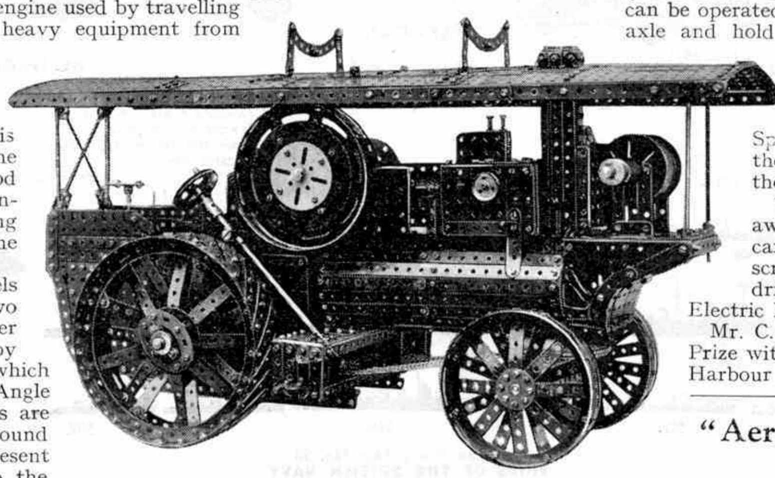
Consolation Prizes of "How to Use Meccano Parts" Manuals: D. Carnegy, Arbuthnott, Reading; J. Beck, Norwich; K. Durham, Christchurch, Hants.; C. Evans, Hale, Cheshire; R. Hodge, Exeter; T. Humphreys, Shrewsbury, Salop; A. Huston, Anglesey; W. Kitts, St. Helens, Lancs.; C. Latham, Westbury-on-Trym, Bristol; I. McKean, Sanderstead, Surrey.



The originality and neat construction of this model Scammell Mechanical Horse earned a prize for its builder, R. Lawford, Bexleyheath.

A First Prize was awarded for one of the best model traction engines that I have seen for some time. It was built by J. E. Matthews of Fillongley, and is illustrated on this page. The model represents the type of engine used by travelling showmen for hauling their heavy equipment from place to place and for providing electricity for the roundabouts and other amusement devices. The dynamo for this purpose is mounted in front of the chimney. Particularly good work is to be seen in the construction of the wheels, steering gear and dummy steam engine mounted on the boiler.

The rims of the rear wheels are each made from two Circular Strips joined together round their outer edges by means of Braced Girders, which are held in place by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. Several $2\frac{1}{2}''$ Strips are then bolted diagonally around the rim of each wheel to represent the strakes usually fitted to the wheels of hauling engines. The spokes are fixed at an angle and run from one side of the rim to the opposite side of the hub, which is composed of two Face Plates. The front wheels are constructed in a similar manner to the rear wheels, but Circular Girders and Bush Wheels are substituted for the Circular Strips and Face Plates respectively.



Good proportion and accurate detail work give a remarkably realistic appearance to this prize model traction engine, built by J. Matthews, Fillongley.

Steering is carried out in the usual manner by means of Worm reduction gear, the final drive being taken from the winding drum to the front steering axle by means of Sprocket Chain. The winding drum consists of several Couplings mounted on a Rod, and the Sprocket Chain passes from the drum round a Ball Bearing fixed to the centre of the front axle support.

The imitation steam engine incorporates a great amount of detail, including piston-rods, cylinders, and valve gear; and when the tractor is in motion the engine is driven in a most realistic manner by an Electric Motor fitted in the rear coal bunker. The Motor drive is taken from the engine crankshaft to the rear wheel axle by means of a Pinion and Gear Wheel.

I am glad to say that this competition produced a great many models of more original type than has been the case in recent contests, a typical example being the Scammell Mechanical Horse that was sent by R. Lawford. The model is illustrated on this page, but to judge this competitor's work properly it is necessary to examine the actual model, in which splendid construction is displayed in the draw-bar mechanism and the braking and steering systems.

Unfortunately, owing to lack of space, I am unable to illustrate the mechanism, but I will do my best to describe it. The model is driven by a 6-volt reversing Electric Motor, from which the drive is taken to a four-speed ball-and-gate type gear-box by means of a $\frac{3}{4}''$ Pinion, a 50-teeth Gear Wheel with a Pinion on its spindle, and a 57-teeth Gear Wheel. From the gear-box the transmission is taken through Universal Couplings to a differential mechanism incorporated in the rear axle assembly. The trailer is fitted with two $\frac{3}{4}''$ Flanged Wheels, which run on rails formed by bent Rods. The Rods are just visible above the rear mudguards in the illustration. Two catches, which can be operated from the cab, engage with the axle and hold the trailer in position. The inner end of the trailer presses up against two spring buffers, formed from Collars and Compression Springs, which take the place of the spring draw-bar employed in the usual type of trailer.

Third Prize in Section A was awarded for a model sports saloon car that is fitted with hinged wind-screens and a sliding roof, and is driven by a 6-volt Meccano Electric Motor.

Mr. C. Harper won a special Editor's Prize with a fine 20 ft. model of Sydney Harbour Bridge.

"Aeroplane Constructor" Contest

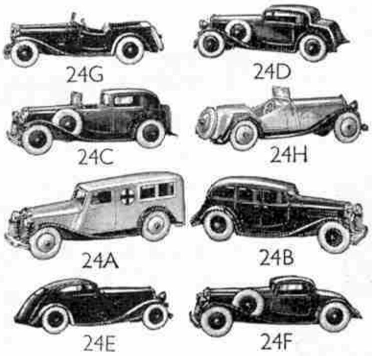
The principal prizewinners in the Overseas Section of the Third "Aeroplane Constructor" Contest are as follows:—

First Prize, Meccano or Hornby Goods value £2-2s.: T. Chew, Kuala Lumpur, Federated Malay States. Second Prize, Goods value £1-1s.: B. Westropp, Rajputana, India. Third Prize, Goods value 10/6: D. May, Kuala Lumpur, F.M.S.

Prizes of Meccano or Hornby Goods value 5/-: C. Williams, Brisbane, Australia; J. Cameron, Sydney, N.S.W.; T. Yip, Kuala Lumpur, F.M.S.; L. Huls, Amersfoort, Holland; E. Fijlstra, Leiden, Holland; M. Fearnley, Wellington, N.Z.; L. Boyer, Invercargill, N.Z.; E. Paasche jr., Bergen, Norway; J. Appleby, Calcutta, India; R. Rasmussen, Bergen, Norway; M. Meredith, Montreux, Switzerland; K. Rosenthal, Kenilworth, South Africa.

MECCANO
DINKY TOYS

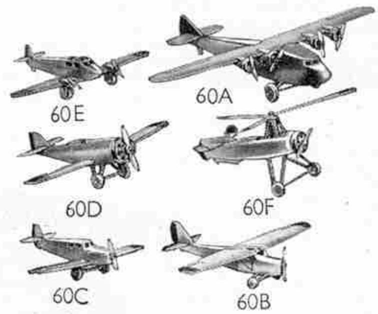
Meccano Dinky Toys are rapidly establishing themselves as firm favourites with boys and girls. They are in big demand because they are the most realistic and the most attractive models in miniature ever produced. New items are constantly being added to the series to increase the fun and fascination. One of the latest of these is No. 50, comprising a fine selection of Ships of the British Navy. Then there are Aeroplanes, Train Sets, Motor Cars, Motor Vans, Railwaymen, a fine Racing Car and many others. These splendid toys may be purchased either separately or in complete sets, at the prices shown. Ask your dealer to show you the full range.



Meccano Dinky Toys No. 24
MOTOR CARS
Fitted with rubber tyres and silver plated radiators.

No. 24a	Ambulance	each 9d.
No. 24b	Limousine	,, 9d.
No. 24c	Town Sedan	,, 1/-
No. 24d	Vogue Saloon	,, 9d.
No. 24e	Super Streamline Saloon	,, 9d.
No. 24f	Sportsman's Coupé	,, 9d.
No. 24g	Sports Tourer (4 seater)	,, 1/-
No. 24h	Sports Tourer (2 seater)	,, 1/-

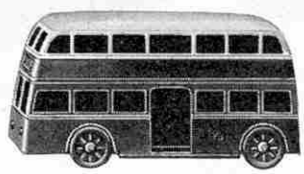
Price of complete set 6/6



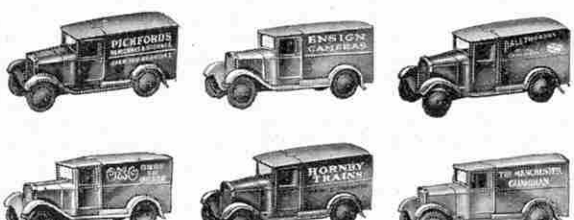
Meccano Dinky Toys No. 60
AEROPLANES

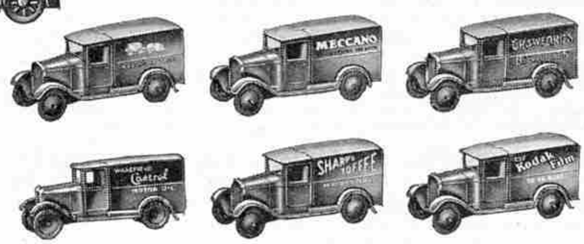
No. 60a	Imperial Airways Liner	each 9d.
No. 60b	D.H. "Leopard Moth"	,, 6d.
No. 60c	Percival "Gull"	,, 6d.
No. 60d	Low Wing Monoplane	,, 6d.
No. 60e	General "Monospar"	,, 7d.
No. 60f	Cierva "Autogiro"	,, 6d.

Price of complete set 3/-



Meccano Dinky Toys
No. 29
MOTOR BUS
Assorted Colours
Price 6d. each





PRODUCT of MECCANO LIMITED LIVERPOOL

Meccano Dinky Toys No. 28/1
DELIVERY VANS

Manchester Guardian Van	each 6d.
Palethorpe's Sausage Van	,, 6d.
Hornby Train Van	,, 6d.
Pickford's Removals Van	,, 6d.
Oxo Van	,, 6d.
Ensign Cameras' Van	,, 6d.

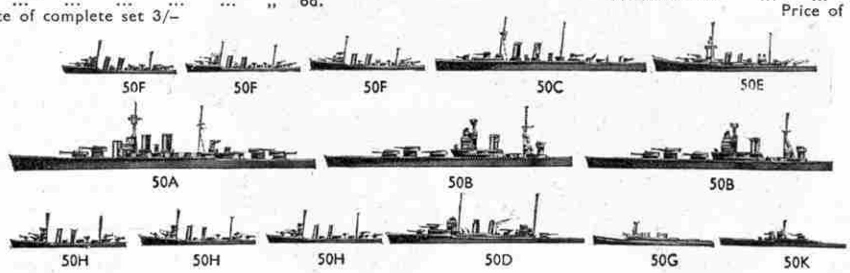
Price of complete set 3/-

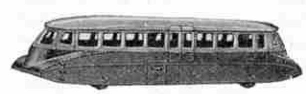
Meccano Dinky Toys No. 28/2
DELIVERY VANS

Kodak Cameras' Van	each 6d.
Sharp's Toffee Van	,, 6d.
Crawford's Biscuit Van	,, 6d.
Wakefield's Oil Van	,, 6d.
Marsh and Baxter's Sausage Van	,, 6d.
Meccano Van	,, 6d.

Price of complete set 3/-

Meccano Dinky Toys
No. 27
TRAM CAR
Assorted Colours
Price 6d. each





Meccano Dinky Toys
No. 26
RAIL AUTOCAR
Assorted Colours
Price 6d. each

Meccano Dinky Toys No. 18
GOODS TRAIN SET

No. 21a	Tank Locomotive	each 9d.
No. 21b	Wagons	,, 4d.

Price of complete set 1/9

Meccano Dinky Toys No. 50
SHIPS OF THE BRITISH NAVY

No. 50a	Battle Cruiser "Hood"	each 9d.
No. 50b	Battleship "Nelson"	,, 6d.
No. 50c	Cruiser "Effingham"	,, 4d.
No. 50d	Cruiser "York"	,, 4d.
No. 50e	Cruiser "Delhi"	,, 4d.
No. 50f	Torpedo Destroyer, Broke class	,, 1d.
No. 50g	Submarine, X class	,, 1d.
No. 50h	Torpedo Destroyer, Amazon class	,, 1d.
No. 50k	Submarine, K class	,, 1d.

Price of complete set 3/6

Meccano Dinky Toys No. 20
PASSENGER TRAIN SET

No. 21a	Tank Locomotive	each 9d.
No. 20a	Coaches	,, 7d.
No. 20b	Guard's Van	,, 7d.

Price of complete set 2/6

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Model-Building Ideas from Excursions

It is interesting to find that in most clubs model-building continues throughout the summer. This of course is not surprising, for the thoughts of Meccano enthusiasts continually return to the little problems encountered in model-building, while on their excursions and rambles, which take them farther afield in summer than in winter, they often see new and attractive subjects for their operations.

Even the most diligent model-builder relaxes at this time of the year, however, and the sections that are most active this month are those concerned with outdoor sport. Cycling Sections are meeting regularly, both in the evenings and on Saturdays, and most of the famous holiday resorts in the country are being visited at various times by representative parties of Meccano boys. Swimming attracts many members, and I hope that in every club full advantage is being taken of every opportunity of enjoying this splendid pastime. Speed boat racing is another favourite summer hobby, and rightly so, for it combines the attractions of tuning up an efficient mechanism with the excitement of racing in healthy open-air surroundings.

Easily Organised Summer Programmes

When for any reason hobbies of this kind cannot be included in the programme, there is no need to abandon thoughts of happy outdoor meetings, for a walk or ramble can be made extraordinarily interesting in a variety of ways. The interest may be derived either from the country passed through, which often has historical associations, or from the living creatures that may be met. Such a pursuit as bird watching can become very fascinating, and a countryside ramble in the company of anyone familiar with animal life is a delightful experience.

Those who are not interested in Nature, or in ruined castles, often can be attracted by converting a ramble into a game of some kind. For instance, a treasure hunt can readily be organised on lines that I have previously suggested, for it is little trouble to hide the necessary succession of clues, each leading to the place where the next can be found, and to conceal the treasure itself at the spot indicated by the final clue.

