VOL. XVIII No. 8. AUGUST 1933

MECCANO MAGAZINE

MACHINING SHIPS' PROPELLERS

(see page 570)

6D.

TRI-ANG

(Regd.)

CLOCKWORK TOYS

MOTOR LORRIES

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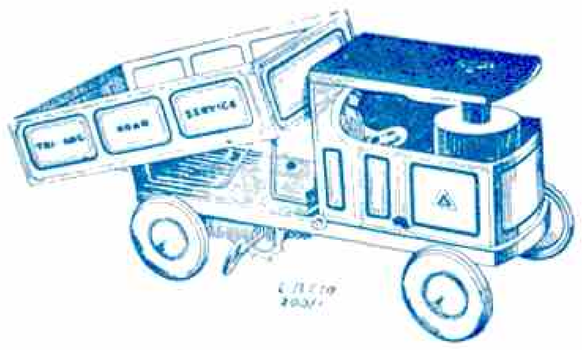

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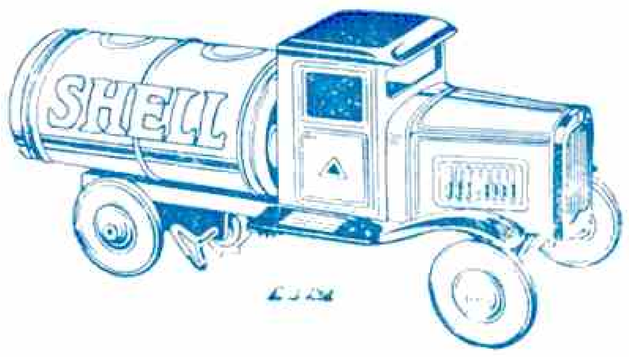

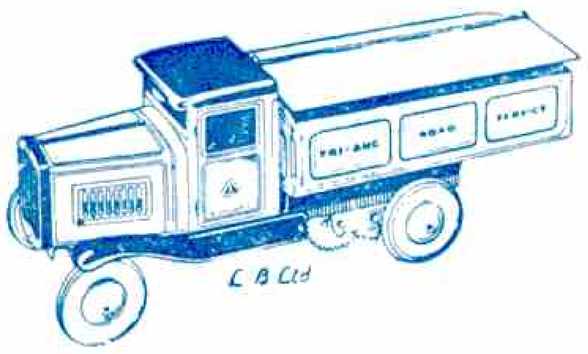

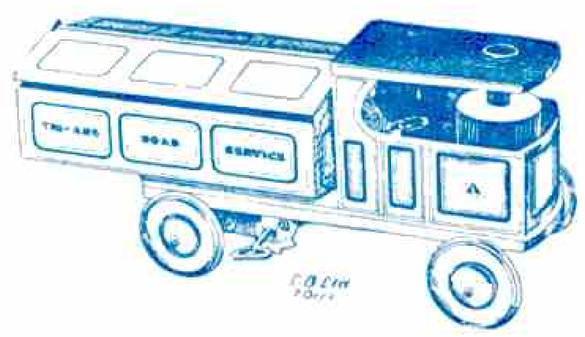

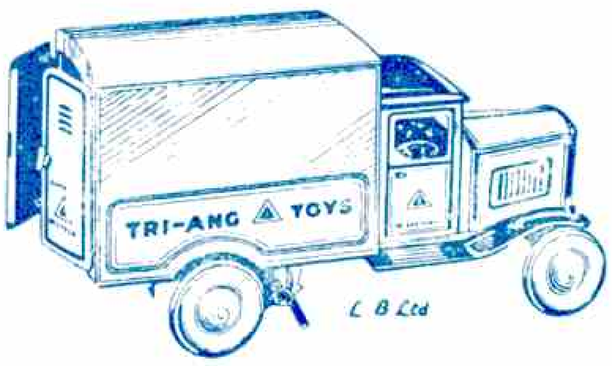

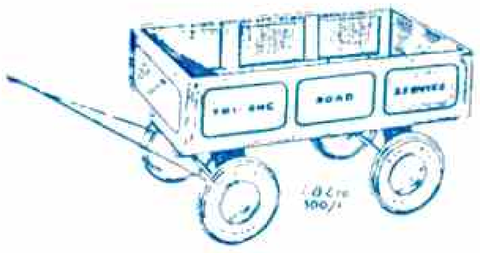

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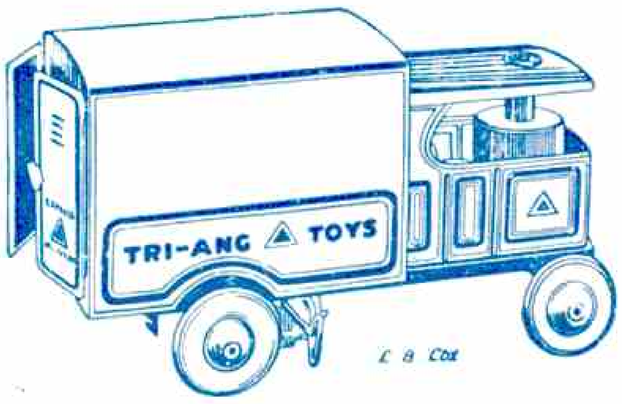

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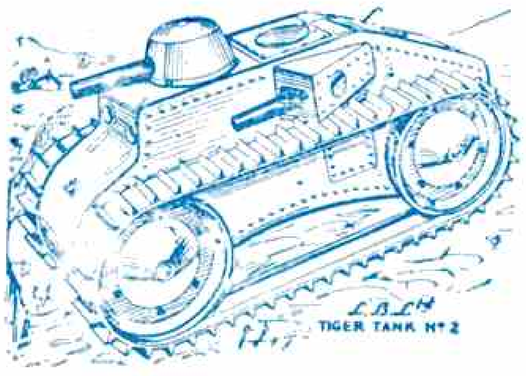

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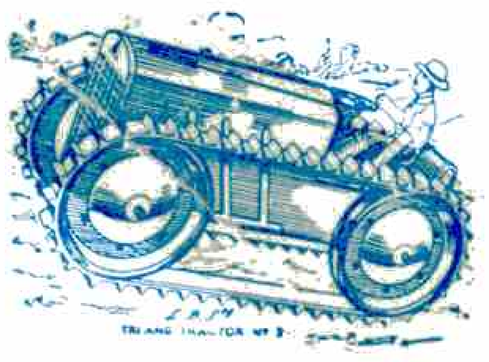

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With the Editor

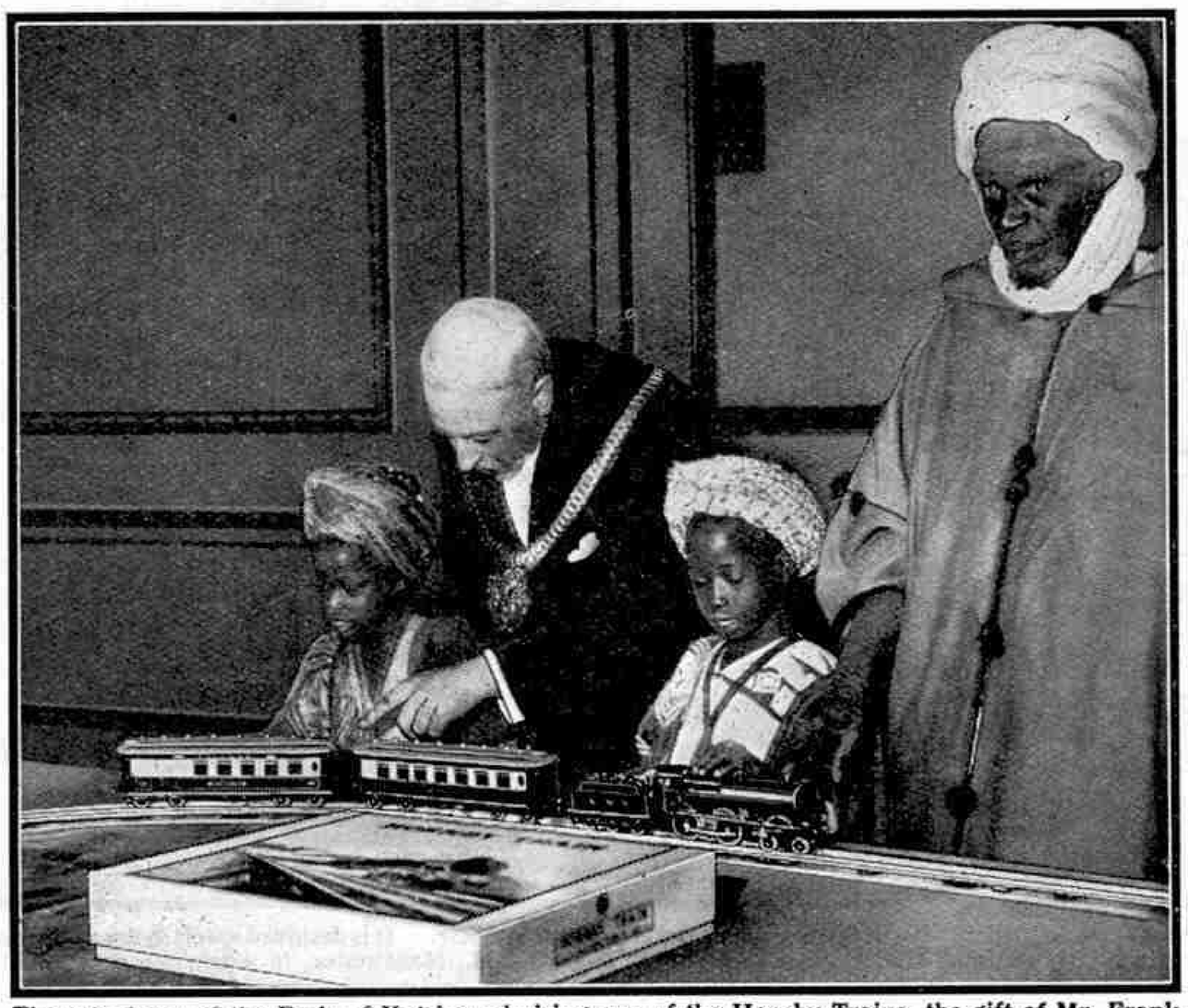
Parachuting for a Living

Parachuting seems a most extraordinary method of making a living, yet we find Mr. John Tranum, a young American of Danish origin, deliberately choosing this career, and apparently thriving on his "ups and downs" in the world. Mr. Tranum is admittedly out to provide the public with the thrills they demand, but his demonstrations and those of other professional "jumpers" have done a great deal to draw attention to the practicability of the parachute as a live-saving device. After Mr. Tranum's delayed drop of some 3½ miles in May last, readers clamoured to know how it was done, and this month the famous parachutist tells us all about it.

"One hundred per cent. 'Boy'"

A collection of the most popular toys of boys of all the nations of the world would show a great variety of types and forms, but if they were carefully sorted out it would be found that the majority were toys that "worked" in some way, or could be used for some definite purpose. Normal boys are full of life, and they want toys with which they can express their activity of mind and body.

An interesting example of the universal appeal of toys that "work" was provided by the visit to England of the Emir of Katsina, a native State in Northern Nigeria that is said to be at least 1,000 years old. The Emir brought with him his two small grandsons, and they had a really wonderful time. They were enthusiastic over everything they saw in the new world around them, but when it came to toys they fairly bubbled over with joy.



The grandsons of the Emir of Katsina admiring one of the Hornby Trains, the gift of Mr. Frank Hornby, M.P., Managing Director of Meccano Ltd., presented to them by the Lord Mayor of Liverpool.

Each day of their visit was full of adventures, but I am certain that two afternoons in particular will live long in their memories. The first was at the works of Lines Bros. Ltd., at Merton, London, where they revelled in the thrills of riding in the firm's electric motor cars, as is well shown in the photograph on page 617. The other afternoon began with a visit to the works of Lever Bros. Ltd. at Port Sunlight, and ended in the presentation to them by the Lord Mayor of Liverpool of two Hornby Train sets, the gift of Mr. Frank Hornby, M.P., Managing Director of Meccano Ltd. Our photograph shows the Lord Mayor initiating the youngsters into the mysteries of the trains, while the Emir listens with the grave interest that is characteristic of him.

I asked a friend of mine who was with the visitors during their stay in Liverpool what he thought was the reason for the remarkable popularity of the little Katsinans over here. "They were popular," he replied, "because they are one hundred per cent. 'boy'."

A Great Civil Engineer

A link with many great civil engineering achievements has been severed by the death of Sir Ernest William Moir, Bt., at the age of 71. On the conclusion of his training Sir Ernest joined the staff of Tancred, Arrol and Company, and was engaged on the construction of the Forth Bridge. Although then only in his twenties, he was given the responsible task of superintending the erection of the southern cantilever, which he carried through successfully. From bridge-building he turned to burrowing beneath rivers, and it is in connection with sub-aqueous tunnelling that he will be chiefly remembered.

Sir Ernest was Resident Engineer of the first tunnel under the Hudson River, New York, and the success of this pioneer work was due largely to a new type of shield that he had designed to enable work to be carried on in compressed air. While engaged on the construction of this tunnel he was faced with another problem, known as caisson sickness. This trouble seriously affected the men working in compressed air, and it was caused by the solution in the blood of the gases of the air. The sickness commenced when the men returned to the upper air, for the gases that had been forced into the blood by the high pressure in the working chamber were then released and formed bubbles in the blood vessels. The result was an attack of severe pain known as "bends." Sir Ernest overcame this trouble by introducing an air lock, in which the men who had been working in compressed air remained while the pressure was lowered so gradually that no ill-effects were experienced. The widespread adoption of this method of preventing bends has saved many lives during tunnelling operations in which it was necessary for men to work in compressed air chambers.

Other tunnels on which Sir Ernest was engaged were the Blackwall Tunnel under the River Thames, and four gigantic tubes under the East River, New York, for the Pennsylvania Railroad. The latter tunnels had to be driven through treacherous rock and quicksand, and at one period almost every day brought fresh difficulties and delays. Sir Ernest showed the greatest courage and perseverance in tackling the problems as they arose, and was always ready to take his share of the danger that often threatened the men working underground.

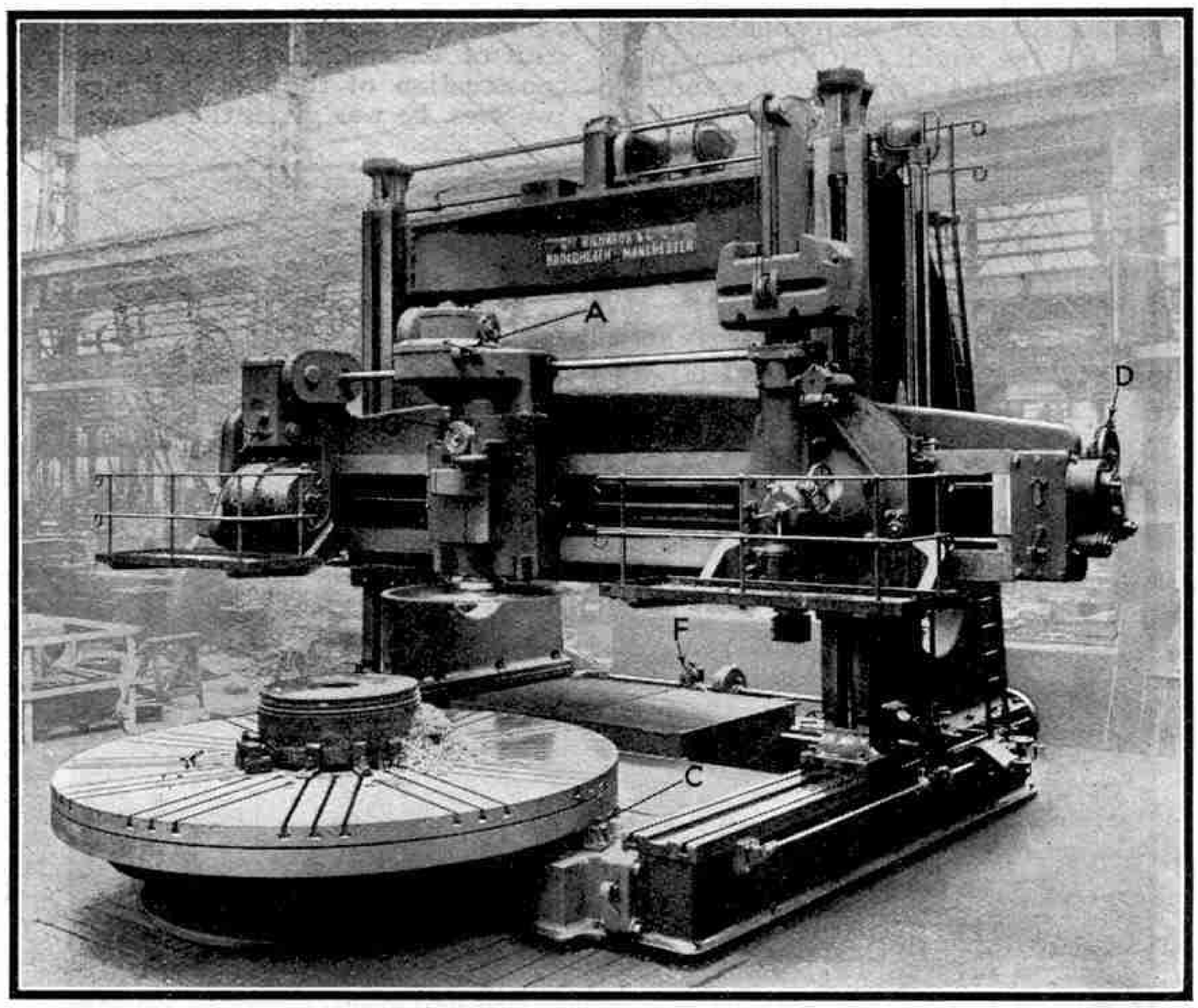
Sir Ernest was also concerned in important dock schemes. He was chiefly responsible for the extension of the Admiralty Harbour at Dover, and later he carried out similar work at Valparaiso and Antofagasta, two Chilean ports that he transformed into sound harbours by building colossal breakwaters.

Machining Ships' Propellers

A New Type Vertical Boring Mill

OUR cover illustration this month shows a large ship's propeller being machined in an English engineering shop. After the rough casting is received from the foundry a great deal of machining has to be done on it before it is ready for fitting to the propeller shaft, and several powerful machines have been designed specially for work of this kind. In this article we describe one of the latest types of these machines, known as a Vertical Boring Mill, made by George Richards & Co. Ltd., of Broadheath, Manchester.

Some of the propellers for large ships weigh over 50 tons, and the machines on which they are bored need to be substantially built and of great rigidity to withstand the heavy strains involved. This kind of work also entails ample table space and special tool feed adjustments, and the machine we are now dealing with has been specially designed to meet these requirements. It is suitable for machining the bosses of all kinds of propellers, including those for the largest ships afloat.



A general view of the large Vertical Boring Mill described in this article. It is designed specially for machining large propellers, and was built by George Richards and Co. Ltd., Manchester, to whom we are indebted for our illustrations.

The machine was built for J. Stone & Co. Ltd., of Deptford, London, and the illustrations here show it at work on their premises. It will accommodate work up to 17 ft. in diameter with the uprights in their normal position, and by moving these rearward it is possible to machine a 25 ft. diameter job. The machine is fitted with a swivelling tool head on the cross-slide and a centre head of special design, the swivel head being used to cut the slot for the key that locks the propeller in position on its shaft, and the centre head for sawing, boring, facing and recessing operations. Contrary to the usual practice in boring machines, the huge work-table on which the propeller is clamped remains stationary during these operations. It is interesting to note, however, that all the necessary mechanism is included to enable the machine to be used as an ordinary boring mill when desired.

The massive centre head embodies a spindle of large size and great strength that drives a 6 ft. diameter circular saw and the boring and facing arms. The spindle is made of carbon steel and revolves in adjustable upper and lower bearings, the upper one of which is of parallel shape and the lower one of double cone form.

For sawing and for big facing operations the spindle is driven by means of high ratio worm and wheel gear, while for boring operations a low ratio worm and wheel gear is employed, the change over being effected quite easily by the movement of a lever in the centre head. This lever can be seen marked A in the general view of the machine reproduced here. The final drive to the spindle is by means of a double helical steel pinion mounted on a steel multi-splined shaft and a double helical wheel mounted directly on the spindle. The spindle can be driven at speeds varying from six to 93 revolutions per minute, the speeds being obtained as follows. The gear-box for driving the centre head, which together with its motor is mounted on the left-hand end of the cross-slide, provides two mechanical changes, and two further changes are available on the centre head itself. These, together with the use of a rheostat that controls a 2 to 1 variable speed motor, enable any desired intermediate speed between six and 93 r.p.m. to be obtained.

The first operation in machining a propeller is the removal of the riser from the boss. This is carried out by a 6 ft. circular saw, provided with inserted segmental teeth. The saw is spigoted on the flanged end of the centre head spindle, and is secured in such a way that there are no screw heads or other parts projecting beneath the surface of the saw. The saw runs at a peripheral speed of 111.5 ft. per minute, the feed being obtained by traversing the head along the cross-slide. The rate of feed can be varied from $1\frac{3}{4}$ in. to 6 in. per minute by means of changeable gears. A horizontal rapid power traverse is provided to the centre head, and vertical rapid power traverse is supplied to the slide on the head.

The riser is sawn off the boss at four cuts as follows. The centre head with the saw is traversed along the cross-slide from right to left and a cut taken across the riser. The saw is then withdrawn and returned

by the rapid traverse gear in readiness for the next cut. The table is then revolved through 90 degrees and a second cut taken, and the same procedure is adopted for the third and fourth cuts. After each cut wedges are inserted in the slot or "kerf" to prevent binding of the saw. Index lines are provided on the periphery of the table for convenience in rotating the table the correct number of degrees for each cut, and the table is firmly locked during sawing by means of a clamp, which is marked C in the illustration on the opposite page.

On completion of the sawing operation, the riser is lifted off and the boring and facing operations are commenced.

The saw is removed from the centre head and a boring bar with its self-acting mechanism substituted for boring the hole for the shaft. In the finished propeller the bore is tapered to fit a corresponding taper on the shaft. The boring bar is first of all carefully centralized by means of a rule and vernier fitted on the driving slide to the boring bar, the bottom end of the bar being keyed to and guided by a ball joint in the centre of the table. Several cuts are taken until a diameter about $\frac{1}{2}$ in. less than the small end of the finished taper bore is reached, when the tool head is removed and another head for step boring mounted on the bar. By means of this head a series of steps are bored through the boss, adjustment to the tools for the different diameters being provided on the head itself by means of a graduated dial.

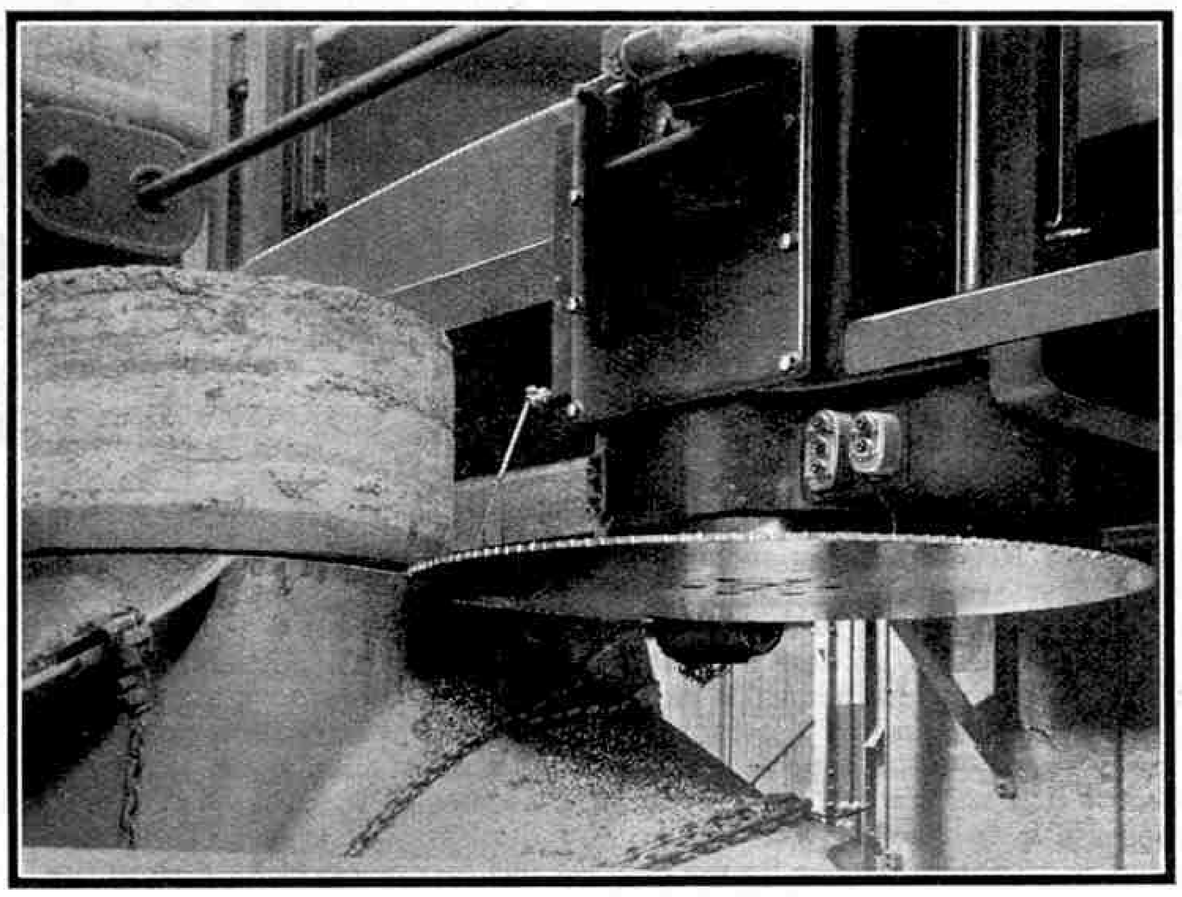
The depth of each step is predetermined, and a depth control mechanism automatically stops the feed when the required depth is reached. This is accomplished through the indexed dial of large diameter seen at G in the general view of the machine. The dial mechanism is driven from the spindle in the centre head, and one revolution of the pointer round the dial is equivalent to a continuous down feed to the boring head of 6 ft. If the length of step required is less than this amount the pointer is set to read accordingly on the dial, and when zero on pointer and dial coincide the feed to the head is automatically stopped by the action of a small limit switch.

After the step boring process the boss is face-machined across the top by means of the double facing arm.

Next follows the taper boring, and for this operation the tool bar is first swivelled over the desired amount, this being accurately recorded by the rule and vernier on the driving slide, and firmly locked in position. The taper boring head is then fed through the boss until the hole is correctly finished to size.

A particularly interesting feature connected with the boring operations is that the boring head, after each pass through the hole, is quickly returned to the top in readiness for the next cut, by means of a small motor with a flexible shaft drive.

When the boring and facing operations are completed the centre head is traversed to the left-hand end of the cross-slide and the right-hand or slotting head then brought into position. The ram of this has a maximum stroke of 7 ft., variation of which is effected through the dial D on the end of the cross-slide. The ram is driven by an independent reversing 15 h.p. electric motor mounted behind the cross-slide at the right-hand end.

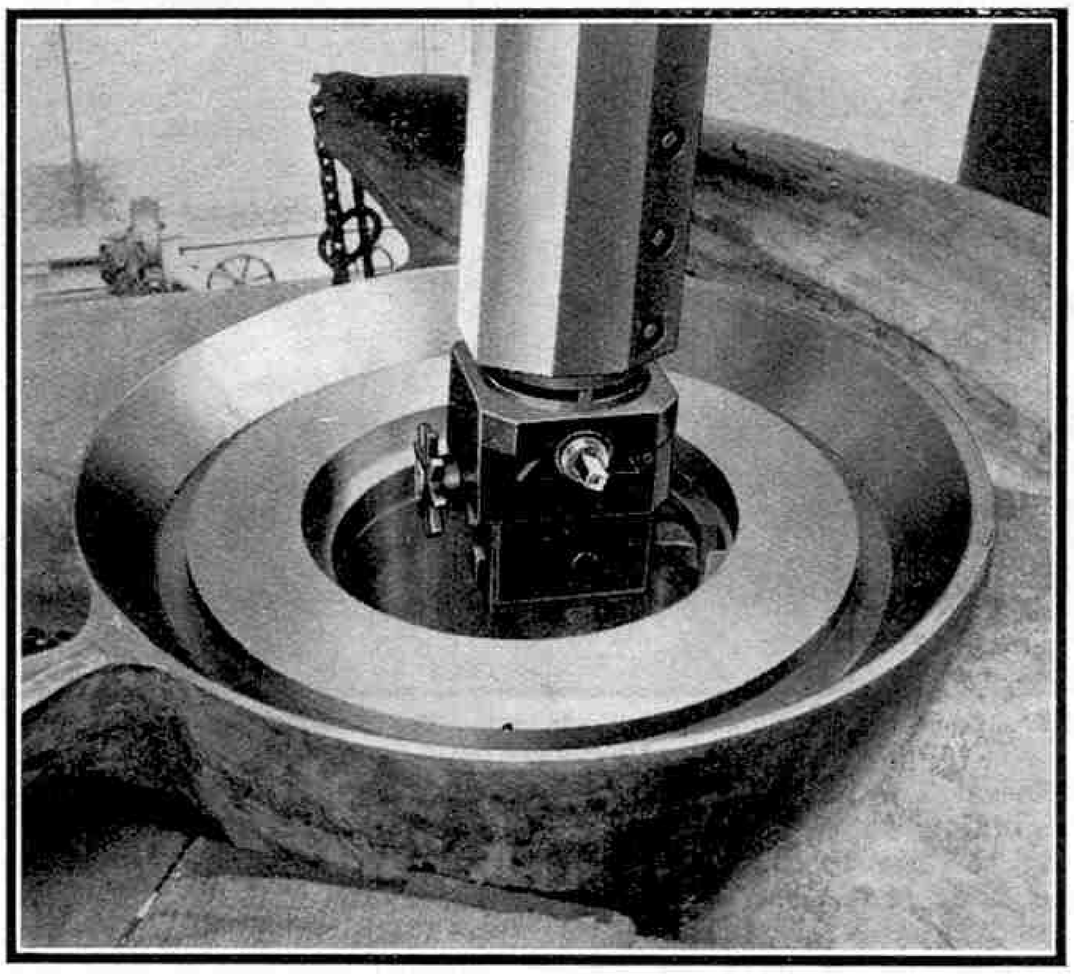


The 6 ft. diameter saw in operation sawing the riser off a large propeller.

Three large chutes are provided in the table to facilitate the removal of the cuttings, which fall through the large hole in the centre of the spindle into a tank placed in the foundation. This tank runs on rails and can be withdrawn from underneath the spindle and lifted out for emptying.

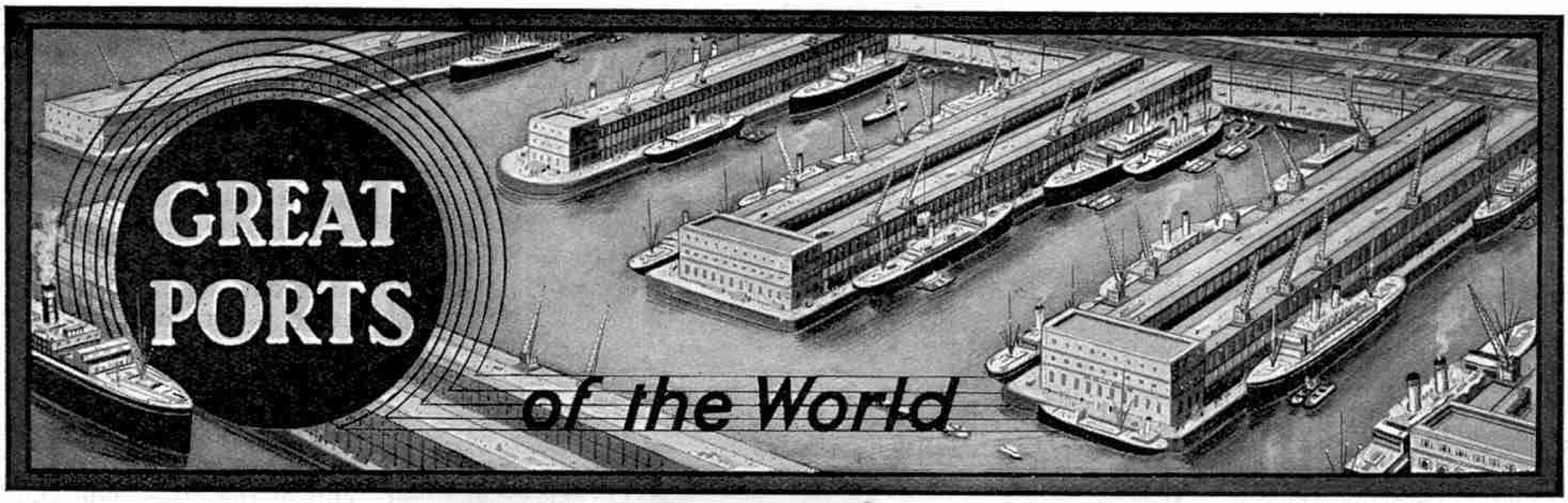
As already mentioned, all the necessary mechanism is included to enable the machine to be used as an ordinary boring mill when desired. For this purpose the driving mechanism provides six speed changes to the table which, used in conjunction with a 50 h.p. variable speed motor, give a full range of speeds to the table.

For turning the table round slowly for spacing purposes when two or more keyways have to be cut in the boss, special reducing gears are incorporated in the drive, giving a minimum peripheral speed to the 14 ft. diameter table of 10 ft. a minute, which greatly facilitates the setting of the index lines on the periphery of the table to the pointer provided. This slow speed is used also for turning the table to the 90 degrees positions during the sawing operation.



View showing the slotting ram in operation.

Efficient lubrication is a matter of the utmost importance in any heavy boring mill, and in this machine it has received special attention. The bearings on the lower part of the machine, including the main spindle and table bearings, are lubricated by two mechanical forced feed pumps, the larger of which can be seen at F. These provide a continuous supply of oil.



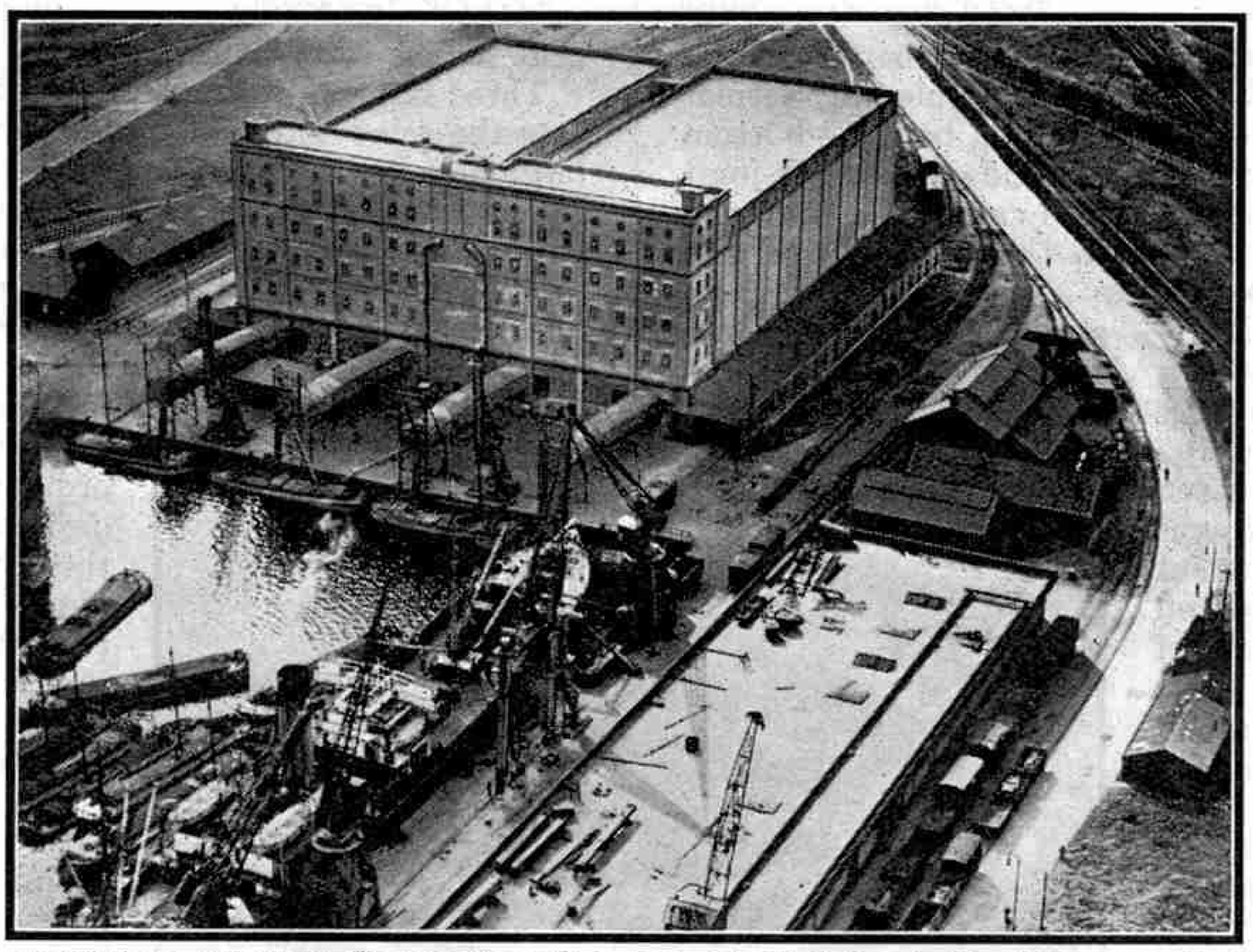
V.—HULL

TWENTY-TWO miles inland the broad River Humber receives the waters of its tributary the River Hull, and at the time of the Norman Conquest a village known as Wyke stood near this junction. This village was the origin of the present great city and port of Hull. Under Norman influence Wyke became a place of importance and a busy port, and in the course of its development it appears to have absorbed the neighbouring village of Myton, as in some old records it is referred to as Myton-Wyke. Another name, Wyke-upon-Hull, is given to it in a Charter dated 1160 by which the place was granted to the "monks of Meaux" by "Maud, daughter of Hugh Camin." Just over 100 years later, in 1278, the monks obtained a license to hold at Wyke-upon-Hull a market every Thursday, and a two weeks' fair commencing on the eve of Holy Trinity.

In 1298 Edward I visited the town while returning from the battle of Dunbar, and he was so impressed with its advantages as a commercial port that he obtained it from the monks in exchange for other lands in Lincolnshire on the other side of the Humber. The King renamed it Kingston-upon-Hull, and issued a proclamation in which he offered special advantages to all who would settle there. He followed this up a year later with a Charter constituting the town a free borough, and granting it the right to hold markets on Tuesday and Friday in each week, and a 30-day fair beginning on St. Augustine's Eve. The natural harbour formed by the mouth of the River Hull was improved, and in 1303 the King sent Commissioners to find out the best routes for new roads to the town, and how the roads could be constructed. A little later a ferry service was established between Hull and Barton, in Lincolnshire, and in 1321 the King authorised the construction of "a wall of stone and lime" and a ditch round the town to protect it from attack.

Kingston-upon-Hull is still the official name of the port, but it is generally referred to simply as "Hull," and we will therefore use this shorter and more convenient name in this article. The town increased steadily in size and prosperity, and in 1359 it was able to supply as many as 16 ships and 466 seamen toward equipping the Navy for war against France. During the reign of Richard II the fortifications were repaired and a strong castle was built on the east side of the River Hull. In the 15th century the problem of obtaining a sufficient supply of fresh water for the increasing population arose, and in 1440 a Royal Charter was granted to the burgesses of the town giving them Hessle and several other neighbouring places as additional sources of fresh water. The Charter declared also that these places "with the town itself should become the county of the town of Kingston-upon-Hull." Apparently the fortifications again fell into disrepair, and when Henry VIII visited the town in 1541 he ordered the construction there of a castle and other fortifications.

Hull stands upon a level plain so low that embankments are necessary to protect it from inundation, and much damage was done by floods in 1527 and 1549. Deliberate flooding was carried out on one occasion during the Civil War. Most of the inhabitants were Royalists, but the town was garrisoned by Parliamentarians, and in 1642 they withstood a siege of six weeks. Finally the Governor, the second Baron Fairfax, compelled the attacking Royalists to retreat by opening the sluices and flooding the surrounding country.



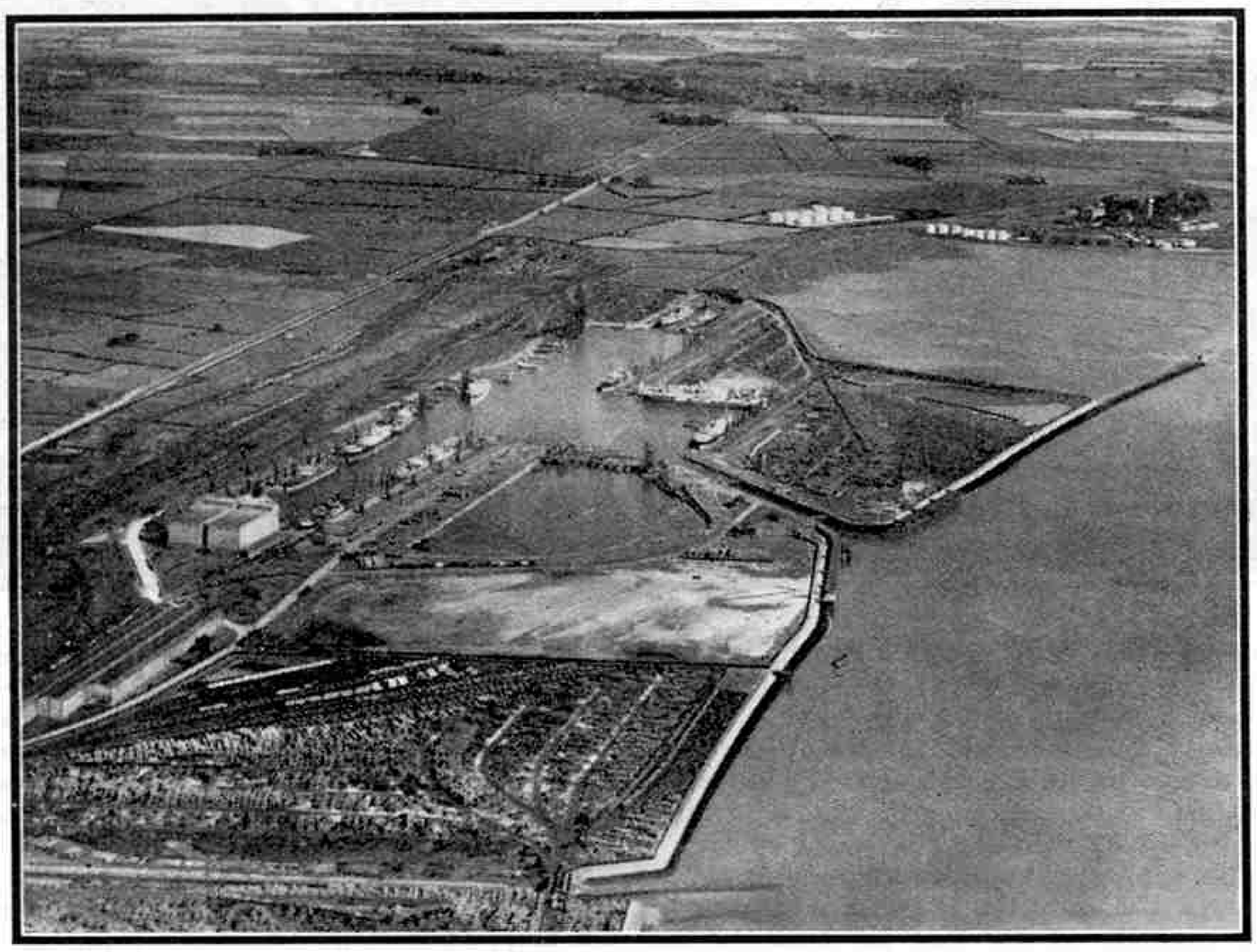
An aerial view of the Grain Silo, King George Dock, Hull. The illustrations to this article are reproduced by courtesy of the London and North Eastern Railway.

During the 16th and two following centuries the trade of the port does not appear to have developed much, and no docks were built at Hull until towards the close of the 18th century. In 1774 an Act was passed by Parliament authorising the construction of a dock on the site of the old fortifications on the right side of the River Hull. The entrance to this dock was to be at the upper end of the old harbour, which faced the old part of the town. The dock was built by the newly-formed Hull Dock Company. It was 1,730 ft. long and 250 ft. wide, and was known as the Old Dock. Twenty-six years later the company built the Humber Dock, 914 ft. long and 342 ft. wide, at the south end of the town; and eventually these two docks were connected by a third and smaller one, 645 ft. long and 238 ft. wide, which was named the Junction Dock. In 1855, to commemorate the visit to Hull of Queen Victoria and Prince Albert in the previous year, the Old Dock was renamed Queen's Dock, and Junction Dock was renamed Prince's Dock.

The three docks, with the rivers Hull and Humber, encircled the old portion of the town and, being almost in the centre of the city as it is to-day, have been known as the Town Docks. Queen's Dock has recently been filled in, however, and the site purchased by the Corporation for the construction of a boulevard for the city. The other two town docks, although now fairly old, are well equipped for the handling of general cargo, and are much used by vessels engaged in the coastwise and Continental trades.

The introduction of railways and the development of steamships

gave a great impetus to the trade of the port, and the opening of the Hull and Selby Railway in 1840 established railway communication with Hull for the first time. A small dock called the Railway Dock, three acres in extent and opening from the Humber Dock, was completed in 1846. Four years later further accommodation for shipping was provided by the completion of the Victoria Dock on the east side of the River Hull. This dock had a water area of about 12½ acres, and in 1863 an extension at the east end increased this area to about 18 acres. In addition to the entrance from the River Hull, the dock can be entered from the River Humber by way of a tidal basin. It is interesting to note that the east end of the dock partly covers the site of an old citadel that commanded the Humber and the mouth of the Hull until about 1863. The citadel was equipped with a battery of 21 guns.



General view of the King George Dock, showing Salt End oil installations in the background.

The steady growth of industry and the rapid development of steamship construction made necessary corresponding increases in the shipping facilities and accommodation of the port, and in 1869 the Albert Dock was opened by the Prince of Wales, afterward King Edward VII. In time even this accommodation became insufficient, and an extension was constructed at the west end of the dock and was brought into use in May 1880, when the name of the dock was altered to Albert and William Wright Dock. The extended dock in 4,928 ft. long, varies in width from 220 ft. to 420 ft., and has an area of 28½ acres.

A few years later the line of docks along the north bank of the Humber was extended upstream by the construction of St. Andrew's Dock, which has a water area of nearly 10½ acres. Additional railway communication with the port was provided by the opening of the Hull and Barnsley line in July 1885, almost simultaneously with the completion of the Alexandra Dock that had been built by the railway company in connection with their line. At the time of opening this dock was the largest on the Humber. It has a water area of 46½ acres, and is situated east of the Victoria Dock. Subsequently an extension, covering 7½ acres, was constructed at the east end of the dock.

In 1893 the Hull Dock Company disposed of their property to the North Eastern Railway, who until then had not possessed any docks at the port. The new owners built the St. Andrew's Dock extension of 9 acres, carried out many improvements in the dock and riverside facilities, and in 1907 built the Riverside Quay, on the Humber side of the Albert and William Wright Dock. This quay is 2,500 ft. long, and is capable of extension to 6,000 ft. or so when increased trade makes it necessary. It varies in width from 85 ft. to 150 ft., and the water alongside is sufficiently deep to enable vessels to berth at all states of the tide. Their cargoes can be discharged direct into railway wagons for immediate despatch, or into transit sheds.

The most important development undertaken by the North Eastern Railway, however, was the construction of the King George Dock, completed in 1914; this is still the largest dock on the North East coast, and is equipped on the most modern lines. It has a water area of nearly 53 acres, and there is provision for future extension to 85 acres. The dock is constructed on low-lying land, of which the greater part formerly flooded at high water, and the area reclaimed for the dock estate totalled about 206 acres. Access to the dock is gained by an entrance lock 750 ft. long and 85 ft. wide, and divided into two pens 500 ft. and 250 ft. long respectively; and the depth of water on the sill is 42 ft. 3½ in. at high water of spring tides.

In 1922 the Hull and Barnsley Railway amalgamated with the North Eastern Company, and when the grouping of the British railways took place in January of the following year the North Eastern Railway became part of the present L.N.E.R., who thus became sole owners of the Hull Docks.

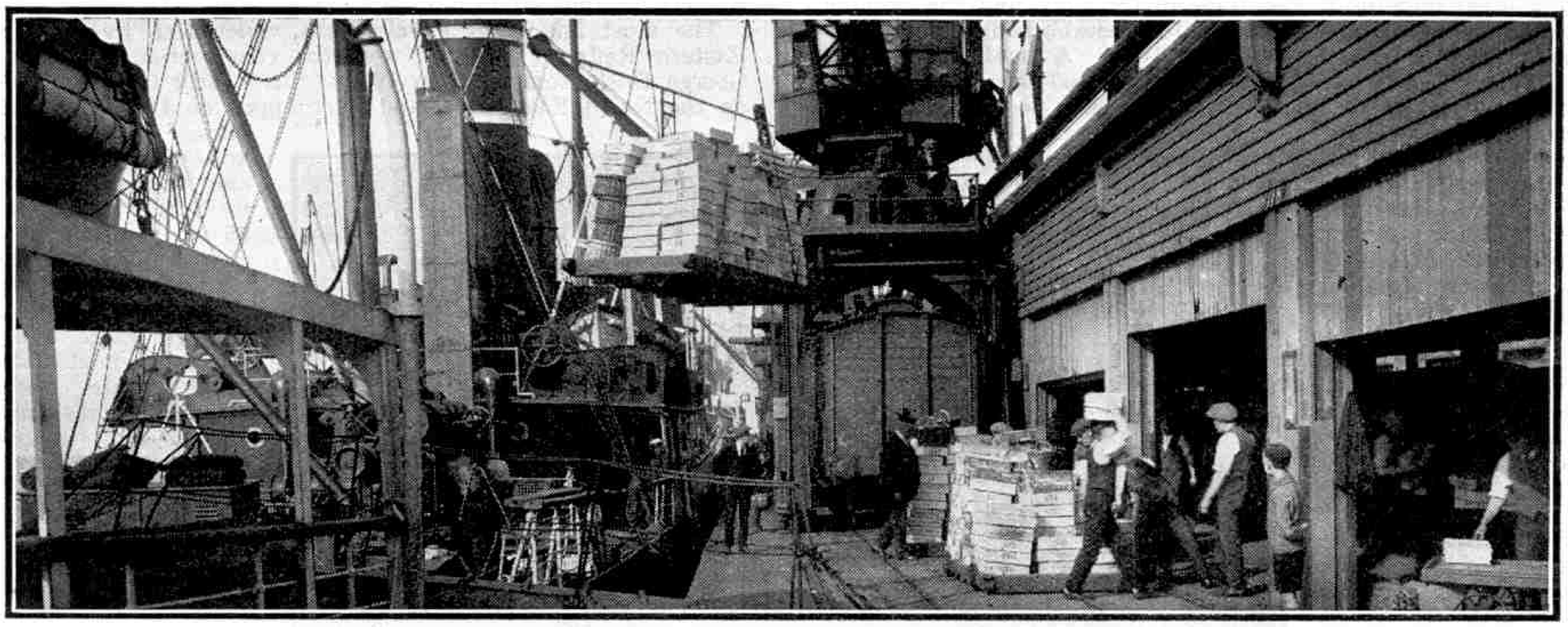
The docks of the port now cover a total area of 210 acres and have more than seven miles of river frontage, 12 miles of quay and approximately 600 acres of open storage space. The port is well equipped for handling the many different classes of goods dealt with, and the dock equipment includes 239 hydraulic, steam and electric cranes, ranging in capacity up to 40 tons. There is also a 100-ton steam crane, an 80-ton steam sheerlegs and an 80-ton self-propelled electric floating crane, together with numerous coaling appliances. The extensive warehouses have a total capacity of 207,000 tons of general goods and more than 350,000 quarters of grain.

Riverside Quay, on the Humber side of the Albert and William Wright Dock. The water alongside the quay is sufficiently deep to enable vessels to berth at all states of the tide.

Hull has always been recognised as a base for trade with the Western European countries. In recent years, owing to the development of the dock accommodation and facilities, and the extensive railway and water communications, it has also become the centre for overseas trade and a transhipment point for commerce between the Continent and far-distant countries. There are regular sailings between Hull and all the principal ports of the world, including weekly or more frequent sailings to the Continent.

The trade of the port is of the most extensive and varied character, and covers on the import side practically every commodity required for the population and industries of the Midland, Eastern and North Eastern counties of this country; as well as the export of the manufactured and partly-manufactured articles from those great industrial areas. Nearly 12,000,000 people live within the area for which Hull claims to be the principal and natural port of collection and distribution.

One of the most important branches of the trade of the port is the fishing industry, which provides employment for nearly

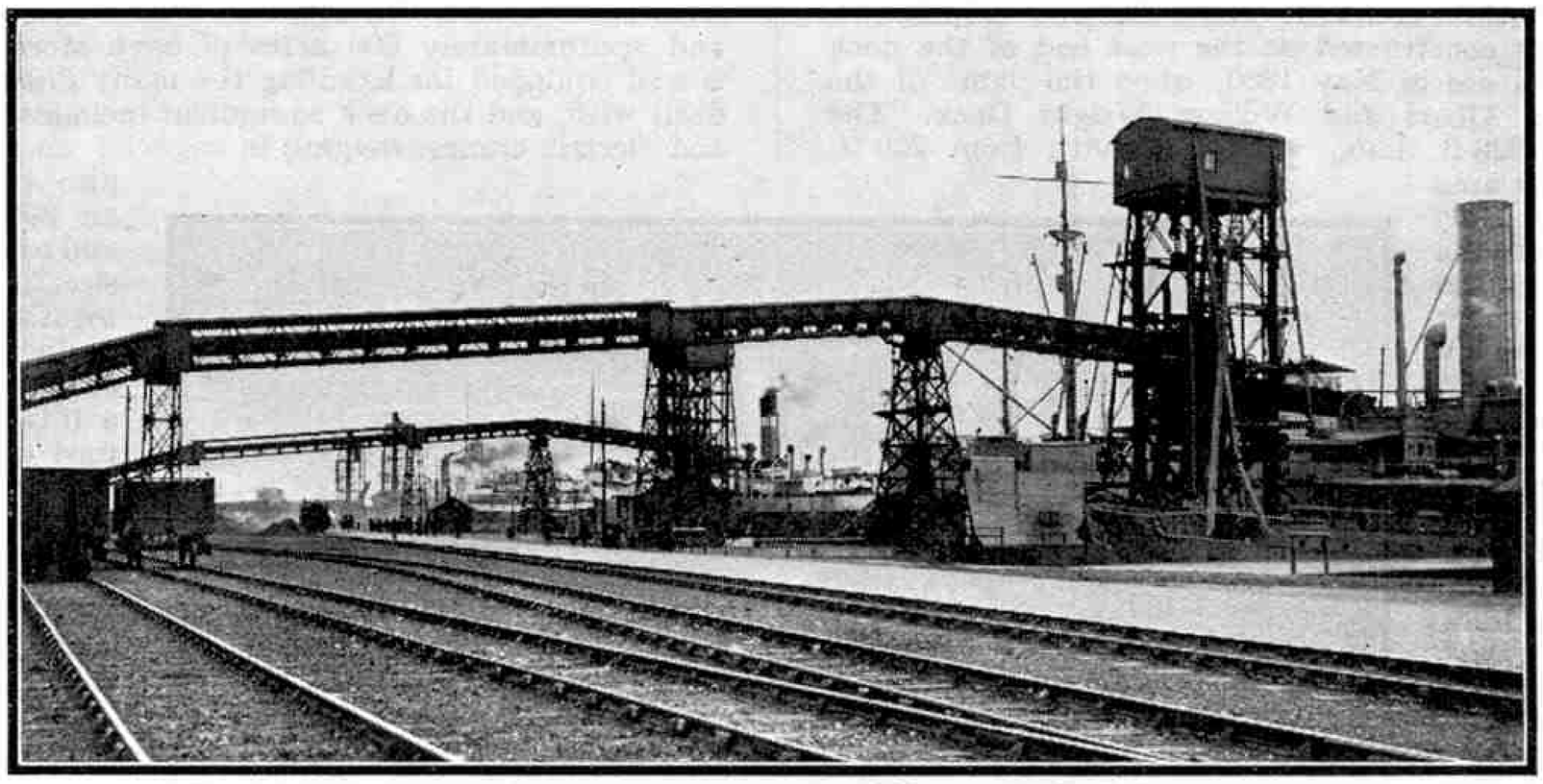


one-fifth of the population of the city; and during 1932 the huge quantity of 241,548 tons of fish was landed at the port. St. Andrew's Docks, at the western extremity of the dock estate, are devoted entirely to this traffic. The north side of the docks is reserved for the landing and marketing of the fish, and the stages there, each under cover and provided with an adjacent railway siding, have a total length of 3,400 ft. On the south side of the docks facilities are provided for supplying coal, ice and provisions to the 300 trawlers engaged in the industry; and the coaling appliances have a maximum capacity of 400 tons per hour. At the west end of the docks there are four slipways with electrically operated cradles and in addition a side slipping berth; also a considerable acreage of fish-drying grounds.

The nearness of Hull to the great Yorkshire wool factories makes the port the natural and cheapest inlet for the vast quantities of raw materials used in the industry, and the wool trade through the port has rapidly increased during recent years. The large wool warehouses at the King George and Alexandra docks are equipped with modern electrical machinery for the quick handling of the wool. Grain is another important commodity handled in large quantities at the port, and spacious warehouse accommodation is provided at the Albert and William Wright Dock and Riverside Quay, and also at the King George Dock where there is a large reinforced concrete grain silo with a capacity of 40,000 tons of grain. Three grain ships can be discharged simultaneously to the silo by means of conveyors that work in ferro-concrete tunnels under the quays.

To deal in detail with all the various commodities imported into and exported from Hull would make monotonous reading. Mention must be made, however, of the timber imports from Scandinavia and the Baltic, which are handled at Victoria Dock; and the fruit, vegetable and provision traffic, which is dealt with at the Albert and William Wright Dock and at the Riverside Quay. On the quay fruit sales are held only a few yards from the point where the fruit is landed, and the purchased goods can be loaded direct into the buyers' wagons for conveyance to destination. Considerable quantities of frozen meat are brought from the Dominions and South America to Hull, and there are three cold stores with a total capacity of 700,000 cu. ft. provided for this trade, two at the docks and one at Blackfriargate, in the centre of the city. The import of petroleum is another and growing branch of the port's trade, and facilities for the large ocean-going tankers are provided at Salt End, on the River Humber, where the L.N.E.R. have constructed two deep-water piers. The principal oil companies of the country have erected extensive storage tanks at Salt End, and oil can be pumped direct from the overseas vessels to these tanks. The L.N.E.R. have also provided facilities there for dealing with molasses in bulk.

The port is very convenient for the export of coal, and this is shipped in large quantities from the collieries in the West and South Yorkshire, Nottinghamshire and Derbyshire coalfields. The traffic is dealt with at various docks, including Alexandra Dock, which is equipped with seven hydraulic coal hoists each capable of shipping at the rate of 400 tons an hour, and at an adjoining river pier where there are two electric belt conveyors each of which can load 600 tons of coal an hour. Similar but larger coal conveyors are provided at the Victoria and King George docks, the two conveyors at the former having a delivery capacity of 650 tons an hour, and the two at King George Dock of 800 tons an hour. The equipment of this dock includes also a twin-hydraulic coal hoist in which each hoist can load 500 tons an hour.



(Top) Unloading fruit at the Riverside Quay. (Bottom) Coaling Belts and Hoists, King George Dock. Each of the two conveyors shown has a delivery capacity of 800 tons an hour.

Hull is also an important passenger port and, as mentioned earlier, the Riverside Quay enables vessels to depart on a timetable independent of the state of the tide. At the west end of the quay there is a fine passenger station that includes Customs examination and waiting rooms where passengers can pass direct on to the boats.

It is essential that a modern port such as Hull should possess ample facilities for the repair and overhaul of shipping, and there are two well-equipped graving docks at the Alexandra Dock. The first of these docks is 528 ft. long, 56½ ft. wide at the entrance, and the second 580 ft. long and 61 ft. wide at the entrance. There are also two graving docks at the King George Dock, the first of which is 466½ ft. long and 66 ft. wide at the entrance, and the second 568¼ ft. long and 72 ft. wide at the entrance. These two docks are served jointly by a 25-ton travelling crane. In addition there is a graving dock adjoining the Albert and William Wright Dock. This is 501 ft. long and 50 ft. wide at the entrance, and has two side berths for accommodating trawlers.

We are indebted to the courtesy of the London and North Eastern Railway for much of the information contained in this article.

Modern Locks and How They Work

Cipher Combination with 100 Million Changes

By Vincent J. M. Eras

IN common with many other articles in general use, locks are among the accepted facts of modern life. Few people give them a moment's thought until they go wrong, and still fewer take the trouble to investigate their mechanism and learn how they work. Nevertheless there is as much difference between a bad lock and a good one as there is between a flimsy toy boat and a battleship; and though a toy boat does give pleasure in its brief spell of life, a flimsy lock creates nothing but irritation. It is valuable therefore to have a knowledge of locks, and to be able to judge how far to trust one and thus avoid purchasing a lock that could make only a pretence of safeguarding one's property.

By far the most important thing about locks is the principle that governs their locking mechanism—in other words, their security against picking. All the well-known lock inventors, Bramah, Cotterill, Tonks, Chubb, to name only a few, had their distinct methods, but for all practical purposes there are now only two systems in really wide use. These are the pin tumbler locking device as applied to cylinder locks, and the lever lock. Each of these principles may be explained quite simply, and therefore it is an easy matter to acquire an understanding of locks generally.

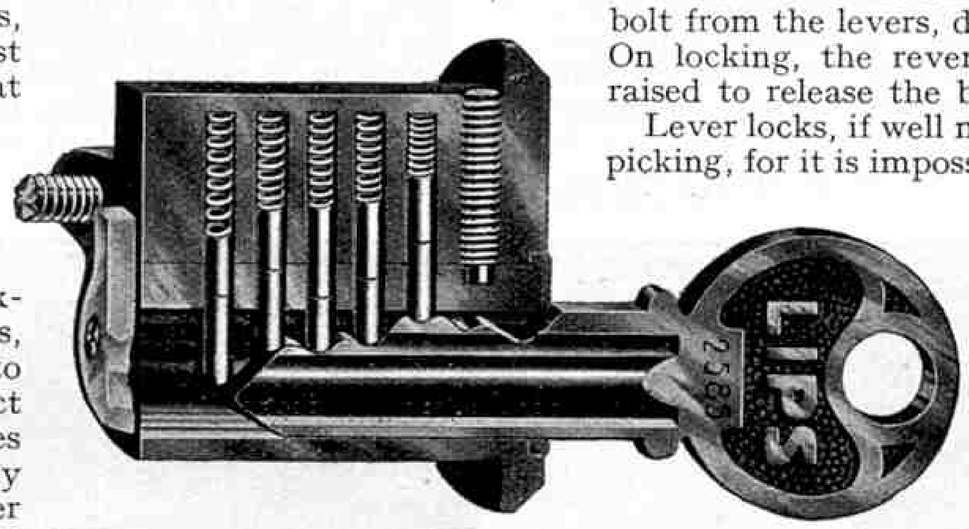


Fig. 1. A sectional view of a pin tumbler or cylinder lock. The manner of raising the pins to the "breaking line" is made clear in this illustration.

Let us first of all examine the principle of the pin tumbler or cylinder lock. Fig. 1 illustrates a lock of this type bisected lengthways, and with a key partially inserted. It will be noted that the cylinder contains a closely fitting revolving cylindrical bar that is pierced lengthways by a slot for the key. This bar is normally prevented from turning by a series of pins known as pin tumblers, each consisting of two parts, that are pressed downward by spiral springs into holes in the bar. It is only free to turn when the tops of all the lower pins are on an exact level with the outside of the bar, forming what is technically known as the "breaking line." This occurs only when the right key is inserted, the action of the key being to raise each of the pin tumblers to its "breaking" position.

The advantage of the pin tumbler locking device is that it permits of considerable variation in keys. Five is the usual number of pins for a good lock, and the slightest variation in the breaking point of one pin tumbler involves the use of a different key to operate the lock, a fact that makes for security. This principle is in general use for better-class entrance door locks, padlocks and even for cabinet locks. Not the least of its merits is that the locking mechanism, that is, the cylinder, need not be very large, and requires only a small, light key to operate it.

Chubb's invention of the lever lock has been developed into a system that, in its present perfected form, produces a secure, strong and serviceable lock. Fig. 2 illustrates one of these locks, and shows the bolt A; the locking stud, B, riveted on the bolt and resting in the forward notch of the levers; the levers, C, in this case six in number, pivoting on the centre pin D; a spring, E, formed by six separate springs, pressing on the ends of the six levers; the longitudinal slots or "gatings" of the levers, F, and the key, G.

The levers are metal discs—in good locks they are made of non-corrosive materials—that are raised by the key exactly to the different heights required to allow the locking stud to pass through the gatings so that the bolt may be withdrawn. The levers are situated one over the other, but quite separate and distinct, in order to allow each and all of them to be raised to different heights by the corresponding incisions on the bit of the key. When the key is turned in the lock it raises the levers to bring the gatings that connect the two notches in the levers into line. Simultaneously the lower or bolt step of the key catches into the tail end of the bolt and presses it backward. The pressure of the key on the bolt causes the locking stud to enter the "gatings," moving from one notch to the other. In this manner the key releases the bolt from the levers, drawing it in entirely, and the lock opens. On locking, the reverse action takes place, the levers being raised to release the bolt stud from the rear notch.

Lever locks, if well made, afford considerable security against picking, for it is impossible to tell when any one lever is lifted to its correct height; much less can the combination of the six be ascertained. Obviously the security of the lock is determined to a great extent by the degree of accuracy with which the gatings in the levers fit the locking stud. The greater the play allowed to the stud, the less secure is the lock; indeed, one may say that excessive play in the levers stamps a lock as inferior. A false key, provided it does not differ appreciably from the true key, may open the lock with equal ease.

The variations or changes that may be effected in a key of the type illustrated in Fig. 2, without altering the length of any of the steps, is $1 \times 2 \times 3 \times 4 \times 5 \times 6$, or a total of 720. Further changes may be obtained by altering the height of each step, including that of the bolt step; or by altering the pin on which the key fits, or the gauge of the pipe of the key. Variations to the number of over 2,592,000 can be effected by these means. The following little story serves to illustrate the amazing number of variations that can be achieved with just a simple lock. A party of seven friends were sitting down to dinner one night. As a joke, one of them persuaded his companions to agree to give him a free dinner each evening until such time that he was unable to arrange the members of the party in a different position at the table. It was a long time before his victims realised that they had committed themselves to providing him with free dinners for nearly 14 years!

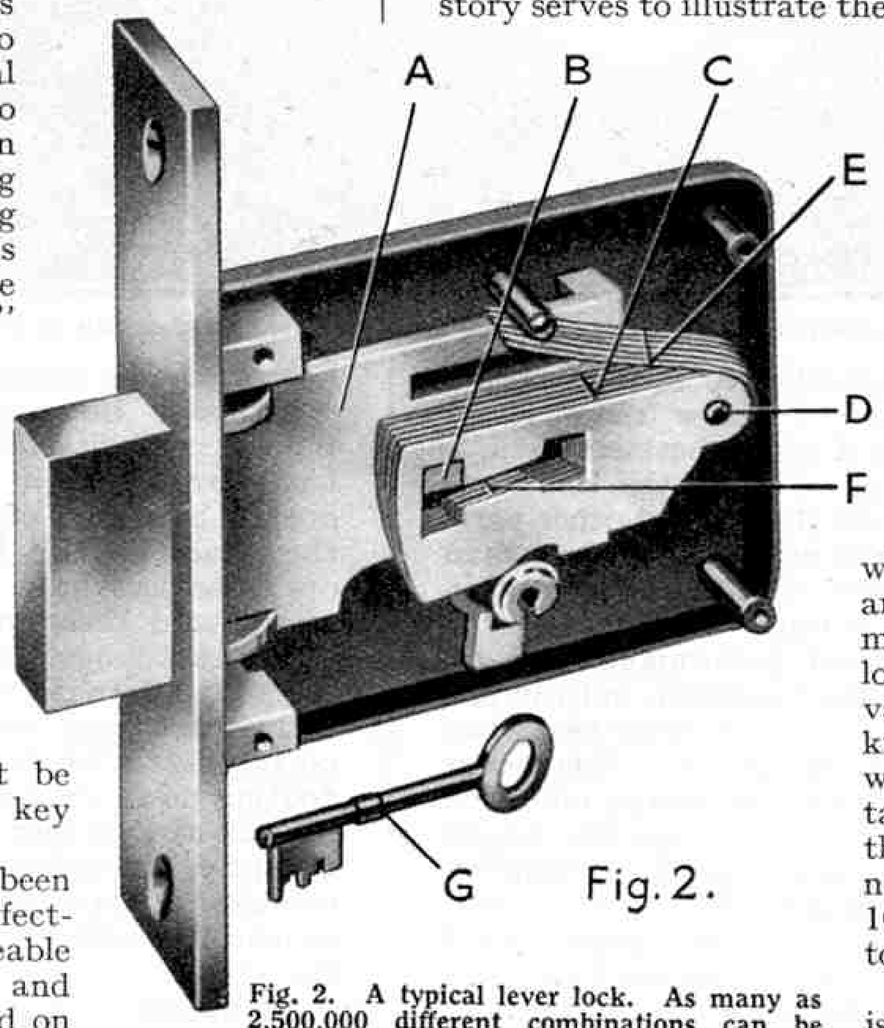


Fig. 2.