Signalling by semaphore code offers another profitable way of spending a short time in the open air. This requires even less preparation than treasure hunting, for it is not necessary to use flags if the distance over which messages are despatched are kept within reasonable limits. The letters of course are indicated by the positions of the arms, one arm alone being used for letters from A to G, and two arms to indicate the remaining letters. The code is easily learned and can be found in most books dealing with boy's hobbies, and I should be very pleased to forward a copy of it to anyone who is interested and has any difficulty in finding the necessary details. When reasonable proficiency has been achieved, attractive contests in speed and accuracy of signalling can be arranged.

Meccano Club Leaders

No. 74. Rev. J. H. K. Dagger

The Rev. J. H. K. Dagger is Leader of the St. Peter's (Wolverhampton) M.C., a very successful club that was affiliated in March 1931, and has since been steadily active in model-building. Recently a special feature has been made of Electrical Nights, on which members have carried out experiments with telephone systems and wireless receivers.

Recent Successful Exhibitions

I have been extremely pleased to receive reports of successful Exhibitions from many quarters, and it is evident that clubs are making a better show in this respect now than at any previous time since the club movement began. Formerly the organisation of an Exhibition was thought to be beyond the powers of all but the strongest clubs, but displays of high quality are now arranged by practically all clubs, and invariably arouse intense interest.

One reason for the fascination exercised by Meccano club Exhibitions is that they are no longer mere haphazard arrays of models of all types and sizes, arranged on a bench without regard to order or suitability. The models displayed still reflect the individual tastes of members, but follow a definite plan, every member doing his best to ensure that the scheme adopted is effectively worked out. For instance, more than one club has made a dock scene the centre of its display. This gives ample opportunity for members to build the types of models in which they are most interested, for the dock itself is filled with ships of all types, and the cranes and other machinery that naturally appear on the wharfs give ample scope for variety.

A comprehensive scheme of this kind provides a splendid opportunity for introducing a Hornby Railway in a very natural manner. To see goods being brought to the docks for shipment, and lifted out of the holds of vessels into wagons waiting alongside to be despatched to various points inland, adds life to the scene, and also shows that the members fully appreciate the part played in industry by the prototypes of the models they build. This adds to the enjoyment of visitors, and increases their respect for the club in which such interesting and comprehensive schemes are worked out.

The attraction of a Hornby Train display has been realised in many clubs, and most successful Exhibitions have included a well-planned layout on which fascinating operations have been carried out. Such an excellent means of interesting visitors, therefore, should not be overlooked when organising a display. Suitable arrangements usually can be made without difficulty, especially when a club includes a Hornby Train section, or an active Branch of the Hornby Railway Company is associated with it, but care should be taken to fit the layout into the scheme of the Exhibition.

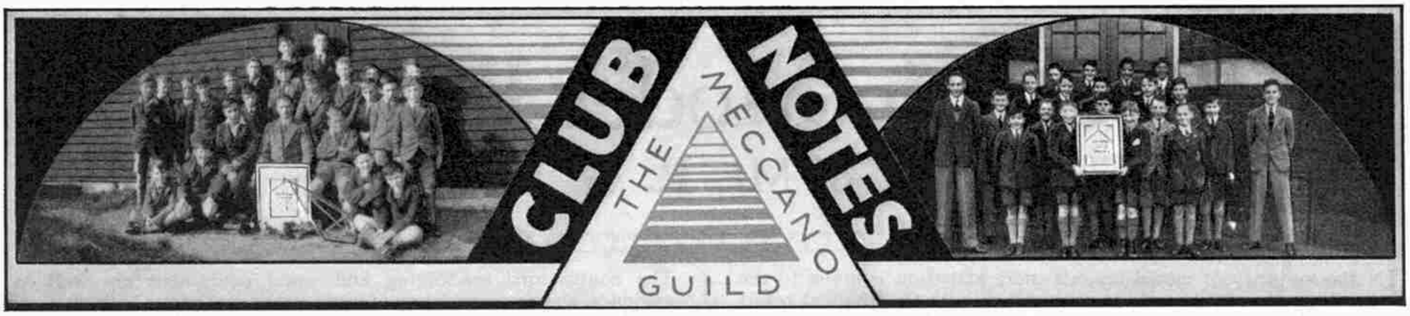
Proposed Clubs

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

DURHAM—Neil Miller, 119, Regent Street, South Shields.

LONDON—P. J. P. C. Woodhams, 97, Pepys Road, New Cross, S.E.14.

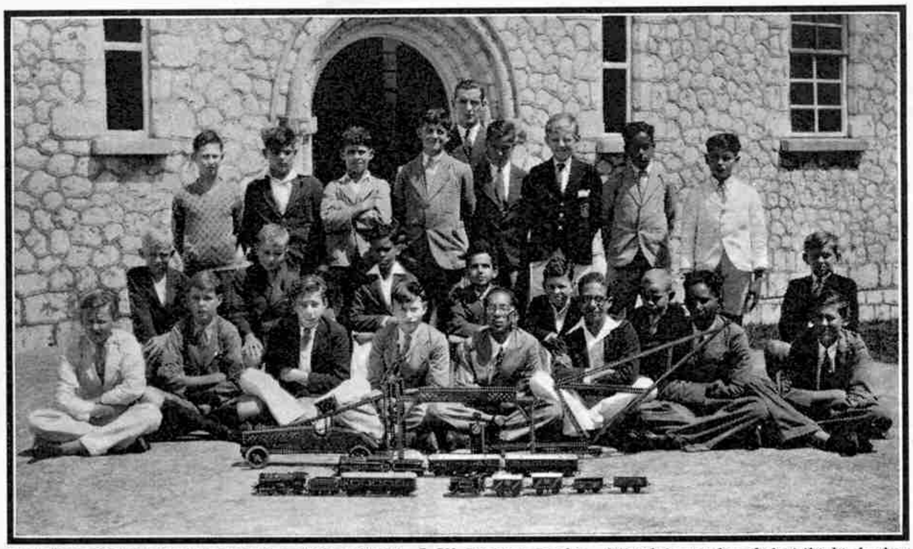
SOUTH AFRICA—C. C. Richards, P.O. Box 51, Windhoek, South West Africa.



Falmouth Wesley M.C.—An interesting talk on "*Africa*" was given by Mr. S. B. Sherman, who is familiar with life in that continent. Other events have included a Social and a Concert, one of the features of which was a sketch produced by Mr. W. J. Stych. The proceeds of the Concert amounted to £5. Mr. Sherman and Mr. Stych have been elected honorary members in recognition of their services. The club has now completed a successful year's working. Membership has greatly increased, and an interesting programme is being enthusiastically followed. Club roll: 29. *Secretary:* W. T. Allen, 7, Marlborough Road, Falmouth.

Hornsea M.C.—The club's Anniversary was celebrated by an enjoyable Tea and Social. This was attended by the first member of the club, which was founded 14 years ago and now has more than 74 members. The ordinary programme of Model-building and other activities has been made more interesting by Lectures on Railway Working and Signalling by Mr. Dry and Mr. Bloomfield, friends of the club engaged in railway work, and by talks on industrial chemistry. Mr. R. W. Shooter, the Leader, gave a talk on "*The Production of Coal Gas*," and this was followed by a visit to the Hornsea Gas Works. Club roll: 74. *Secretary:* L. Chapman, "Cleveleys," Hull Road, Hornsea.

Braintree High School M.C.—Model-building Competitions continue to be popular with members, who are particularly interested in "Packet" Contests, when models are built from a restricted number of parts. At a joint meeting with the School Society, members of the club supported the motion "*That membership of a Meccano Club is the best preparation for becoming a useful member of the community.*" In the Table Tennis Match that followed, the Meccano club was successful by a large margin. An interesting form of meeting has now been introduced. A short talk on some form of mechanism is given, and this is followed by the construction of models to illustrate the principles involved. Club roll: 18. *Secretary:* M. K. Miles, 1, Wordsworth Road, Bocking, Braintree.



Members of Munro College, Jamaica, M.C., with Mr. J. W. Peshett, Leader. The club was founded at the beginning of the year and was affiliated in April. A large share in the management of the club is taken by members themselves, and a very successful display of models has already been given.

Worcester Y.M.C.A. M.C.—The club's Exhibition was remarkably successful. The models displayed included a Beam Engine and a Funicular Railway, and all attracted favourable attention from visitors. Members later pooled their resources in order to construct a giant Blocksetting Crane for display in a shop window in Worcester. Cinematograph Evenings and Games Nights have been held, and the Club Supper was followed by a special meeting to discuss progress and to plan the outdoor programme for the summer session. Club roll: 16. *Secretary:* R. Price, 60, Bath Road, Worcester.

St. George's (Edinburgh) M.C.—Recruits still continue to come in, and special arrangements have been made in order to prevent overcrowding of the club room, particularly during track operations on the club's Hornby Railway. The first issue of "*The Mechor*," the club's magazine, has appeared. Its name is derived from the words "*Meccano*" and "*Hornby*" and it contains many interesting features, including an excellent summary of recent meetings, and an account of the club trip to Glasgow for the Scottish Motor Show. Visits to Printing Works and other interesting places are being arranged for the summer term, and indoor activities include operations to time-table on the club's extensive model railway. Club roll: 87. *Secretary:* A. Matheson, 18, Hutchison Terrace, Edinburgh.

Harlesden Methodist M.C.—Chief interest centres in Model-building operations. Contractors Nights are held regularly, and in a new form of competition members are set such problems as "The Conversion of a Vertical Movement into Horizontal Movement with a given increase in Speed." The judgment of members also is being improved by competitions in which they write criticisms of a series of specially constructed models. Special models of locomotives and rolling stock for use on the club's Hornby Railway also have been built. Club roll: 20. *Secretary:* J. A. Ford, 139, Wakeman Road, Kensal Rise, London, N.W.10.

Anderson Baptist M.C.—A very enjoyable outing to Eastleigh and Southampton attracted 28 members and their friends. At Eastleigh the works of the S.R. were inspected, and this was followed by a tour of the docks at Southampton, and a visit to the "*Olympic.*" A prize was offered for the best essay on the visit. At other meetings Debates and Mock Trials have been held. Club roll: 28. *Secretary:* R. E. Hoffler, "Darleigh," Wokingham Road, Earby, Nr. Reading.

Bexleyheath Boys' Central School M.C.—Increased enthusiasm has been shown since affiliation was secured. Meetings are held in the School Science Room. A display of models has already been given, the Meccanograph, Gantry Crane, Battle Cruiser and other models on view arousing great interest among visitors. Good use is made of the Club Magazine. This is free to members, and a small charge is made to others. Club roll: 35. *Secretary:* D. Choppen, 29, Marlborough Road, Bexleyheath, Kent.

Colfe's Grammar School M.C.—Members are full of enthusiasm and have the distinction of being the only club in the school to arrange a public Exhibition. Meetings are chiefly devoted to Model-Building Contests, the subjects for which are often chosen from competitions announced in the "*M.M.*" A novel competition suggested by a member was a Meccano Roller Skating Contest. A surprise entry in a Simplicity Contest was a model of a pterodactyl consisting of one Meccano part—a Boss Bell Crank! Good prizes have been awarded in further Model-building Contests in order to encourage members. Club roll: 35. *Secretary:* H. H. Renyard, 74, Fernbrook Road, Lewisham, London, S.E.13.

St. Nicholas (Sevenoaks) M.C.—A house has been generously placed at the disposal of members, who have decorated it suitably and adapted it to their proceedings. Separate rooms have been allotted to the club's Hornby Railway operations and to Model-building, and facilities for scientific experiments have been provided. The club house is open every night and invariably is the scene of intense activity. Club roll: 14. *Secretary:* J. Kemp, 4, Bosville Road, Sevenoaks.

CANADA

St. Clair Y.M.C.A. (Toronto) M.C.—Members are rapidly becoming more skilful in the design and construction of models, and enthusiasm is rising. The club is now affiliated, greatly to the satisfaction of members, who are interested in Guild activities and in the progress of Meccano clubs generally. Club roll: 21. *Secretary:* G. Bell, r., 13, Rockvale Avenue, Toronto 10, Ontario, Canada.

ITALY

Milan M.C.—An excellent programme has been arranged for this newly-formed club. At one meeting Sr. Cesare Vigo, President of the club, addressed members on "*Engineering*," illustrating his remarks by means of Meccano models. Rambles and Visits, chiefly to engineering works, have been arranged for the summer session. A Library has been formed and Model-building is carried on at every meeting. Club roll: 10. *Secretary:* E. Vigo, Corso Genova N, 19 Milano, Italy.

NEW ZEALAND

Christchurch M.C.—The club is again making good progress and many new members have been secured. The Hornby Train section planned and constructed a new layout, which was examined and criticised by members of the Meccano section; in return, entries in a special Model-building Contest were judged by those responsible for the Hornby Train layout. Interesting hikes in the Bush have been arranged and Games Nights, which are held regularly, are greatly enjoyed. Club roll: 30. *Secretary:* R. F. Worsley, 50, Opawa Road, Opawa, Christchurch, New Zealand.

Clubs Not Yet Affiliated

Calgary Y.M.C.A. M.C.—Members are now carrying out railway operations on a Hornby Train layout 90 ft. in length. The construction of this was an ambitious undertaking, but is being completed in a workmanlike manner. *Secretary:* W. Sinistrin, Y.M.C.A., Calgary.

Broadview Y.M.C.A. M.C.—Members are very keen and enthusiastic and the attendance record is improving, which is a sure sign of progress. A good all-round programme has been arranged and Meccano boys who join the club will find excellent scope for model-building activities in company with others who are as keen as themselves. *Secretary:* Mr. K. Smith, 275, Broadview Avenue, Toronto.

Central Y.M.C.A. (Toronto) M.C.—Members built a model Suspension Bridge 10 ft. long. Every part was carefully thought out, and the accuracy in detail of the model aroused considerable admiration when it was exhibited in the lobby of the Central Y.M.C.A. Buildings. Enquiries about the model led to the acquisition of many new members. Other models built have included a Hammerhead Crane, a Battleship, and a realistic Aeroplane. Lectures have been given by Mr. A. Scharlow, President of the club, and several members. *Secretary:* Wm. Moore, Central Y.M.C.A., 40, College Street, Toronto.