Fig. 2. A typical lever lock. As many as 2,500,000 different combinations can be effected with the lock and key illustrated.

The modern cipher combination lock that is employed extensively on safes is an even more interesting example of what can be achieved by ingenuity in arranging changes, for as many as 100 million changes are possible in this type of lock! The explanation of this staggering variety is that better-class locks of this kind contain four discs, each provided with a gating to receive the bar of the bolt tail; and each disc allows 100 changes in the position of the gating. The total number of possible changes, therefore, is $100 \times 100 \times 100 \times 100$, or the amazing total of 100 millions!

In this type of lock the underlying idea is the same as that of the breaking line of the cylinder lock. The gatings in the discs must be brought into line to allow the bar on the bolt tail to drop into the groove thus formed. The four discs then revolve by a turn of the knob, and the lock opens to permit the withdrawal of the bolt. The principle of these combination locks is a loose core in each disc by means of which it is possible to vary at will the position of each gating in relation to the others.

For the illustrations to this article we are indebted to Lips' Brandkasten- en Slotenfabrieken, Dordrecht, of which firm the author is Managing Director.

"How I Make my Parachute Descents"

Jumping from Aeroplanes as a Career

By John Tranum

"LIVE dangerously," advised a famous German philosopher, and I suppose most people think that as a professional parachutist I follow this advice. But I do not believe that my job of dropping out of an aeroplane more than 100 times a year is as dangerous as they imagine. As I am still young, I value my life highly, and I certainly do not wish to throw it away in a horrible manner from sheer recklessness and irresponsibility.

After 11 years' experience of parachuting, I declare in all seriousness that it is a comparatively safe occupation for me, now that I am a master of all its recognised difficulties and have the privilege of using a type of parachute as perfect as present knowledge can make it. I hope to continue my career for many years yet and to retire sound in mind and limb, although my aerial antics include wing-walking and riding on the undercarriage during flight, when I have to depend solely on anticipating the forces that try to fling me into space. It is useless to carry a parachute for this work, because, in order to make it an effective thrill for the crowd, the machine must stunt at a height that would be too low to enable the canopy to open before hitting the ground.

It is admitted by aviation experts that the parachute event is the most attractive feature of an aerial display and therefore the best "gate-puller." Although I know that many of the spectators half-anticipate that I shall be killed, I do not lose any sleep, and if I shared in the smallest degree in their anticipation I should retire at once.

Mr. J. Tranum, the author of the accompanying article, packing his parachute in preparation for a display.

I do not consider myself a possible human sacrifice performing to satisfy morbid curiosity. I am a parachutist because I know more about parachutes than anything else, and as I am a business man, I never perform in public without reward. During the last three years my work has been confined to Great Britain and other parts of the British Empire. At home I have never earned less than £1,000 a year, and during a six months' tour of Great Britain last year I earned £2,700 for over 120 jumps.

Let me now describe one of my usual performances. I invariably wear two parachutes, not because I have no faith in one alone, but because it is obviously more sensible to wear two when one can do so. I only open both in an emergency. This means that the second is opened only about once in 100 jumps, and even then the emergency is usually not serious. Perhaps the bigger parachute does not open fully at once because some of the connecting cords have become entangled in part of the canopy. I can clear the entanglement in a few seconds, but merely as a precaution I open the second and smaller parachute first. Incidentally, this kind of fault is not due to a defect in the design of a parachute, but is caused by the pockets in the pack that hold the cords in position becoming loose as a result of daily use. The performer, who should always pack his own parachute when touring, should watch these pockets and have them tightened periodically, for it is important that the bunch of connecting cords should remain intact in the closed pack and not sprawl into the folded canopy.

I usually get into the front cockpit of the aircraft, because from it I can easily reach the lower wing, from which I leap. Now it is wrong to suppose that, in order to drop into the landing field, it is sufficient to get right above it and drop out. Drift has to be allowed for, as in dropping a bomb; and this calls for great judgment, particularly when the wind is very strong. The altitude I usually jump from in calm weather is about 800 ft. When the wind is strong, however, I ask my pilot to climb much higher in order to give me time during the descent to control my direction, for to jump at a low altitude in a high wind is to risk a dangerous swing into the ground, or into a tree or a hedge.

As I stand waiting on the bottom wing for the right moment to drop, I face the tailplane and watch the field and crowd below. My last act before stepping into space is to see that my parachute ring is in its pocket. As I fall I do not grab it frantically and pull. Instead I take my time, for except when jumping for life at an extremely low altitude it is very dangerous to pull the ring while leaving the aircraft. The golden rule is "Jump and Pull"; never "Pull and Jump." The parachutist who neglects this rule and pulls while in contact with the aeroplane will become entangled with the canopy and the machine, and probably will be crushed to death on landing.

The parachute I use is the manually-operated type, as employed by the Royal Air Force. This has been instrumental in saving more than 600 lives throughout the world. After 14 years' experience of this type, the experts are now convinced that the probability of an airman failing to pull the ring is very remote. If it is true that a drowning man will grasp at a straw, then surely any man falling into space will grasp and pull the parachute ring when he knows his life depends upon it.

Although the use of a manually-operated parachute places full responsibility for its operation on the parachutist, experience has proved that it is safer than the automatic type, which is opened by means of a long cord connected to the aircraft and to the airman's pack. This cord, when stretched out to its full length, opens the parachute. The chief defect of this type is the probability of the cord becoming entangled in a falling spinning aeroplane, and thus failing to act.

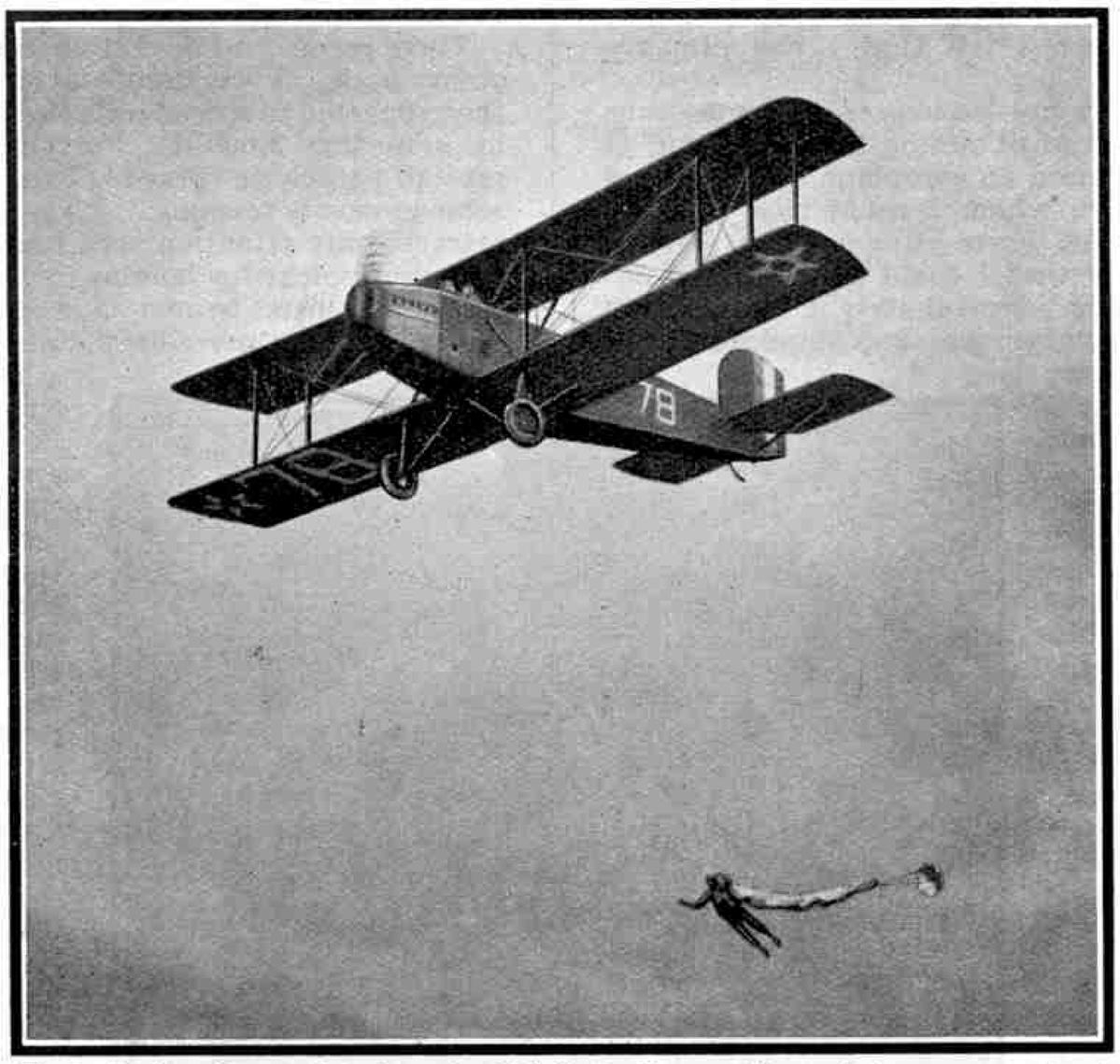
As I fall from the wing my body turns slow somersaults, although it does not seem like it to me. There is no sensation of falling, no gasping for breath, no urge to struggle madly. I feel as though floating down on a cushion; and when I pull the ring, and the big silk canopy flies out of the pack, my headlong fall is checked abruptly, but without wrenching my body, unless I have made the mistake of having my harness too loose. Parachute harness should be worn as tight as is bearable, for then it absorbs all the shock.

On opening and pulling me upright the parachute swings, but I quickly steady it by jerking the silk cords above my head, first on one side and then on the other. This crumples each side of the canopy in turn, spilling air out and causing the parachute to lose lift, and thus to drop instead of to swing. Immediately I stop jerking the cords a normal steady descent results. I control my descent in a similar manner. If I am drifting too far in one direction I crumple part of the canopy and drop vertically. By continually repeating this action when descending in a strong wind I can usually land on the chosen spot. There may be danger in this for the inexperienced parachutist, however, for if he does not

allow the canopy to regain its normal shape and lifting power several moments before alighting, he may hit the ground while falling at too high a speed. More fatalities occur through lack of skill in controlling the parachute than through failure of the parachute to open. In all ordinary circumstances no failure to open should ever occur with a parachute of approved design.

Apart from personal considerations, it is important that a parachutist should know how to land accurately when giving public displays, in order to avoid expensive damage to his parachute by collision with objects such as trees and buildings. A parachute costs at least £60, so that he or his employer cannot afford to provide a stock of more than two, and serious financial loss follows if these are put out of action when a performer is touring the country with an air circus.

I know that a landing in a tree or on a building provides a thrill for the crowd, but it also proves that the parachutist has given a faulty display, and his employer will not echo the crowd's delight! I take a pride in making the centre of the aerodrome my "bull," and hitting it. To achieve this I often do not drop from the lower wing until the machine is actually passing right out of the field, for it heads into the wind when I am about to jump, and I drift backward on leaving it. When I was performing spectacular jumps in America for films I always earned a specially high fee by landing on a given spot at the first attempt, and thus saving the film companies the expense of re-takes.



The beginning of a parachute descent. This illustration, and the one below, are reproduced from official photographs of the United States Army Air Force.

In harping on this question of landing skill I do not want readers to imagine that I have never made a faulty landing. If I mention that during my career my injuries have included the fracturing of my ankle several times, and also of my ribs, a horrible gash across my left cheek, a broken pelvis, and bruises without number, it will be realised that sometimes I have blundered!

Most of my injuries were received when doing dangerous work for the films. Once in California I jumped off a bridge only 154 ft. in height. My parachute opened all right, but the impact with earth was not very pleasant! One is obliged to attempt foolish feats for the films. Perhaps my worst was a mad motor-cycle ride over a Californian cliff 200 ft. in height. Three men had already been killed in attempting this, their parachutes having failed to open in time. I avoided a similar fate by altering my parachute pack to fit my head. In this position it fortunately opened more quickly than if coming from the usual position at the back.

The Eiffel Tower in Paris has been the scene of many fatal parachute jumps, chiefly by inventors of new types. On one occasion I was engaged by a film company to jump from the top of the Tower. When everything was ready I stepped towards space, and simultaneously two pairs of firm hands grasped me. They belonged to two gendarmes, who gently but determinedly divested me of my parachute. I have since received permission from the Sureté to make the jump, however, and it is to be one of my future experiences.

The delayed jump, or falling a long way before opening the canopy, is one of the feats in a versatile parachutist's bag of tricks. It is not nearly so dangerous as it seems, for to fall a long distance does not impose a great strain on the parachute when it opens, or require greater nerve on the part of the performer than an ordinary jump. It does demand a high degree of judgment, however, and for this reason it is never wise to attempt it below, say, 2,000 ft., that is if you propose a delayed drop of a considerable distance for a spectacular appeal.

Common notions about delayed jumps are quite wrong. The body does not fall more and more rapidly, as is usually thought, for there comes a moment during its earthward career when the resistance of the air prevents further increase in the speed of its downward rush. The greatest velocity that can possibly be attained is 119 m.p.h., and this is reached in about 11 sec., and after a fall of 1,200 ft. An airman can be flung into space from his aircraft at a higher speed than this, of course, for the velocity at which he leaves an aeroplane, whether he jumps out or is flung out, is always that at which the machine is travelling. If he is thrown out of a machine that is plunging earthward at more than 119 m.p.h., however, the rate at which he falls quickly decreases until it reaches that figure.

It will be seen that stories about falling at the rate of 250 m.p.h. or even more during a long delayed jump are mere guesses on the part of those who do not understand what is involved. If I drop from 20,000 ft., and open my parachute after falling 2,000 ft., my velocity at that moment is 119 m.p.h.; and even if I allow myself to fall 10,000 ft. before pulling the ring, my velocity is still no more than 119 m.p.h.

The easiest and safest method of judging distance during a delayed drop is to count seconds, for it is impossible to judge the distance of the ground with accuracy when falling. I always follow this plan, and know that I have fallen about 1,000 ft. when I have counted 10. I have then attained the maximum velocity, and after that fall 175 ft. every second, neither more or less. I also know the altitude at which I left the machine. My system of counting therefore tells me how far below earth lies, and it is not necessary to attempt to judge its distance.

A parachute jumper altering his direction by pulling on the shroud lines.

Once I made a delayed drop through a thick bank of cloud that was high enough for me to decide that I could pull the ring as soon as I emerged below it. But the thickness of that cloud seemed endless. I fell and fell and fell, and still I could see nothing but cloud. Feeling thoroughly alarmed, I pushed up my goggles, and discovered with horror that I was far below the cloud and rapidly approaching earth. Fortunately I was not too late. The cause of this incident was mist on my goggles, and ever since I have counted on every delayed drop.

The greatest feat in my career was a delayed drop of 3½ miles at the Royal Air Force aerodrome at Netheravon, Wilts., on 24th May last. This fall created a new world record for its class. The previous record was held by Mr. E. S. Manning, an American, who once fell 15,256 ft. before opening his parachute, and for many years I had set my heart on beating it.

My preparations for the attempt on the record included getting myself physically fit, for there must be more than the normal co-ordination between thought and action when falling long distances and operating the parachute at any precise moment. I was medically examined and subjected to a special lung test in the Siebe Gorman decompression chamber, in which the airmen who flew over Mount Everest also were tested before their great flights. This is a globular metal chamber, equipped with oxygen apparatus.

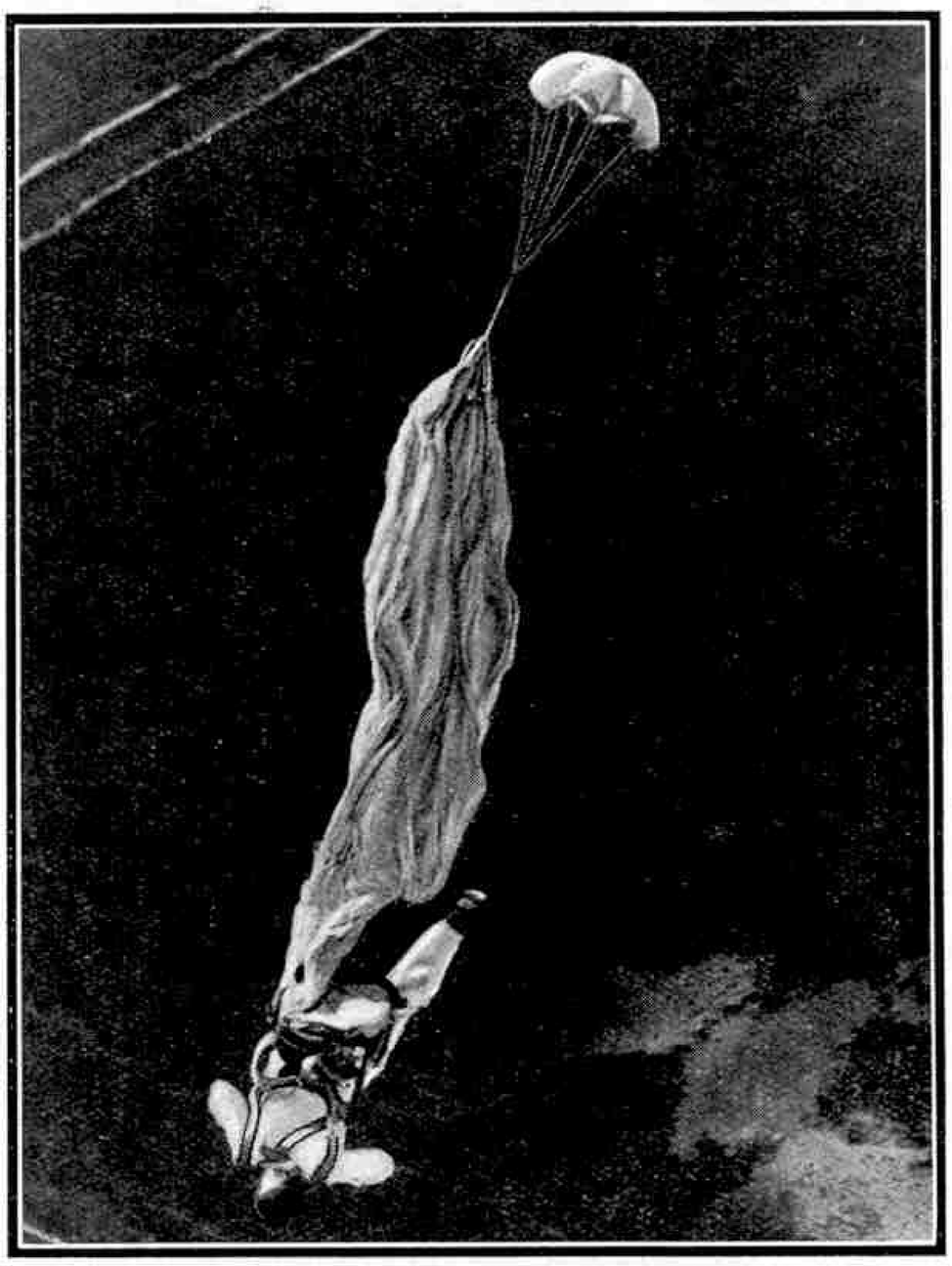
I was bolted in it and the pressure was reduced to that prevailing at an altitude of 24,000 ft. At a given signal it was then increased at the rate I should experience when actually falling, but I suffered no discomfort beyond a slight drumming effect in my ears.

I also made several fairly long delayed jumps for practice, including one of 9,000 ft. and then I felt that I was properly prepared for my task.

One of the difficulties that beset a free-lance parachutist desirous of performing special feats is that of obtaining the right kind of equipment and assistance. I required an aeroplane with a ceiling of at least 25,000 ft., a pilot upon whom I could rely, and the best type of parachute. Royal Air Force equipment is perhaps the best in the world, and I knew that I could not make a safer choice if it were within my power. Fortunately I was able to obtain a Hawker "Hart" day bomber, which is standard in the R.A.F., and Service Irvin parachutes; while my pilot was Mr. "Jerry" Sayer, the famous Hawker test pilot.

On 24th May Mr. Sayer and I set off from Heston Air Park, near London, for Wiltshire, intending to arrive above the Netheravon Aerodrome at a height of 26,000 ft. My pilot did not begin to climb progressively until we were over the aerodrome, however, and then we shot up from 4,000 ft. to 26,000 ft. in about 20 minutes. It was mid-afternoon, and we were disappointed to find thick mist at the high altitude. This was as impenetrable as a brick wall so far as vision went, and we reluctantly began to descend. We did not emerge into clear air until we were at a height of 17,000 ft., and as this was too low for my purpose we landed on the aerodrome, intending to wait for clearer weather.

Two hours later we set off again, but after another swift climb we found that we could not reach 26,000 ft. with any advantage, so we cruised around in cloud at 21,000 ft. searching for a gap through which we could see the distant ground. We found one, and I decided to take my chance. Switching over from the oxygen apparatus in the machine to my own small supply, which would last 10 minutes, I stepped from the warm cockpit on to a bottom wing. With the temperature at 35°F. below freezing point, and a powerful wind striving to blow me off prematurely, I was not too happy as we tried to find another gap in the clouds. At length my pilot saw one and drew my attention to it as he flew towards it. I had then only four minutes supply of oxygen, so I neatly stepped off the wing into space and successfully dropped through the gap.



Falling headlong after jumping from an aeroplane. Our photograph shows how the pilot parachute pulls the main canopy away from the airman's body, thus avoiding risk of entanglement.

As I fell I began to turn somersaults. This did not confuse me, however, and I was able to keep my eye on my stop-watch, which was strapped to my hand. Somersaulting in fact is the usual manner of falling in the first stage, and on this occasion, after falling 5,000 ft., I flattened out into a graceful dive, with my body at an angle of about 45°.

So far there had been nothing to upset my usual comfort and self-possession, and I had no difficulty in watching the hand of the watch ticking away the seconds that told me how far I had fallen. I was breathing almost normally and there was little sensation of falling. Then a minor discomfort suddenly developed, for my eyes began to water, although my goggles were airtight, and a mist covered the glass. I tried to wipe the mist off, and then as I fell through warmer air it cleared naturally. My eyes still watered, however, and I tried to wipe them, after lifting my goggles, but without success.

Falling makes one's view blurred, and although the earth was always in sight, my first clear view of it as I stepped off the wing was also my last. The blurred effect that I suffered made the earth seem closer than my watch recorded, and increased the constant temptation to open the parachute too soon. Finally I did pull the rip-cord ring of my front parachute because my eyes suggested that I was near enough to the ground, but then my watch showed that I had fallen the distance of more than 17,000 ft. at which I had aimed.

The shock of being pulled up when falling at 119 m.p.h. was terrific. I felt as though I was being drawn apart, but the confusion of the sudden braking contributed more to the effect than did actual physical hurt. I suffered just one bruise on one shoulder, but in a second came the tranquillity of a gentle descent under the billowing silk canopy.

There seemed no need to disturb the emergency parachute pack on my back. I was tired, and rather indifferent to the area of trees that appeared to spread unbrokenly below me as I floated downward for more than 3,000 ft. Fortunately I alighted on grass, although my tall parachute sprawled over the branches of a tree. I lay for some moments relaxing. Then the sound of a low-flying aeroplane attracted my attention, and I sat spellbound as the designer of my parachute picked a hole in that wooded area in order to land his Puss Moth close to me. I was a few miles from the aerodrome, but he was by my side within a few minutes of my landing.

My record jump was not merely a personal stunt in my own interests. It was carried through with the approval and supervision of responsible experts who made independent observations of the fall, and its results are of value to aviation. If there are wars in the future the fighting aircraft will engage in mortal combat at altitudes above 20,000 ft., and pilots therefore will have to face parachute jumps for life at such altitudes. My experience proves that human beings can fall great distances without losing consciousness, or being rendered incapable of operating a parachute for any other cause; and also that a parachute can be relied upon to bear the shock of opening after long drops.

I have now jumped from aircraft more than 1,400 times, and readers therefore may believe in my sincerity when I declare that I approach my work as calmly as they approach theirs. As I prepare for a jump to-day I feel not the slightest apprehension, except when the field is unfavourable for a descent. Unfortunately this often is the case in this land of so few aerodromes, and many times when performing on the outskirts of towns I have had to jump into fields surrounded by houses, main roads and moving traffic. Even then my fears are not for myself, but for my reputation for accurate landings.

In conclusion I will explain for the first time my idea of falling in a bomb, from which I propose to release myself after diving several hundred feet, to complete my descent more naturally by parachute.

My bomb is now being manufactured for me. It will be about 6 ft. long, so that I can lie in it at full length. It is to be made of aluminium, and will have a cap of celluloid through which I shall be able to see the earth as I hurtle downward. The bomb will be slung in an ordinary bomb rack under the machine, and I shall be already encased within it when the machine takes off. At an agreed height my pilot will pull the bomb toggle in his cockpit and the bomb will immediately fall. On reaching a certain altitude I shall pull out a pin securing the aluminium body to the celluloid cap, and elastic bands will immediately cause the body to close up like a telescope, and remain fixed round my feet. My arms will thus be free, and I shall open my parachute. This done, I shall draw up my feet, and take off the telescoped aluminium body dangling there. On releasing a spring that had been compressed when the bomb was telescoped, the bomb will spring back into its normal elongated shape, and I shall then take off the celluloid cap from my shoulders and fix it in its proper position on the nose of the bomb. Finally I shall tuck the bomb under my arm, and thus I hope, give the crowd a staggering surprise by alighting with it!

Silly, you may say, but I reply that giving the public thrills is my living, and the greater the thrill the greater the reward!

* * * *

Mr. Tranum, the author of this article, is the most famous civilian parachutist in the world and readers who are interested in his record delayed drop will find a full account of the Irvin parachute employed, which is standard in the Royal Air Force, on page 696 of the "*M.M.*" for September 1930.—The Editor.

Flame Tracer Cartridges for Shot Guns

How a Difficult Problem was Solved

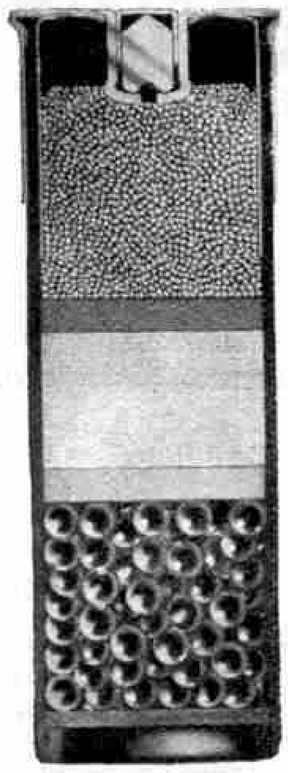


Fig. A.

SINCE the introduction during the earlier part of the Great War of flame tracer ammunition for aerial and other branches of warfare, this ammunition has been developed to fulfil two purposes—first to give an indication of projectile flight, and second to produce an incendiary effect on reaching its target. The potential value of an adaptation of the flame tracer for use with shot-gun ammunition has long been realised and many experiments have been carried out; but only recently have any successful results been obtained.

Before attempting to give a detailed explanation of the Eley "Rocket" cartridge, in which the system evolved from these experiments has been embodied, it must be pointed out that the problems connected with the inclusion of a tracing device in shot-gun ammunition are far greater than any experienced with rifle ammunition. The main requirements of all types of tracer are first, that they should follow exactly the line of flight of the projectile with which they are incorporated; and second, that they should be readily ignited by the combustion of the propellant powder charge. In a rifle tracer cartridge the first requirement is easily attained by seating the tracer composition in the base of the bullet itself; and the pressure and temperature of the gases produced by the combustion of a rifle cartridge powder charge are so high that there is no difficulty in meeting the second requirement.

In a shot-gun cartridge the position is altogether different. First, as will be seen from the sectional view of a sporting cartridge in Fig. A, none of the small pellets of which the shot-charge is composed is large enough to carry the tracer composition. Moreover, by the time the pellets have travelled 30 yds. from the gun they are spread over a circle of at least 30 in. diameter. The problems to be solved are overcome in the following manner.

Fig. A shows the component parts of a loaded shot-gun cartridge. These are a paper case with a brass head holding a percussion cap; a charge of smokeless powder covered by a card wad; a felt wad, and a second card wad; and a charge of shot held in the case by a top wad of card, and the end of the case turned over on to it. When the hammer of the gun falls on the percussion cap the composition is detonated, causing an intensely hot flame under high pressure to pass through the flash-hole and ignite the powder. The powder develops a pressure of between 2½ and 3 tons per sq. in. to overcome the inertia of the wad and shot column and the resistance of the turnover, and propels the shot charge on its flight through the gun barrel. The wadding acts like a piston in an engine. It affords sufficient resistance to allow an adequate pressure to be attained before the ejection of the shot, and it also prevents the exploding gases from reaching the shot in its passage up the barrel.

Fig. B shows the modifications in loading of the "Rocket" cartridge as compared with standard cartridges. The wadding column consists of a card wad over the powder, a felt wad slightly thinner than standard, topped by a third wad also of felt. All these wads are pierced with a central hole that allows the burning gases to ignite the tracer composition. The tracer pellet itself consists of a small flat-based capsule of copper, about ¼ in. in diameter and ¼ in. in depth, weighted with lead at the base and containing a small quantity of tracer composition, the whole charge being held in the capsule by a disc of tinfoil. The capsule is seated loosely in the wadding, with its open end towards the powder.

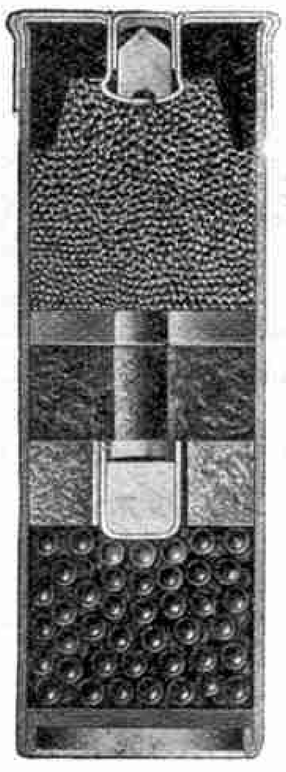
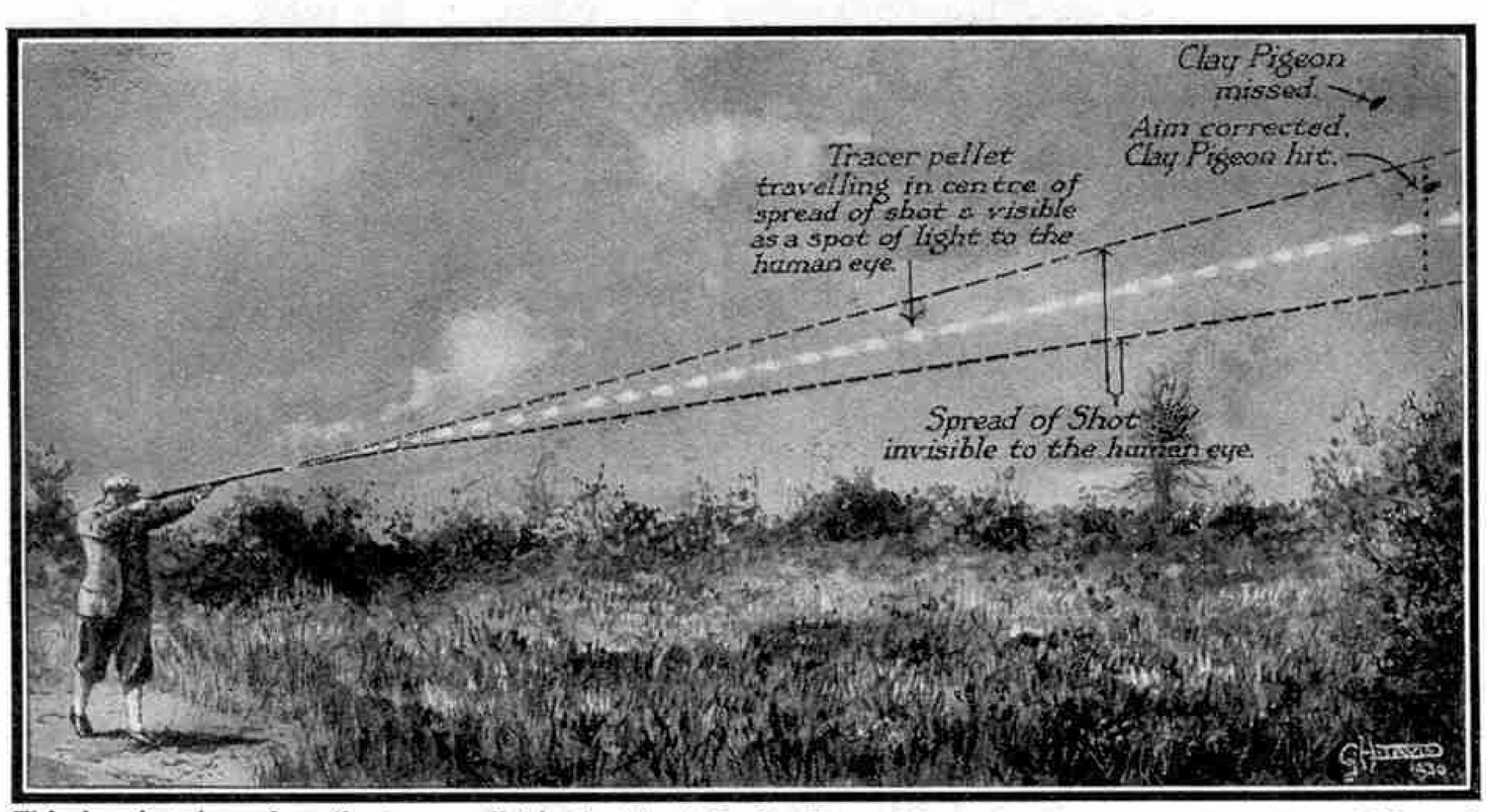


Fig. B.

The tracer pellet is never found more than a few inches from the centre of the spreading charge at 40 yds., and accuracy of trace is assured. The weight of the tracer pellet is greater than that of the individual pellets of the shot-charge, and therefore its range is greater also; steps are being taken to remedy this by the use of a disintegrating capsule. The tracer is extinguished by the time it has travelled 75 yds., and even if it strikes the ground before being extinguished, the risk of its igniting the undergrowth is negligible.

The object of the "Rocket" cartridge is of course to enable the shooter to see the line of flight of his shot-charge, and to correct any faults of aiming into which he may have fallen. With this end in view the cartridge was originally designed for tuition purposes at shooting schools, and for use on clay-bird ranges. In both these capacities it has proved itself of the utmost value. It results in great economy, because it shows by the expenditure of a single cartridge faults that, on the old "trial and error" system, might have resulted in the waste of at least 10 cartridges before they were discovered.



This drawing shows how the tracer pellet in the Eley "Rocket" cartridge makes the course of the shot visible and thus enables mistakes in aim to be corrected immediately without the waste of cartridges that is almost inevitably involved in the old "trial and error" method. The tracer pellet travels in the centre of the invisible spreading charge of shot as a spot of light that can be easily followed by the eye. It is extinguished by the time that it has travelled a distance of approximately 75 yards. For the illustrations to this article we are indebted to Imperial Chemical Industries Ltd.

The use of the "Rocket" cartridge was extended to the field with the proviso that game actually hit by the pellet should not be eaten. This proviso does not entail any great loss, however, for most game is killed by three or four pellets out of a shot charge of perhaps 300 spread over a circle of at least 30 in. The odds against the tracer pellet actually hitting the target are therefore fairly high.

The Eley "Rocket" cartridge has been brought to a very high state of efficiency in regard to such important matters as recoil, velocity and pressure. The cartridge is therefore not only extremely interesting when regarded from the point of view of technical achievement but also is of great practical value to those who seek their sport with the gun.

For the information contained in this article, and also for the illustrations, we are indebted to the courtesy of Imperial Chemical Industries Ltd.

Engineering News of the Month

Large Reservoir for Northern Ireland

After construction work that has occupied 10 years, a large reservoir in Silent Valley, in the Mountains of Mourne, has been put into service to supply water to Belfast and a large number of towns and villages in Northern Ireland. During the course of the work many difficult engineering problems were encountered, but Silent Valley has now successfully been turned into a lake 2½ miles in length, holding more than 3,000,000,000 gallons of water. The cost of the work has been about £1,500,000, while that of the conduit that carries the water to Belfast was £1,000,000. This conduit is 40 miles in length and was constructed some 30 years ago.

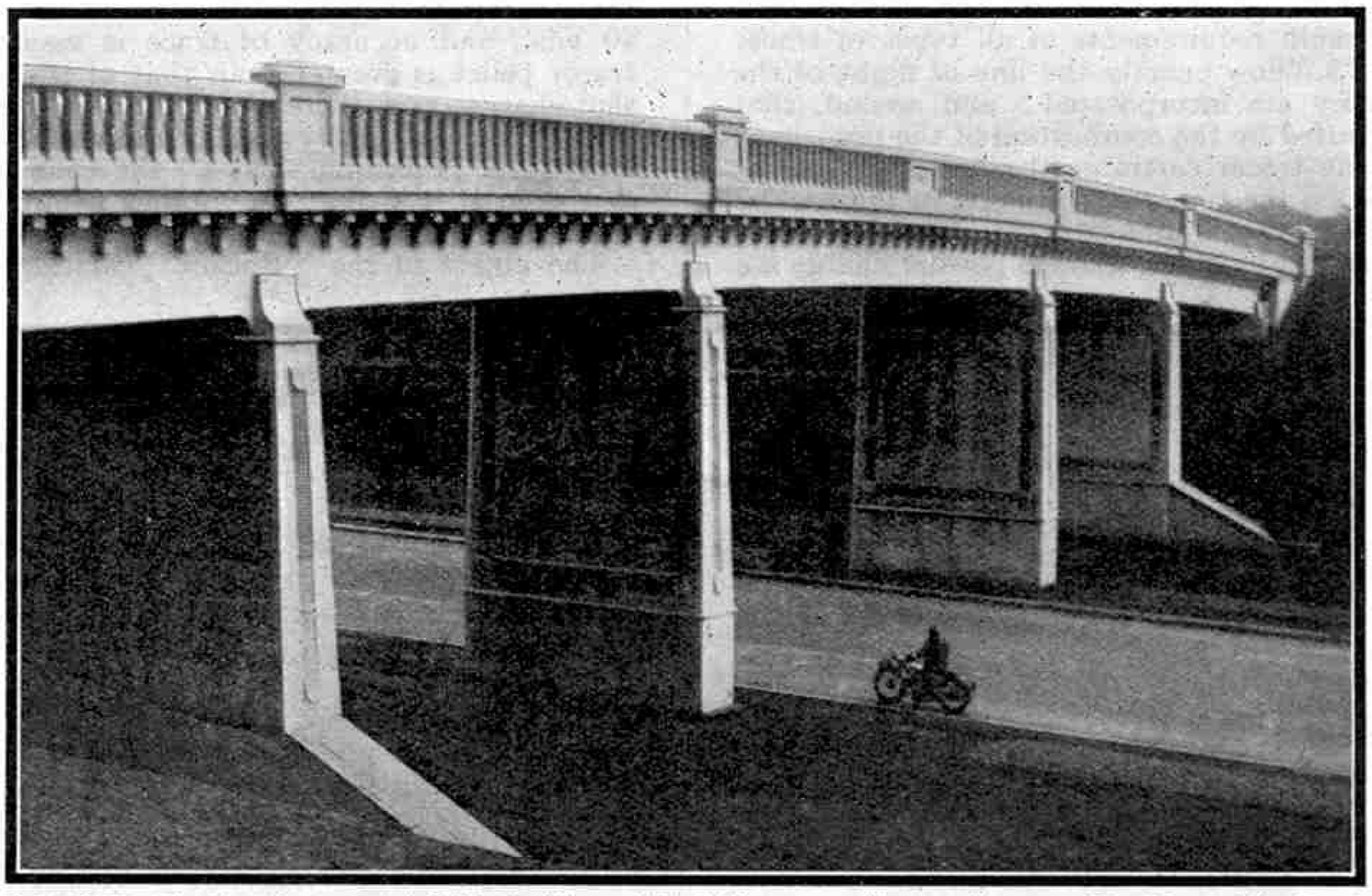
Before work was commenced upon the reservoir, it was thought that rock would be encountered at a maximum of 50 ft. below the surface of the ground. It was soon discovered, however, that in some parts of the valley the solid rock was 150 ft. below ground level, a fact that greatly increased the difficulty of the work and added to the cost.

Multi-Purpose Dam in India

Work is now proceeding rapidly on the Mettur Dam across the Cauvery River in India. The dam is being built to form a reservoir that will be capable of storing about 93,500 million cu. ft. of water, with a surface area of 59.25 sq. miles. Some of this water will be distributed by an irrigation canal that will supply an area of 301,000 acres; and a hydro-electric power station capable of generating 15,000 h.p. is also being built. The dam will improve the distribution of the water in the delta of the river, which has an area of about 1,000,000 acres; and it is stated that when the dam is finished 70,000 more acres of this than at present will be capable of producing a double crop. Another feature of the dam is that it will considerably reduce the amount of damage done by the high floods that are experienced periodically.

The World's Largest Steel Tank

A water tank in Milwaukee, Wisconsin, that has a capacity of 6,000,000 gallons and is claimed to be the largest steel tank in the world, has been constructed entirely by arc welding, not a single rivet having been employed in the construction of the whole shell. When the tank was being erected the bottom was first assembled and welded. The first row of side plates was then put into position and welded to the bottom, after which the successive rows were welded as erected. The tank is about 165 ft. in diameter and measures 37½ ft. in height to the eaves and 57 ft. to the peak. More than 700 tons of steel were welded during the work.



A good example of modern concrete bridge building. This bridge crosses the recently-opened East Lancashire Road at Windle, near St. Helens, and is used by private traffic to Windle Hall. Photograph by W. A. Tomlinson, Prescot.

Another Nile Bridge

Another bridge across the Nile is now in use. This is one that has been built by Dorman Long & Co. Ltd., to replace the old Kasr-el-Nil Bridge built in 1871. The new bridge has eight spans and is 1,260 ft. in total length. Two of the spans are of the electrically-operated opening type and give clear passages 66 ft. in width for river traffic. The bridge is 66 ft. in width and carries a central roadway and two wide footpaths, one on each side of the road. About 3,000 tons of British steel have been used in the construction of the bridge, which has cost more than £308,200 to build.

Welded-Steel Buildings

Electric arc welding is to be used to join the whole of the steelwork required for 20 large buildings that are now being built at East Tilbury, Essex. Each of the 20 buildings will cover an area of about 16,150 sq. ft. and will be 260 ft. in length and 62 ft. in width. The first has already been erected, and eventually the buildings will include a number of factories, office buildings, private residences, and a cinema and recreation room, the total area of land that they will cover amounting to about 600 acres.

The buildings will form a small town, and are being erected for the Bata Shoe Company on similar lines to those adopted at the headquarters of the Company in Zlin, Czechoslovakia. At Zlin not a single rivet or bolt is used in the construction of the steel-frame buildings, as electric welding enables a saving of about 11 per cent. to be made in the weight of the material used.

Bridge Over the Mississippi

The construction has been commenced of a combination railway and footway bridge over the Mississippi River at a point about nine miles upstream from the business district of New Orleans. The bridge is of the cantilever type, and will have a main span 790 ft. in length and anchor spans each 530 ft. in length. The total length, including approaches, will be 3½ miles, and there will be a clearance at the central point of 135 ft. at high water in order to prevent the obstruction of navigation. The most difficult part of the construction will be the erection of the foundations, as the piers will have to be sunk to a depth of more than 150 ft. below low water level.

It is calculated that the bridge will give employment to about 2,000 men, while about 4,500 men will be required to provide the necessary building materials, which will include 60,000 tons of structural and reinforcing steel, 200,000 cu. yd. of concrete and masonry, 4,000,000 ft. of timber, and 1,200,000 ft. of piling.

Vacuum Tube Control for Synchronous Motors

A new type of vacuum valve control that enables synchronous motors to be operated at various speeds by remote control has been developed in America by Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company of New York.

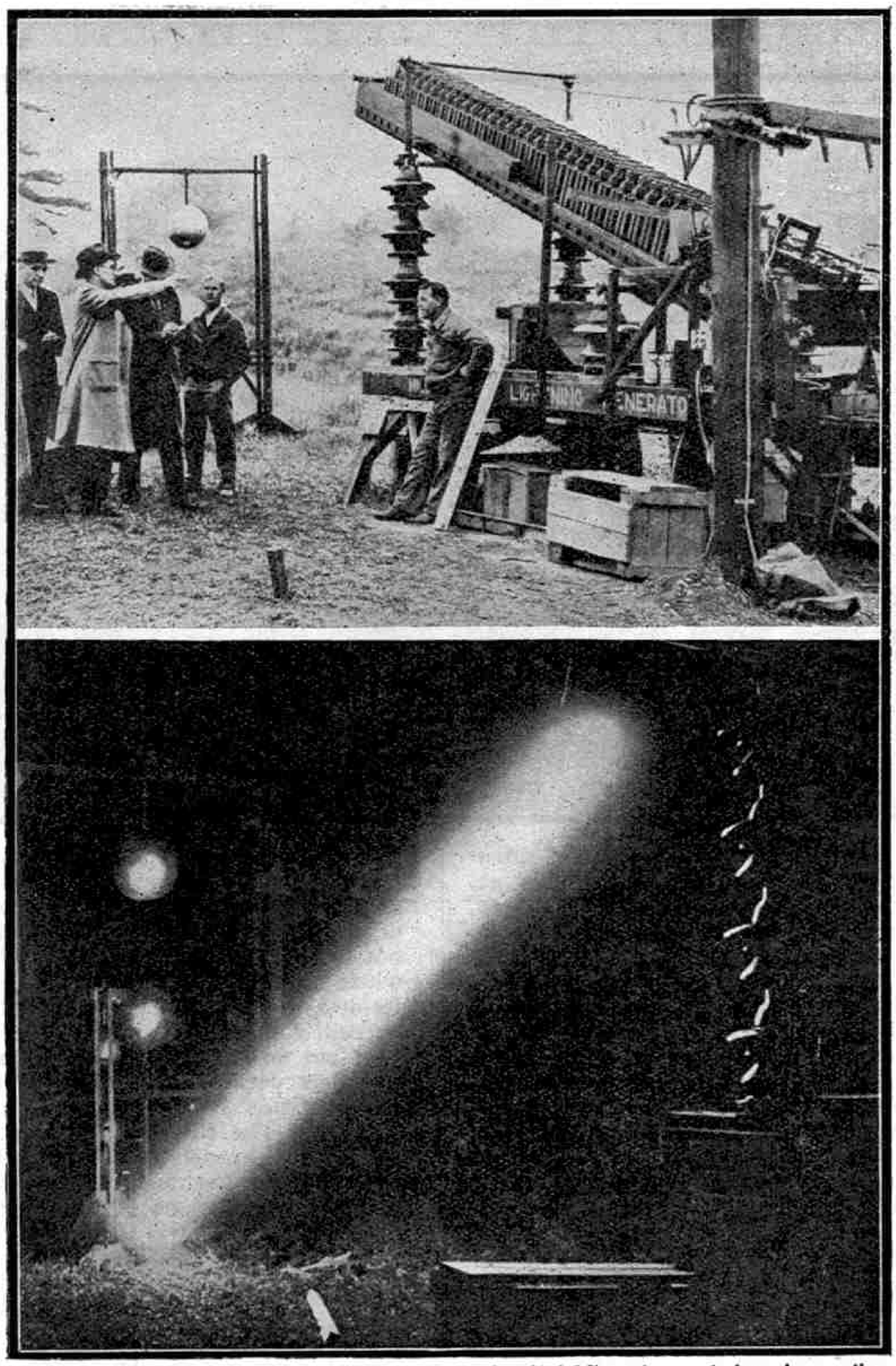
This new method of control makes use of vacuum tubes of the Thyratron type, and should find many important users. It promises to be of particular value in connection with turbo-electric propulsion for shipping. Steam turbines operate most efficiently at full speed, but to slow down the propeller motors it is necessary also to slow down the turbines. With the new equipment, however, the turbines will be able to operate at one speed at all times, for the frequency of the alternating current fed to the motors is altered by means of the vacuum valve control, and their speed varies in accordance with these changes. It will therefore be possible for the speed of the driving motors to be regulated directly from the bridge, instead of by orders to the engine room.

It is stated that with ordinary commutator motors the efficiency between power lines and the motor shaft is about 90 per cent., but that with Thyratron control the efficiency will be increased to about 98.5 per cent.

Motor Fire Escape for China

One of the largest motor fire escapes yet built has been constructed by Merryweather and Sons Ltd., of Greenwich, for service in China. It is provided with an extending steel ladder that is mounted on a turntable at the rear of the chassis and can be extended to a height of 100 ft. in 25 seconds. The ladder is built in four sections and is raised by the engine of the vehicle, the controls being arranged near the driver's seat. An automatic mechanical brake controls the lowering of the ladder, but auxiliary gearing is provided so that the ladder may be operated by hand if desired. A loud-speaking telephone enables the fireman at the top to maintain communication with those on the ground, and the cable connected to this telephone is carried on a drum that automatically pays it out and winds it up as the ladder is raised or lowered.

The fire engine is provided with a 170 h.p. motor in order to enable it to operate satisfactorily in Hong Kong where there are very steep gradients even in the main streets. The motor is of the six-cylinder type and is provided with a four-speed gearbox.



The lower of these two photographs shows a flash of artificial lightning, and above is seen the apparatus employed in its production. In order to give the desired effect, mains current at 110 v. was transformed into current at 1,500,000 v.

Luxury Bus for Long Distance Travel

A luxury bus has been built on an A.E.C. "Regal" chassis, fitted out as a moving home for travellers. The vehicle is of the two-deck type, and has a lounge and a kitchen on the ground floor, and on the upper deck two bedrooms and a balcony at the front over the driver's seat.

The luxury bus has been produced primarily for use in connection with shooting and fishing excursions and for general travel. It is provided with radiators, and a special wireless set has been built into the wall of the saloon. The kitchen is fitted with a cabinet, a gas stove and a sink, all the water required being obtained from a gravity tank in the upper rear compartment, which is supplied by an automatic pump from a main water tank mounted on the near side of the chassis. A total supply of four gallons of water can be carried, and all the tanks are provided with special baffles in order to reduce movement and noise to a minimum. Special provision has been made for the drying of wet waders and mackintoshes.

A Turntable for Shipping

A turntable very similar to those employed for locomotives has been installed at the port of Lorient-Kéroman, on the coast of Brittany. The port is used mostly by steam trawlers, drifters, and other fishing craft, and the turntable has been built in connection with a big scheme of improvements that have recently been carried out, including the provision of docking space for a large number of vessels. When the scheme was first considered it was stipulated that it must be possible to lower into the water any particular vessel at any time, whatever her position, and without interfering with other craft, and the plan selected therefore was that of building a number of radial berths round a turntable. When a boat is to be hauled up, the turntable is tilted until it is in line with a slipway that leads to the water. The boat is then hauled up the slipway into position on the bridge of the turntable, and carefully secured, after which the turntable is levelled and swung round until the boat is opposite the radial berth where it is to be docked. The turntable is again tilted, and the vessel slides off into position.

The tilting turntable is approximately 146 ft. 10¾ in. in length, and the table or bridge itself is made up of two steel girders 18 ft. 4 in. in depth at the centre, decreasing to 4 ft. 7 in. in depth at each end. The girders are firmly braced together, and the whole arrangement is capable of carrying trawlers up to 650 tons in weight.

The tilting of the turntable is controlled by three rams, two of which are arranged at the seaward end and one at the landward end, each capable of exerting a pressure of 120 tons. They are operated by oil supplied by a pump driven by a 25 h.p. engine. When the bridge is tilting at the correct angle it is locked in position by bolts operated by hydraulic pistons.

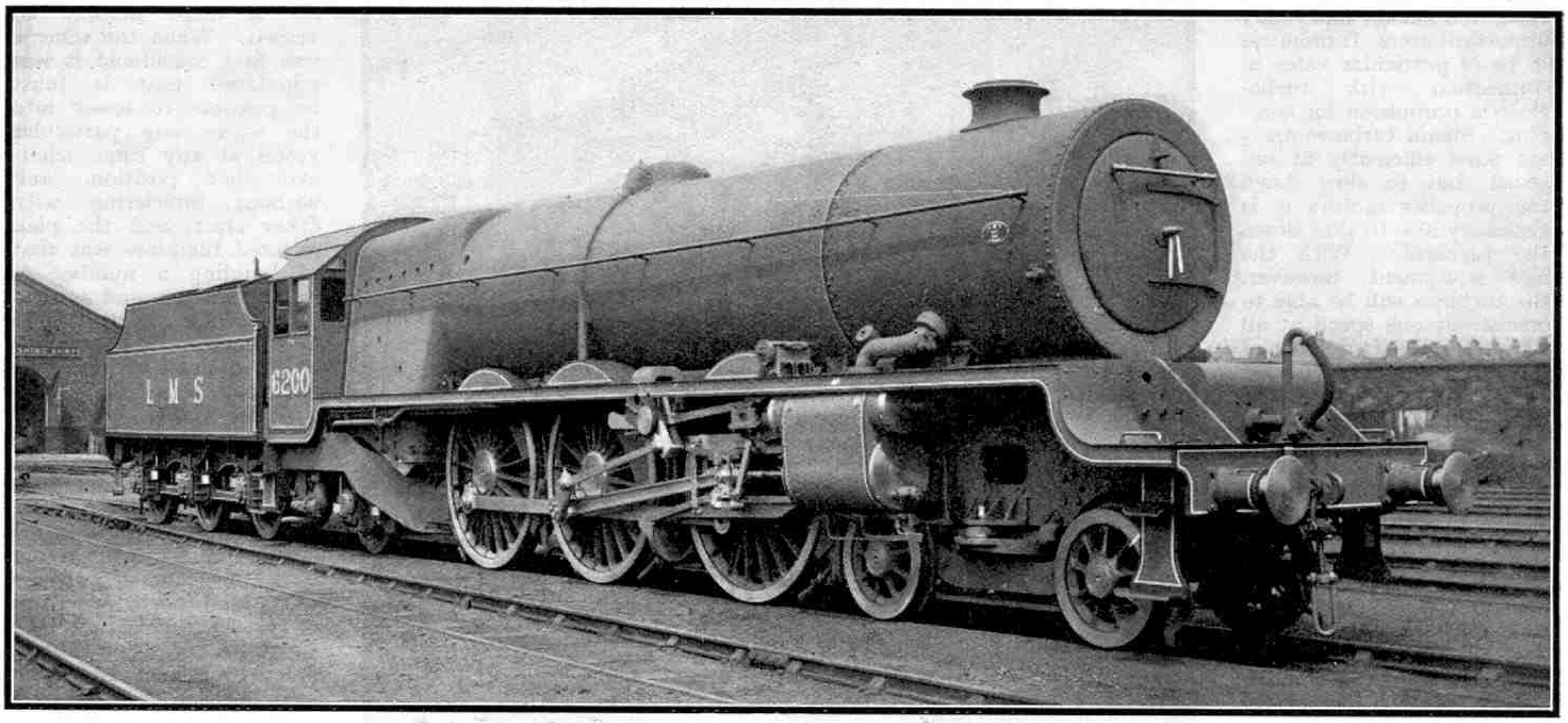
New Use for Photo-Electric Cell

Many original uses for the photo-electric cell have been discovered by engineers and inventors, the latest being the control of a belt conveyor in an American factory. The belt is used to carry various articles placed on it by workers along each side to an operator at the head of the belt who removes the articles and places them on another belt that carries them through an oven. The photo-electric cell is used to prevent the articles from piling up at the end of the first belt, for if the last operator misses one, a beam of light is interrupted and the conveyor stopped.

Britain's Mightiest Express Engine

New "Pacific" Locomotive for the L.M.S.R.

By "Observer"



The photograph above, reproduced by courtesy of the L.M.S.R., shows the massive appearance of the new "Pacific" locomotive, No. 6200. The wide fire-box and tapered boiler barrel are important innovations in L.M.S.R. practice.

WITH the completion of "No. 6200," the first of the three 4–6–2 "Pacific" locomotives that are being built at Crewe, the L.M.S.R. can now claim to possess the most powerful express passenger engine in Great Britain. It had been expected that the new engine would be finished early in July, but actually it emerged from the works a few days sooner, the final stages of erection having been carried through with exceptional rapidity. The boiler was not lowered into its place on the frames until 20th June, yet within a week of that time the work of erection had been completed, the engine had been painted grey, with white lettering and lining, and was in steam. To get in advance of schedule time in this manner was surely a good omen, and prophetic of what will frequently happen when "No. 6200" is put into regular express working.

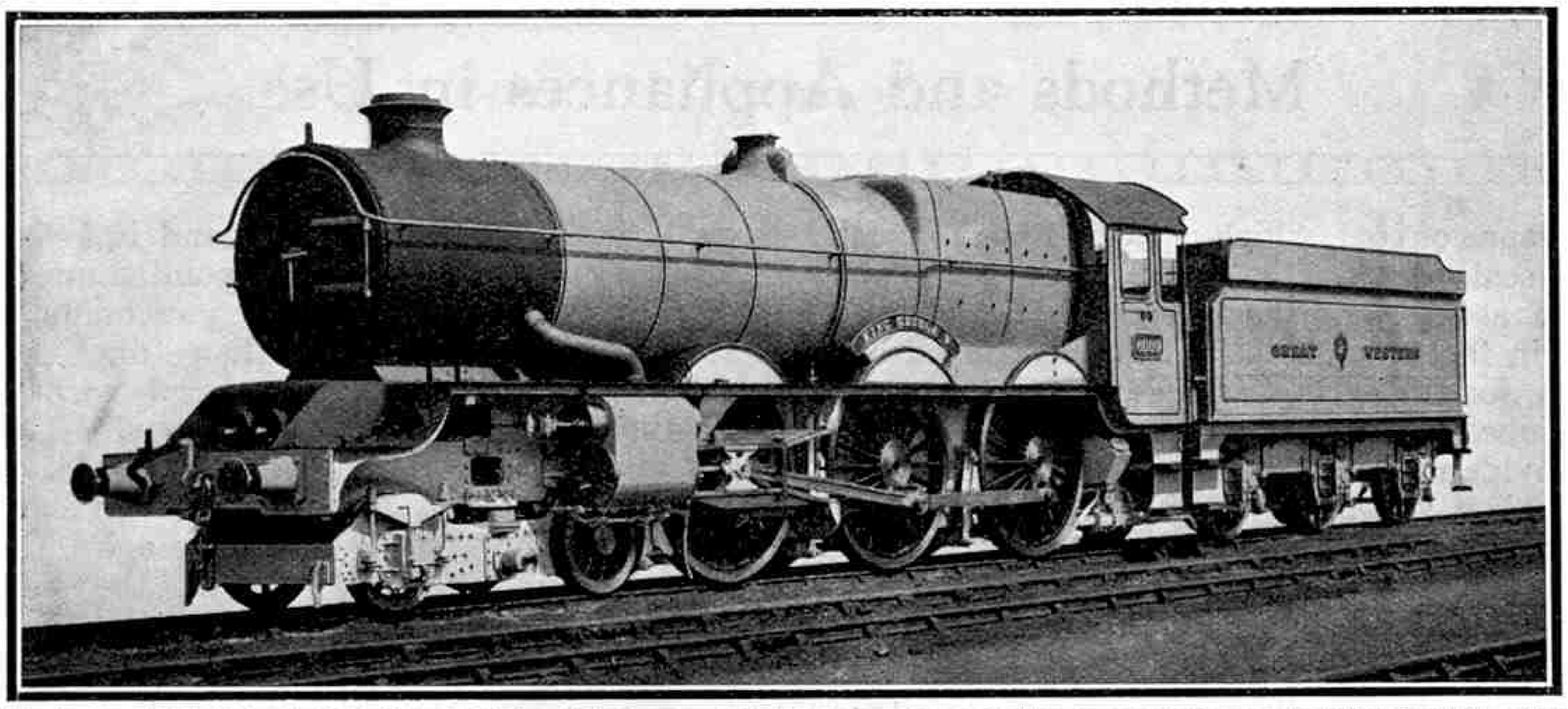
Almost immediately after its completion the new "Pacific" travelled up to London, and on Wednesday, 28th June, was placed for exhibition at a platform in Euston Station. Only a few persons were privileged to make the inspection, but in that favoured group I was numbered as representing the hosts of keenly-interested "*M.M.*" readers. Mr. W. A. Stanier, Chief Mechanical Engineer of the L.M.S.R. and designer of the new locomotive, met us at Euston Hotel and explained to us the reason for building an engine of so much greater size than the standard express locomotives of the "Royal Scot" type. These latter, he said, were doing excellent work, but increasing loads demanded increased power. In particular it was found that, for the long runs that modern locomotives were called upon to make, bigger fire-boxes were necessary, so that an engine that had travelled through from London might still have a sufficiency of power when the stiff gradients at Shap on the fells of Westmorland had to be tackled. The new engine, which had been designed in the chief drawing office at Derby and built in the works at Crewe, would be able to take 500 tons over Shap unaided. Mr. Stanier added that it practically reached the limit of what was possible in size and power on the British standard track and within the restrictions imposed by the loading gauge.

After Mr. Stanier had spoken to us we were taken to the railed-in enclosure on the platform by the side of which "No. 6200" was standing. I was thrilled as at last I gazed upon this long-looked-for super-locomotive. What a giant it seemed—a veritable monarch of the iron road! But no sooner had I noted the massiveness of its proportions than I was impressed by the gracefulness of its lines. Mr. Stanier had evidently been at pains to produce not only a thing of power but of beauty too. The engine as a whole and in its many details bears the unmistakable stamp of its designer's long connection with the G.W.R. It might almost be called a "super-King!" The long, tapered boiler with top-feed but no steam dome, the chimney and its moulded top, the cylinders with their curved steam pipes, and the leading bogie with its side bolsters, are all suggestive of well-tried G.W.R. practice. The cab is different, however, and might be said to be of the Lancashire and Yorkshire pattern. When I was on the footplate nothing surprised me more than that, in spite of the huge dimensions of the boiler and fire-box—the maximum width of which exceeds 7 ft.—Mr. Stanier has contrived to give the enginemen such large look-out windows, affording an excellent view of the line ahead. I was pleased, too, to discover that the engine did not carry side sheet smoke deflectors, which at best are unsightly and mar the appearance of any locomotive. I asked Mr. Stanier whether he intended to fit them, and he answered with a decided "No," adding that he did not think they would be necessary. The flush smoke-box and tapering boiler will doubtless help to make them unnecessary and, in addition, Mr. Stanier has managed to fit a chimney of quite considerable length, in spite of the size of the boiler, the centre line of which is 9 ft. 1 in. from the rail level. This is $1\frac{3}{4}$ in. higher than the centre line of a G.W.R. "King," and $2\frac{1}{2}$ in. lower than that of a "Royal Scot," which has driving wheels of 3 in. greater diameter. As compared with a Gresley "Pacific" on the L.N.E.R. the new engine's centre line is $3\frac{1}{2}$ in. lower; it is also 1 in. lower than that of a S.R. "Lord Nelson."

The new locomotive has few really novel features; it is rather a thoroughly sound design that embodies and develops all that is best in the past locomotive practice of both the L.M.S. and G.W. Railways. It is of interest to note that as the cylinder and driving wheel dimensions and the boiler pressure of the new "Pacific" are exactly identical with those of a G.W.R. "King," its tractive effort is also precisely the same, namely, 40,300 lb.

at 85 per cent. boiler pressure. The greatly enlarged boiler of the L.M.S.R. engine makes it decidedly more powerful than the "King," however, and there can be no doubt that in actual working it will prove itself to be Britain's mightiest passenger locomotive, capable of taking the Anglo-Scottish expresses and other famous L.M.S.R. trains and maintaining the fastest schedules even with maximum loads.

After its brief exhibition at Euston, "No. 6200" returned to Crewe, and for about a month it will be working slow trains and so getting "run in." Then, when it has been painted the standard deep red of the L.M.S.R., it will take up full express service.



The famous "King George V" of the G.W.R., which the new L.M.S.R. locomotive resembles in many respects, including its high boiler pressure and the arrangement of its four cylinders.

Some of the principal dimensions were given in the *"M.M."* for June last, but for convenience they are repeated here, and other technical details, based upon official information, are added.

The boiler barrel is 20 ft. 7 5/16 in. long and tapers from a diameter of 6 ft. 4¾ in. at the throat plate to 5 ft. 9 in. at the smoke-box tube plate. The fire-box is of the Belpaire type and its water legs have been carefully proportioned to ensure efficient circulation. The feed water is supplied through top feed valves, which are covered with a domed casing, the superheater header and regulator being a combination fitting provided in the smoke-box. The operation of the regulator is by the usual type of handle conveniently placed in the cab. An exhaust steam injector is provided on the fireman's side, and a live steam injector on the driver's side of the engine. The superheater is a special design proportioned to give sufficient superheat combined with maximum evaporation. The safety valves are of a standard pop type, and the old Caledonian design of whistle has been adopted, which gives a melodious note. As a result of the restriction of the gauge, it has been necessary for the whistle to be fitted in a horizontal position. The Company's standard type of water gauge frames and protectors and other standard boiler fittings are used wherever possible. All steam supplies to the various fittings controlled from the cab are taken from a manifold fitted at the top of the fire-box tube-plate, and this is provided with a main valve that enables the whole supply to be shut off.

Special attention has been given to the arrangement of the steam and exhaust passages from the cylinders in order to ensure maximum efficiency, and a jumper blast-pipe cap is provided so that, when working under heavy conditions, excessive back pressure is avoided. A deflector plate is also provided in the smoke-box to equalise the draught over the whole of the boiler tubes.

The provision of sufficient primary air to the large grate is controlled by three separate damper doors fitted at the front, middle and rear of the ashpan, with a separate control handle in the cab for each damper. In addition, side dampers are provided between the foundation ring and the ashpan, so that a good air supply is available at the sides of the grate to further promote efficient combustion. These side dampers are also controlled from the cab by means of a separate handle.

The two outside cylinders drive on to the middle coupled axle, and the two inside cylinders on to the leading coupled axle, which is of the built-up type. Each cylinder is provided with an 8 in. diameter piston valve operated by Walschaerts gear, the travel being 7¼ in. To ensure an efficient steam distribution to each cylinder, each valve is provided with an independent set of gear.

Principal Dimensions:

Cylinders	
Number	Four
Diameter	16½ in.
Stroke	28 „
Wheels	
Bogie	3 ft. 0 in. diam.
Coupled	6 „ 6 „ „
Trailing	3 „ 9 „ „
Heating Surface	
Tubes	2,523 sq. ft.
Fire-box	190 „ „
Superheater	370 „ „
Total	3,083 „ „
Grate Area	45 „ „
Working Pressure	250 lb. per sq. in.
Tractive Effort at 85 per cent. boiler pressure	40,300 lb.
Adhesive Weight	67 tons 10 cwt.
Weight of Engine in working order	104 „ 10 „
Weight of Tender „ „	54 „ 2 „
Total weight of Engine and Tender in working order	158 „ 12 „
Coal capacity of Tender	9 „
Water „ „	4,000 gallons
Total length over buffers... ...	74 ft. 4½ in.

The coupling and connecting rods are made of high manganese molybdenum steel, and special attention has been given to the lubrication of the crank pins, big and little ends and other motion parts, to ensure sufficient oil capacity for long through runs. The coupled wheel centres are steel castings, and the balance weights consist of built-up steel plates, the requisite amount of weight required being provided by filling in between the plates with lead. The usual procedure of determining the correct amount of balancing in each pair of wheels is checked by testing in a wheel balancing machine.

The coupled axle-boxes are steel castings with pressed-in brasses, and ample bearing area has been provided. Oil is mechanically fed to the crown of each axle-box. The underkeeps fitted to the axle-boxes are of ample capacity, and an oil pad is provided. The intermediate and trailing axle-boxes are arranged to allow the underkeep to be withdrawn while the axle-box is in place. The leading crank axle does not permit this for the leading boxes. A 16-feed mechanical lubricator of the company's standard design has been provided to lubricate the pistons and valves, and the oil is thoroughly atomised by a jet of steam before arriving at the point to be lubricated.

Special attention has been given to the design of the laminated bearing springs that are provided on all the coupled wheels, and this, in conjunction with the bolster type bogie and truck, results in a smooth riding locomotive. A ribbed section of steel plate is used, the material being a silico-manganese steel; and the plates are fixed in the buckle by means of a wedge cotter. The spring hangers are of the screwed type with a knuckle thread, so that independent adjustment can be obtained. As an experiment, one of these engines will be provided with compensating beams, to enable observations to be made in order to ascertain whether a better running engine is thus obtained.

The leading 4-wheeled bogie is provided with side bolsters and a carefully designed bogie side check

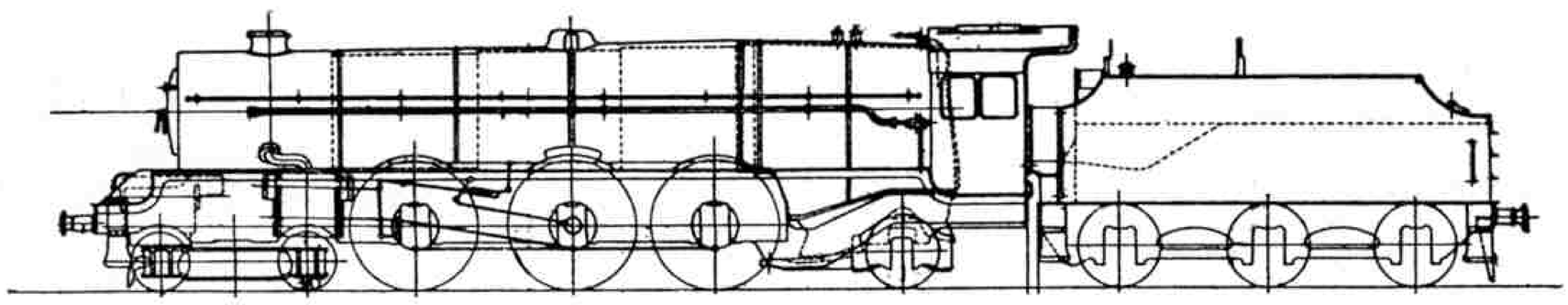


Diagram showing the chief features of "No. 6200."