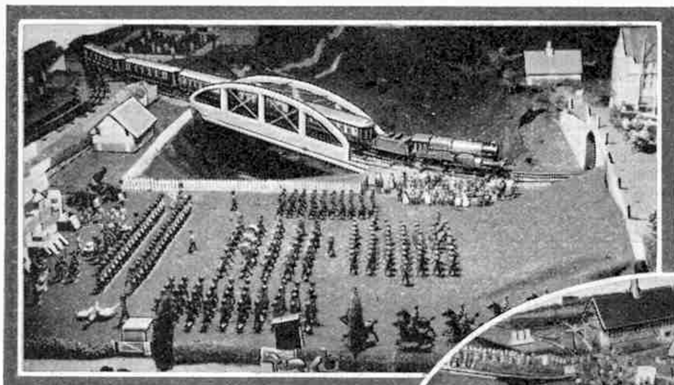
New Westminster Y.M.C.A. M.C.—A start has been made with the organisation of this club, and plans for regular meetings have been arranged. More members are required, and those interested are asked to communicate with Mr. F. J. Robins, Secretary, Boys' Work Division, Y.M.C.A., New Westminster, British Columbia.

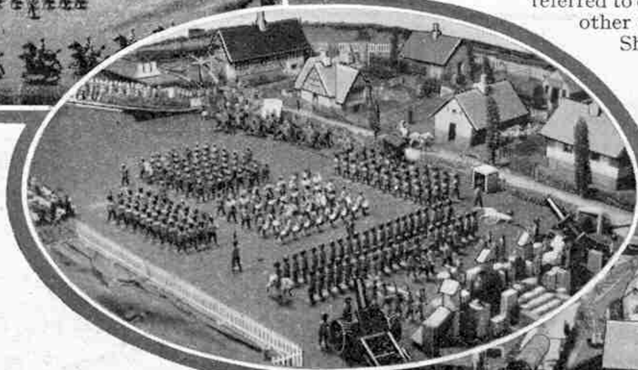
West End Y.M.C.A. (Toronto) M.C.—Outstanding models brought by members to the club room for criticism and discussion have included a Well Driller, a Motor Van, a streamlined three-wheeled Motor Vehicle and a wind-driven Screen Wiper. A Library of engineering magazines has been started. Debates are held regularly and proceedings are varied by visits to places of interest, spells in the gymnasium and swimming meetings. Club roll: 40. *Secretary:* E. Pankowski, 301, Shaw Street, Toronto, Canada.

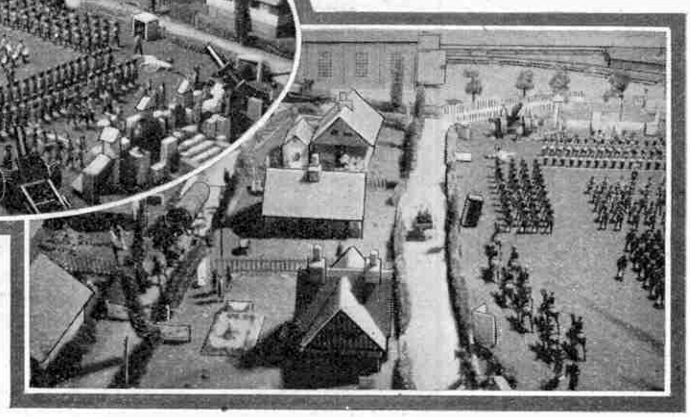
A Scenic Model Railway

The Layout of Mr. R. G. Hadingham

IN the majority of model layouts more attention is given to the railway than to its scenic surroundings, with the frequent result that the realistic effect of the line is spoiled because there is too much railway! There are of course exceptions, and in planning the layout shown in the photographs on this page special attention has been given to the perfection of the scenery, while imagination and originality have been exercised in the arrangement of the whole.







Views on the layout described on this page.
(Top) An express crossing the viaduct.
(Centre) A military ceremony in progress.
(Bottom) A closer view of the roads and realistic houses.

This layout, which occupies a space 16 ft. long and 12 ft. wide, has been developed by Mr. R. G. Hadingham and his younger brother, of Wimbledon Common, and it has taken several years to bring the scheme to its present state of completeness. The railway track itself is oval in form and a double line of rails is provided right round the layout. There is in addition an inside loop connection across the middle of the layout, but this is only joined up to the inner track. This loop line is carried across the viaduct that is shown in the uppermost of the three illustrations on this page.

The layout is arranged on a raised platform built of planks of wood, and in order to accommodate a centrally situated valley the middle of this baseboard is specially cut away so that a natural undulating effect is obtained. This relieves the unrealistic appearance that so many layouts present where hills occur suddenly in the midst of otherwise level country.

At the bottom of the valley is a lake, the appearance of water being obtained by blue paper placed beneath a suitable piece of glass. The shores of the lake are imitated by sand sprinkled round the edge of the glass, the usual uneven outline of the lakeside being thus easily obtained. This lake is crossed by the viaduct already mentioned. The hillside that slopes up from the valley towards one end of the layout was formed by building up a rough framework of wooden strips covered over with crepe paper of a suitable shade, as suggested several times in the *"M.M."* This crepe paper was previously crumpled in order to give the necessary rough effect. Part of the way up the hill is a four-gabled house that stands on a special platform arranged for it in the woodwork. An interesting detail is that near the top of the hill is a miniature windmill, which actually is worked by an electric motor concealed in the hollow space underneath the surface of the hill.

Various roads connect different parts of the layout, and these are made up of the well-known lengths of roadway of the Hornby Countryside Sections. Numerous cottages and houses are included and, as the photographs show, these have a most realistic appearance. They are surrounded by suitable gardens, and at one point a scene is arranged representing a large building under construction. The contractors' scaffolding and usual equipment are well in evidence, and men are shown at work on the roof of the building. A small factory is placed at one point, and there is also an inn with a tennis court adjoining, marked out correctly and surrounded with the usual netting. Elsewhere on the layout there is a cricket field where a match is in progress between teams of appropriate die-cast figures.

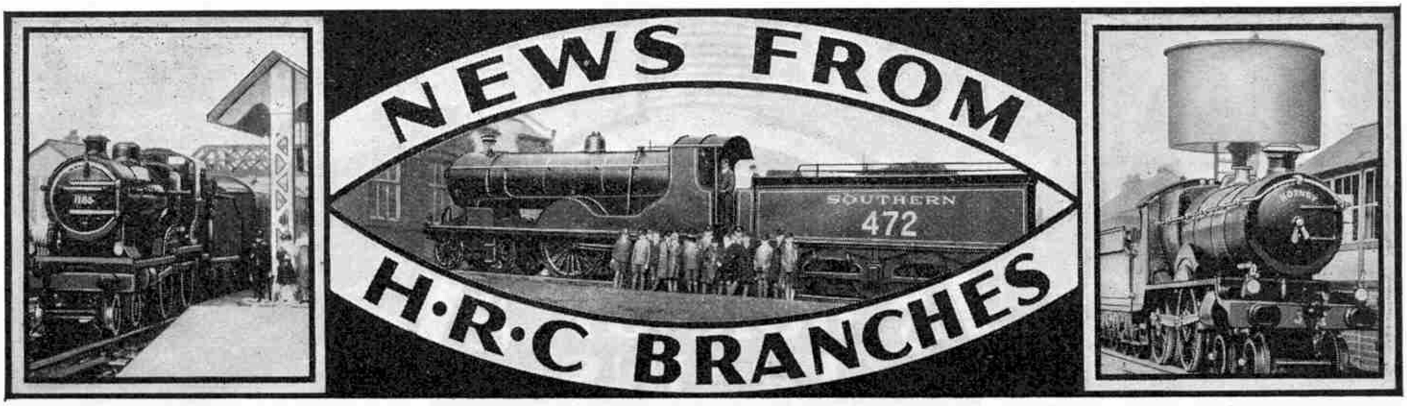
A specially interesting feature of the layout is that in a large level field, centrally situated, a spectacular military display is arranged. The formation of the troops has been carried out in a very careful manner, and the whole gathering has an air of military pomp and ceremony about it. A crowd of interested spectators is made up of civilian figures of all kinds, and these may be seen in the top photograph by the side of the railway track.

There is a passenger station on one side of the layout, the main platform being of the island type with the usual offices in the centre. The usual width between the up and the down track is increased in the neighbourhood of the station in order to allow of the island platform. The inner track is diverted from the outer by reverse curves. At one end of the station the loop line previously referred to diverges from the inner track, and at the other end points lead off to the No. 2 Engine Shed. In addition to the island platform there is a shorter platform serving the inner track only, and connected to the main road by a pathway lined with Hornby Fencing. The island platform is long enough to accommodate a locomotive and three Hornby Pullman Coaches.

At the opposite end of the layout to the passenger station is a goods platform that serves only the inner track. This track maintains the same level throughout the circuit, but the outer one slopes down near the goods platform and disappears below the surface. It reappears again on the same level as and parallel to the inner track, where the latter emerges from the tunnel that bores through the hillside.

The track itself is composed of miniature steel permanent way on wooden sleepers, this material being necessary in view of the slightly damp situation of the line. Ballast of fine granite chippings is laid all round, the permanent way thus appearing very effective. Connection between the up and the down track is afforded by means of the crossover points which, following the usual practice, are of the trailing type. The points on the layout are for the most part operated directly by hand levers, although one of them is wired up to a control frame.

Apart from the ordinary means of lighting in the centre of the room, each of the miniature houses and buildings is correctly illuminated inside. The necessary wiring connections are carried underneath the wooden baseboard that accommodates the layout, and small lamps of the type used for Christmas tree decoration are employed. This arrangement of individual lights is most attractive, especially when the models alone are illuminated and the main light is switched off.



Branch News

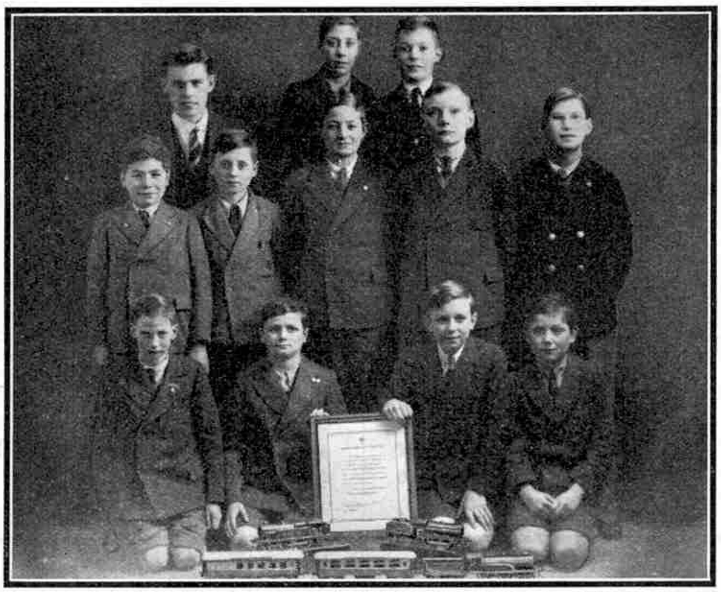
HOLLANDERS.—The permanent track is now floodlighted and passenger and goods services are operated with the lights in use. Members continually suggest improvements both in the layout and in working, and all proposals are considered at special meetings before being accepted or modified. A new bridge has been built for use on the layout, and the provision of Double Crossover Points and additional sidings has added to the interest of operations. Secretary: R. Sparling, 4, Gore Lane, Spalding.

BURTON MODEL RAILWAY.—Track meetings are held regularly, and recently were devoted to developing a satisfactory layout for the Exhibition arranged in conjunction with Loughborough Grammar School Hobbies Club. Afternoon and Evening Displays were given at this event, and were remarkably popular with visitors. A profitable visit was paid to the L.N.E.R. District Control Room at Victoria Station, Nottingham. Diagrams showing the positions of trains on the system were explained to members, who were allowed to listen to telephoned reports from signal cabins in the district. Secretary: R. E. Trotter, 2, Radmoor Road, Loughborough, Leics.

MACCLESFIELD CENTRAL SCHOOL.—A special room was allotted to the Branch at the School Exhibition of Work, when an excellent Hornby railway was operated, a novelty being the floodlighting of the track in various colours, changes being made at intervals of five minutes. Many new members have joined and four groups have been formed for special activities, each group being distinguished by a special badge. In two of these groups electrical experiments and model aeroplane flying are being carried on, and special meetings have been arranged in order to give members ample opportunity for good work. Secretary: A. Morlidge, 4, Blagg Street, Macclesfield, Cheshire.

SANDHURST.—At early meetings of this Branch there were too many accidents during track operations. A committee was formed to deal with offenders, and the result of investigations has been a great improvement, members being more careful and alert. The Branch track is being overhauled and an improved layout has been designed. New members are required and the secretary will be pleased to hear from those who are interested. Secretary: F. Y. Fairhall, "Canterbury Bell," Sandhurst, Kent.

SOUTH BIRMINGHAM.—Full track meetings have been resumed in a new Branch room. An interesting layout has been planned. Many extensions that have been suggested will improve working when they are carried out, and members have come to the conclusion that a Branch layout can never be completed because it can always be made larger and more interesting. Secretary: E. E. Sharp, 156, All Saints Road, Kings Heath, Birmingham.



A group of members of the Harlesden Methodist Branch, No. 242. Mr. G. B. Weightman, Chairman, and J. P. Summers, secretary, are on the left and right respectively of the back row. The Branch was incorporated in March, 1933. Track work is the chief occupation of members, and the Branch is closely associated with the Harlesden Methodist M.C., the two organisations arranging successful joint Exhibitions and special meetings.

STREATHAM PARK.—An event of special interest was a visit to King's Cross Engine Sheds, where members were allowed on the footplate of the "*Flying Scotsman*" and given a footplate trip on an engine that was being coaled. Keen questioning was fully dealt with by the guide, and members showed that they had profited by the visit by re-designing the terminal station of the Branch layout to represent King's Cross as far as possible. Timetable working has since been resumed on the reconstructed track. Secretary: J. B. Cass, 161, Ribblesdale Road, Streatham, London, S.W.16.