(*Continued on page 617*)

British Railways and Coal Traffic

Methods and Appliances in Use

THE conveyance of coal, which is carried out on such a large scale by our railways, has been well described as the transportation of the nation's energy. Coal in fact may be said to have started our railway system, for the early wagonways and tramways from which railways eventually developed were constructed to provide means of transport and distribution for the products of the mines.

The Middleton Colliery line, near Leeds, on which Blenkinsop's locomotive worked, was an example of the use of steam power for colliery purposes as early as 1812, in which year Stephenson visited the line; and in 1813 the "*Wylam Dilly*" of William Hedley was tried successfully on the Wylam wagonway. The "easy conveyance of men and commodities from place to place," stated by Francis Bacon to be a necessary condition for national prosperity, accounted for the Stockton and Darlington and Liverpool and Manchester railways, the original purpose of the former being to provide an outlet for South Durham coal. The Leicester and Swannington line, the centenary of which occurred last year, was laid down to secure cheap transport of coal from the Leicestershire mines to the districts around the county town. Canal transport had previously been employed, but the Charnwood Forest Canal burst its banks in 1799 and was never repaired. This little company grew into, or at all events was the earliest portion of, the pre-group Midland Railway, a great coal-carrying line serving the coal-bearing areas of South Yorkshire and the Midlands generally. It is now of course part of the L.M.S.R., the coal traffic of which forms an important feature of its operation, and has many points of interest.

The needs of Edinburgh in regard to fuel resulted in the laying down of a railway line. In 1792 the city was so badly off for coal that the magistrates offered a premium of a shilling on each ton entering the city. The Lothian fields contained an abundant supply, but the difficulties in regard to transport were considerable. Thus there came into being the Edinburgh and Dalkeith line, which greatly improved the transport of coal to Edinburgh, and was finally absorbed by the North British Railway in 1845. The coal depot at St. Leonards dealt with a large tonnage, and it is interesting that advertisements of the period pointed out the desirability of purchasing coal from the merchants who had their store-yards there, rather than from those who were said to mix "some better coal with refuse bought at the Coal Hills and sell the whole as the best of its kind." For the further benefit of the public, we are told, "the carters are watched through the streets by one of the company's constables."

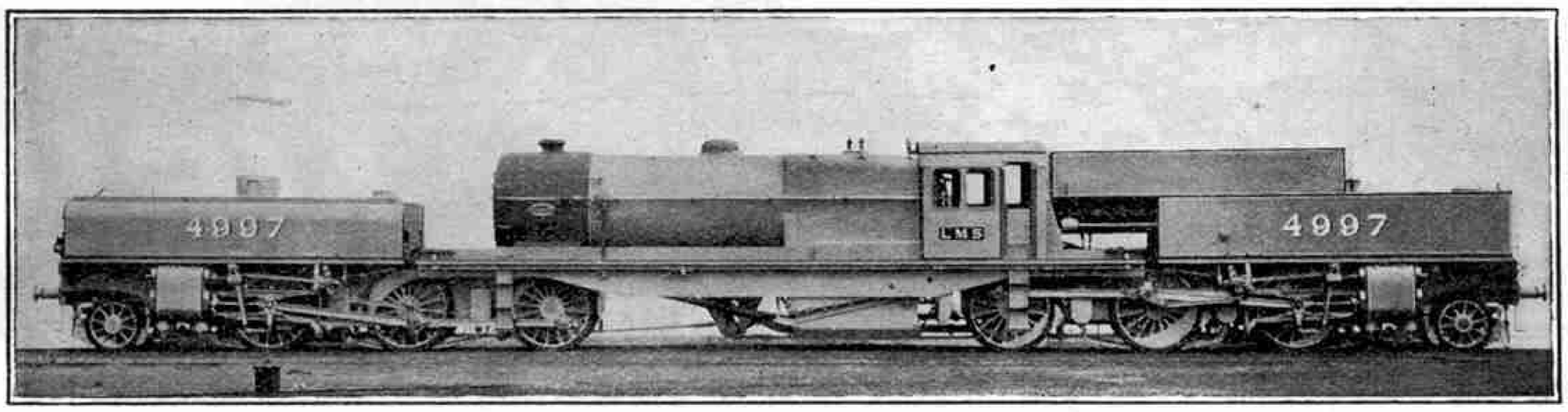
The coaling plant recently provided at Toton Sidings. This and other similar installations are typical of the up-to-date methods in use for the handling of coal for locomotive purposes. Photo courtesy L.M.S.R.

Another constituent of the present L.N.E.R., the former Great Northern Railway, had as one of its chief objects, when promoted as the London and York Railway, the provision of facilities for the carriage of coal from South Yorkshire to London and the towns along its route. It was in fact the first railway to carry coal to London in any quantity. By means of connections with the railways south of London much traffic was carried through from the Great Northern, its trains from the North being dealt with at Ferme Park yards, Hornsea.

The tonnage of coal handled by the railways into London alone amounted to 8,000,000 in 1931, the total for the whole coal traffic being 167,000,000. It is particularly interesting to examine the railway methods of dealing with bulk consignments of this traffic, for the trains carrying coal to London are among the heaviest in Great Britain. The L.N.E.R. provide trains of from 80 to 100 wagons, some of 20 tons' capacity, each train carrying perhaps 1,000 tons of coal; and the engines particularly associated with their haulage are the two monster three-cylinder "Mikado" or 2-8-2 engines. These are the only British standard gauge examples of their type, and they were specially designed to maintain higher average speeds than usual with this type of train. They are ably supplemented by the three-cylinder "Consolidation" or 2-8-0 engines developed from the earlier two-cylinder examples of the same type. From the first the Great Northern were always well represented by their motive power for coal traffic, so that the unique character of the most up-to-date engines on this section of the L.N.E.R. is in keeping with tradition. In addition to Ferme Park yards there is the Temple Mills depot on the

Great Eastern section, which has the largest yard in London and is capable of dealing with 5,000 wagons in a day.

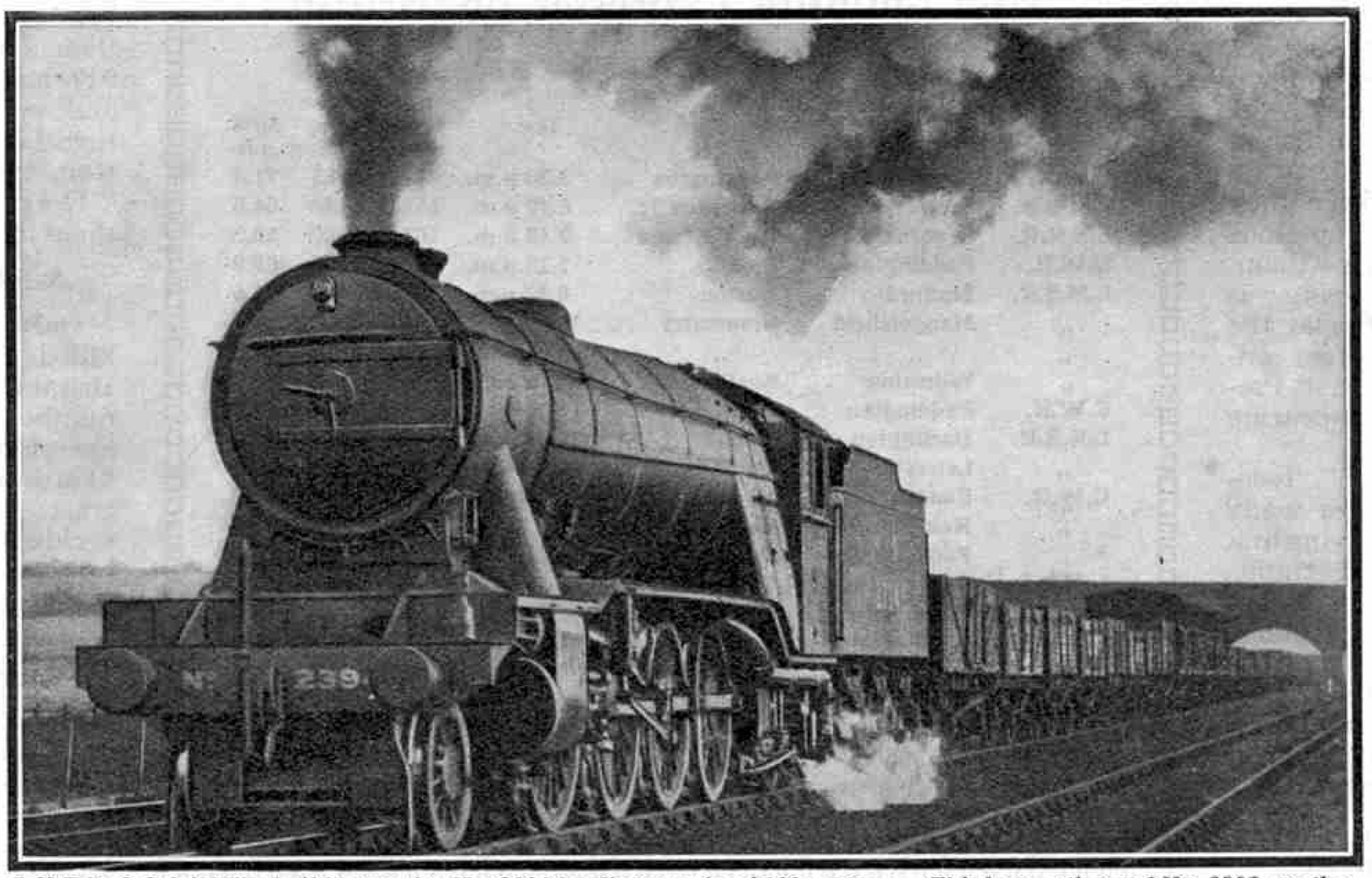
Particular interest attaches to the L.M.S.R. traffic that is received from the colliery districts of Derbyshire and Nottinghamshire and concentrated at Toton Sidings, near Nottingham. This is one of the largest marshalling yards in the world, and traffic is forwarded from here to Brent Sidings, Cricklewood, for distribution. The route is sharply undulating, yet 90 loaded wagons in the up direction, and 100 empty wagons in the down direction, are regularly booked loads. With an average gross tonnage of 1,400, the scheduled speed is about 19 m.p.h. for up trains and 24.4 m.p.h. for down trains. For years these "black snakes" were regularly hauled by six-coupled tender engines working in pairs, as weight restrictions on the Midland main line prevented the use of larger engines of ordinary types. In 1927 the bold experiment was made of trying articulated locomotives of the Beyer-Garratt pattern on the work. These are of the 2-6-0 : 0-6-2 type, and as far as their engine units are concerned, are similar to the standard "Mogul" mixed traffic locomotives. In due course the definite economy of these giants was established, and 33 of them are now in use. They have circular self-trimming coal bunkers rotated by steam power that work their fuel forward to the shovel without any labour on the part of the fireman; and they are fitted with water scoops for operating in both directions. Ordinary 10-ton or 12-ton wagons are employed in great numbers, and the steel bogie wagons previously introduced by the Midland Railway are made use of as much as possible.



The L.M.S.R. "Beyer-Garratts" are the first of the type in regular main line service in this country. The normal type of coal bunker is shown, not the patent self-trimming pattern as recently applied to the class. Photo courtesy S.R. Magazine.

Trains of 90 wagons are the rule on the magnificently-graded Great Western Railway, the great receiving centres for the London district being Acton and Old Oak Common yards. The big Swindon "Consolidation" engines are well known, and give splendid service on the trains from South Wales. The Great Western own a large number of 20-ton wagons, and to encourage their use they offer traders a rebate on the charges for the carriage of full loads of coal in them. Between Stoke Gifford Junction and Swindon the loads are reduced, the full tonnage being made up at the latter place. On Sundays 100-wagon trains are brought up, and the empties taken down to Stoke Gifford usually total about the same number in each train.

In the handling of fuel for their own use, the railways have made great strides in recent years, mechanical coaling plants being a feature of many of the larger locomotive depots. There are 18 such installations on the L.M.S.R. alone, and one of the largest of its kind, recently provided at Toton locomotive depot, is illustrated on the previous page. This installation incorporates a hoist for lifting wagons with a capacity of up to 20 tons, and the coal is tipped into a bunker 70 ft. high and 35 ft. square that can deal with 3,000 tons per week. The coal is released from the bunker into the tenders of locomotives standing beneath.



L.N.E.R. 2-8-2 "Mikado" locomotive No. 2394 hauling a train of 102 wagons. This locomotive and No. 2393 are the only examples of this wheel arrangement on standard gauge lines in Great Britain. Photo Railway Photographs, Liverpool.

British railways are frequently criticised for their persistent use of large numbers of wagons of small capacity. It is pointed out, for instance, that in America 12-wheeled gondola cars carry 100 tons of coal, whereas in Britain 12 tons in a four-wheeler is the usual thing. These criticisms seem to indicate a comparatively poor showing on the part of our railways, but naturally there are two sides to the question. The critics ignore or overlook the facts that the average length of haul in this country is short and that small consignments are the rule; that colliery plant generally is not adapted to the handling of larger wagons, and that there are enormous numbers of colliery-owned wagons running on the railways. The general conditions of the coal trade in this country appear to be met fairly satisfactorily by the wagons now in use. In America services are less frequent and long hauls are the rule, so that high-capacity wagons are employed and coal handling plant is adapted to their use.

For their own purposes, such as the haulage of locomotive coal of which 13,000,000 tons are consumed annually, our railways make

(*Continued on page 617*)

Excellent Work by "Baby Scots"

Five more 4–6–0 locomotives of the "Baby Scot" class are being built at Crewe in place of former "Claughtons." The first of them is No. 6015, "*Private E. Sykes, V.C.,*" and is already in service. No. 6018, "*Private W. Wood, V.C.,*" a sister—or rather, brother—engine, was observed by a correspondent recently on "*The Comet,*" one of the fastest expresses on the L.M.S.R., and a punctual arrival at Euston had been achieved. Engines of the "Baby Scot" class are now in regular service on almost all the most important main line sections of the L.M.S.R., not only in England but in Scotland too. They do excellent work wherever they go and win golden opinions from the men who drive them.

Considerable scrapping is going on and in particular the 4–4–0 passenger express engines of the L.N.W.R. "Precursor" class are disappearing rather rapidly.

The first "Pacific" locomotive–No. 6200–is now ready for express working, having first been run in on local traffic. It has undergone satisfactory trials, during which it attained a speed of 80 m.p.h. An illustrated article giving a full description of this remarkable engine is published on page 582 of the present issue.

New "Halls" and Tank Engines at Swindon

Work on the new series of 4–6–0 engines of the "Hall" class was carried through according to programme and all were completed before the end of July. Further tank engines of the smaller types are now in hand at Swindon.

Large numbers of engines have been scrapped during the past few months. They have been mostly of the older tank and goods classes but the following express passenger locomotives have been included among the condemned:—No. 3805, "*County Kerry*"; No. 3822, "*County of Brecon*"; and No. 3828, "*County of Hereford,*" all of the 4–4–0 outside cylinder "County" class; No. 2901, "*Lady Superior*"; No. 2984, "*Guy Mannering*"; and No. 2998, "*Ernest Cunard,*" of the two-cylinder 4–6–0 "Saint" class; and No. 4002, "*Evening Star,*" of the four-cylinder 4–6–0 "Star" class.

The advent of Mr. W. A. Stanier's "Pacific" locomotive on the L.M.S.R. has excited keen interest at Swindon, where he is so well known and deservedly honoured as a very capable engineer. It is recognised that the new engine is almost the last word in British locomotive building, but rumours are going round that Swindon may presently give an effective answer to its challenge.

New Station on the L.M.S.R.

A new passenger station at South Kenton on the L.M.S.R. electrified line between London and Watford was opened for traffic on Monday, 3rd July. It will afford welcome facilities to a rapidly-growing new residential area of greater London.

L.N.E.R. Locomotive News

Further three-cylinder 4–4–0 express locomotives of the "Shire" or "Hunt" class are at present building at Darlington works. Two 0–6–0 freight engines of the "J39" class recently turned out from there are numbered 1482 and 1483.

The conversion of the former 4–4–4 N.E.R. tank engines of the "S" class into 4–6–2 tank engines is being steadily proceeded with and five have now been so converted. They are Nos. 1518, 1525, 1528, 2155 and 2162.

A 100 h.p. "Sentinel" locomotive has been ordered and will be employed for shunting duties at the Company's works at Darlington.

Mile-a-minute Expresses on British Railways

Railway	From	To	Train	Distance miles	Time min.	Sp'd m.p.h.
G.W.R.	Swindon ...	Paddington ...	3.55 p.m.	77.3	65	71.4
L.M.S.R.	Crewe ...	Willesden Jc.	6.12 p.m.	152.5	142	64.5
L.N.E.R.	Grantham ...	King's Cross	9.40 a.m.	105.5	100	63.3
G.W.R.	Paddington ...	Bath	1.15 p.m.	106.9	102	62.9
L.M.S.R.	Stafford ...	Euston ...	6.52 p.m.	133.6	125	62.5
,,	Mangotsfield	Gloucester ...	10.50 a.m.	32.0	31	61.9
,,	,, ...	,, ...	2.43 p.m.	32.0	31	61.9
,,	Wilmslow ...	Euston ...	10. 8 a.m.	176.9	172	61.7
G.W.R.	Paddington ...	Bath ...	11.15 a.m.	106.9	104	61.7
L.N.E.R.	Darlington ...	York	9. 7 a.m.	44.1	43	61.5
,,	Leicester ...	Nottingham ...	4.30 a.m.	22.5	22	61.4
G.W.R.	Paddington ...	Exeter ...	12. 0 noon	173.7	170	61.3
,,	Kemble ...	Paddington ...	9. 1a.m.	91.0	89	61.3
,,	Paddington ...	Bristol ...	1.15 p.m.	118.3	115	61.7
L.M.S.R.	Coventry ...	Willesden Jc.	5.12 p.m.	88.6	87	61.1
L.N.E.R.	Huntingdon ...	King's Cross	9.30 a.m.	58.9	58	60.9
G.W.R.	Paddington ...	Kemble ...	5. 0 p.m.	91.0	90	60.7
,,	,, ...	Westbury ...	3.30 p.m.	95.6	95	60.4
L.M.S.R.	Euston ...	Wilmslow ...	6. 0 p.m.	177.0	176	60.3
G.W.R.	Swindon ...	Paddington ...	1.14 p.m.	77.3	77	60.2
L.N.E.R.	Darlington ...	York	8.49 p.m.	44.1	44	60.1
G.W.R.	Paddington ...	Bristol ...	11.15 a.m.	118.3	118	60.1
,,	High Wycombe	Banbury ...	9.43 a.m.	41.0	41	60.0

Further Locomotives of "Schools" Class

The latest 4–4–0 engines of the "Schools" class to be turned out from the works at Eastleigh are:—No. 917, "*Ardingly*"; and No. 918, "*Hurstpierpoint.*" It may be noted that the locomotive department has altered the sequence of names. It was originally intended that No. 917 should be "*Hurstpierpoint*" and No. 918 "*Ardingly.*"

When the members of the Institution of Locomotive Engineers visited Eastleigh on 22nd June in the course of their summer meeting, No. 917 had just been completed, and was placed on view, together with an engine each from the "Lord Nelson" and "King Arthur" classes, for their inspection.

Safety on the Railways

Only four passengers were killed in train accidents in Britain during 1932. The number injured was 214, the lowest for 25 years. These figures stand in striking contrast to similar returns of accidents on the roads. A railway train is still one of the safest of all places.

Success of "Southern" Electrification

How completely the enterprise of the Southern Railway in its vast schemes of electrification has been justified was demonstrated by Sir Herbert Walker, the General Manager, in a speech he made recently. He said that they had electrified 293 miles of the suburban area, which was equivalent to 800 track miles. They had eliminated or dispensed with 8,152,820 miles of steam working and replaced them with 20,651,000 electric train miles. For every two trains they had before they had put on five. These were accelerated and thus the public gained in both frequency of service and speed. As for costs, during 1932 (the first complete year of suburban operating) the working expenses for 20.6 million train miles of electric services at £1,225,200 were only £206,100 greater than for only 8.2 million miles of steam services withdrawn. Electric receipts, at £4,792,600, rose £1,316,700 above steam earnings and gave a net revenue increase of £1,110,500.

Sir Herbert explained that the figures were for the London suburban area only, and added that the new extension to Brighton and Worthing was doing very well.

Summer "Speed Up" on Railways

The summer train services that came into operation on the British railways on Monday, 17th July, show many improvements, but there are no drastic accelerations comparable to those introduced last year. The timetables reveal an all-round speeding up of local, branch and main line trains; faster schedules between big cities and to holiday resorts; and new and improved cross-country, week-end and Sunday services. It is claimed that never before has the travelling public been offered such rapid transport for business or pleasure; and that a further saving of 11,099 minutes (185 hours) daily in the journey times of trains has been made during the present summer.

The S.R. "Golden Arrow" Pullman express leaving Victoria Station for Dover. The locomotive at the head of the train is the well-known four-cylinder 4-6-0 No. 850, "Lord Nelson," and immediately behind it are the special vehicles for registered baggage. Photograph, Railway Photographs, Liverpool.

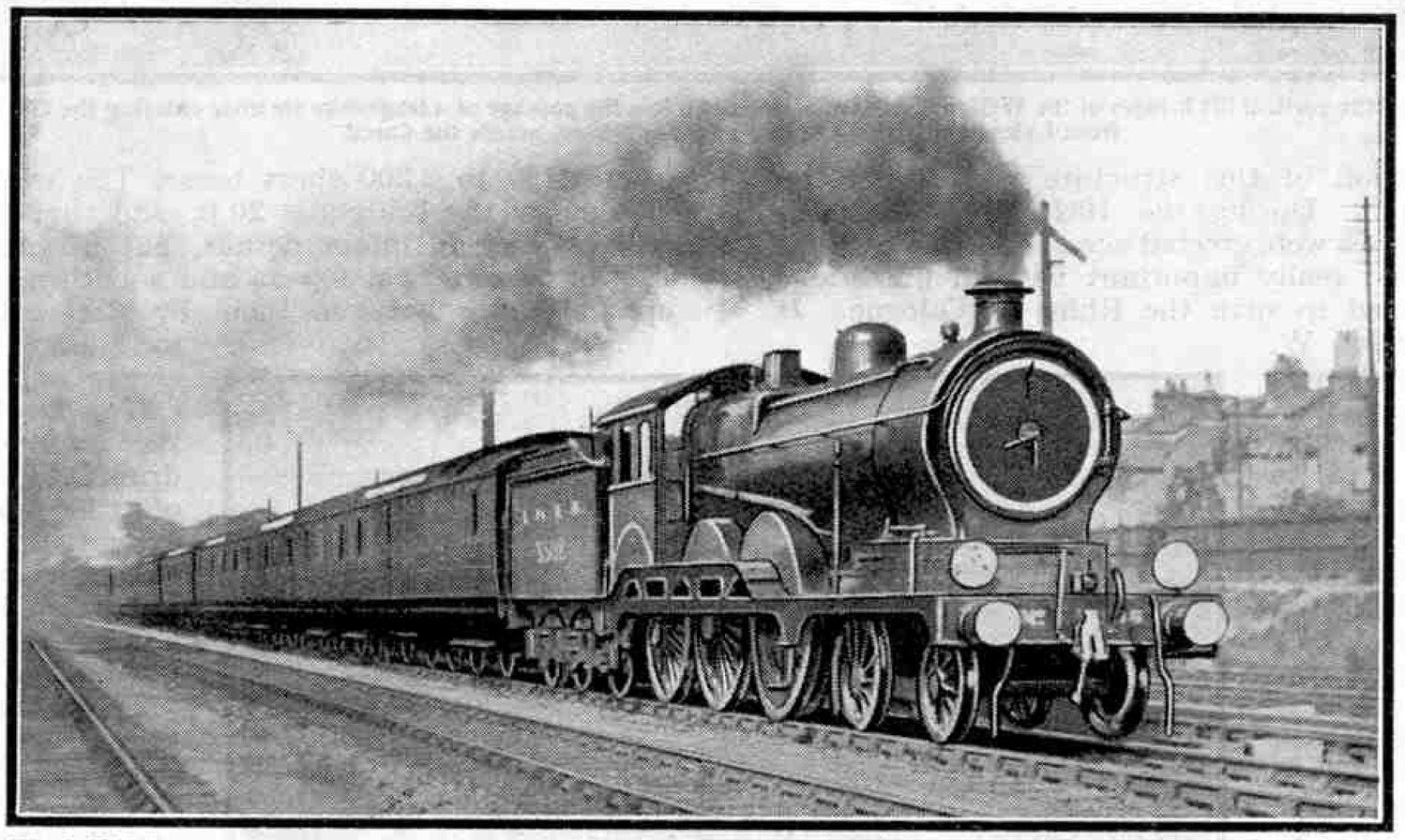
In the new programme of the L.M.S.R., 2,182 trains have been accelerated by a total of 6,656 minutes daily. Its additional high-speed schedules include two runs—both of them between Mangotsfield and Gloucester—at practically 62 m.p.h. start to stop, which are smart performances.

The speed-up has been applied in its most intensive form in North Wales, enabling great savings in journey time to be effected not only between London, Birmingham, Liverpool, Manchester and the North Wales coast resorts, but also between these places and Ireland (via Holyhead) and Scotland. Thus on the afternoon service from Afonwen and Holyhead accelerations of 32 minutes to Manchester and 48 minutes to Leeds have been effected, while travellers to Hull and Harrogate by this service arrive 2 hours 9 minutes and 2 hours 13 minutes earlier respectively. On Saturdays, three services from London (Euston) to the North Wales coast have been accelerated, by as much as 85 minutes in one case.

New express services have been provided in each direction daily between London and Blackpool and Southport. The 12 noon express from Euston to Windermere, which previously has run only on Saturdays, now runs daily, and the through Blackpool portion arrives at 4.52 p.m. except on Saturdays, when the service leaves Euston 11.35 a.m. and arrives at Blackpool at 4.4 p.m. A non-stop run is made each Sunday between London and Wigan by the express leaving Euston for Glasgow at 11.30 a.m., the 194 miles being covered in 207 min.

Another important feature of the new programme is the improvement effected in Lancashire and Yorkshire. On the L.M.S.R. Central Division, covering most of this area, 307 trains have been accelerated by 862 minutes daily, including 91 expresses and 216 local trains.

New services from North Lancashire and Windermere to London are given by the "*Mid-day Scot*" express, which now calls at Lancaster; while the 10.5 a.m. from Aberdeen to London makes an additional call at Warrington without increase in overall journey time. New express services are also given between London (Euston) and Manchester and Liverpool, and vice versa.



The L.N.E.R. "Hook of Holland" express passing Chadwell Heath, with one of the Great Eastern "1500" class at its head. "Sandringhams" are now invariably used for these trains. Photograph, Railway Photographs, Liverpool.

The L.N.E.R. services follow closely upon those of last summer. "*The Flying Scotsman*" expresses again make the journey between London (King's Cross) and Edinburgh, 392¼ miles non-stop in 7½ hours. Perhaps the most noteworthy acceleration is that of the "*Scarborough Flyer,*" the timing of which has been cut by 15 minutes in each direction. For the 188¼ miles between London and York, 3¼ hours are allowed, requiring an average speed of 58 m.p.h. and giving the fastest timing between those cities. Scarborough is brought within 4 hr. 10 min. of London. A new Saturday-only restaurant car express leaves King's Cross at 12.5 p.m. for Leeds, Bradford and Skegness. Seven new buffet car services have been introduced, chiefly between London and East Anglia.

The summer programme of the Southern Railway contains few novelties but very ample and attractive services are provided to the numerous holiday resorts throughout that system and to the Continent. The all-Pullman train, the "*Bournemouth Belle,*" is again running daily.

Reference was made in last month's "*M.M.*" to the speed-up on the G.W.R. It may be added that the "*Cheltenham Flyer*" has been accelerated by 5 min. Leaving Cheltenham at 2.40 p.m.—10 min. later than formerly—it now reaches Paddington at 5 p.m.—five minutes later than before. The running time between Swindon and Paddington remains at 65 min. for the 77¼ miles. The later arrival at Paddington is a wise arrangement since it gives that much greater margin between the "*Flyer*" and the preceding "*Cornish Riviera Express,*"—a useful provision should the "*Riviera*" be running late.

Train Cruises on the "*Northern Belle*"

The first cruise of the L.N.E.R. "*Northern Belle*"—Britain's pioneer cruising train—was so thoroughly successful that a second was arranged to follow immediately upon it. For this the same route was followed as for the first, to the complete enjoyment of the full complement of passengers. Starting from London, the first stop was made at Edinburgh, and from there the train travelled north to Aberdeen and the Moray Firth. The cruise included also visits to the Scottish Highlands, the Border country, the Lake District and the Yorkshire coast, and the return was made by way of Lincoln, Ely, and Cambridge.

It seems likely that train cruises will become a railway definite feature.

Modern Types of Opening Bridges

III.—Vertical Lift Bridges

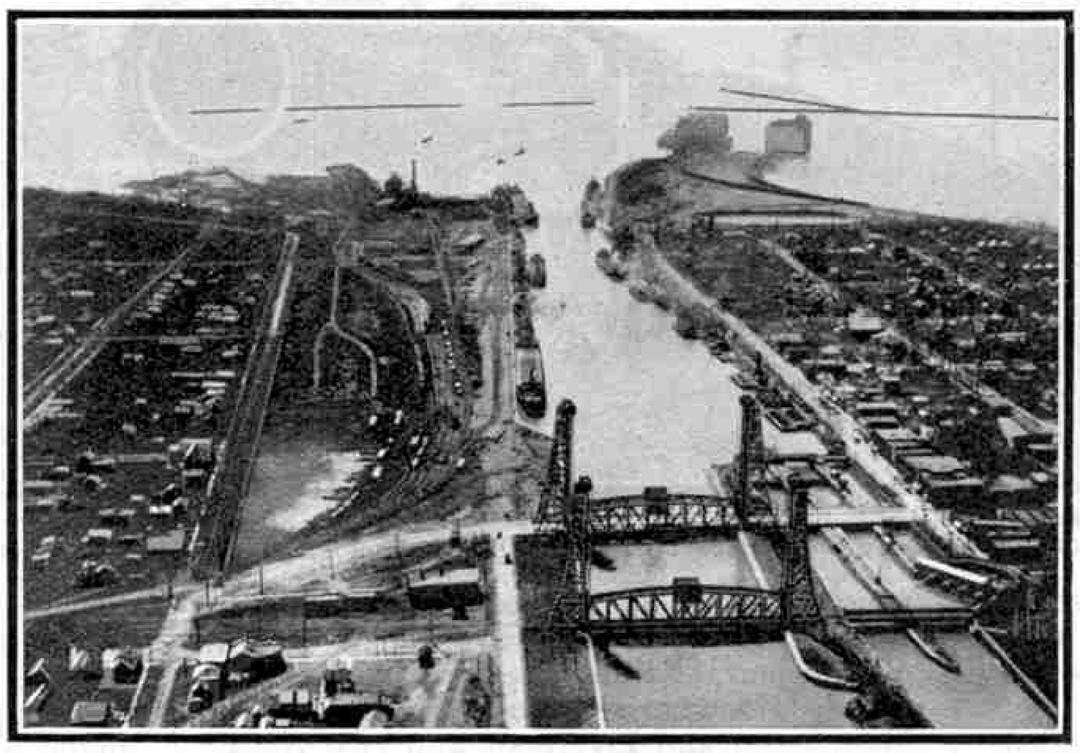
IN the first article in this series we dealt with opening bridges of the bascule type, with special reference to the famous Tower Bridge over the River Thames at London, and in the second article we described modern swing bridges. We come now to the vertical lift bridge, a type of opening bridge that has been extensively adopted abroad, especially in America. The main feature of this type is a movable span that can be raised or lowered when necessary, but always remains in a horizontal position. The weight of the moving span is borne by wire ropes that pass over pulleys at the top of tall towers, one at each side of the span, and are attached to counterweights.

It is not known when the first vertical lift bridge was built, but the earliest of which there is any record formed part of a wooden trestle across the River Danube at Vienna. The lifting portion of this structure was 30 ft. long and could be raised 6½ ft. During the 19th century several short span vertical lift bridges were erected across canals in Europe and in America. The first really important vertical lift bridge to be planned was intended to span the Rhine at Cologne. It was designed by Captain W. Moorson of London, and was entered in 1850 in a competition in connection with the bridge scheme, but it did not win the prize. The bridge would have had a lifting span 100 ft. long that could be raised 54 ft. An even more ambitious design that also was rejected was for a vertical lift bridge across the River Tees at Newport, near Middlesbrough. This proposed bridge had a lifting span 200 ft. long that could be raised 40 ft., and was to be moved up and down by withdrawing water from and adding it to a tank that formed part of the counterweight of the bridge.

The first large vertical lift bridge was erected over the South Chicago River at Chicago in 1894 by an engineer named Waddell. It had a lifting span 130 ft. long, which, when raised, provided a vertical clearance of 155 ft. The span was raised and lowered by wire ropes that passed over sheaves at the top of the towers and led down to winding drums in the engine room, which was below street level. At first the bridge was worked by two 70 h.p. steam engines, but later electric motors were substituted. Subsequently Waddell and another engineer named Harrington formed a company that erected many lifting bridges in various parts of the United States. In 1909 they obtained a patent for the working of vertical lift bridges by means of cables attached to the top and bottom of the lifting span and actuated by motors fixed in the centre of the span, and this method of working is a feature of many of their structures.

Two of the vertical lift bridges of the Welland Ship Canal open to allow the passage of a large lake steamer entering the Canal from Lake Erie. There are 20 of these bridges across the Canal.

Some excellent examples of modern vertical lift bridges are to be seen spanning the reconstructed Welland Canal in Canada. The many bridges built across this famous waterway include 11 vertical lift bridges, seven of which carry roadways, three are railway bridges, and one carries both an electric railway and a road. The height of lift of the bridges ranges from 108 ft. 2 in. to 115 ft. 2 in., and the combined weight of lifting span and counterweight is from 1,160 to 2,300 short tons. The width of the lifting span of some of the bridges is 20 ft. and that of others 30 ft. These bridges vary in minor details, but in general design each consists of two vertical towers and a horizontal span that is moved up and down between them by steel cables worked from the machinery house situated at the centre of the lifting span. The cables for hoisting and lowering the span pass from the winding drums to sheaves on the ends of the span, and from there extend up to the top of the towers, where they terminate; and the lowering cables pass downward and end close to the base of the towers.