KIDDERMINSTER.—The Branch Exhibition attracted 200 visitors and increased local interest in model railways. The attractions of the Branch layout were supplemented by the exhibition of a working model of a Tank Locomotive, on loan from Meccano Ltd., and other working models kindly loaned by a local Meccano dealer. Good use is now being made of the Branch playing field, and the Cycling, Swimming and Photographic Sections are enjoying a busy season. Secretary: C. P. Harris, "Railway House," Kidderminster.

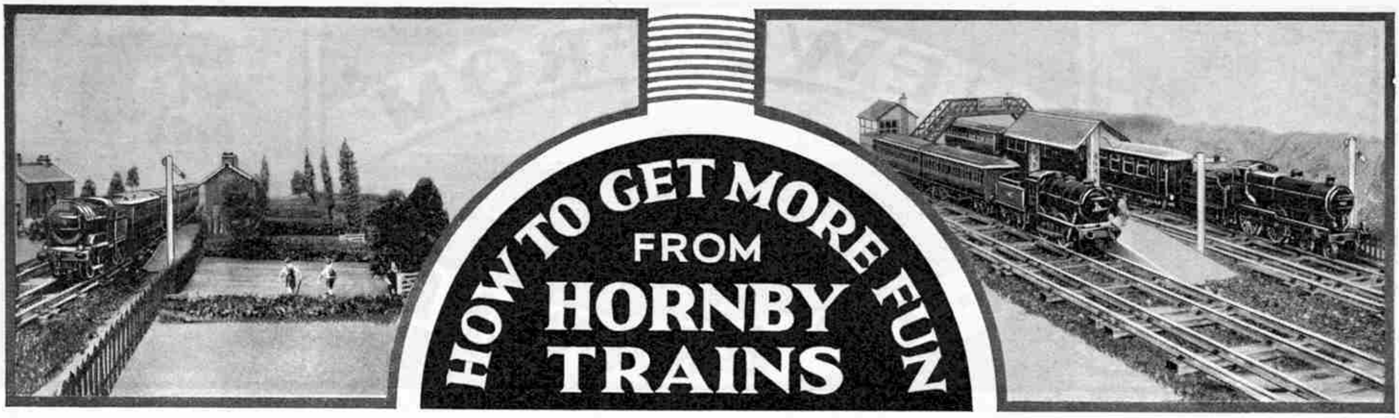
LYONSDOWN (NEW BARNET).—Members are showing increasing zeal and skill at track meetings. They work in pairs, each pair being responsible for one section of the layout. At one meeting trains were purposely despatched awkwardly and quick thinking was necessary to avoid mishaps. Members showed considerable skill in tackling the problems presented to them. The first Exhibition arranged by the Branch was more successful than was expected. Many new members were enrolled, and visitors greatly enjoyed track operations and inspection of the models on view. Secretary: D. A. Edington, Normandhurst, Lyonsdown Road, New Barnet, Herts.

BELFORT (CATFORD).—Varied practice is enjoyed on Track Nights. On one occasion a model hump was constructed and was used by Mr. S. V. Sutton, Chairman, in a demonstration of the working of a model hump-shunting yard. A talk on "*The Work of a Guard*" was given by the father of one of the members. The lecturer has had 30 years' experience, and later he complimented the members on the manner in which they adhered to true railway practice in track operations. Secretary: J. H. Forth, "Gleneagles," 31, Ardoch Road, Catford, S.E.6.

SHEFFIELD.—All sections are making excellent progress, and special interest is being shown in timetable working and in tests of speed and hauling power. The work of extending the layout is being continued, each addition being tried out in practice before becoming permanent, and part of the track is being converted for electric working. Cinematograph Shows have given variety to the programme. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield, 8.

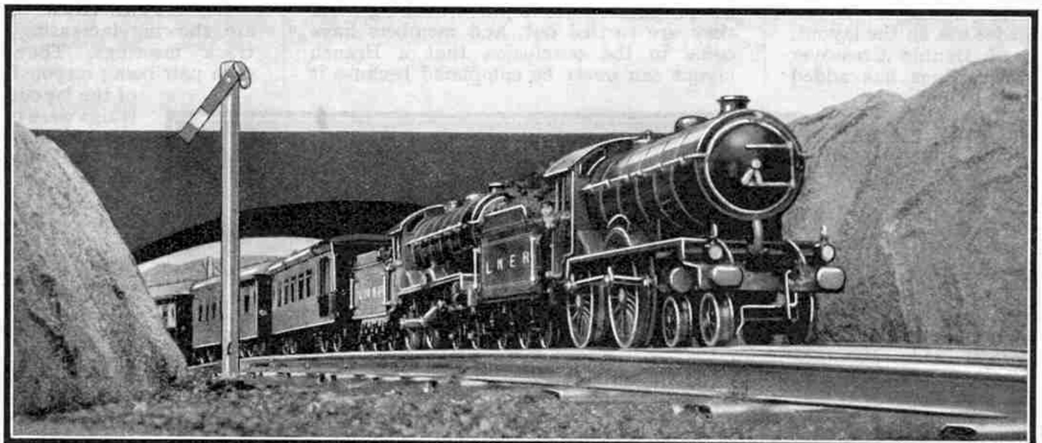
Incorporated Branches

264. PERTH—J. Stanbridge, 285, Lord Street, Perth, W. Australia.
265. CROCKENHILL—C. V. Reeves, 4, Railway Cottages, Swanley Junction, Kent.



LXIX.—SUMMER TRAFFIC FEATURES IN MINIATURE

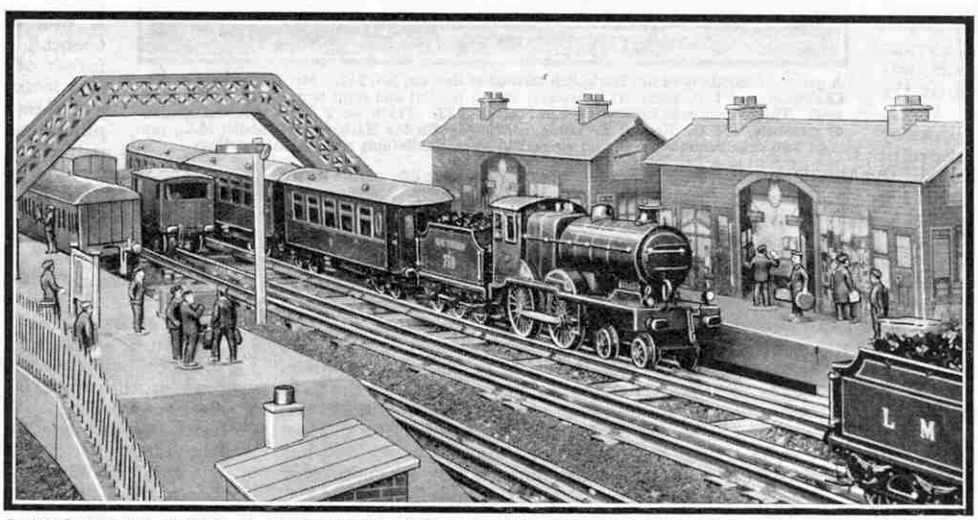
MANY readers who have developed an interesting layout, and have a fairly good supply of locomotives, rolling stock and accessories, are content to operate their train services without much alteration. Their interest is concerned mainly with bringing the operation of their layouts to the highest possible pitch of perfection, so that all services work swiftly and smoothly. The majority of really keen Hornby railway enthusiasts, however, are always on the look-out for something new that can be incorporated in their programme of operations. For this reason, although the main scheme of their train services may remain unaltered, they make frequent changes in detail that enable them to reproduce features of topical interest.



A heavy holiday express in miniature hauled by two L.N.E.R. "Shire" Locomotives. The use of two such engines together is subject to certain restrictions in actual practice, as described in this article.

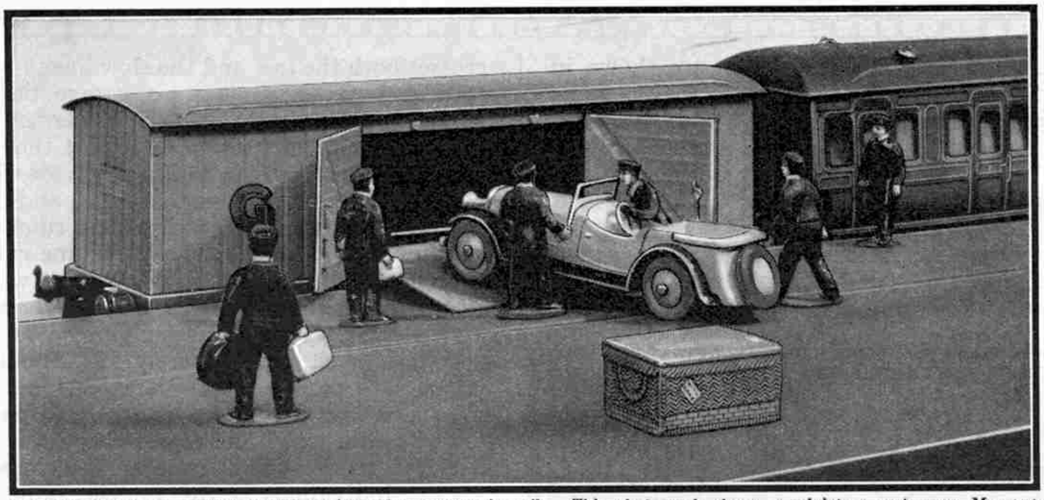
The next two months are essentially a holiday period, and the special conditions of summer working on real railways have many interesting results that can be reproduced in miniature. We have dealt on previous occasions with suggestions of this nature, but recent developments on our railways for dealing with public demands are making the summer traffic of this year more than usually interesting. Readers who wish to keep their layouts up to date will find it useful to try out the suggestions contained in this article, which are based on actual railway practices of topical interest.

A notable feature of the summer services of this year and last has been the development by the L.N.E.R. of the "Train Cruise." A special train, known as the "*Northern Belle,*" made each week in June an extensive tour of England and Scotland. As complete accommodation for day and night travel is included, a good variety of rolling stock is necessary in the make-up of a train of this kind. Such a train would be a novelty in the programme of operations carried out on a Hornby railway at this time of the year, and wide scope would be afforded in the selection of vehicles forming it. No. 2 Saloon Coaches in L.N.E.R. colours would probably make up the bulk of the train, but an odd Metropolitan Coach, and possibly one or two Guard's Vans, might be added to complete its composition.



Interesting through working on a Hornby layout. A Southern Railway Locomotive is about to start from a junction station with a train of L.M.S.R. Saloon Coaches.

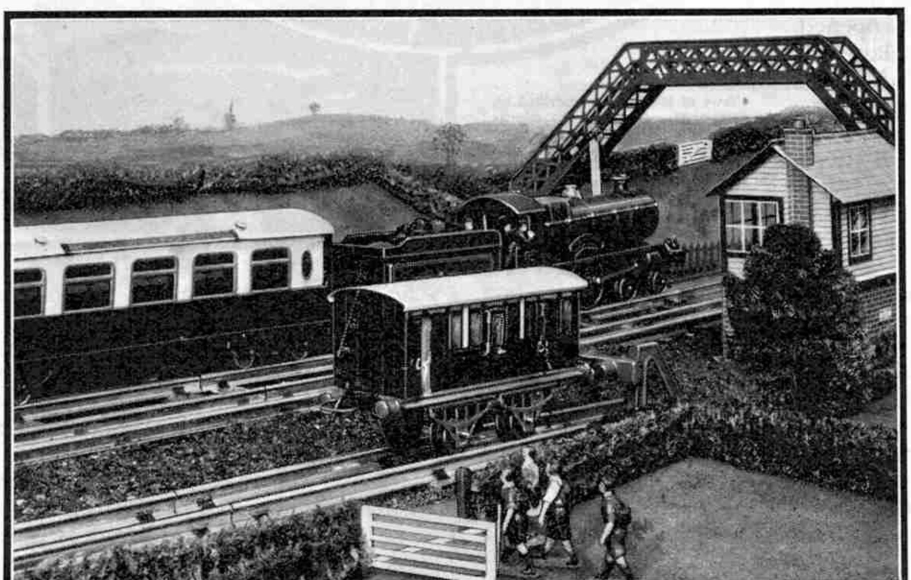
Another feature of L.N.E.R. practice is the introduction of the special "tourist trains" described in the "*M.M.*" last November. These are particularly adapted for general day-excursion work, and mark a departure from the usual standards of construction and of colouring. Readers no doubt will recall the illustration that appeared on page 68 of the January 1934 "*M.M.*" showing a train of Hornby No. 2 Pullmans specially arranged to represent one of these "tourist trains." This is a suggestion that L.N.E.R. enthusiasts may take advantage of, and thus increase the realism of their train operations.



Special facilities are afforded for the carriage of motor cars by rail. This photograph shows a miniature motor car, Meccano Dinky Toy No. 24g, being loaded in a realistic manner by the station staff.

A recent popular development is the provision of what are known as "camping coaches." These vehicles are completely fitted up inside to provide living accommodation for the parties hiring them, and are placed at selected places on various routes. This "railway caravan" scheme will provide an item of topical interest to a Hornby railway, and a suitable coach—a No. 1 Passenger Coach for example—may be placed at some convenient spot, miniature figures such as the familiar Hikers being arranged in order to complete the scene.

Apart from such special features as those we have just dealt with, the usual summer traffic working is invariably of interest. Important expresses may have to be run in two or more parts owing to the pressure of traffic. An alternative that reduces the period of occupation of the track is to make up such trains to their full weight, and if necessary to provide two locomotives. This latter form of working is found most attractive in miniature by Hornby railway owners. It is not necessary that the two engines should be identical in capacity, but it is certainly advisable that they should be of similar capabilities, as they will thus work better "in tune" and enable some really good loads to be taken. A locomotive that is only capable of covering a short distance should not be coupled to a long-running engine, for obvious reasons.



A party of hikers returning to their camping coach. The employment of such coaches in miniature is a topical suggestion for the summer months.

An interesting point in connection with the double-heading of trains is that, as mentioned previously, the concentration of weight caused by two fairly large engines together may be excessive on certain sections of a system. Similar considerations may be held to apply on a Hornby layout, and the types and classes of engines used together must be watched. A list of permissible arrangements may be drawn up for the guidance of the "Locomotive Running Superintendent." Such attention to detail makes the operation of the line more interesting, and the strict observance of the regulations will cause the provision of motive power to be studied more carefully than usual.