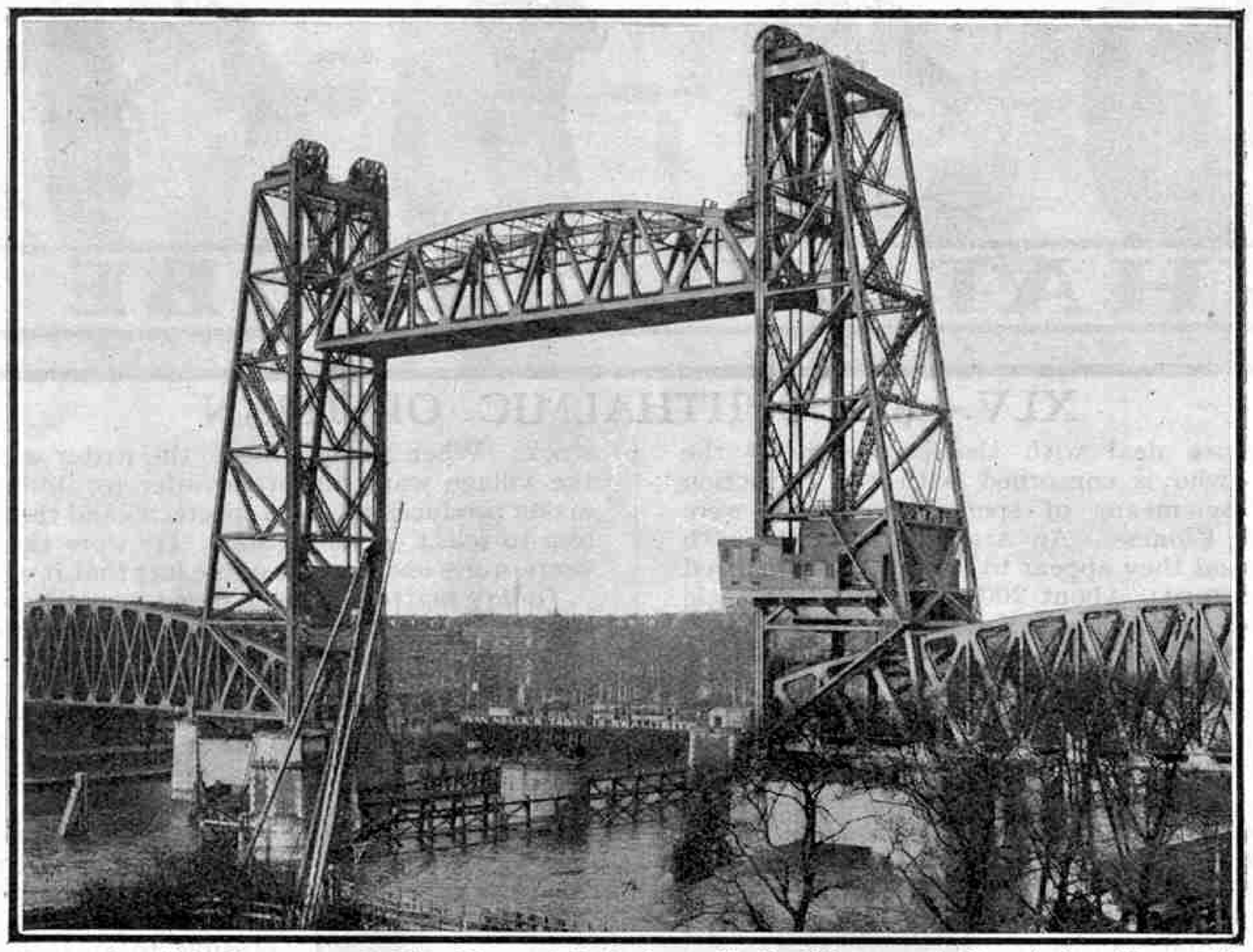


An aerial view of the two lift bridges at Port Colborne at the entrance to the Welland Ship Canal from Port Erie.

The counterweight cables pass from each end of the span to the top of the towers, where they travel over huge sheaves and are attached to heavy counterweights that move up and down in the towers. The sheaves are steel castings each grooved to take 12 ropes, and the counterweights are of reinforced concrete with a steel framework and hooked bars. Guides, each consisting of two angle girders riveted back to back and secured on the outside of the main columns of the towers, keep the span to its vertical path when it is being raised or lowered. The bridges are electrically operated, and the current is fed through vertical conductors on one of the towers to trolleys at one end of the spans.

A remarkable vertical lift bridge of a slightly different type

is to be seen at Rotterdam, the famous Dutch port on the Meuse. This bridge was built to replace a railway swing bridge that was destroyed in November 1918 by a ship colliding with the swinging portion and knocking it into the river. The span is 174 ft. long, and the towers between which it moves up and down are 197 ft. high from their foundations. Each tower was built in stages, the first three sections being placed in position by means of powerful floating cranes that lifted the steel members, some of which weighed 30 tons and were 65½ ft. long, from wagons on the quay. The cranes were too short to place in position the upper parts of the towers, and for this work the contractor erected a large revolving crane that could be raised as the work advanced.



The vertical lift bridge across the River Meuse at Rotterdam, with the lifting span in the raised position. This span is 174 ft. long and the towers between which it moves up and down are 197 ft. high from their foundations.

The task of placing the centre span in position was interesting but difficult, for river traffic had to be interrupted as little as possible, and in consequence the work had to be carried out very rapidly It would have been comparatively simple to assemble the span in a workshop on the quay, transfer it to pontoons and float it to the bridge site, and there raise it into position between the towers by means of cables made ready beforehand. The contractor preferred to bring each member of the span to the site separately, however, and they were placed together by means of floating cranes, the parts were joined up and the cables attached. The span was raised into position during the night, so that the minimum disturbance of traffic took place.

The centre span is suspended by 48 cables each 14 mm. in diameter, passing over eight six-grooved pulleys at the top of the towers. Each of these pulleys supports a weight of 75 tons, and consists of two rings between which are inserted two series of rollers in the form of drums. Access to the pulleys is a difficult matter, and it is fortunate therefore that they do not require lubricating more than once a year. The counterweights that balance the weight of the span are of concrete.

It was at first intended to adopt the Waddell system of operation, but in order that the centre span, which weighs 600 tons, should not be overburdened by the addition of machinery weighing 100 tons, it was decided that the working apparatus should be situated in the south tower of the bridge. The hoisting winch has a double winding drum, and the hoisting cables pass from the first drum to the top of the south tower, descend the other side, pass under pulleys to the centre span and after traversing this span ascend to the top of the north tower, where they are fixed. The lowering cables are wound inversely on the second drum and describe exactly opposite movements. In order to maintain the span in a horizontal position there are two sets of balance cables. The first set is fixed to the foot of the south tower, passes round the pulleys at the southern end of the span and from there to the opposite end of the span, where it passes round a further pulley and is fixed to the north tower. The other set of cables take the opposite course. As certain engineers had expressed doubt as to the ability of the span to maintain equilibrium, the method of working was reproduced in a model of the bridge 1/50th of the actual size. Experiments carried out with this model proved the exactness of the calculations previously made.

The two cable drums are operated by a 440 volt D.C. motor of 200 h.p., and the centre span can be raised to its full height of 134½ ft. in one minute, whereas the opening of the swing bridge previously used took four minutes. A 30 h.p. motor is kept in reserve. The cable drums can be brought to rest without shock by the application of a compressed air brake. The bridge is worked by one man, who occupies a small cabin situated against one of the foremost pillars of the south tower. In this cabin are all the necessary levers, and an indicator level that enables the operator to note at any time the exact position of the moving span.

Another view of the vertical lift bridge at Rotterdam, with the span closed.

The famous 5½ mile-long bridge across the James River, America, that was described in the *"M.M."* of June, 1931, contains a vertical lifting span about two-thirds of the way across from the north. The span is 300 ft. long and is suspended between towers 200 ft. high above mean high water level. It is electrically operated, being controlled from an operator's cabin at the base of the north tower; and the complete upward or downward trip takes 1½ minutes.

So far we have dealt only with vertical lift bridges abroad, but an important bridge of this type is now being built in this country by Dorman Long & Co. Ltd., the builders of the Sydney Harbour and other famous bridges. It is being erected across the River Tees at Middlesbrough and when completed will have a lifting span 270 ft. long and suspended by steel ropes from towers 170 ft. high. The span will have a width of 56 ft., made up of a roadway 38 ft. wide and a footpath on each side 9 ft. wide. When raised to its full height it will provide a vertical clearance of 120 ft. at high water of ordinary spring tides, and will be raised and lowered electrically. We hope to deal more fully with this interesting bridge in a future issue of the *"M.M."*

XLV.—AN OPHTHALMIC OPTICIAN

IN the present article we deal with the profession of the ophthalmic optician, who is concerned with the correction of defective vision by means of spectacles. These were probably invented by the Chinese. An Arab writer of the 11th century mentioned them and they appear to have been introduced into Italy in the 13th century. About 200 years later spectacle making was one of the trades carried on in Nuremberg, in Germany.

The earliest reference to the making and use of spectacles in Great Britain is found in a book published in 1563. Later the "art or mistry" of making spectacles and of fitting them to those whose sight was dim was gradually developed and in 1628 a group of those engaged in it presented a petition for incorporation to Charles I in order to obtain official standing for their occupation. A Royal Charter was granted in 1629 to the spectacle makers of London in order to encourage them in their trade, to increase their numbers and to reform many abuses that had already sprung up, and thus the Worshipful Company of Spectacle Makers came into being as one of the livery companies of London.

The powers of the new Company were very large. Through its elected officials it framed regulations for making and selling spectacles, and imposed fines for selling bad work, and for other breaches of its rules. Only members were allowed to sell spectacles within the City of London, and the stocks of unauthorised dealers were destroyed when their practices were detected. Persons who were not members of the Company were permitted to trade outside the City, but were compelled to carry on their business under restrictions imposed by it.

The officials of the Company enforced the regulations strictly, but they seemed to have tempered justice with mercy, for in the year 1669 a wholesale haberdasher caught in possession of 31 dozen imported spectacles was granted the sum of 10/– when he complained that he had sustained great loss by the breaking of the glasses and also by the Great Fire that had raged in London a short time previously. It is recorded that the culprit accepted the gift thankfully! Other offenders were not so leniently treated.

The activities of the members of the Spectacle Makers Company were at first confined to grinding and polishing lenses and mounting them in horn rims. As the members became more skilful in the manufacture of lenses they turned their attention to the production of optical instruments. Spectacle making and fitting then became neglected, and gradually the Company ceased to exercise its powers of exacting fines and punishments for bad work and of enforcing its regulations in regard to the selling of spectacles. The practice then developed among unskilled retailers who were not members of the Company of buying glasses in large quantities and allowing their customers to select by trial those that seemed to suit them best. Thus the term "optician" came to denote the man who dealt in telescopes, microscopes and other kinds of optical instruments, and those so described seldom had anything to do with the supply of spectacles. People who needed these aids to sight usually were sent to a jeweller or watchmaker, or, in later years, to a chemist, and were provided with glasses taken from stock. When a young man, the writer was sent by his doctor to the village watchmaker in order to obtain glasses. The watchmaker produced a tray of spectacles and the daily paper, and invited him to select a pair to suit. He wore the pair selected for some years, quite unconscious of the fact that it was an unwise proceeding.

To-day matters have changed very much for the better, for the modern optician is qualified to undertake sight testing, and has undergone a thorough training, and passed examinations by physicists and by ophthalmic surgeons, before receiving his diploma or certificate.

Mr. L. E. E. Durran, F.B.O.A. (Hons.), President of the British Optical Association. This Association was founded in 1895 for the purpose of encouraging the application of the science of optics to the improvement of vision, and it has helped to establish the optical profession on a sound basis by holding qualifying examinations, and awarding scholarships and grants to Technical Colleges in which opticians receive their training. During the war, the Army Spectacle Depot formed at the Association's headquarters supplied more than a million pairs of spectacles to the troops.

It must be clearly understood that the qualified optician is not a doctor, and has no right to treat disease of any kind. One of the first lessons he has to learn is that the moment he recognises the presence of disease of any kind in the eye, he must at once send the patient to a doctor, and if possible to an oculist or ophthalmologist, as one who has made a special study of the eyes is called.

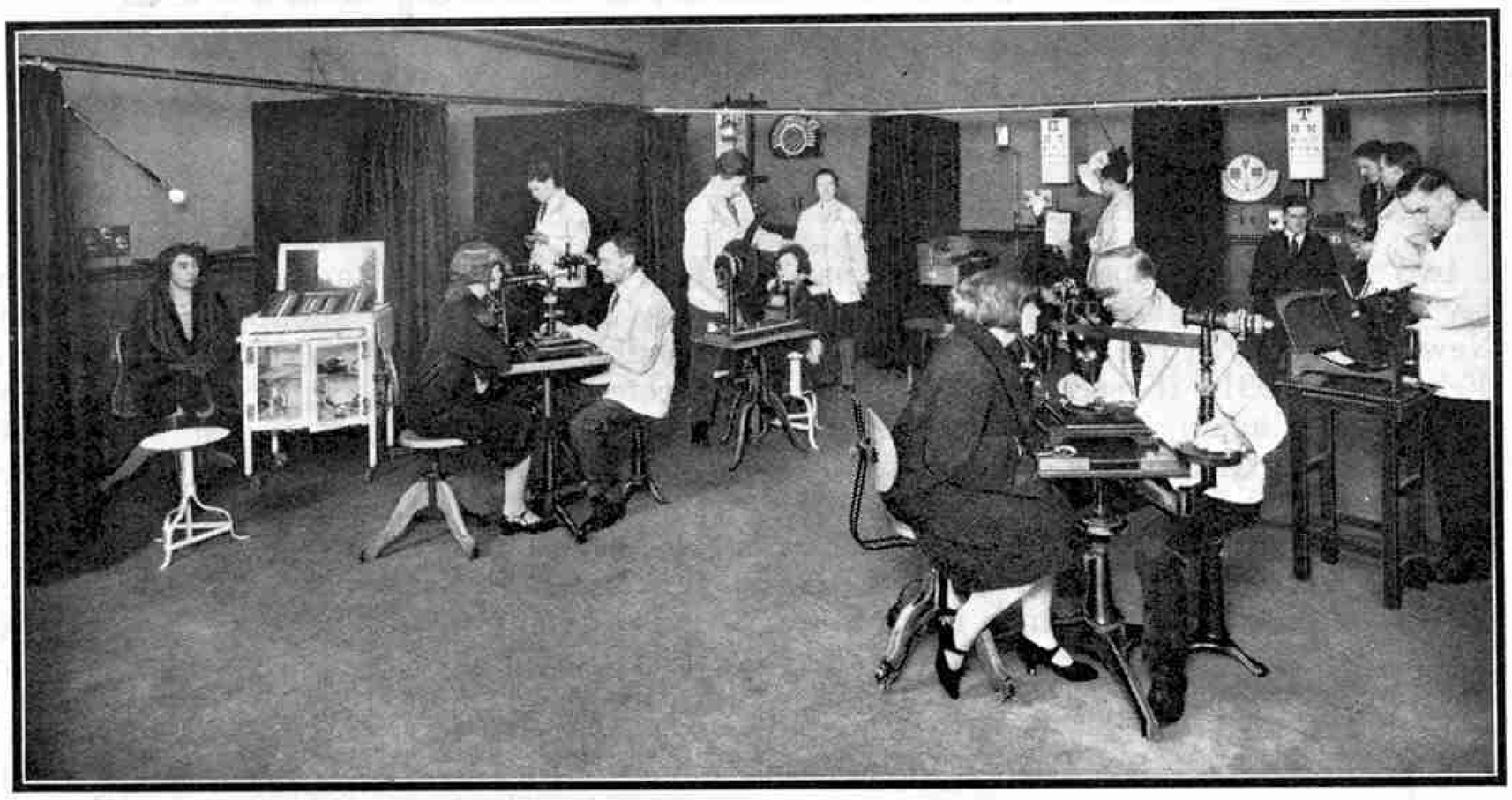
Unfortunately there is no law to prevent anyone calling himself an ophthalmic optician, so that sometimes men set up as opticians without proper training, and cause their patients a great deal of trouble and expense.

In order to become a properly qualified optician it is necessary to gain one of the diplomas awarded after examinations by various optical bodies of good standing. Two of these examining bodies are of special importance. The oldest and best known is the Worshipful Company of Spectacle Makers, to which we have already referred. It no longer exercises the great powers conferred upon it, which were intended for the protection of the public from bad workmanship, and also from fraud, but since 1898 it has conducted qualifying examinations for those taking up the profession of optician. These examinations are held twice a year in various centres, and candidates are examined in the theory of light and vision, and the effects of mirrors and lenses. At first it did not concern itself with sight testing, but in 1902 this was included in its scheme, for it was realised that the recognition by qualified opticians of the presence of disease in the eye would help to protect the public from imposters, who can cause great harm to people suffering from serious defects by supplying them with glasses that appear to bring about an improvement. Full details of the examinations held by the Company may be obtained on application to the Clerk of the Spectacle Makers Company, 36, Furnival Street, London, E.C.4.

The second examining body is the British Optical Association, which has existed for many years and has done exceedingly good work in fitting opticians for their sphere of public service. It was formed in 1895, when the Spectacle Makers Company was not as active as it has been during the last 30 years. Its chief object is the examination of sight-testing opticians, and in addition it holds scientific meetings and interests itself in legal questions affecting the rights of opticians. It issues a monthly journal, "*The Dioptric Review*," and members also receive other publications dealing with matters of interest and importance to them.

In company with other bodies concerned, the British Optical

Association has steadily sought to raise the standard of optical education by making grants to recognised training institutions throughout the country, and by awarding scholarships, both for those wishing to take training courses, and for advanced students engaged in research work. Membership of the Association can only be secured by passing its examinations, success in which qualifies for the Fellowship (F.B.O.A.). Full details of its examinations, and of the Association generally, may be obtained from the Secretary, The British Optical Association, Cliffords Inn Hall, Fleet Street, London, E.C.4.

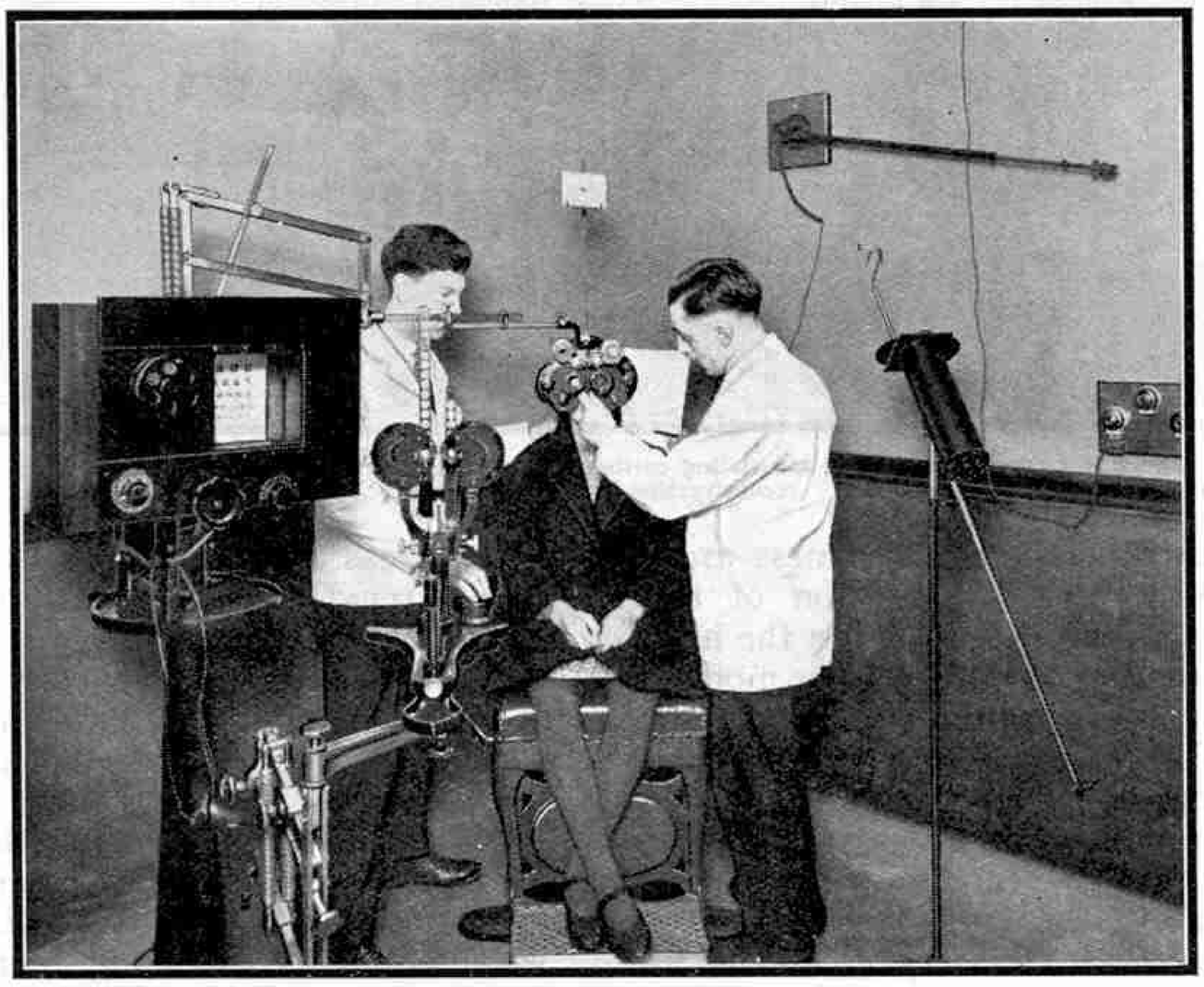


A section of the main sight-testing theatre in the London Refraction Hospital. For permission to publish this photograph and the one below, we are indebted to the courtesy of the London Refraction Hospital.

The standard of ordinary education required by those who enter upon an optical career is that of one of the recognised preliminary examinations for any of the professions, such as the University Matriculation, Oxford or Cambridge Locals, General School Certificate, or any other examination that is generally recognised as being of similar standard.

The best course for the student who desires to enter this profession is to enter one of the Technical Colleges that give recognised complete courses in ophthalmic optics. A course of this kind usually takes three years. Under certain conditions it can be completed in a shorter period, but the student does not then get the full certificate from the College.

In this course the student receives a thorough training in the theoretical side of optical work, not only with regard to spectacles, but also in connection with optical instruments for various purposes. He has to make spectacle frames and fit them with lenses of his own grinding and finishing. He also gets experience in sight testing, and practice in the use of such instruments as the ophthalmoscope, which enables the optician to see inside the eyes of his clients; the perimeter, by means of which the field of vision can be mapped out; the scotometer, employed for tracing portions of the eye that are blind or defective; and various other forms of apparatus for which use is found in the consulting room of the up-to-date optician.



Undergoing sight-tests in a cubicle in the London Refraction Hospital.

A typical example of the course provided for those who wish to become ophthalmic opticians is that of the Northampton Polytechnic Institute, St. John Street, London, E.C.1. The full-time day course extends over two years and provides complete training for students who intend to become ophthalmic opticians or dispensing opticians, and others who are concerned with the construction, supply and use of spectacles and ophthalmic instruments.

Students must be at least sixteen years of age and are required to pass an entrance examination, if they have not already passed one of School Certificate standard. In the first year they take courses in optics, anatomy and physiology, mathematics, physics, chemistry and biology. Considerable importance is attached to practical work, and lectures are supplemented by laboratory practice and experiments. The second year's course is more specialised in character and deals with such subjects as visual optics, the anatomy and physiology of vision, and sight testing. In the laboratories and workshops instruction is given in the use of ophthalmic instruments, and the making and mounting of lenses, and full opportunity is given for clinical practice, in which patients with defective vision are examined and means of correction worked out.

A diploma is awarded to successful students, and the course covers the syllabuses of the examinations conducted by the British Optical Association and the Worshipful Company of Spectacle Makers. An alternative one-year course in specialised ophthalmic subjects is provided for students who are unable to take advantage of the complete course. Admission to this course is limited to students over 21 years of age and the diploma of the College is not granted to those who complete it.

In addition, there are refraction hospitals, such as those in London, Leeds and Glasgow, in which the optician gets a more specialised training in the recognition of the presence of disease, and more advanced training in technique and in muscle exercises, the latter being used in certain cases of "squint." Any student therefore can get a really thorough training in his particular branch of science, and so fit himself to be of considerable assistance not only to the members of the public who come to him, but also to the medical man to whom he may send his cases, as he is able to give him a report of the case that will save time and trouble in discovering what may be wrong with the patient's eyesight.

It is possible for the student to be coached for the examinations at various reputable schools, but it is impossible for him to obtain in this manner the practical knowledge and full acquaintance with the various parts of the profession that he receives at one of the full-time Colleges.

Not every person is suitable for the optical profession. For those who possess the right characteristics, there undoubtedly are prospects of a fine career in the optical profession, but the possibility of success must not be measured by the student's capacity to pass examinations. Apart from actual professional knowledge, the first great asset required undoubtedly

(Continued on page 648)

After the Earthquake

The Rebuilding of Napier, New Zealand

By V. May Cottrell

MORE than two years have sped by since that fateful day when swift calamity descended on Napier, New Zealand. In the days immediately following 3rd February, 1931, it seemed impossible that Napier could ever rise again, so complete was the havoc wrought by the great earthquake and the subsequent fierce conflagration that consumed the whole business section of the town. But once the first shock was over, the actual severity of the disaster aroused the fighting spirit in Napier's citizens, bringing forth fine qualities and developing the courage, strength and foresight required to cope successfully with the situation. Capable leaders appeared among the populace, and the great common need inspired a feeling of goodwill and mutual helpfulness that resulted in the friendly co-operation that spells success to any undertaking.

Napier is rapidly recovering from the devastating earthquake of 1931, and this photograph shows some of the reconstruction now in progress.

Only residents and those who visited Napier immediately after the great earthquake can have any conception of the labour involved in clearing away the huge piles of debris that were all that remained of Napier's business area. Large gangs of workers, under the direction of the Public Works Department, toiled incessantly in the heat of those scorching summer days, and for many months afterwards, in the endeavour to bring some semblance of order out of the chaos. Within a few days the main thoroughfares of the ruined city were cleared for vehicular traffic. On account of the extensive damage to all public services during the earthquake, and the consequent danger of pestilence, it was decided to evacuate the town until these services could be at least partially restored. Consequently the great majority of the townspeople, women and children especially, were accommodated for some months in public camps and private houses in other parts of New Zealand. The great kindness everywhere accorded to earthquake refugees during that trying period cannot be over-stated.

The stark desolation in the shattered city at that time can be more easily imagined than described, the absence of all street lighting making it specially dismal and eerie at night. The one bright spot during those first difficult weeks and months following the disaster was the temporary shopping area. This consisted of hastily constructed blocks of sheet iron buildings erected in two garden squares close to the ruined business section of the city, at a cost of £10,000. Within six weeks of the disaster some 60 shopkeepers were accommodated in this way, while the banks and many business and professional people carried on as best they could in temporary premises near by.

The prompt action of those in charge of city affairs in thus providing facilities for the early resumption of business no doubt saved Napier from the total extinction that at first appeared inevitable. But if it had not been for the help and co-operation of wholesale firms in other parts of New Zealand and abroad, in advancing stocks of goods to the ruined business people, they could not possibly have made a fresh start as expeditiously as they did.

The work of demolition has gone on steadily during all these months and is still in progress in some areas. Powerful wrecking cranes have pitted their strength against shattered buildings standing at crazy angles, bringing them down eventually with a resounding crash and roar. Steam shovels and hundreds of workmen have been kept busily employed in clearing away the wreckage and loading the huge piles of debris into waiting motor trucks. Continuous streams of these useful vehicles, laden with broken bricks, shattered masonry, twisted iron and all manner of ruined property, raced here and there, conveying the spoil wherever it was required for filling purposes. By this means dangerous craters in the streets and huge fissures in many of the roads in and about Napier were quickly repaired.

Much general reclamation work also was speedily accomplished. Take for instance the Marine Parade, a two-mile esplanade that extends along the sea front. Here the ruins of a large private hospital across the street were dumped on the beach as a foundation for the several acres of lawns, gardens, tennis courts, walks, parking areas, band pavilion and open-air dance floor that make up a new beautifying scheme for the sea front. The result is that Napier citizens and visitors

are now cheered by the sight of smooth lawns, gay flower beds and graceful ornamental shrubs where previously there was only an unsightly shingle beach.

This article deals only with the rehabilitation of Napier's business area, lack of space making it impossible to give an account of the restoration of our homes, which also suffered severely. I must mention in passing, however, that owing to the wonderful generosity of sympathisers all over New Zealand, and elsewhere, all repairs to homes were paid for out of the Earthquake Relief Fund, and much-needed assistance was rendered in special cases of hardship, permanent injury and so on.

The actual rebuilding of Napier commenced late in 1931. This was heralded by the appearance of a solitary new building, or an isolated block of buildings, dotted here and there among the ruins. These cheering evidences of Napier's renewal gradually increased in number as time went by, but it was only during the latter part of 1932 that the rebuilding assumed large proportions, and up to the present time we are in the midst of a regular race of reconstruction.

Napier as it is to-day. (Top) The new Hotel Central. (Left) A typical block of rebuilt shops. (Centre) Map of New Zealand, showing position of Napier. (Right) New buildings rising out of the wreckage. (Bottom) Playground and Park, Marine Parade. This two-mile esplanade has been laid out on land filled in with spoil from the earthquake.

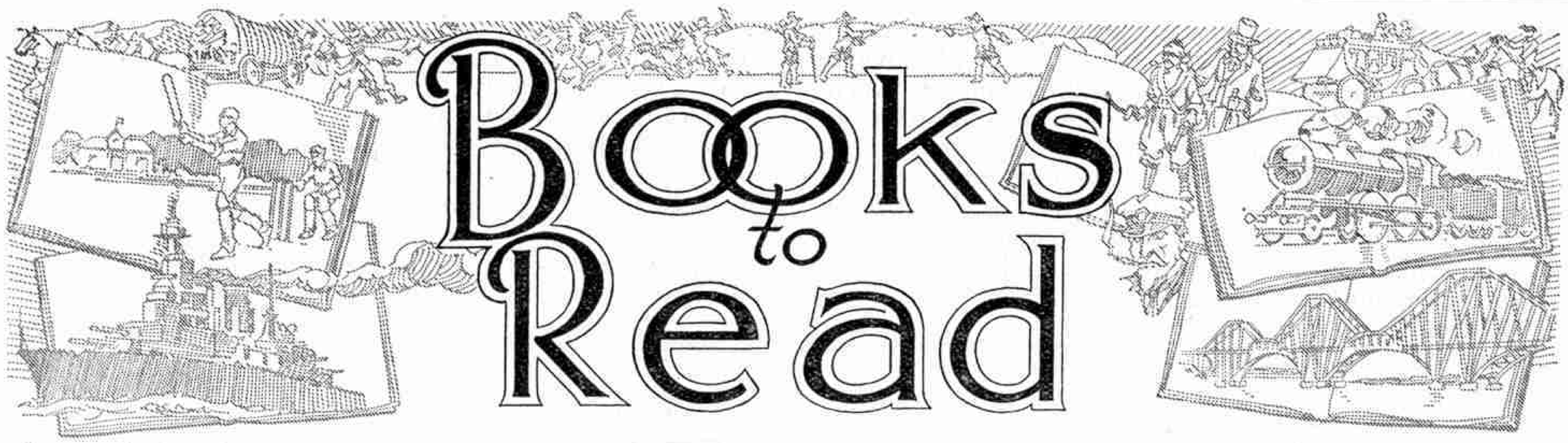
Hotels, offices, shops, professional premises, warehouses, etc., in all stages of construction, confront us as we wend our way about the streets. Premises that have achieved the beauty and dignity of completion and occupancy stand side by side with those that are still concealed by scaffolding, while near by the concrete foundations of others are just being laid. Owing to the large numbers of workmen employed on the buildings, as many as 100 at a time in some instances, the progress noticeable from day to day is truly remarkable. Many of the new buildings almost appear to grow in the night, so quickly do they reach completion. The three main thoroughfares are a veritable hive of industry, for on nearly every section there is now either a completed building or a block of buildings in course of construction; and the footpaths and newly-widened streets are being relaid by large gangs of workmen. Every week-day from 8 a.m. till 5 p.m. there is the constant clang and clamour of hammers, the scratching and scraping of shovels, the grinding of concrete mixers, the sputter of riveters, the "chug-chug" of engines and the blaring of motor horns, as the work of reconstruction goes on.

The municipal authorities, assisted by voluntary organisations, have utilised the opportunity afforded by the wholesale destruction of the city to improve its general layout. Several of the main business thoroughfares have been widened considerably, and at convenient points new streets have been created. This will add greatly to the appearance of the new Napier, and must prove beneficial also in relieving traffic congestion. In addition to this all overhead electric cables with their unsightly poles, are being done away with. The cables are to run beneath the concrete-slab paved footpaths, where they may be easily reached for attention at any particular point. Service lanes are being provided at the rear of the business premises so that merchandise may be readily transferred without interfering with traffic in the main streets.

Over £120,000 has been spent by the municipal authorities in reinstating the four principal public services, sewerage, water supply, storm-water drainage, and roads and streets. A further £18,000 has been devoted to street widening, the reconditioning of public buildings, and the general improvement of the town. The rebuilding of the business premises has already cost over £1,000,000 sterling. The sewerage reconstruction work is still in progress after all these months. This is due to the fact that the actual rise of the land during the upheaval ranged from 8 ft. in some parts to 2 ft. or 3 ft. in others. This meant that, in addition to innumerable breakages in the pipes, in some localities the fall was in the wrong direction after the earthquake, necessitating the finding of new levels.

The new buildings captivate the eye with their simple graceful lines, soft colourings, and small effective decorations in brighter tones. The buildings are uniform in style, their architecture being of the Spanish colonial type, but individual taste is displayed in their colouring and decoration which varies considerably.

The wonderful achievements of the citizens in bringing into being the beautiful new Napier, of which we are so justly proud, serves to show what great things can be accomplished in any community even in the face of dire disaster and apparently unsurmountable difficulties when steadfast courage, full co-operation and dogged perseverance are brought into play.



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"Sea Escapes and Adventures"

By "TAFFRAIL." (Philip Allan. 2/6 net)

This is one of the popular "Nautilus Library" series, previous volumes of which have been reviewed from time to time in these pages. The present collection of sea stories—compiled from information obtained from several different sources, which are enumerated in the preface—tells of many famous happenings, all of which make interesting reading. There is, for instance, the remarkably gruesome story of the sloop "*Peggy*." In 1765 she ran into bad weather and was in such a distressful condition that the crew were in danger either of sinking with their ship or floating in her until they died from starvation. Food was so short that everything possible on board was devoured—even the ship's cat, the oil for the lamps, and the leather from the washers in the pumps! In this way the crew managed to exist somehow for nearly three months—thereafter it becomes a gruesome story of cannibalism.

More inspiring are the stories of the "*Victory*" in the Arctic; the Escape of the "*Terra Nova*" from an Antarctic hurricane in 1910; Sir Ernest Shackleton and the "*Endurance*" in the Weddell Sea; and finally the adventure of Hawker and Grieve whilst attempting to fly the Atlantic in 1919. When they had flown 800 miles engine trouble developed, and after amazing escapes from death they were rescued by a tramp steamer.

The escape of H.M.S. "*Calliope*" from the great hurricane in Samoa was a remarkable incident. It was in 1889 that a squadron of men-of-war lay in the harbour of Apia, when the barometer commenced to fall, indicating the approach of bad weather. Before long a gale struck the island, and with a fierce sea running, two ships in the harbour crashed into each other, others being torn adrift and dragging their anchors. When dawn broke many ships in the harbour were in difficulties; others had sunk, the crews being drowned. The officers of the "*Calliope*" were horrified to see the reef only fifty yards astern, but despite this, and the fact that enormous seas were washing over the ship's bows and rising half way up the foremast, the "*Calliope*" managed to clear the entrance to the harbour and make good her escape. No tribute can be too great to pay to her officers and crew, for they showed a wonderful display of seamanship in conditions of dire peril.