An actual instance of restrictions of this kind that has been referred to previously in the "*M.M.*" is found with regard to the Southern Scottish Area of the L.N.E.R. The 4–4–0 locomotives of class "D49," more familiarly known, perhaps, as the "*Shires*," are only allowed to work from Edinburgh to Berwick, Carlisle, Aberdeen, Perth, and to Glasgow via Falkirk. They must not work on routes such as the West Highland line, and two of them must not be run coupled together anywhere in the area except between Berwick and Edinburgh.

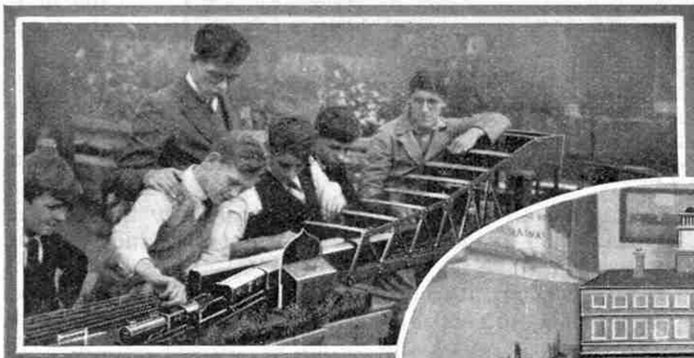
To the enthusiast who is keen on the joint working of the engines and stock of two or more groups on the same layout, or into a certain station, summer traffic presents numerous opportunities. Exchange of traffic between various groups takes place all the year round, but the summer season is essentially the time for special trips between certain centres, for organised outings and excursions of all kinds.

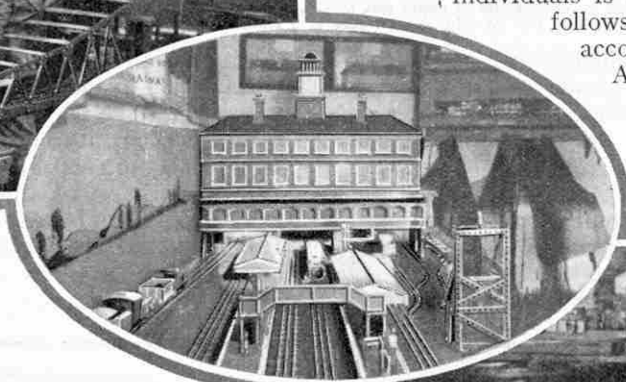
Among other features may be mentioned the special arrangements for the conveyance by rail of motor cars belonging to passengers. Thus the loading and unloading of cars is frequently to be seen on many stations. It can be carried out also on a Hornby railway with the Meccano Dinky Toys Motor Cars.

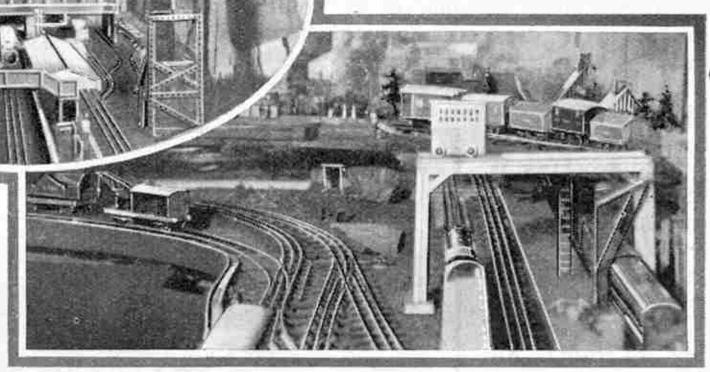
The Ken View Miniature Railway

An Interesting Joint Layout

THE miniature railway of which parts are shown in the photographs in the centre of this page is interesting in many respects. The actual work entailed in its construction was carried out exclusively by a group of boys, who are also responsible for the maintenance of the railway and its stock. It was originated by its owner, Mr. A. G. Beech, as a means of passing the time one wet afternoon when some young friends who had called were wondering what to do. His proposal was enthusiastically taken up, with the result







Views of the layout described on this page. (Left.) Train operations by the lifting bridge. (Centre.) The platforms and station hotel at "Central Junction." (Right.) An interesting corner on the indoor section. Photographs by Mr. S. B. Wavell, Muswell Hill.

that a very complete system is now available, partly indoors, but mostly outside. The railway has the distinction of having been opened by Sir William Whitelaw, the chairman of the L.N.E.R., and it is operated for charitable purposes.

Starting from "Bishops Avenue" station the track runs along three sides of a rectangle to the other terminus, which is called "Garage Road." For a good deal of the way there are separate up and down lines for fast and for slow traffic respectively. The four lines converge into two in order to cross a notable bridge constructed of Meccano parts and 25 ft. long; and soon after running off this bridge the other terminus is reached. Between these termini there are three intermediate stations named respectively "Hose Pipe Corner," "Cement Bridge Junction," and "Johns Road." The application of the name "Cement Bridge" is particularly appropriate, for at that point the lines bore under the cement garden path.

An outer track, a good deal of which is at a higher level, follows the general course of the main line, but crosses above the two terminal stations and so forms a large oval track. At one point, close to a station known as "Deansway," this line runs across the lifting bridge shown in one of the photographs. This bridge was built of steel by one of the older boys, without any elaborate equipment, and is a notable piece of work.

From this outer track a branch is thrown off that crosses both the fast and the slow lines. Climbing at the rate of 1 in 30, it enters a garage building centrally situated within the layout. Before entering the building, through a tunnel formed in one of the walls, the line, which up to this point is single, divides into two. One of these tracks continues to ascend, and finally proceeds to an indoor terminus station after running round three sides of the building. The other line runs on the level from the point of division and connects with an extensive system of lines that serve a station known as "Central Junction." A large hotel building spans the track here, and this is shown in one of the illustrations. From "Central Junction" these low-level lines also proceed round to the indoor terminus mentioned previously.

The rolling stock in use for the traffic of the railway is varied, as is usually the case when the stock of several individuals is run on the same line, for each follows his own choice in its selection according to his favourite company.

A feature of the practice of this railway is that a great deal of new rolling stock is built of wood by the boys themselves, who are remarkably proficient in this direction. Bogie coaches are numerous on the system, and there is a fine assortment of goods wagons of all kinds. There are steam, clockwork and electric locomotives of various types and classes, in the colours of several different railway companies, so that it is possible to operate almost any kind of train with an appropriate engine.

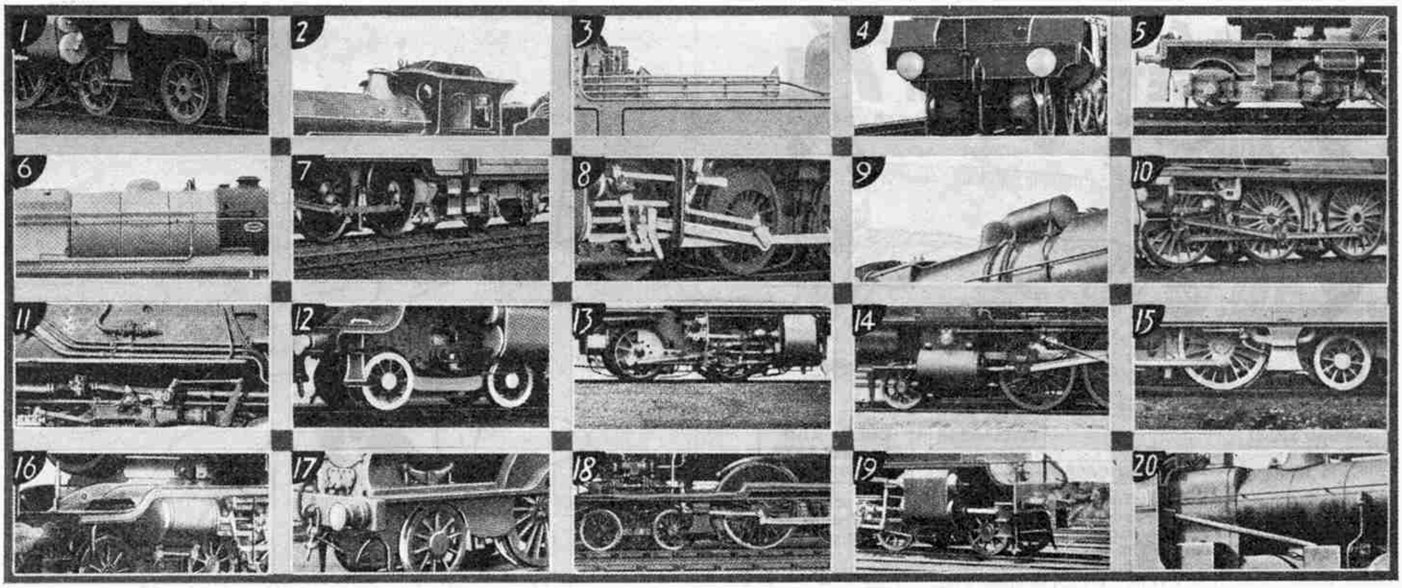
Power for the electric locomotives is supplied in the usual manner from the third rail laid in the centre of the running rails. The current is obtained from a motor-generator operated from the house mains supply, and arrangements are made that in the event of a short circuit occurring the generator is instantly cut out. The Station Hotel at "Central Junction" can be floodlighted, also a model aerodrome and R.A.F. barracks.

The railway is situated at the corner of Bishops Avenue and Deansway, East Finchley, N.2, and may be inspected between 7 p.m. and 9.30 p.m. on weekdays. It is also open between 10 a.m. and 10 p.m. on Sundays, when the trains are in operation.

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to Meccano Ltd., Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

AN INTERESTING LOCOMOTIVE PROBLEM



Among the many locomotives owned by British railways, there are some classes that closely resemble one another in external outline. At a casual glance, therefore, the ordinary observer might easily regard two engines of similar appearance as belonging to the same class. There is, however, invariably some feature of design that enables enthusiasts such as H.R.C. members to distinguish between apparently similar locomotives. Thus the "Royal Scots" and the "Baby Scots" of the L.M.S.R. are almost identical in general external outline, but the boiler of the "Royal Scot" design is noticeably the larger, especially when the engines are seen together. As a result the chimney and dome are smaller than those fitted to the "Baby Scots," and these differences alone enable the two classes to be distinguished.

Most H.R.C. members are no doubt familiar with these locomotives and with others that are interesting from the identification point of view owing to the problems they present. The illustration on this page shows portions of well-known locomotives of different railways, and each of the 20 pictures includes some prominent feature peculiar to the particular class concerned. Competitors are required to state to which class each locomotive belongs, the group owning it, its wheel arrangement, and the characteristic feature in the picture by which the locomotive was identified.

To the competitor in each of the two sections, Home and Overseas, who sends in the most accurate solution, Hornby Train material (or Meccano products if preferred) to the value of 21/- will be awarded; and to the senders of the three entries next in order of merit similar goods to the value of 15/-, 10/6 and 5/- respectively. In the case of a tie, neatness will be the deciding factor.

Envelopes containing entries should be marked "*H.R.C. July Locomotive Competition*" in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st July. The Overseas closing date is 31st October.

Railway Photographic Contest

The new series of Photographic Contests announced in April is producing some really fine photographs, and the free choice of a subject is evidently very popular. In these contests competitors may send as many prints as they desire, but no competitor can win more than one prize in one contest.

The contest will be divided into two sections, Home and Overseas, and prizes of Hornby Train or Meccano products to the value of 21/-, 15/-, 10/6 and 5/- will be awarded in each section.

Envelopes containing entries should be marked "*H.R.C. July Photographic Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st July. The Overseas closing date is 31st October.

Drawing Contest

The entries submitted each month in these contests have been of very high standard. This month we choose a subject with which all true railway enthusiasts will be familiar, "*An Engine Cleaner at Work.*" Most railway enthusiasts have visited an engine shed and witnessed a large express passenger engine being prepared for the road by the shed staff.

To the senders of the four best drawings received in each section, Home and Overseas, prizes will be awarded consisting of Hornby Train (or Meccano goods if preferred) to the value of 21/-, 15/-, 10/6 and 5/- respectively. In the case of a tie for any prize, the prize money will be equally divided between the two competitors whose entries, in the judges' opinion, are both worthy of the prize for which they have tied.

Envelopes containing entries must be marked "*H.R.C. July Drawing Contest*" in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st July. The closing date for the Overseas Section is 31st October.