"Whalers and Whaling"

By E. KEBLE CHATTERTON. (Philip Allan. 2/6 net)

In this volume—another of the popular "Nautilus Library" series—Mr. Keble Chatterton tells us something of the adventures of those engaged in an industry that forms one of the most romantic sections of maritime history. We have a vivid picture of whaling ships, and of the lives of those who undertook cruises that often lasted for several years and extended north, south, east, and west; up to the Arctic; down to the Antarctic; and around the world.

The profession of the whaler has called for some of the highest qualities of courage and skill in different generations and in varying vessels. We learn of the particularly hard experiences and uncomfortable mode of life that the early whalers were compelled to undergo. Not only have there been great depressions through which the occupation had to pass, but also brilliant successes—and more particularly in recent times in connection with the highly prosperous steam whaling.

As Mr. Chatterton points out, the story of whaling is linked up with that of exploration. The desire to discover fresh territories and develop new markets, and to discover new resources, was in a large measure responsible for the development of this industry. The motive that sent the old-time whalers to sea was the great commercial reward of the oil from the blubber, and the spermaceti that was a valuable ingredient of ointments and had other uses. Throughout the nineteenth century, however, the introduction of gas and electricity had its effect and the demand for oil declined, with disastrous results. Later, however, new uses were found for the products of the whaler, and the industry revived.

Another set-back occurred at the beginning of the twentieth century when the scarcity of the cachalot whale seemed to indicate that the industry would become extinct. In 1904, however, a new whaling ground was found in sub-Antarctic seas, and such an impetus was given to the industry that it enjoyed an unprecedented success. To-day, the industry in those waters depends almost entirely upon the blue whale, the largest known animal, which measures up to 200 ft. in length.

English ships have been engaged in whale hunting since the sixteenth century. Although whalers sailed to the Arctic from Whitby, Scarborough, and London, it was the port of Hull that was best known for this trade. In 1861, no fewer than sixty-one whalers sailed out of Hull—thirty-two for the area between Greenland and Spitzbergen, and twenty-nine for the Davis Straits. The last whaling voyage from Hull was made by the "*Truelove*," a remarkable vessel that during seventy-two voyages captured 500 whales. She was built in Philadelphia in 1764, and in addition to her whaling voyages was variously engaged—at one time in the Oporto wine trade, and at another as a "letter of marque." Finally, she was captured by the British during the American War of Independence, and so came to Hull. She commenced her career as a whaler in 1784, and her last voyage was made in 1868.

To fit out a whaler for the South Seas required an expenditure of anything up to £12,000, as the ship was generally away two and a half years and often longer, the capital being tied up all that time uselessly if the result was unsuccessful. On the other hand, if the whaler was entirely successful she might return from the South Seas with sperm oil that would realize £24,000. Thus the capital expended in fitting her out would be doubled, and in addition the promoters would have the ship and some of her remaining stores. To-day, the ships engaged in whaling are no longer three-masted barques, but steel-built and steam-driven vessels such as have from time to time been described in the "*M.M.*" They are of from 150 to 180 tons and combine the main features of a steam trawler and an ocean-going tug. They are generally about 100 ft. in length and 20 ft. in beam, and are fitted with three-cylinder engines working on a boiler pressure of 200 lb. to the square inch, giving an average speed of up to 15 knots. They steam from Northern Europe down the North

An example of post-war architecture: Professor Einstein's Observatory. From "The Junior Outline of History" reviewed on the next page.

Sea and across the Atlantic, across the Equator, and through the heavy gales and treacherous ice of the Antarctic circle.

The hand harpoon and the boat work of the earlier whalers have been superseded by the modern explosive harpoon. This is a conical bomb over a foot in length and filled with gun cotton, fired by a time fuse three seconds after it leaves the muzzle of the gun.

With the passing of the old-time vessels much of the romance has disappeared also, as is inevitable in an age of strenuous action rather than of sentiment. It is all the more interesting, therefore, to read of the romance of the earlier days, and this book forms a splendid introduction to the subject.

"The Junior Outline of History"

By I. O. Evans. (Denis Archer. 7/6 net)

Some years ago Mr. H. G. Wells wrote the "Outline of History"—a book that has become very well known, and one that readers of the "*M.M.*" will probably read later on. The present volume is based on the earlier book by permission of Mr. Wells.

As the author remarks in his foreword, when he was learning school history, he was puzzled because things seemed to happen without any kind of an explanation. To-day, as then, there are hundreds of questions that national history does not answer. The Romans taught the Ancient Britons civilization, for example, but where did they learn it themselves? Why were we fighting the Germans, a large number of whom, since the war, have shown themselves to be pleasant and likeable people? Why are the nations arming as though they meant to fight someone else? Who are the Fascists and Bolshevists, and what is their object? What is evolution and socialism? Why do we have to go short of some things in the midst of plenty?

These, and many other questions of a similar nature, are not easily answered, but Mr. Evans set himself the task of finding out about the past so as to understand the present. Naturally it was not enough for him to delve into national history only for an answer to his questions, because a nation is but a part of a world-wide civilization that was formed through the work of other civilizations long ago. To-day, when there is so much distress throughout the world, it is more than ever our duty to endeavour to understand the causes that have affected almost every nation.

To those who are of the same enquiring turn of mind as Mr. Evans, this book can be recommended despite its somewhat unattractive title. In reading it you should remember that, although none of you actually took part in the greatest and most terrible war in which man has ever been engaged, the lesson of the war is yours to learn. The human family of which we are members, has two sides to its nature. There is the better side that revealed itself in devotion to duty, self-sacrifice, and love; and the baser side that showed itself in cruelty, selfishness, and hatred. When you have read Mr. Evans' book you will understand this even more clearly. You will learn of Man's long struggle upwards towards a nobler way of living; you will learn, too, that savagery still remains in him—a relic of the far distant ages when he roamed the earth among wild beasts. You will see how powerful the savage in all of us still is, and then it will be clear to you how you can help by your conduct to make the next page of history—your own lifetime—happier and brighter.

"Black on White"

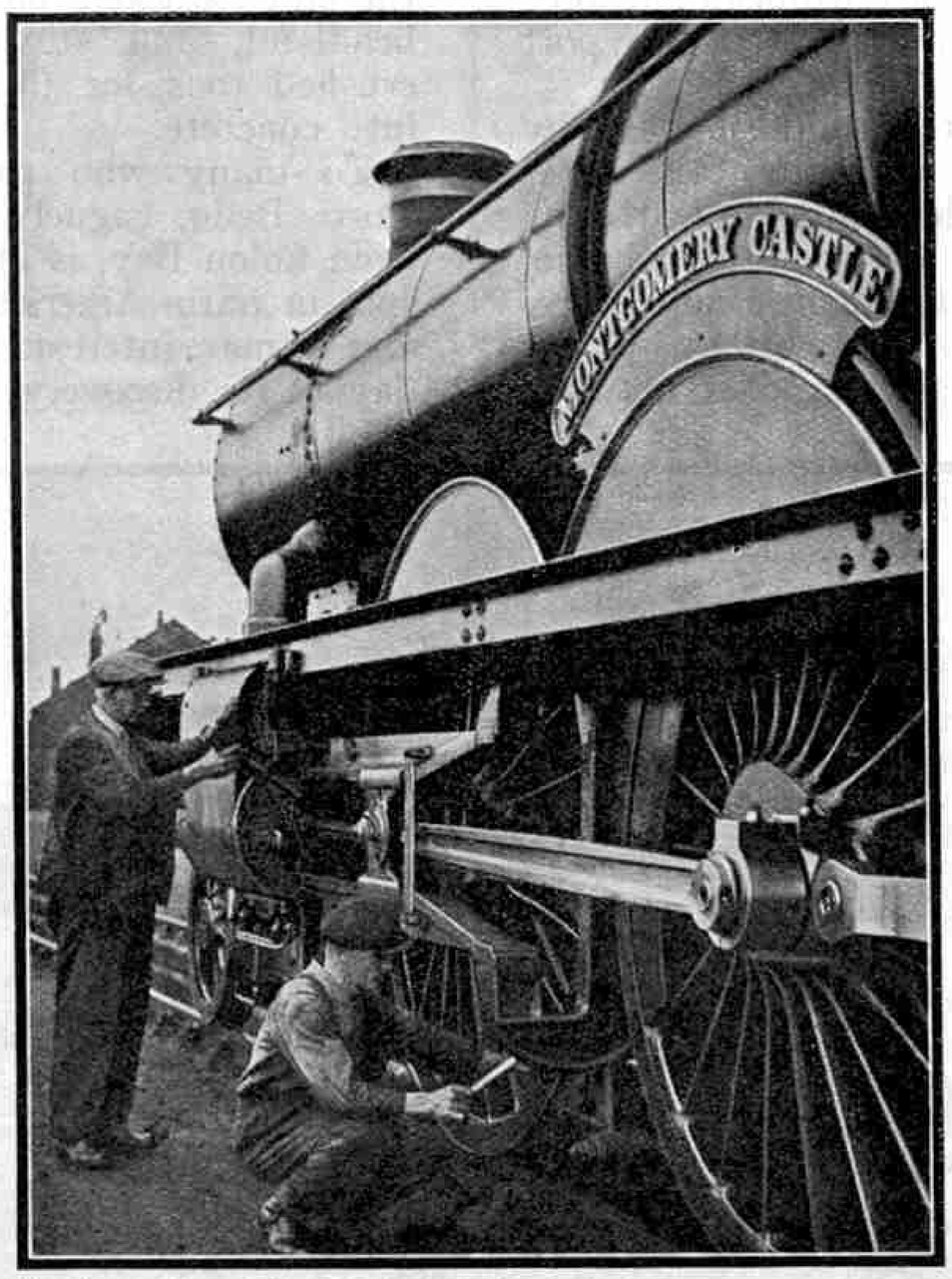
By M. Ilin. (Routledge. 3/6 net)

In this little book, dealing with the history of communication, we are given a readable account of the origin of the written and printed word. Not only do we learn of the cave pictures of prehistoric man, of the hieroglyphics of Ancient Egypt, and of the evolution of the alphabet, but also of the materials that have been used—the papyrus of the Nile, the parchments of the Middle Ages, and the wampum of the Red Indians. We learn, too, of the manufacture of paper from rags; how these are first reduced to a pulp that is fed in at one end of a big machine while the finished paper comes out at the other. Where these machines work "there are hardly any people in sight, yet the work never stops. There are machines that produce over two hundred thousand pounds of paper per day." The paper in such a machine is delivered on to a net stretched over two rollers, and in one of these machines the net travels as far in a day as the distance from London to Birmingham.

One of the most curious forms of communication was knot writing, which was used with great skill by the Ancient Chinese, Persians and Mexicans. If the message was given on a rope tied to a stick, the nearer the knot was to the stick the more important was the matter to which it referred. Knots of different colours had different meanings—a black knot meant death, a white one peace, a red one war, a yellow one gold, and so on. The thickness of the cords, and the manner in which the knots were tied and arranged, all had their special meanings. The art of knot writing still exists among shepherds in some countries, and it is surprising to find how much information can be conveyed merely by knots in a rope.

The Hurons and the Iroquois, two Red Indian tribes, used beads of different colours made from shells in place of knots. They sawed the shells into little flat beads, and strung them on cords. They then made these strings of beads into belts, which were known as "wampum" belts.

The colours of the shells each had their special significance, and it is interesting to note that some of the colours still retain their meanings. For instance, a white flag is still the emblem of peace, while black is the symbol of mourning.



The locomotive of the "Cheltenham Flyer," the fastest steam train in the World. From "The Junior Outline of History."

"How to Use Books" and "How to Find Out"

By Lionel McColvin
(Humphrey Toulmin. 2/6 each)

These volumes are the first of the "Enquiring Mind" series, the purpose of which is to help readers who wish to learn something of human ideas and activities, by providing them with a concise guide to the chief means of acquiring information.

The first volume explains how to find books on any subject on which information is required, but it is much more than a mere list of reference books and a classified guide to literature, for it emphasises the part played by books in arousing new interests. In addition it gives valuable advice on buying books and on the building up of a home library, and shows how to make the best use of books, whether they are read with a definite desire to learn something or merely as a pastime.

The second volume explains how to set about extracting knowledge from books, periodicals and other sources, public and private. It describes the most useful general works of reference and other "question-answering books," and shows how to track down specialised information by following clues that lead to books and papers written by experts. Other sources of information dealt with include wireless talks, newspapers and other periodicals through which enquiries are made, and personal enquiries from specialists. Anyone who works diligently along the lines suggested by the author can scarcely fail to obtain any information of which he is in search, provided that a record is in existence.

"Animals in Black and White" Vols. 1 and 2

By E. F. Daglish. (Dent. 2/6 each)

These two artistic books, dealing respectively with the larger and the smaller beasts, are something quite new in nature books. They are illustrated with woodcuts, and both illustrations and the text are the work of Mr. Daglish, who is not only a considerable artist but a naturalist of note. The text is written in simple language, but is full of information as to facts, appearance, character, and other details, about each of the many creatures dealt with in it.

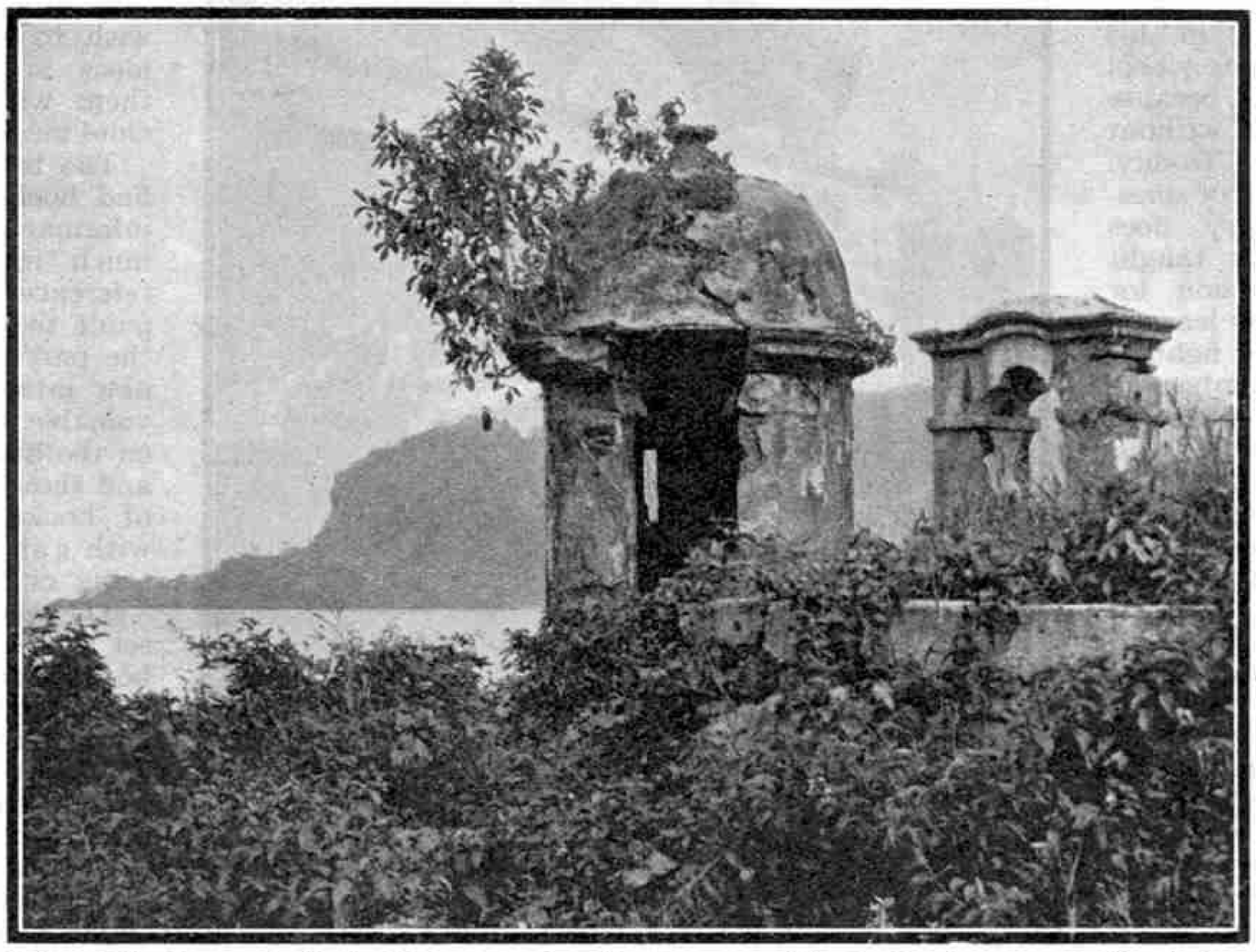
There are six volumes in the series, the others covering birds, reptiles, fishes, and sea animals. Any of these volumes would make a charming birthday gift for a younger brother or sister.

The Romance of an Ancient Treasure Port

Columbus and Porto Bello

ALONG the North shore of old Darien, to-day the Isthmus of Panama, some 20 miles north-eastward from the Atlantic or Caribbean entrance of the Panama Canal, lies the ancient treasure port of Porto Bello.

The ancient haven, discovered and named by Columbus, and for more than a century the chief harbour from which Spain's galleons, laden with the loot of Peru, took their annual departure for home, has figured in a thousand tales of romantic adventure. To-day it is obscure and almost forgotten by the world. A huddle of small houses stretches between its shore and the encroaching jungle that creeps upon it with stealthy pace. Its forts and public buildings, among the finest examples in Latin America of the European stone workers' craft, crumble amidst rank green, overrun with vines and brambles and unwholesome creepers, and crawled upon by lizards, land crabs and serpents. Guns of the once powerful fortresses lie dismounted, blotched and rusty. The harbour where Spain's treasure ships swung at anchor, the carving of their high, gilded poops glistening in the ardent tropic sun, their gay pennons and royal standards of red and yellow—blood and gold—streaming in the trade winds, now lies deserted, except for the occasional visit of a trading schooner or a small coastwise steamer.



Ruins of the famous Castle de Gloria at Porto Bello, Panama. The headland seen across the harbour provided most of the stone used in building the famous Canal.

Across the harbour rises a bold headland scarred by quarrying. Thence came great quantities of hard rock for the construction of the Panama Canal—the last and perhaps the final contribution of this old treasure port to the wealth of man. Until the American engineers began their blasting Porto Bello had not been roused from a siesta of more than 150 years that followed its decline as a treasure port. There had seemed no reason why it should awake. It had little business, the climate was enervating, and the people were not ambitious, and malaria and fever were common. With the coming of the Americans things improved for a time in Porto Bello. The deadly character of the mosquito and means of keeping him at bay were made known by American doctors. The town was cleaned up, and took on a new lease of life. For 10 years its harbour was a place of activity, as the stone workers blew off the face of the cliffs on the headland, and steam lighters took out cargoes of crushed rock for the workers on the Canal to make into concrete.

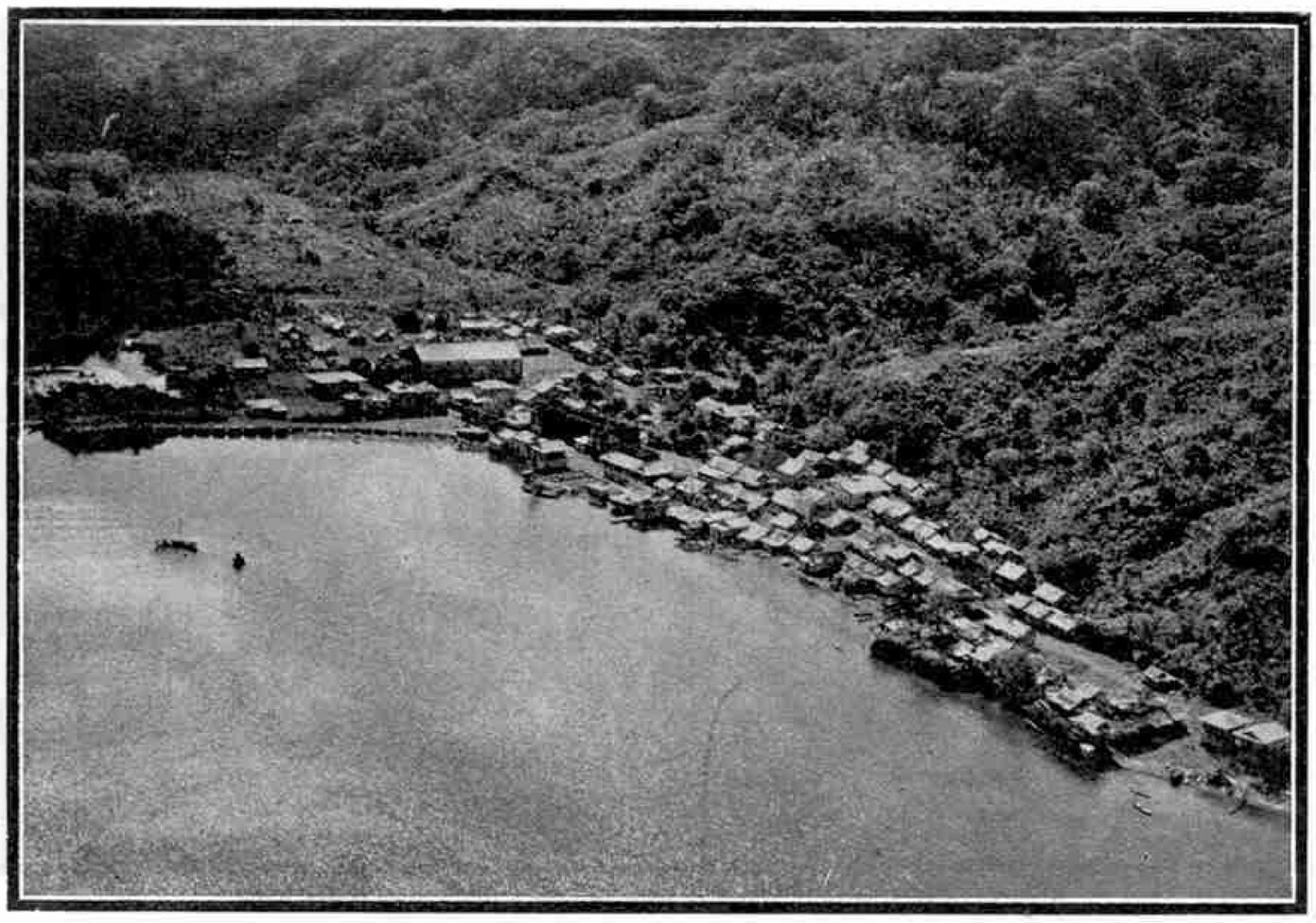
To many who pass through the Panama Canal, Porto Bello, vaguely indicated as lying down the coast from Colon Bay, is but a name; yet there is no single spot in Latin America with a richer heritage of historic and human interest. Sentiment invested it from the day of its discovery. Indelibly written in its annals are the names of three heroic figures in romantic adventure — Christopher Columbus, Sir Francis Drake and Sir Henry Morgan. Columbus found the harbour—the best on the Isthmus—on his fourth and last voyage, and named it, in an involuntary and emotional tribute, "the beautiful port." That was in November, 1502. Another white man may have been there before him, Rodrigo de Bastidas, who cruised along that coast in 1501 and was undoubtedly the first European to visit Darien; but there is no authentic record of a visit by this navigator.

In the case of Columbus the story of his discovery of the harbour is fully told. The great mariner had come from Spain with four ships, to seek the elusive strait that he still believed led to Cathay. He did not understand the nature of the Isthmus, or guess that across its narrow mountain range lay the Pacific. Anchoring in the quiet waters of Porto Bello, he tarried seven days to recruit his strength to continue his weary quest, for by this time hope and faith were growing dim. The chronicler of the voyage noted that there was a prosperous village at Porto Bello; that "the country about . . . is tilled and full of houses . . . It looks like the finest landscape man can image."

Columbus remembered Porto Bello, and in the following year, after many hardships in cruising along the coast to the westward, he came back to it for shelter, with misfortune dogging his footsteps. He had now only three ships and one of these, the *Biscaina*,

was in a sinking condition, and was abandoned here. This left but two vessels for the survivors of his four crews, and these two also were in a sorry state. Worms had riddled their planking, and the weary, sick and undernourished seamen had to work day and night with pumps and buckets to keep them from sinking.

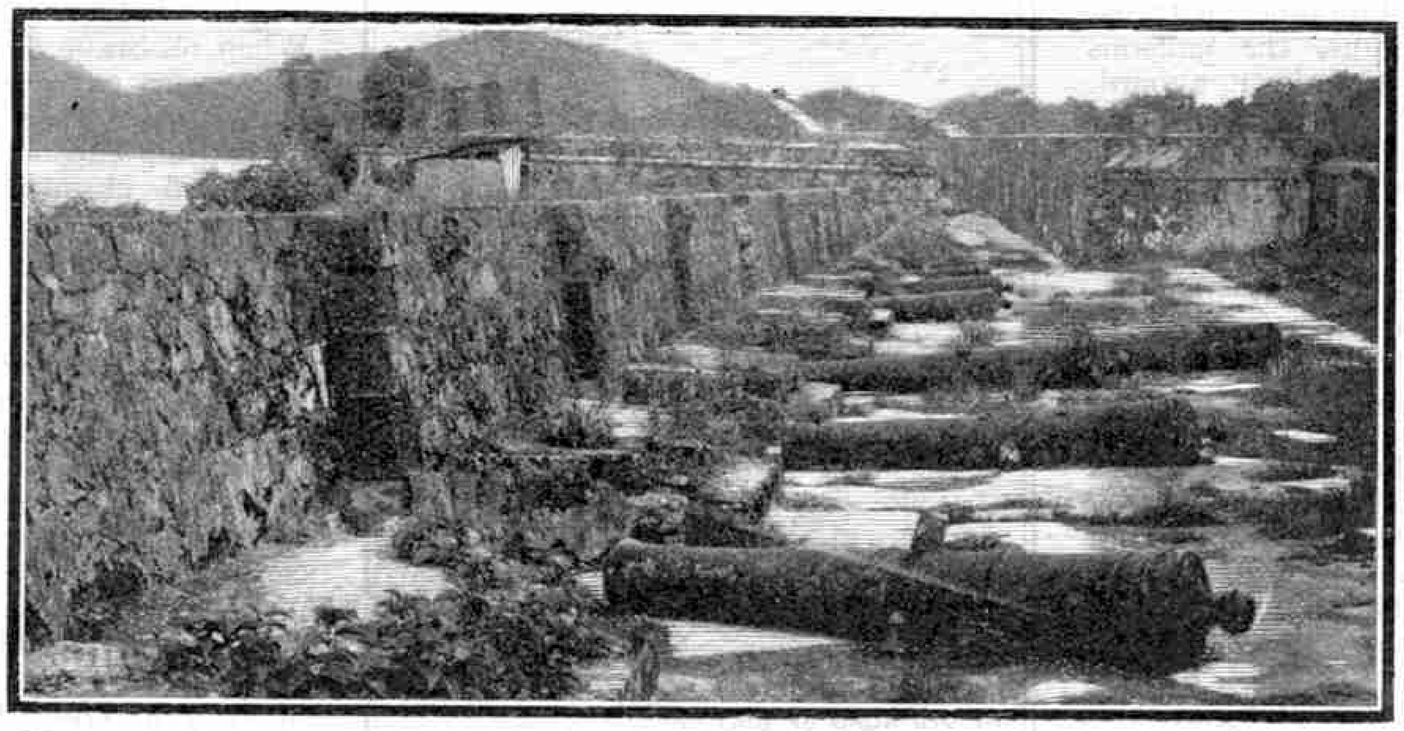
In this desperate plight Columbus left Porto Bello to try and win his way across the Caribbean to Hispaniola, and aid. It was a forlorn hope. His worm-riddled ship literally sank under him, and with it the other, at the island of Jamaica, settling on the sand of an uninhabited shore at what is now known as St. Anne's bay, on the north coast of the island. Here Columbus, sick and dejected, suffered for months in tropic heat under a slight palm shelter built on the deck of his derelict vessel, until succour could be summoned from Haiti. Such was his end as a sailor. Porto Bello had proven his last port.



Looking down on Porto Bello, once a flourishing port where the Spanish treasure ships took aboard their cargo. To-day it is obscure and almost forgotten by the world.

Another dramatic incident in the story of Porto Bello took place twelve years after the Spaniards had decided to make it the haven of their galleons. On an evening in January, 1596, a British squadron sailed slowly into the bay, and came to anchor, out of range of Spanish guns. Their flags were at half staff.

On the quarter deck of the flagship, draped in the Union Jack, was a leaden coffin, that contained the body of England's greatest seaman of his time, Sir Francis Drake. The man who had defeated the Spanish Armada, making England a first class naval power; who was the first Englishman to look on the Pacific, and the first to carry the British colours around the globe, like the Great Discoverer, had made Porto Bello his last port.



Old guns that at one time kept pirates away from the treasure port. The guns were dismantled more than a century ago when the place was abandoned as a military post.

Drake started out with a powerful squadron to reduce the strong places of Spain on the coast of Darien. He had taken and burned Nombre de Dios, the older treasure port, and had sent an expedition across the Isthmus to attack Old Panama. Failure had resulted in the land campaign. Misfortune followed every later move of the enterprise. Finally Drake had fallen ill of dysentery. Feeling his end near, as the squadron sailed along the coast toward Porto Bello, he signed his will, and declaring that he would die as he had lived, a fighting man, he ordered his attendants to dress him in his best armour. Thus accoutred, he met the Reaper. That was in the morning of 28th January.

After spending that night at Porto Bello, the fleet next morning stood offshore one league, and as the ships lay with topsails backed, the body of Drake was consigned to the blue waters of the Caribbean, while bugles wailed a lament and drums rolled. Two small ships of the fleet were set on fire, a funeral pyre for the great British sailor, and the ceremony ended, the fleet stood on its way, for home.

Drake had lain on the sea bottom outside the harbour for a quarter of a century before Porto Bello attained the importance as a treasure port that made it known to the world. Spain had chosen it because it had a better harbour than Nombre de Dios, and she did not neglect to build a considerable city here. The principal buildings erected were of stone—a great storehouse for goods and treasure, a custom house, a mansion for the lieutenant governor, a church and monastery, and a hospital. The population was made up of a modicum of whites, chiefly in official positions, and many persons of colour. The latter could stand the climate better than the whites, for the place was breathlessly hot at times, and always damp, with an excessive rainfall.

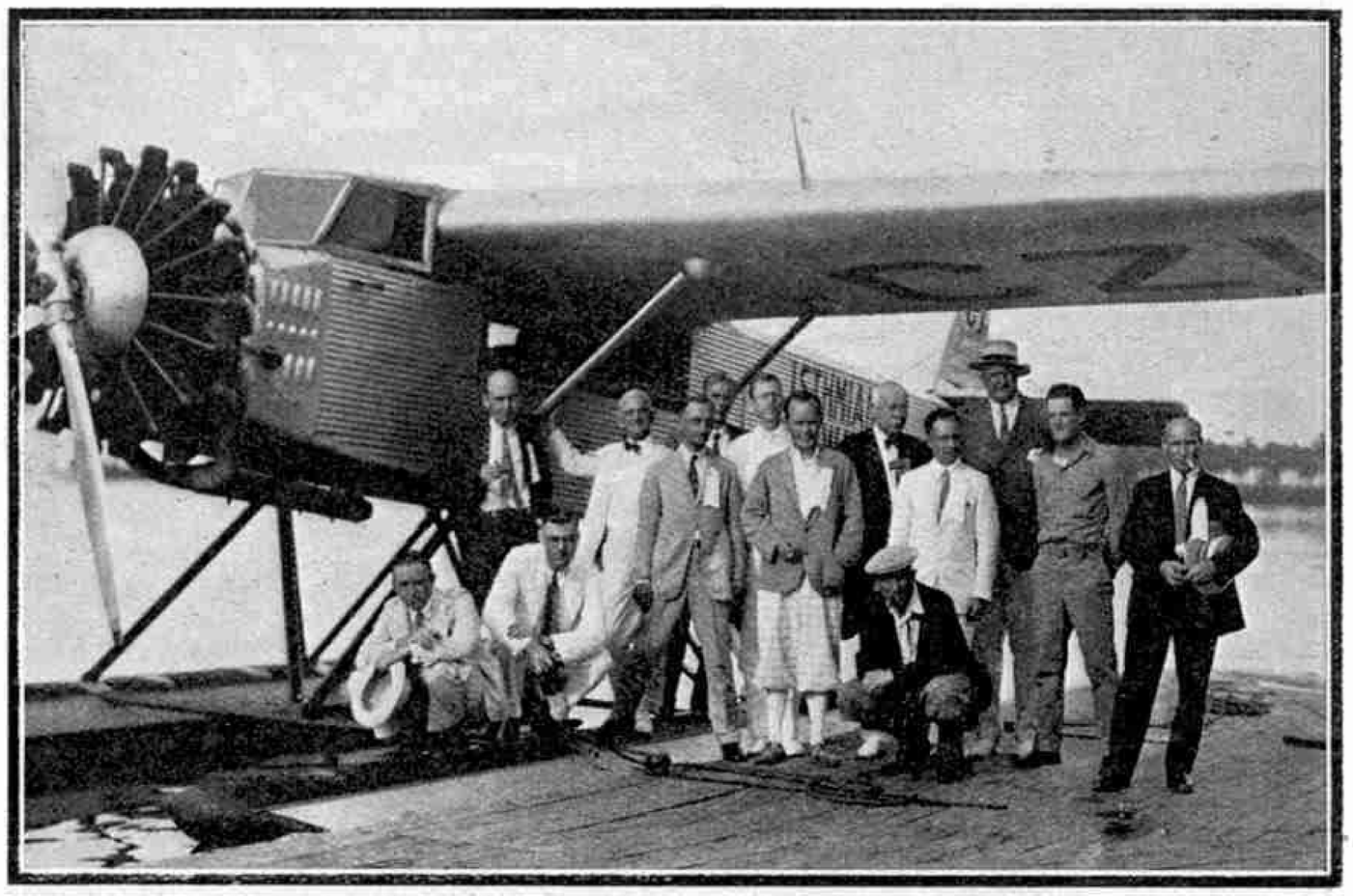
To make Porto Bello secure, Spain lavished money on fortifications. On the cape across the harbour was built the so-called Iron Fort. On the landward side was the Castle de Gloria, and at the town, the San Jeronimo Castle. These forts were of the heaviest possible masonry, with elaborate architectural details.

Behind Porto Bello, winding in the dense jungle, and now trod only here and there by human feet, lies the old gold road across the Isthmus—the only highway ever built from sea to sea—over which the treasure to be taken to Spain in the galleons was transported from the Pacific side, where it was landed at Old Panama, following its sea passage from the ports down

the West Coast of South America.