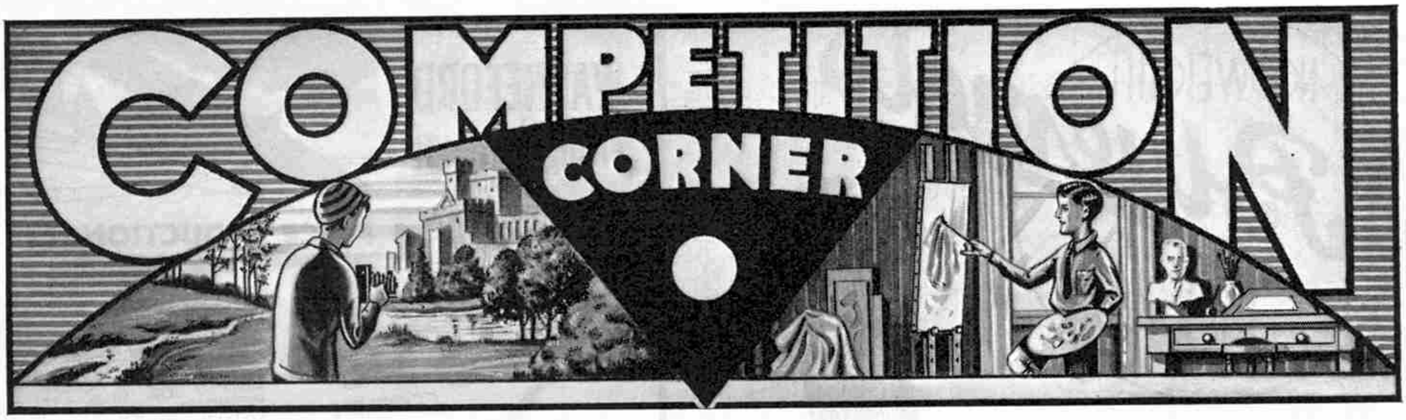
COMPETITION RESULTS

HOME

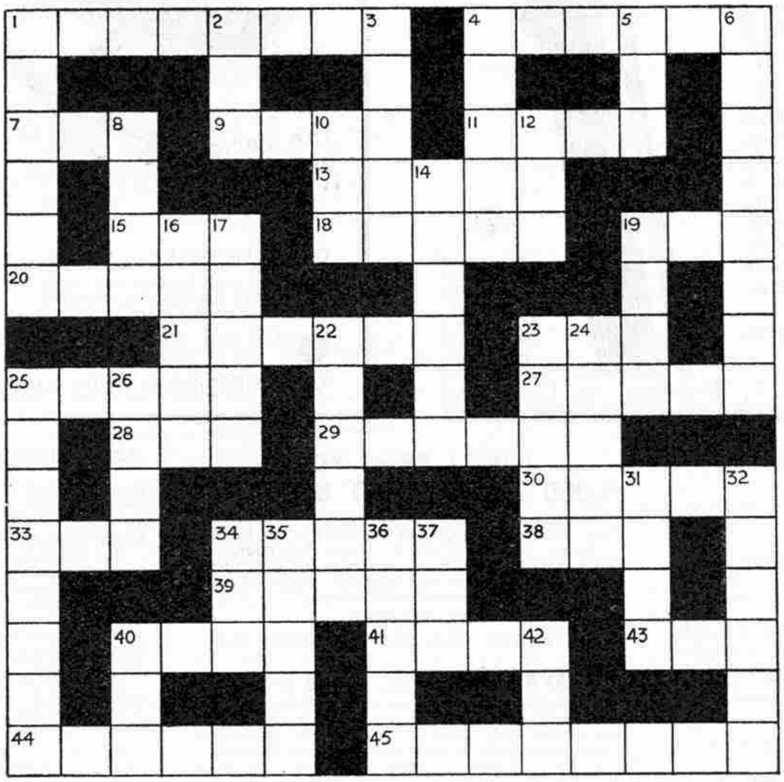
April "Hidden Stations Contest."—First: R. C. Forrest (18603), Ilford, Essex. Second: W. S. Arnott (18451), Edinburgh. Third: D. T. Howsley (24784), Matlock, Derbys. Fourth: A. H. Robinson (24997), Cheetham Hill, Manchester 8.

April "Photographic Contest."—First: V. L. Breeze (2134), Kingston, Lewes, Sussex. Second: H. L. Comber (13952), Harrogate, Yorks. Third: D. Fear (18477), Taunton, Somerset. Fourth: S. Garbutt (30122), Altrincham, Cheshire.

April "Drawing Contest."—First: A. Marsh (20196), Kates Hill, Dudley. Second: R. C. T. Lyle (30157), Tupsley, Hereford. Third: W. Dean (35099), Glasgow, S.W.1. Fourth: H. Dixon (34165), Huntington, York.



JULY CROSSWORD PUZZLE



CLUES ACROSS

1. Work of reference
4. Rest
7. Curve
9. Prescribed food
11. Supply
13. Area
15. Single point
18. In that place
19. Light blow
20. Automaton
21. Whine
23. Copy
25. A good time
27. Carried
28. Wander
29. Sell
30. Stone fruit
33. Conjunction
34. Cold snap
38. Time
39. Covering
40. Beams
41. Stains
43. Plaything
44. Penetrates
45. Serenade

CLUES DOWN

1. Joker
2. Evil
3. Sailing vessel
4. Submit
5. Help
6. Reject
8. A winch
10. Consume
12. Employ
14. Return
16. Cringe
17. Upper air
19. Stone pillar
22. Last provincial herald
23. Stay
24. A type of bear
25. Set apart
26. Study
31. Sharp
32. Lithe
34. Insect
35. Grates
36. A famous French city
37. Endeavour
40. Beaten track
42. Definite

This month's crossword puzzle will be found to follow the lines of the previous ones we have set on this page, all of which have proved remarkably successful. Every effort has been made to provide a fair and interesting puzzle, without any traps in the form of alternative solutions. The clues are all perfectly straightforward, and every word used can be found in Chambers' or any other standard dictionary. The rules that govern the solution of crossword puzzles are by now so well known that it is unnecessary to give any further explanation of the requirements of the competition.

The prizes will consist of Meccano or Hornby Train goods (to be chosen by the winners from the current catalogues) to the value of 21/–, 15/–, 10/6 and 5/– respectively, to be awarded to the senders of the four neatest or most novelly-prepared correct solutions, in order of merit. The prizes will be duplicated for the Overseas section, which is open to all readers living outside Great Britain, Ireland, and the Channel Islands.

Entries should be addressed "July Crossword Puzzle, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 31st July. Overseas closing date, 31st October.

Competitors should not mutilate their magazines by cutting out the crossword illustration. Instead they should make a copy of the square on the same scale, or larger, and use that for the Contest.

July Photo Contest

As announced in our April issue, our photographic contests this year are again open to photographs of any subject and size, made with any make of camera, plate, film or paper. Entries may be professionally developed and printed, but the exposure must have been made by the competitor.

Each month's competition will be divided into two groups, Home and Overseas, and in each of these groups there will be two sections, A for those aged 16 and over, B for those under 16. Prizes of Meccano Products or Photographic Materials to the value of 21/– and 10/6 will be awarded in each section. In the judging, all other things being equal, preference will be given to entries that are the competitor's own work throughout.

Entries sent this month must be addressed "July Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st July. Overseas closing date, 31st October.

Unsuccessful entries will be returned if a stamped addressed cover is enclosed.

COMPETITION RESULTS

HOME

May Jig-Saw Contest.—1. J. Gale (Portsmouth); 2. R. C. Forrest (Ilford); 3. M. Dombrowski (London, N.16); 4. P. S. Crowther (Bacup).

OVERSEAS

1933 Cover Voting.—1. E. S. Davies (Montreal); 2. D. E. Yockney (Auckland, N.Z.); 3. M. N. Davies (Montreal); 4. J. Lloyd (East London, S. Africa). Consolation Prizes: P. Malcolm (Dunedin, N.Z.); L. H. Orsmond (Transvaal); G. E. Schulz (Coromby, Australia); R. A. Wragg (Bandikui, India).

Conundrums.—1. J. S. de'Conti Manduca (Sliema, Malta); 2. E. Middleton (Otago, N.Z.); 3. C. W. Wadham (Carterton); 4. J. Barry (Johannesburg).

Figure Drawing Contest.—1. S. D. Kurlawala (Bombay); 2. M. Conly (Dunedin, N.Z.); 3. M. McCrorie (Otago, N.Z.); 4. R. Wood (Port Elizabeth).

Aircraft Carriers—(*Continued from page 523*)

the flying deck of the aircraft carriers. These vessels are always attended by a number of destroyers, and if an aeroplane should descend in the sea one of them would immediately proceed to its assistance.

The aeroplanes that are used for work on aircraft carriers are of various types, the usual ones being the Fairey 111F, the Hawker "Nimrod," a version of the "Fury," and the Hawker "Osprey," which is a variation of the Hawker "Hart" high-speed day bomber specially modified for the work. The Fairey 111F is gradually falling into disuse for the work, and will eventually be replaced by newer types.

Fleet Air Arm aeroplanes are all of the two or three-seater type, a navigator being necessary in order to ensure that the exact course is kept and that the mother ship can be found when flying duties are completed. Aeroplanes keep in touch with the carrier by means of wireless during the whole of the time that they are in the air.

Great care has to be taken of the aeroplanes used, and each machine has at least two men whose sole duty is to look after it. A two-seater aeroplane, for instance, is in charge of two R.A.F. airmen, a fitter and a rigger; and a three-seater, such as the Fairey 111F, has also a Telegraphist Air Gunner, who is a naval rating and accompanies the pilot and the navigator on their flights, in addition to being responsible for keeping the wireless apparatus in repair. A handling crew always deals with the same aeroplane, and usually consists of about 10 naval ratings. It is interesting to note that pilots who make more than 100 deck landings qualify for entry into the Perch Club. This is probably one of the most exclusive clubs in the world, and in this respect resembles the Caterpillar Club, membership of which is restricted to airmen who have saved their lives by successful parachute descents.

A WELL TOLD TALE

"Bill told me that you told him that secret I told you not to tell him," he said.

"He's the limit," replied Sam. "I'll tell him about it."

"All right, but don't tell him I told you, because he told me not to tell you he told me you told him what I told you."

* * * *

Tom was telling his friends about a trip to London. "John thought it was very funny when I spoke to a waiter in French," he said.

"I should think so, too," said one of his hearers.

"Yes, it was," replied Tom, "I told the waiter to give John the bill."

* * * *

Manager: "What do you mean by this? You've put all the credits on the debit side."

New Clerk: "I'm sorry, sir, but you see I'm left-handed."

* * * *

Mr. Brown (noted for his pompous manner): "Ah, Mr. Jones, have you spoken to that boy of yours about mimicking me?"

Mr. Jones: "I have indeed. I told him not to act like an idiot."

* * * *

He was bragging about the great age to which his relations had all lived.

"Wonderful," agreed a friend. "But I had a grandfather who died at a hundred and fifty."

"A hundred and fifty!" gasped the boaster.

"Yes—High Street."

* * * *

Mrs. Fitzbrown: "Do you summer by the sea?"

Mrs. Jones: "No, we simmer in the city."

* * * *

Countryman (arriving in London for the first time): "Hey, porter, which is the way to the town?"

Porter (in astonishment): "To the what?"

Countryman: "You know, the street where the shops are."

* * * *

The small girl was standing in front of the mirror with her eyes shut.

"What on earth are you doing"? asked her mother.

"I'm trying to see what I look like when I'm asleep," was the reply.

* * * *

SO HE DID!

Absent-minded Professor: "Who's there?"

Burglar: "No-one."

Absent-minded Professor: "That's funny, I was certain I heard something."

* * * *

"As soon as I heard the burglars," said the boaster, "I jumped out of bed and dashed down the stairs."

"I suppose the burglars were on the roof," said his fed-up listener.

WHY HE WAS SATISFIED

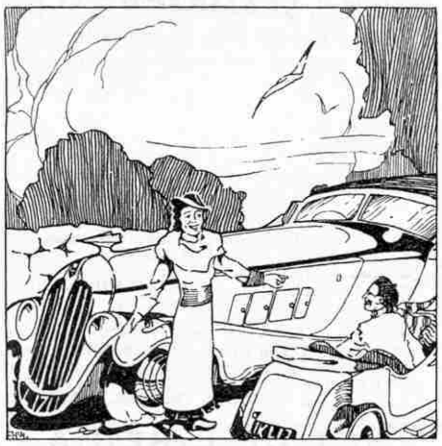
Willie had been called on to the platform to help the conjurer.

"Listen," said the conjurer, as he held a folded handkerchief to Willie's ear. "Do you hear your watch ticking inside the handkerchief? Are you satisfied?"

"More than satisfied," replied Willie, "My watch hasn't been going for a month."

* * *

HEARD ON THE ROAD



Gallant Occupant of Baby Car: "Can I do anything to help you?"

Driver of Super Limousine: "Well, if you have time to spare perhaps you would drive round to the back of my car and bring the spare wheel for me."

* * * *

The small boy arrived home from school enthusiastic about his history lesson. "We heard to-day," he said, "all about Columbus who went 2,000 miles on a galleon."

"You mustn't believe all you hear about those American cars," said his father.

* * * *

"Now my good man," said the lawyer, "Tell me exactly how your stairs run."

The witness thought hard for a minute or two.

"When I am upstairs," he replied, "they run down; and when I'm downstairs they run up!"

* * * *

What is the difference between a cat and a sentence?

A cat has claws at the end of its paws, while a sentence has pauses at the end of its clauses.

* * * *

"Old Jones is a clumsy sort of fellow."

"Yes; he can't even try on a new shoe without putting his foot in it."

* * * *

"I think there's a burglar downstairs," whispered Johnny as he woke up his father during the night.

"That's alright, my boy," sleepily replied father. "He'll get nothing here but practice."

* * * *

"What do you think of the new shooting tenant? I'm told he's only a poor sportsman."

"Well, he's a man of his word, anyway. He said he'd send all he shot to the village hospital, and two beaters and a guest have just passed me in the ambulance!"

* * * *

Teacher: "Give me a sentence with the word 'politics' in it."

Johnny: "Our parrot swallowed a watch and now 'Polly ticks'."

* * * *

"I never clash with my boss."

"No?"

"No; he goes his way and I go his."

CONSISTENT!

"When are you going to pay me the ten shillings you owe me?"

"Next week."

"Yes, that's all very fine, but you said the same thing a week ago."

"And I'll say it again next week. I'm not one of those fellows who say one thing one week and something else the next."

* * * *

"Cook must be very angry."

"What makes you think that?"

"She's just been beating the eggs, and now she's going to whip the cream."

* * * *

Father: "I notice that Uncle smokes his cigars very much shorter these days."

Son: "Yes, Dad; that's because he smokes them longer."

* * * *

He was always trying to borrow something.

"Didn't you have some books on magic?" he asked his friend, a clever amateur conjurer.

"I did," was the reply; "but they all seemed to disappear."

* * * *

A Scotsman and a Welshman were having an argument about the fertility of their respective countries.

"Hoots, mon!" said the Scotsman, "in Bonny Scotland a stick thrown on the ground one night is hidden by grass in the morning."

"That's nothing!" the Welshman replied. "In Wales now, there is a piece of land where if you turn a horse out on it one night, you will not see it the next day."

* * * *

"Any crows in the wheat field?" asked the farmer.

"I counted 23," replied the new hand, a city boy.

"Did you drive them away?"

"No, I thought they belonged to you."

* * * *

Professor: "What is steel wool?"

Student: "Shearings from hydraulic rams."

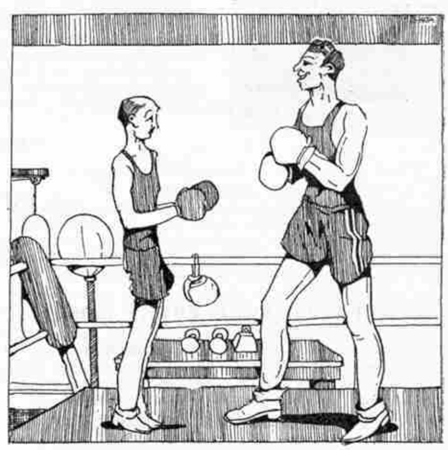
* * * *

"How can I drive a nail without hitting my finger?"

"Hold the hammer with both hands."

* * * *

BREAKING HIM IN



Nervous Pupil: "How many lessons do you think I shall need before I get into the way of things?"

Cheery Pugilist: "Oh, you'll do that immediately, sir. I'll show you the ropes and you'll find you'll go a long way in the very first lesson."

* * * *

"Were your people surprised when you passed your matriculation?"

"No. They had been expecting it for several years."

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For further Stamp Advertisements please see page 584

Stamp Gossip
and Notes on New Issues

Art Treasures on Stamps

The choice of a reproduction of Whistler's "Portrait of the Artist's Mother," as the design of the special U.S. Mother's Day stamp to which we referred in our last issue, has aroused quite a storm of controversy in France.

The Whistler picture is one of the

wonderful collection of pictures in the Louvre Galleries at Paris, although at present it is on loan to New York. The suggestion is that the French Authorities should make use in their stamp designs of other of the great masterpieces in the Louvre. Opinion is sharply divided on the question. It is generally agreed that there is everything to be said for the idea of making French art treasures more widely known, but it is also argued that unless the reproductions can do full justice to their subjects, the matter is best left alone.

The stamp that has caused all the bother is illustrated here.

The "Hind" Sales

Following the disappointing results achieved in the United States when the U.S. sections of the "Hind" collection were put up for auction, the disposal of the remainder of the collection has been transferred to London, and placed in the hands of Mr. H. R. Harmer, the famous London stamp auctioneer.

A series of auctions covering Great Britain, European Colonies and British North America commenced on 30th April, and other sections will follow up to the middle of July. The European and foreign sections will remain for disposal in another series of sales commencing in September.

* * *

The Belgian Congo, and the Mandated Territories of Urundi and Ruanda, have followed the example of their Home Country and have issued special mourning stamps in honour of the late King Albert. The Congo stamp is a three-quarter length portrait of the late King clad in tropical uniform complete with sun helmet and wearing the Order of the Grand Cordon.

Siamese Stamp Triplets

A most remarkable hitch occurred in the production of the special stamps issued by Siam in December last in connection with a Government Fair held at Bangkok to celebrate the first anniversary of the country's new constitution.

It had been decided to overprint the current series of stamps with a device representing two bowls, one resting on the other, the upper one bearing the Sacred Book of the new constitution. The Post Office prepared a handstamp for the purpose, but when a trial was made the impression was found to be too large! Its use would have resulted in each stamp bearing a portion of the device plus overlapping portions from neighbouring stamps on the sheet. To secure a single well-centred overprint it would have been necessary to buy three stamps, and the general effect would have been most unfortunate.

Ultimately it was decided to overprint the stamps only after they had been sold and affixed to the envelopes! The handstamp was installed at the Post Office in the Fair grounds, and there applied to all letters presented for despatch or to individual stamps on request.

The question that now has to be decided by the stamp collecting world is whether the overprinted stamps are to be regarded as "overprinted" in the ordinary acceptance of the term, or whether the inscription is to be regarded merely as a form of cachet. Whatever the decision on the status of the device, the stamps will be worth collecting, for supplies in mint condition are not plentiful.

A Postal "Sermon"

A most extraordinary propaganda postmark was recently applied by the Republic of Honduras to air mail covers in the form of a cachet. It read: "Drunkards often become thieves, assassins and incendiaries. Drunkenness leads rapidly to the graveyard, or, what is worse, to penal servitude or the asylum."

Gibbons' Stamp Monthly, from which we glean this interesting item, comments that it is about the most drastic postal publicity sermon that has yet appeared, and suggests that some interesting results might arise if the idea were taken up by other countries. The United States, for example, might expound the dangers to health that are incurred by exposure to machine gun bullets!

New Italian Issues

There are several very interesting designs among the new Italian issues to hand this month.

The 10th anniversary of the annexation of Fiume is the occasion of the issue, and short sets of ordinary and air post stamps have been produced. The designs are mainly allegorical, and the most interesting is the 2l.75c. illustrated here, showing a galley, a gondola and a battleship.

The Italian colony, Tripolitania, also has issued sets of air and general issues in connection with the 8th Exhibition at Tripoli. The designs of both issues are largely devoted to native and desert scenes, and we have chosen the 25l. air stamp for illustration.

* * *

We illustrate this month the design of the new Dominican Republic issue, which shows the San Raphael Suspension Bridge, the largest bridge of its type in the West Indies. The bridge forms part of an extensive programme of public improvements now being carried through in the Republic, and the new stamp issue, consisting of three values, ½c., 1c. and 5c., is to celebrate the successful completion of this section of the programme.

The "X.L.C.R." Stamp Finder

A handy little booklet that would prove helpful to every young stamp collector has been produced by Mr. V. Bancroft under the title "The X.L.C.R. Stamp Finder."

It provides a complete index of the symbols, abbreviations and inscriptions commonly found on stamps, and provides the answer, so frequently puzzling in the case of out-of-the-way stamps, to the question "Where shall I put it in my album?" In addition the "Stamp Finder" gives many interesting stamp collecting hints and brief stories of many of the world's famous stamps and stamp personalities.

Copies may be obtained price 4d., post free, from Mr. Victor Bancroft, Stamp Dealer, Matlock. The "*M.M.*" should be mentioned when writing.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

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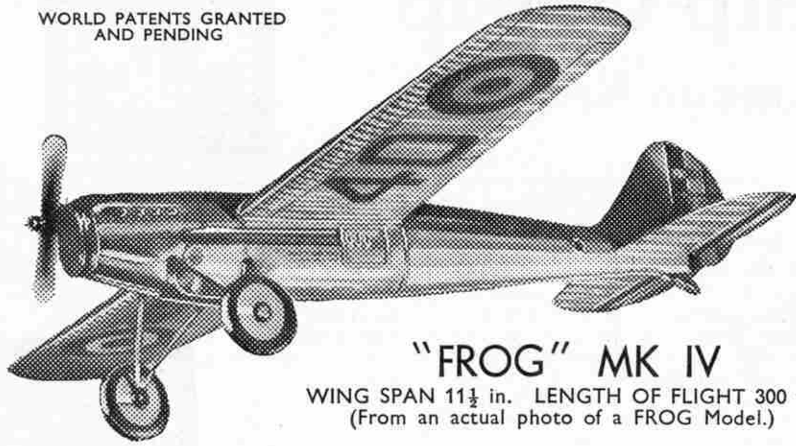

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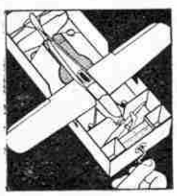

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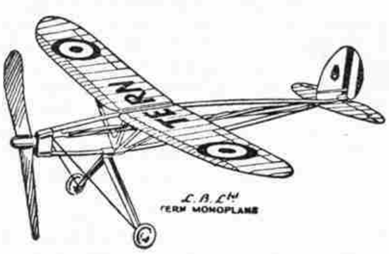

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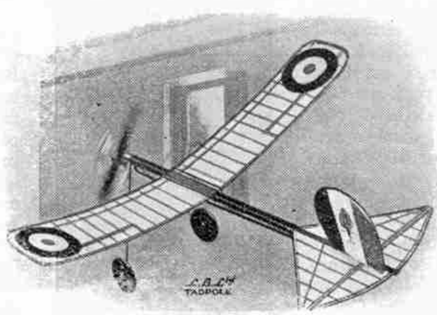

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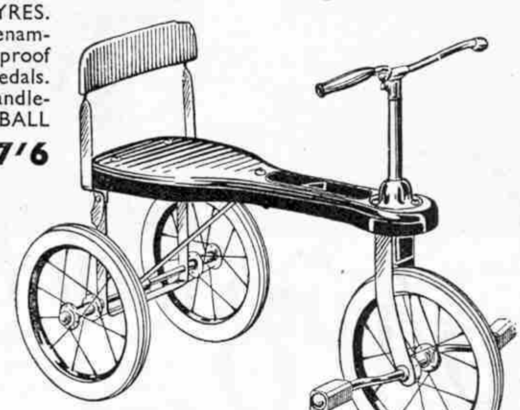

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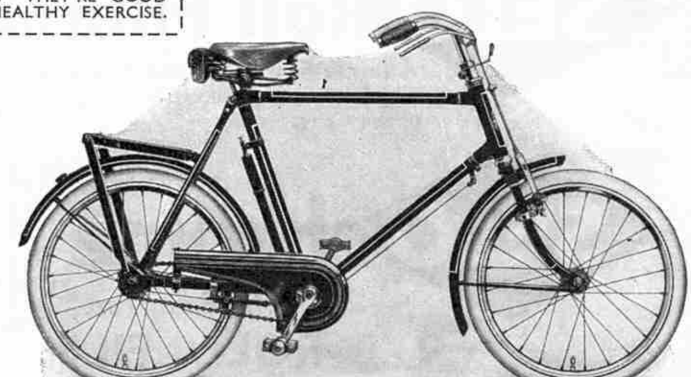

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Hamleys News

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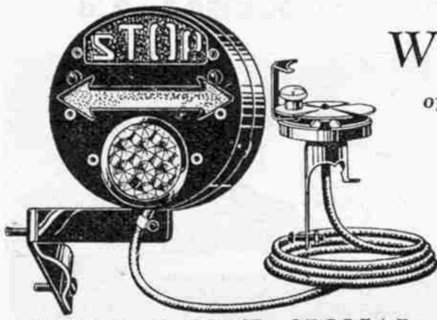
Number Fifteen *Something New—Something from Hamleys* *July, 1934*

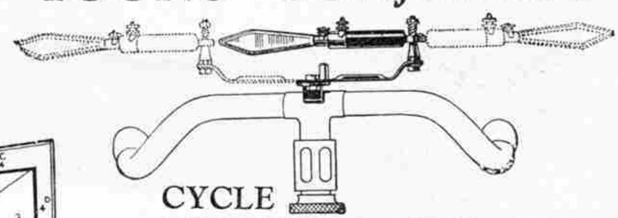
A MAGICAL SOCIETY FOR YOUNG CONJURORS

WRITE to the Conjuring Dept. for full particulars of the Yelmah Society.



"NEW" CYCLE SIGNAL

A perfect illuminated Signal of direction by means of an automatic THREE-WAY switch on the handlebar which can readily be operated whilst applying the brake. Fits on rear fork of any cycle; operates with a standard pocket battery. Half pressure on the switch illuminates the TELL-TALE light proving that the Direction Indicator at the rear is working. Full pressure cuts out the Tell-tale light to illuminate fully the DIRECTION Signal. Price **6/-**
Battery 4½d. extra. Post 6d.



CYCLE DIRECTION INDICATOR

Secured in the middle of handlebar with expanding bolt. Visible both back and front. Battery 3d. extra. Postage 6d. Price **4/6**

Fully illustrated Conjuring Catalogue No. M.2 containing more than 400 tricks, Post 3d. on request.

Practical Jokes for heaps of Fun

MATCH BOX
Sparkles when opened. Price **1/-**
COLLAPSIBLE TABLESPOON
Price each **1/-**
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Price each **6d.**
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BLACK FACE SOAP. Price **6d.**
DISTORTING MIRROR
Price each **7½d.**
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DEMON RUBBER NAIL
Price **1/-**
Postage extra on orders under 20/-.

THE TEST MATCHES!

Latest Scores every 15 Minutes on
SPECIAL SCORE BOARD

Come to Hamleys during the Test Matches and see the exact progress of the game at a glance on this wonderful Score Board.

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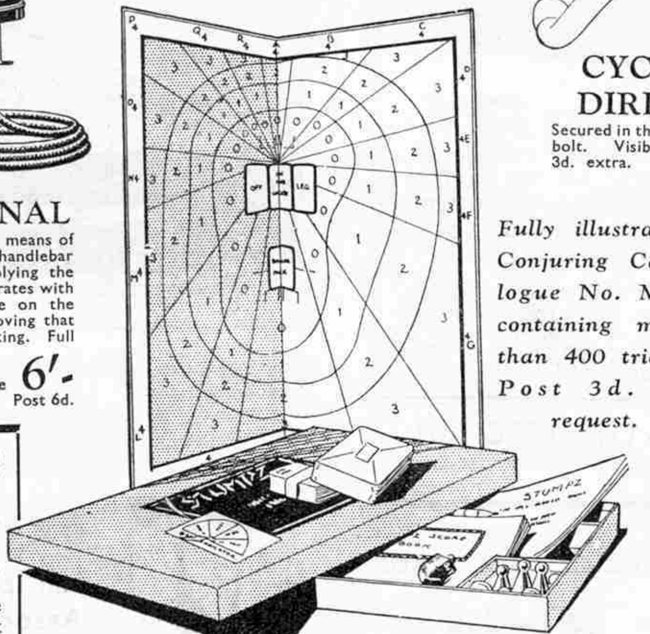

"STUMPZ"—IT'S REAL CRICKET

All the Australians are playing it!

Played by means of specially marked cards and an 18 in. square field. Bowlers place the field and bowl accordingly, while batsmen have a choice of eight shots. With STUMPZ cricket enthusiasts can be independent of time and weather and play real cricket when and where they like. Prices **5/- and 10/-**
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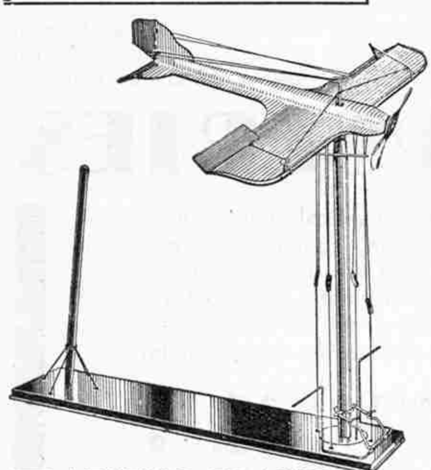

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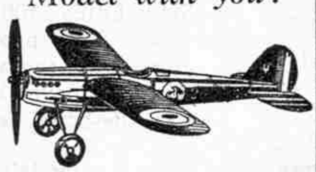
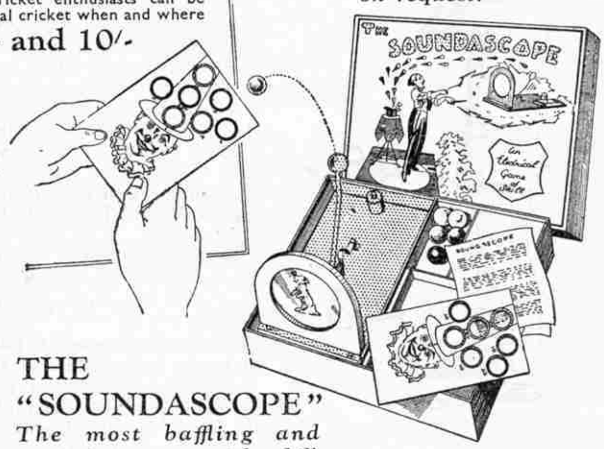
Become air-minded and learn the theory of flying with the "Training Plane," simply constructed. When set up, the "Joy-Stick" and rudder pedals transmit the correct movement of the plane surface and rudder. Manœuvres can be practised and the rudiments of flying quickly absorbed.
Post 9d. Price **8/6**

Take your "Frog" Model with you!



You'll have endless fun with your "Frog" if you take it on all your trips. Strap it to your cycle and choose your own flying ground. Complete with patent high-speed winder, spare motor, gear box, oil, elastic, lubricant and illustrated flying manual.
Postage 6d. Price **7/6**

Obtainable in seven different National Colours: R.A.F., ITALIAN, FRENCH, BELGIAN, DUTCH, ARGENTINE and U.S.A.



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The most baffling and intriguing game of skill ever invented.

A ball is placed in the cup and by facing the diaphragm and clapping the hands the ball is thrown towards the player who endeavours to catch it in the scoring board. As no visible means of release can be seen players are completely mystified. Any number of amusing games can be thought of. Complete with instructions.
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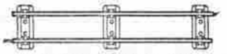
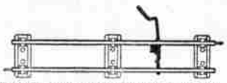
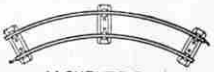
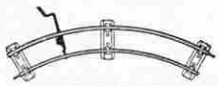
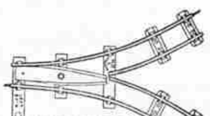
Hornby Rails, Points and Crossings

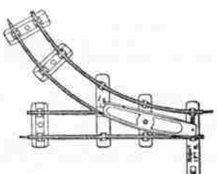

B1 STRAIGHT RAIL

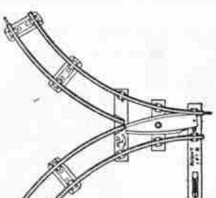

BB1 STRAIGHT BRAKE RAIL

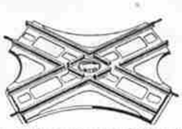

A1 CURVED RAIL


AB1 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


CA2 ACUTE-ANGLE CROSSING

Rails for Clockwork and Steam Trains, Gauge 0, $1\frac{1}{4}''$

CURVED RAILS

9-in. Radius (for M0 Trains)

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

1-ft. Radius

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

2-ft. Radius

A2	Curved rails	... per doz.	4/6
A2½	Curved half rails ...	... „	3/6
A2¼	Curved quarter rails	... „	3/-
AB2	Curved brake rails ...	... each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

STRAIGHT RAILS

BM	Straight rails (for M0 Trains)	per doz.	2/9
B1	Straight rails	„	4/-
B½	Straight half rails ...	„	3/-
B¼	Straight quarter rails ...	„	2/6
BB1	Straight brake rails ...	... each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track	½ doz.	6/6

CROSSINGS

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

POINTS

9-in. Radius (for M0 Trains)

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

For 1-ft. Radius Curves

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

For 2-ft. Radius Curves

PR2	Right-hand points	... per pair 4/-
PL2	Left-hand points	
PSR2	Points on solid base, right-hand	per pair 8/6
PSL2	Points on solid base, left-hand	

PARALLEL POINTS

PPR2	Parallel points, right-hand	per pair 5/-
PPL2	Parallel points, left-hand	
RCP	Rail Connecting Plates ...	½ doz. 2d.

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

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

For 2-ft. Radius Curves

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

CROSSOVER POINTS

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

Rails for Electric Trains, Gauge 0, $1\frac{1}{4}''$

CURVED RAILS

1-ft. Radius

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

2-ft. Radius

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

STRAIGHT RAILS

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

POINTS

For 2-ft. Radius Curves

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

CROSSINGS

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

DOUBLE SYMMETRICAL POINTS

For 2-ft. Radius Curves

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

PARALLEL POINTS

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

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/-
ECOL2	Crossover points, left-hand		
TCPL6	Terminal Connecting Plates (6-volt)	each	1/6
TCPL20	Terminal Connecting Plates (20-volt)	„	1/6

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

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. Radius

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

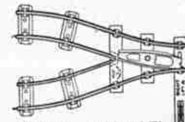
2-ft. Radius

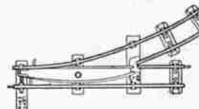
AC2	Curved centre rails ...	... per doz.	1/-
AC2½	Curved centre half rails ...	„	9d.
AC2¼	Curved centre quarter rails	„	6d.

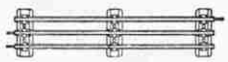
STRAIGHT CENTRE RAILS

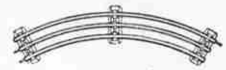
BC1	Straight centre rails	... per doz.	1/-
BC½	Straight centre half rails ...	„	9d.
BC¼	Straight centre quarter rails	„	6d.
ICR	Insulators for insulating centre rails	... per doz.	3d.
CCR	Clips for fixing centre rails...	„	6d.

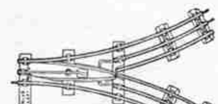
The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many interesting illustrations and much useful information is given in a booklet entitled "How to plan your Hornby Railway." This booklet is obtainable from your dealer, price 3d., or from Meccano Ltd., Binns Rd., Liverpool 13, price 4d. post free.

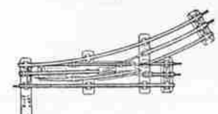

PPR2 PARALLEL POINTS (RIGHT-HAND)

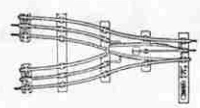

PL2 POINTS (LEFT-HAND)


EB1 ELECTRICAL STRAIGHT RAIL

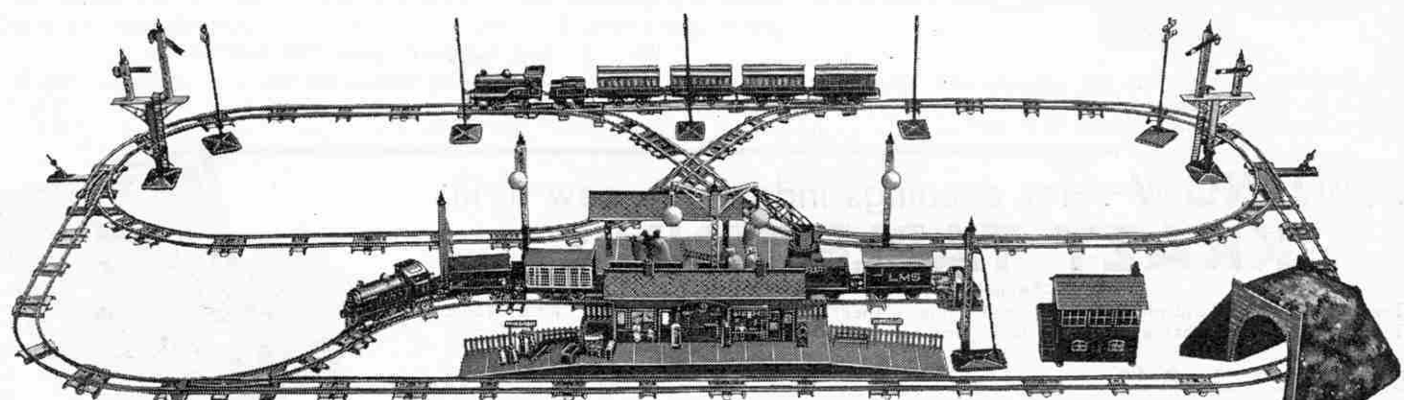

EA1 ELECTRICAL CURVED RAIL


EDSL2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


EPL2 ELECTRICAL POINTS (LEFT-HAND)


EPPR2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)


ECR ELECTRICAL RIGHT-ANGLE CROSSING



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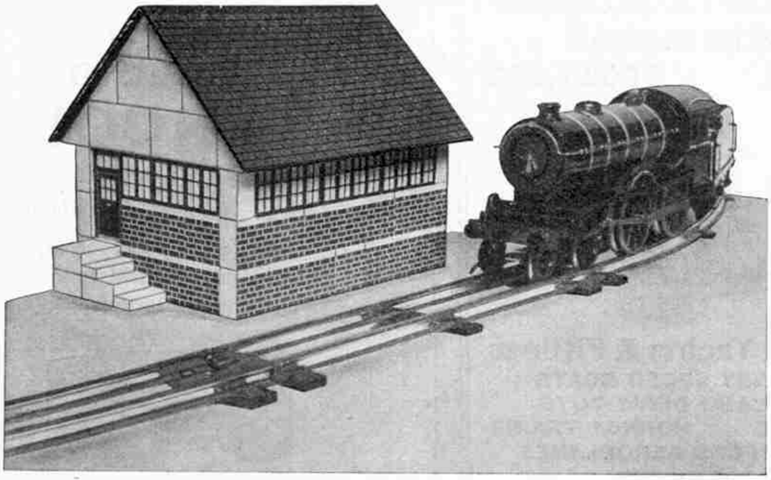

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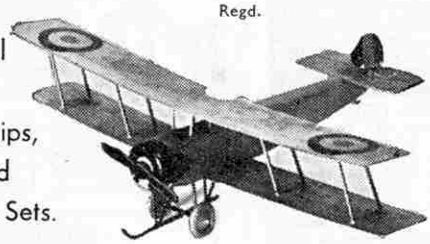

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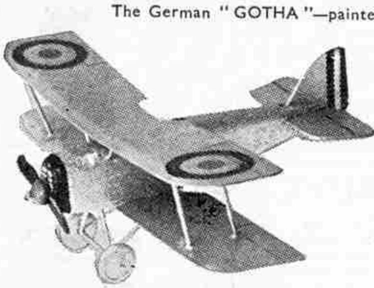

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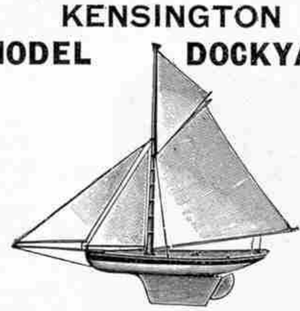

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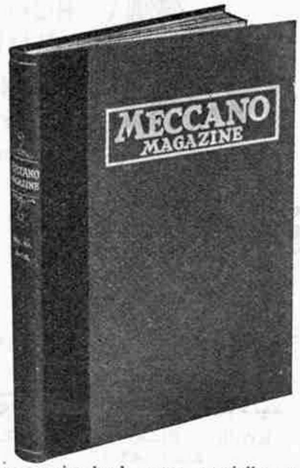
There are two methods of binding the "*M.M.*" to preserve back copies from the destruction that inevitably will be theirs should they be handled for any lengthy period without protection. First there is the spring-back binder system, that permits the copies to be inserted or removed from the binding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



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These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 5/9 for six issues or 7/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines will be included unless otherwise specified.

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The Dunlop Rubber Company, Fort Dunlop, Birmingham, include in their advertisement on page 593 of this issue a coupon entitling readers of the "*M.M.*" to a copy of Mr. Shirley's booklet, free of charge. Any reader who prefers not to mutilate his copy of the "*M.M.*" by cutting out the coupon may send a written application, but it is essential that the "*M.M.*" should be mentioned in the letter.

This Month's Special Articles

READERS' SALES

Sale. Lott's Chemistry Set, new, cost 10/6, take 5/6.—Spink, 72, Wennington Road, Rainham, Essex.

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Stamps. Collector wishes to exchange duplicates with other collectors on Catalogue basis.—Price, "Springfield," 22, Tyrfran Avenue, Llanelly.

Sale. "Meccano Magazines," July 1924–Dec. 1931. Also 10 further copies. Offers?—P. J. Sisam, Lloyds Bank, Moreton-in-Marsh, Glos.

Pathé Kid Cinema, almost new. Cost 55/-. Six Films also, 30/- or nearest offer.—Wood, 19, Coniston Road, Stretford, Manchester.

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"Meccano Magazines" 1928–1932, best offer.—Chalk, 25, Plemont Gardens, Bexhill, Sussex.

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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

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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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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/- for six months and 16/- for 12 months (post free); Canada, where the price is 10c. per copy, and the subscription rates 65c. for six months, and $1.25 for 12 months (post paid).

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Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 34, St. Patrick St., Toronto.
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AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Limited, Third Floor, Paykel's Buildings, 9, Anzac Avenue (P.O. Box 129), Auckland, C.1.
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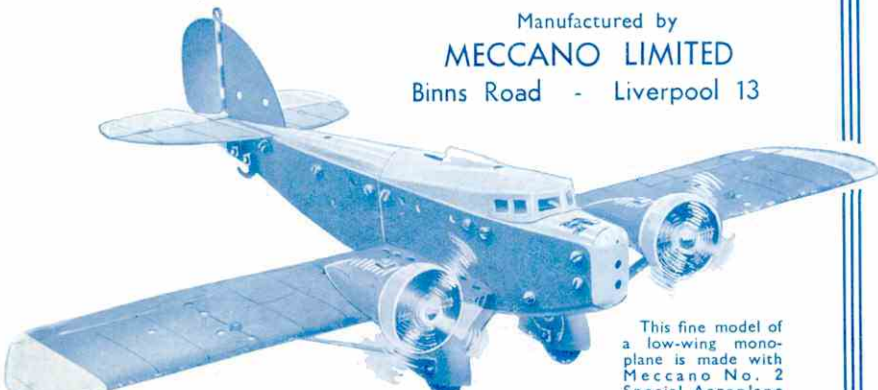

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