There is stone paving to be seen on the old Road of Gold, if one can find it in the tangle of the jungle. Some few years ago a company of American soldiers traversed the road, as a sentimental tribute to the pioneers who built it. Hidden in war department reports is the record of that march, which took a month, and cost the lives of men, including the commander of the detachment. This road was America's first trans-continental highway. It began at Old Panama, and ended at Porto Bello, its total length being about 40 miles. From Old Panama the road ran northward over the mountains to Cruces, on the Chagres river, which flows into the Caribbean west of Colon Bay. At Cruces the trail divided. On the right hand the road turned up the Chagres valley, and then northward through the hills to Porto Bello. It was by this route the treasure was transported.

On the left it became a water route down the Chagres, whose winding course was navigable by small boats between Cruces and the sea. The same route is seen to-day in the channel of the Panama Canal across the artificial lake of Gatun. Down the Chagres in the old days were sent the heavier goods received at Old Panama from Peru, for forwarding to Porto Bello—including vicuña wool, cacao and quinine. At the mouth of the Chagres the goods were transferred to seagoing boats, for transportation down the coast to Porto Bello, some 27 miles away, there to be sold, or to be stowed in the galleons for transportation to Spain.



A party of U.S. visitors about to emplane for a flight over Porto Bello.

The treasure fleet came to Porto Bello once a year. Following their arrival from Spain, they refitted at Cartagena, the largest and best defended city along the Spanish Main. Their preparations for their homeward voyage completed, they waited word that the treasure fleet from Peru had arrived at Old Panama. While the treasure was being unloaded at Old Panama, for transportation across the Isthmus, the galleons proceeded to Porto Bello, to take it aboard. The lading of the ships was always a leisurely process, taking about two months. There was no hurry, for the fleet could move only when winds favoured it, and that was at a certain known time in the year.

One must be possessed of a lively imagination to picture the scene in Porto Bello at the time of the annual visit of the galleons. The town then awoke from a nap of some months to find itself suddenly plunged into extraordinary animation. As the great ships came into the harbour and anchored, a fleet of lesser craft followed them, and anchored near by. Men of many races came ashore, sporting tarry pigtails and hard hats, and bringing strange commodities for sale. Long trains of mules came down the mountain trail, heavily laden with silver or gold, the tinkling of their bells giving notice of their approach. This was the treasure transport train from Old Panama. Silver bars were piled at times like wood outside the public warehouse, waiting storage. Gold was handled as freely as merchandise. The port was so well protected that there seemed no fear of marauders.

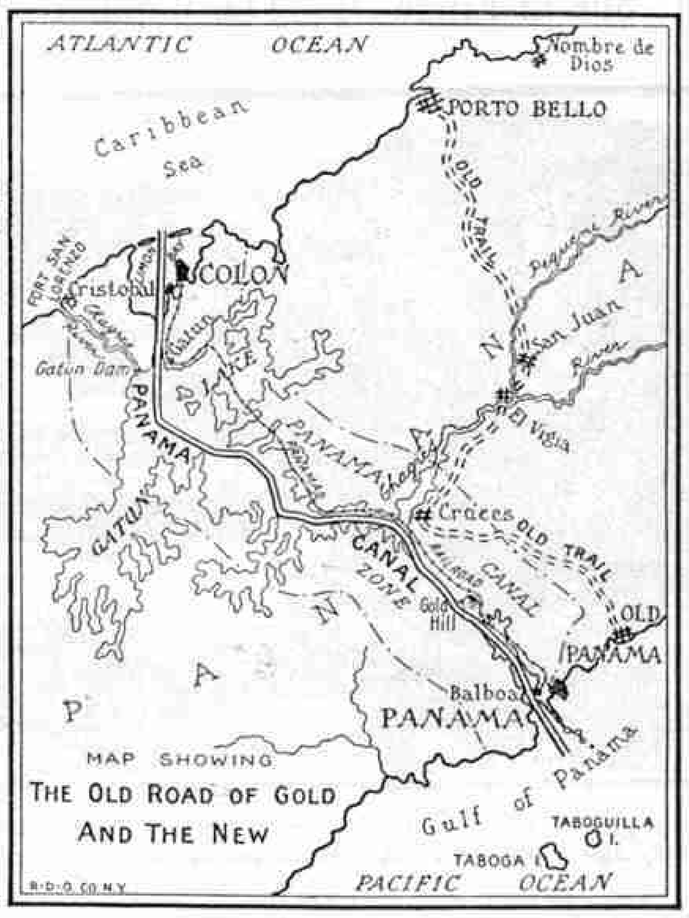
Great tents made of ship's sails were erected in the public square for the reception of goods to be sold by visiting merchants. Buyers came in from far and near. Even distant Peru sent its quota, bringing the products of their country and bargaining for the goods of Spain and other Continental countries. In effect, a great fair was opened, to last as long as the galleons remained in port, with all the fanfare of sport and depravity that belonged to the time and place.

When at last, well laden and with a favouring breeze, which could be depended on in the winter, the galleons set sail for Spain, the fair broke up; the tents were taken down; the trading vessels that had come with the great ships unloosed their sails and departed, the hangers-on disappeared as if into the forest or the sea, and Porto Bello prepared for another peaceful period, to last until the treasure ships came again.

Quite naturally the prosperity of Porto Bello and the wealth that was pouring to Spain out of its haven attracted the cupidity and envy of every sea-going adventurer far and wide. Corsairs lay in wait for the galleons; statesmen plotted to rob Spain of her wealth-producing colonies; admirals yearned for the glory of reducing Cartagena and Porto Bello. England's growing sea power—won for her by Drake—made her the most powerful enemy of Spain in the Caribbean, and it was due to this circumstance that the third of the great figures already mentioned strode with sword in hand across the stage at Porto Bello—Sir Henry Morgan.

The attack of Morgan and his buccaneers was in the year 1668. They came in force from Jamaica, anchored some ten miles from the port and under cover of night approached it in small boats. Landing near the outer fort, they surprised and overpowered a sentry before he could make an outcry, and learning from him the force of the garrison, Morgan delivered a quick attack.

The fighting lasted from dawn to noon. Few of the sanguinary stories of history can compare for vividness with the description of this fight left by the chronicler Esquemeling, who was one of Morgan's men. The Spanish garrison, under the governor of the town, made a gallant stand. Morgan and his men fought with brutal determination. Not even women and children were spared. Nuns were used as shields for the attackers; priests were made to place ladders against the walls of the fort. When its brave defenders had been captured, they were gathered into a small space and blown up. Then the town was sacked, and its captors entered on an orgy that even the hardened chronicler Esquemeling hesitated to describe.



Map showing the route by which the Spanish conveyed the treasure to Porto Bello, and the modern trade route—the Panama Canal.

The horror of those scenes can scarcely be made to seem real as one stands to-day amidst the lush vegetation covering the weather worn stones of the old fort, and hears no sound in the drowsy air but the chirp of insects or the call of parrots in the nearby forest.

Porto Bello recovered in time from the assault of Morgan, and for more than half a century, though harried occasionally by pirates and other enemies, it maintained something of its old prestige. Then came a declaration of war between Spain and England, in the year 1739, that was to mark the beginning of the end for Porto Bello as a stronghold of Spain.

Early in the war England dispatched Admiral Edward Vernon to the Caribbean, with orders to attack both Cartagena and Porto Bello. Admiral Vernon's attacks on Cartagena failed, but his reduction of the forts of Porto Bello, with six ships, marked the end of Spain's strength in Darien. The articles of capitulation signed by the Spanish commander of Porto Bello provided that his men might "carry off two cannons, mounted, with ten charges of powder for each, and their match lighted."

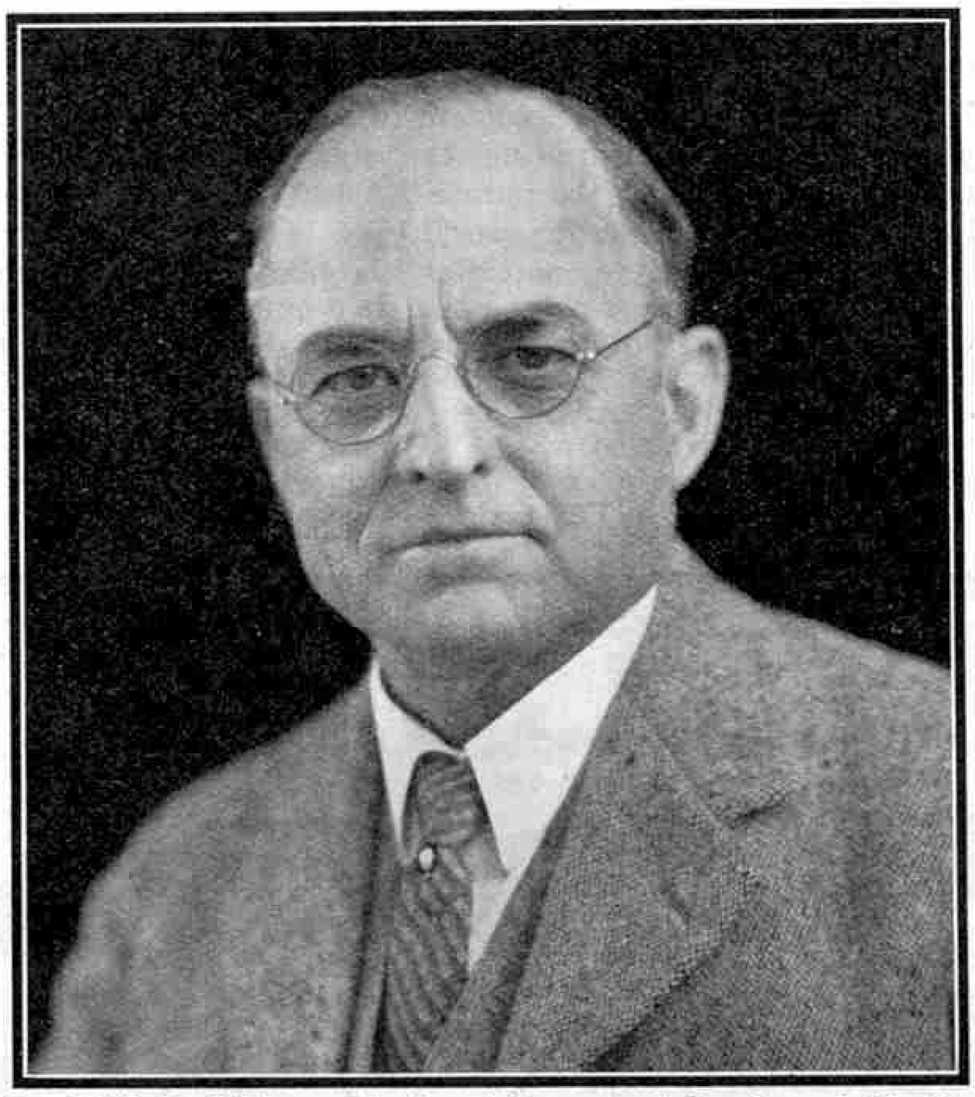
As a result of this capitulation the English secured two Spanish men of war of 20 guns each, forty brass cannon, four brass mortars, eighteen smaller brass guns, a quantity of (*Continued on page 617*)

The Coming of the Electrical Age

A Glimpse at the Past and the Future

INVENTIONS and discoveries are being made so rapidly nowadays that it is difficult for us to adjust our ideas to the existing state of things. For this reason it is useful sometimes to pause for a few minutes and ask ourselves where we really stand. The great danger is that we should begin to take it for granted that the marvellous scientific developments of the last few years have brought us within sight of more or less complete knowledge.

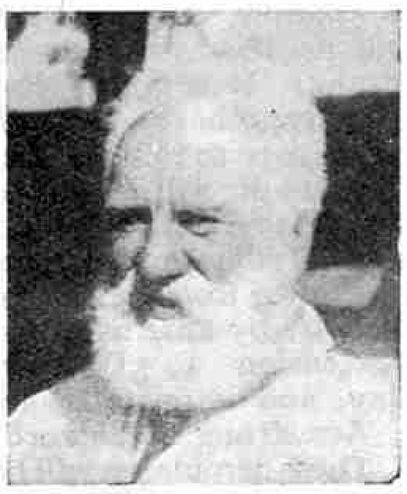
This is particularly the case in regard to electricity. We often hear the phrase: "This is the age of electricity," whereas actually the electrical age has scarcely begun. Dr. W. R. Whitney, director of the famous research laboratory of the General Electric Company of America, who has witnessed the birth of many a marvel in electricity, says: "Our present accessories in electricity, mechanics, and electronics are only the latest added steps, but not the last. They lead to new kinds of people with new kinds of minds. We live in the Garden of the Gods, but as yet we are eating only grass." The late Dr. Charles P. Steinmetz, the well-known American engineer, confidently looked forward to an age in which electricity will do for everybody all that it can now do for anybody, and in which it will do a multitude of things of which we have not yet even dreamed.



Dr. Willis R. Whitney, Director of Research at the General Electric Company of New York, to which we are indebted for this photograph.

The progress in the last 90 years or so seems truly astonishing when we look back. We think of the incredulous wonder that filled people's minds on that spring day of 1844 when Samuel F. B. Morse sat at a telegraph key in Washington, and transmitted to Vail, in Baltimore, in a fraction of a minute, the historic words: "What hath God wrought!" It was years before the public generally could believe that the telegraph could really send messages instantaneously. Even more astonishment was felt in regard to the telephone, which slowly made a place for itself after Alexander Graham Bell's memorable sentence—the first telephone message—spoken in his garret workshop in Boston one June day in 1876: "Mr. Watson, come here, I want you!" It was a long time before people stopped shaking their heads about those who ventured to invest money "in the machine that talks over a wire."

The late Thomas Alva Edison, persevering stout-heartedly in his efforts to place the electric light in the homes of America, was obliged to endure ridicule from all sides. When the incandescent electric lamp finally appeared in 1879, and was seen by the country at large from 1882 onward, people called it, in wondering amusement, "the red-hot hairpin in a bottle." About the same time street cars propelled by electric motors first began to travel through large cities. Many managers of horse-car services almost refused to believe their own eyes, and insisted: "If you want to make a car go, you must put something in front of it to pull it. You might as well talk of putting one of our horses inside the car!"



Alexander Graham Bell.

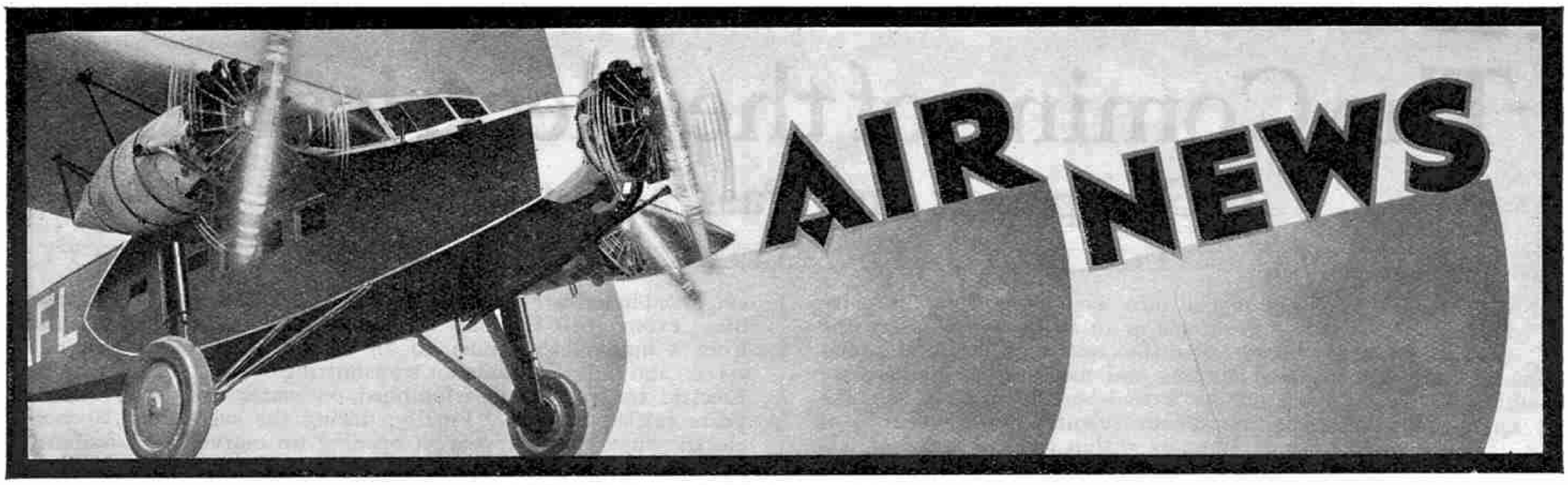
Between 1890 and 1900 the electric motor began to drive machinery of every description, and electric pictures were born in which living beings actually moved. Soon afterwards electric heat began to be employed in industry, and in a small but growing degree in domestic life. From 1910 to 1920 communication without wires passed from a nine-days' wonder to an everyday practice, with radio speech and radio facsimile for transmitting documents and pictures. Electric transportation triumphed on water as it had done 30 years earlier on land. Finally, during the succeeding 10 years, electric supervision appeared, opening up marvellous possibilities of control of machinery by electronic tubes.

Even now there is no halt, nor even any sign of a halt. Since the present decade opened, the electric doctor has emerged in definite outline from the mist of the immediate future. With the most powerful X-ray tubes so far known, yet easily and effectively controlled, and with a machine for producing electric fevers at will, also under absolute control, the physician of 10 years from now will be in a better position than ever before to wage deadly war on disease. He will do this in a golden era, in which electric weather will be a reality in dwelling houses and in buildings of all kinds, with the temperature and humidity preserved in their proper relations throughout the year, and with the dust washed from the air before it is breathed—all without human supervision. Electricity then will be so cheap that there will be no excuse for not using it for every purpose.

All these and many other marvellous things will be matters of everyday routine when the electrical age arrives in its full perfection, and yet with all this scientific and mechanical perfection the human brain will need to continue its ceaseless efforts towards still greater perfection. To quote Dr. Whitney again: "Discoveries and inventions are not terminals, they are fresh starting points from which we can soar to new knowledge. The marvels of electricity around us fill us with pride, and foolishly we imagine that we have exploited electricity to its limit. As a tool, electricity has improved every field of human endeavour, except thinking. It works, listens, records, remembers and talks—but it does not contemplate."

In Great Britain the use of electricity has increased enormously during the present century, and as much as 11,609 million units of electrical energy was generated by power stations during the year 1st April, 1931 to 31st March, 1932. The bulk of the increase has taken place since the War, and innumerable small power stations, independent of each other and each serving a local area, have come into existence to meet the general demand for electric power. These stations vary a good deal in the type of current they supply and the smaller and less efficient of them are now being closed down, and the generation of electricity at standard frequency is being concentrated in a limited number of large and powerful stations selected or specially built for this purpose. This scheme is being carried out under the direction of the Central Electricity Board, and is the beginning of a great development that will provide electrical energy at a cheap rate even in isolated parts of the country. The scheme is popularly referred to as the "Grid" transmission system.

Thomas A. Edison.



The Prince of Wales' New Machine

The Prince of Wales has acquired a machine of the Vickers "Viastra" type for his own personal use. It is an improved edition of the machine that was described and illustrated on page 678 of our issue for September 1932 and is equipped with two Bristol "Pegasus" engines of the type used in setting up the world's altitude record. It is capable of a range of some 1,050 miles.

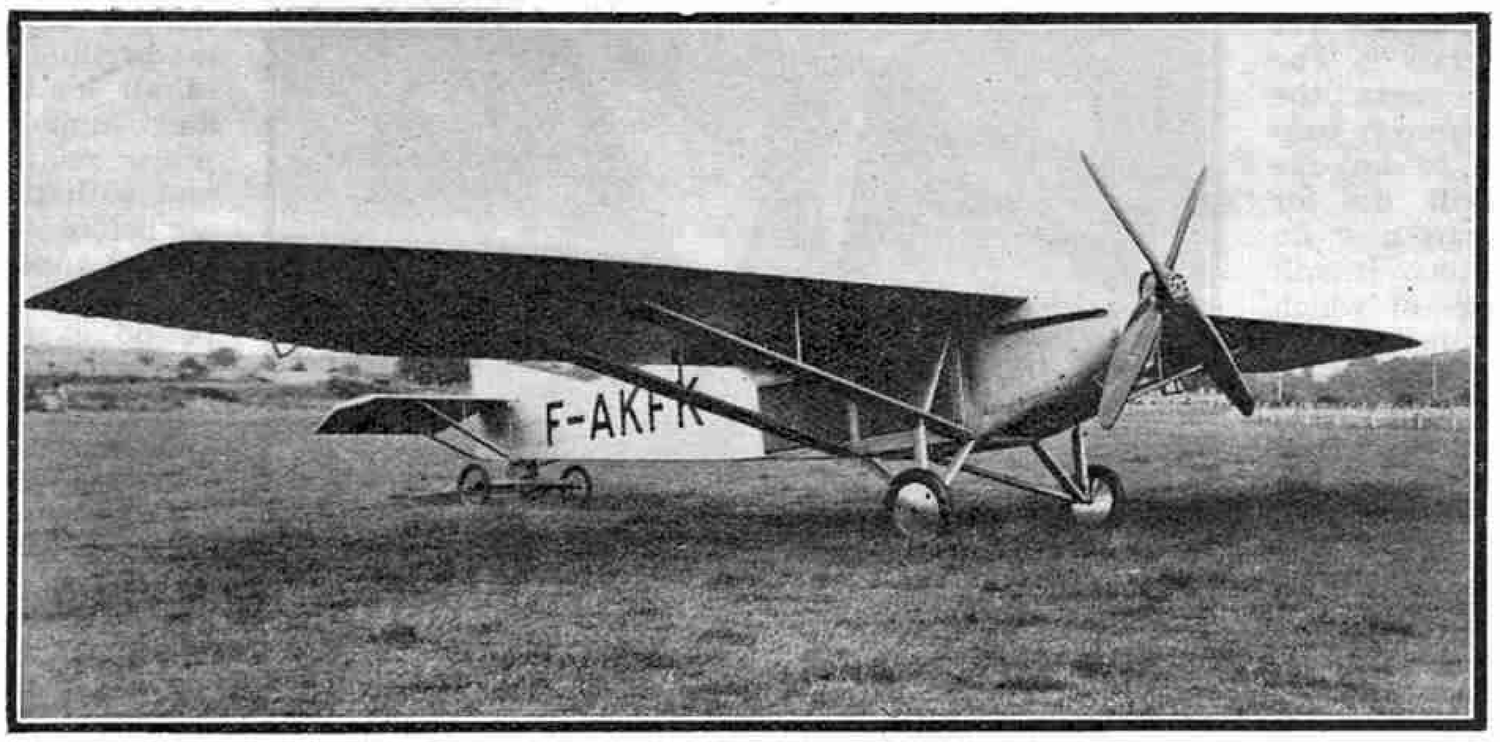
The machine is provided with a well-equipped dashboard all the instruments on which are illuminated, and a particularly interesting feature is that a red "bullseye" continues to shine in front of the pilot until the rear door is safely locked. A landing searchlight is carried in the left wing, and this can be operated by remote control from the pilot's seat. In the outfitting of the cabin much ingenuity has been displayed to reduce noise. Among other things a layer of chamois leather and another layer of what are known as "dry zero blankets" are provided, while there is also a fireproofed air-tight paper partition. It is claimed that the cabin is quieter than a carriage in an express train, and owing to the fireproofing of all material, smoking in it is quite safe.

Inside the cabin are six parachutes, carried in the actual cabin roof, while an additional two are available under removable tip-up seats. At the rear end of the cabin is a small compartment for writing, containing a panel that forms a table for a typewriter when necessary. There is a luggage compartment in the rear, and this can be reached from the cabin when the machine is in flight. It contains a small refrigerator plant, and stowage for a portable typewriter and a gramophone and records. Spats are fitted over the under-carriage wheels and the tail wheel.

The new machine is lettered G-ACCC. It has a span of 70 ft. and is 45 ft. 6 in. in length, the cabin being 15 ft. 9 in. long, 5 ft. wide and 6 ft. 1 in. high. It has a cruising speed of 130 m.p.h. and a normal range of 700 miles, but an additional tank may be mounted under the fuselage, when the range is increased to 1,050 miles.

New British Aircraft Hallmark

The British Certificate of Airworthiness is rapidly acquiring the significance in aviation that the phrase "A.1 at Lloyds" has in the marine world, and in order to identify all commercial aeroplanes that have obtained this certificate a new official mark has been issued by the Air Ministry. This consists of a golden lion rampant enclosed in three rings of red, white and blue, with the words "British Certificate of Airworthiness" inscribed within the white ring. The first of these new marks has been affixed to the Imperial Airways liner "*Astraea*," one of the four-engined Armstrong Whitworth "Atalanta" air liners of the type designed for use on the Africa route between Cairo and Capetown, and on the India-Singapore route.



The Farman monoplane F.1000. This interesting machine was specially built for experimental flights in the stratosphere, at altitudes of 15,000 m. or nearly 50,000 ft.

Light Aeroplane Speed Record

By covering a 100 km. circuit at a speed of 333.765 km.h., or about 207.268 m.p.h., the French airman M. Delmotte has set up what is claimed to be the world's speed record for light aeroplanes. M. Delmotte was flying a Caudron monoplane equipped with a specially developed Renault Bengali engine. It is interesting to note that on the same day that this record was set up another French aviator, M. Arnoux, had set up new figures in a Farman monoplane also fitted with the Renault Bengali engine. M. Arnoux' speed was 303.387 km.h. or 188.4 m.p.h. The previous record was held by Mr. H. S. Broad who, on 24th August, 1927, covered the 100 km. circuit at a speed of 300.1 km.h., or 186.36 m.p.h., in the D.H. "Tiger Moth" middle wing monoplane.

Pusher-Engined Monoplane

In the early days of flying the pusher-engined aeroplane was very popular. During the War the tractor engine was more used, and when peace came the majority of designers continued to place the engines in the noses of their machines. The old pusher type had many advantages, however, the most outstanding ones being the better view obtained from the cockpit, the absence of slipstream round the cockpit, and the reduction of noise that reaches the passengers.

Because of these facts an interesting two-seater high wing pusher monoplane has been produced by two British aeronautical engineers. It is known as the S.M.1, the initials standing for Mr. W. S. Shackleton and Mr. Lee Murray, the two collaborators. So far only an experimental model has been produced. This is equipped with a 70 h.p. four-cylinder-in-line inverted air-cooled German Hirth engine, which gives the aeroplane a maximum speed with full load of 90 m.p.h., a cruising speed of 75 m.p.h., and a landing speed of 35 m.p.h. The machine has a range of 250 miles and an endurance of 3¼ hours, and is 40 ft. in wing span, 25 ft. 7 in. in length, and 12 ft. 9 in. in overall span when the wings are folded back. We hope to publish photographs and further details of this aeroplane in a future issue of the "*M.M.*"

London-Karachi Service Extended

On 1st July last the London-Karachi service of Imperial Airways was extended to Calcutta. This is another stage in the setting up of an air mail service between England and Australia. It is hoped that on 1st October next still another step will be taken by extending the service to Rangoon, and that by Christmas it will reach to Singapore. The Imperial Airways section of the Australian service will terminate here, for the mails will be flown from Singapore to Darwin, in Australia, by an Australian company. The extension to Calcutta is flown in one day, and is operated by machines of the Armstrong Whitworth "Atalanta" type. These aeroplanes will be used on all the sections east of Karachi.

The Short "Singapore Mark 11"

Details are now available of the Short "Singapore Mark 11" flying boat, which was briefly described on page 371 of our issue for May 1931, and is illustrated on this page. The flying boat is a service machine of the high performance type, capable of making long reconnaissance flights over the open sea. It is provided with four Rolls-Royce engines, mounted in tandem in two nacelles situated in the gap between the planes, Rolls-Royce "Kestrel 11 M.S." engines being employed at the rear and "Kestrel 111 M.S." at the front. The difference between the two engines is in the gearing, and they are used in this way to compensate for the fact that one airscrew works in the slipstream of the other. Some idea of the efficiency of the engines may be gauged from the fact that when fully loaded the "Singapore" is able to maintain height with only the two rear engines running. It is interesting to note that a new system of supporting the engine nacelles was used in this flying boat, only two interplane struts being employed. This greatly reduces unnecessary drag on the machine, and was regarded as very daring when the machine first appeared some three years ago.

The Short "Singapore Mark II" flying boat, details of which are given on this page. It is fitted with four Rolls-Royce "Kestrel II" engines mounted in pairs in tandem. Photograph by courtesy of Short Bros. (Rochester & Bedford) Ltd.

The boat is provided with five cockpits, one right in the nose, an enclosed cabin for the two pilots, two gun positions behind the planes, and a final one built on to the tail behind the rudder and tailplane. Immediately behind the pilots' cockpit is a compartment for the navigator, the radio operator and the engineer, and behind this the living space for the crew, which is provided with folding bunks. There is also a galley fitted with a cooking range. The boat is provided with space for a work bench, and for dinghies, ladders and other necessary equipment.

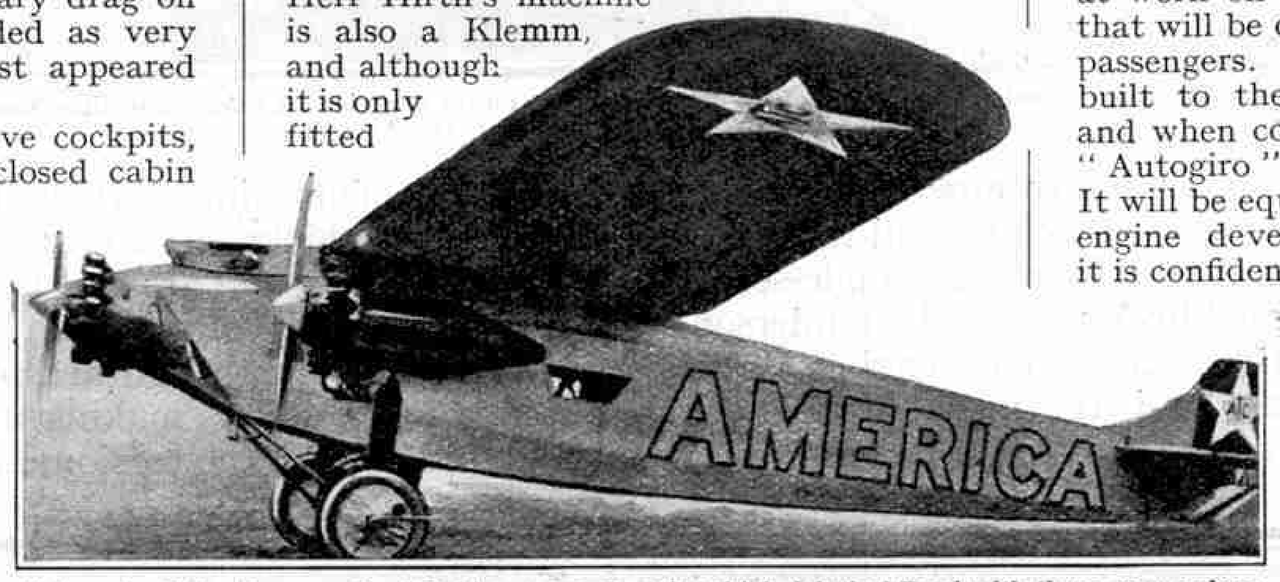
The machine has an overall span of 90 ft., and the span of the lower wing is 73 ft.; the overall length is 64 ft., and the overall height 24 ft. 3 in. When loaded normally the boat is 27,750 lb. in weight, the disposable load, including fuel and oil, being 9,400 lb. It is capable of being flown at a maximum all-up weight of 32,000 lb. and when carrying normal load has a maximum speed at 2,000 ft. of 138 m.p.h. and a maximum speed at 10,000 ft. of 125.5 m.p.h. The maximum rate of climb is 680 ft. per minute, the service ceiling is 12,200 ft., and the range 1,100 miles.

* * * *

The Liverpool Municipal airport at Speke was opened on 1st July last by Lord Londonderry, Secretary of State for Air. It covers 284 acres, and is the largest civil aerodrome in the country.

Towing an Aeroplane

If the engine of a motor car breaks down when the vehicle is on the road, it is customary for the car to be towed home behind another machine. This procedure is not usually thought of in connection with aeroplanes, but a British pilot, Mr. A. B. Gibbons, attempted to have his machine towed to England when he experienced trouble with the engine in Germany. Mr. Gibbon's machine was a Klemm low wing monoplane fitted with a Pobjoy engine, and the German pilot who was going to tow him to this country was Herr Wolf Hirth, who conducts a gliding and sailplaning school in Silesia. Herr Hirth's machine is also a Klemm, and although it is only fitted with a 60 h.p. Hirth engine, a number of test flights were successfully made with Mr. Gibbons' machine towed at the end of a wire cable about 100 yds. in length. Owing to the small power of the Hirth engine it was only possible to exceed by a very small margin the minimum flying speed of the machine, but a height of 200 ft. was reached after climbing at a speed of 47 m.p.h. for 15 minutes. It was found that the maximum speed that could be obtained when the machines were flying level was 48 m.p.h.



"America," the three-engined Fokker monoplane in which Admiral Byrd with three companions flew across the Atlantic Ocean.

The project was eventually abandoned owing to the fact that it would have been necessary to find a chain of aerodromes sufficiently large and good enough for the delicate take off required, within 100 miles of each other. Many aerodromes would have been satisfactory, but one stretch of the flight would have had to be made over an area more than 100 miles in length where there was no suitable aerodrome.

Europe's Fastest Air Liner

The Wibault Penhoet 282.T.12 that is now in operation on the cross-Channel service of Air Union, the well-known French air line company, is claimed to be the fastest multi-engined air liner in Europe, and to be capable of flying from London to Paris in 105 min. It is a low wing cantilever monoplane, employing three Gnôme-Rhône "Titan-Major" engines, each of which develops 280 h.p. It has an all-up weight of 13,552 lb. and is capable of carrying 12 passengers at a maximum speed of 165 m.p.h. for short periods. Its cruising speed is 140 m.p.h. and the normal range 625 miles.

The new Penhoet machine can maintain flight with full load with one engine out of commission, and is provided with apparatus so that in case of emergency the two petrol tanks with which it is equipped can be quickly jettisoned. This greatly reduces the dangers of fire in the event of a crash.

"Autogiro" To Seat Five

The Cierva Autogiro Co. Ltd. are now at work on an experimental "Autogiro" that will be capable of accommodating five passengers. The new machine is being built to the order of the Air Ministry, and when completed it will be the largest "Autogiro" yet built in this country. It will be equipped with a radial air-cooled engine developing about 500 h.p., and it is confidently expected that the machine will have a maximum speed of more than 160 m.p.h., a cruising speed of about 130 m.p.h., and a minimum flying speed of about 20 m.p.h. Further details will be published in due course.

Air Race to Australia

An air race from London to Melbourne is to be held in the Autumn of 1934 in connection with the centenary celebrations of the City of Melbourne. Machines of any nationality may be entered for the race, and there is no restriction on the power or types, or upon the number of the crew. No addition can be made to the crew during the journey, however. The race is to start on 20th October 1934, and all machines must call at five control points during the flight. These have been provisionally fixed as Baghdád, Calcutta, Singapore, Darwin and Charleville. The machines may of course land at other points if necessary. They may be refuelled in the air if desired, and there is no restriction against night flying.

* * * *

A D.H. "Dragon" equipped with two "Gipsy Major" engines has been purchased by West Australian Airways Ltd., and put into service on their Northwest route between Perth and Derby.

British Aircraft Developments

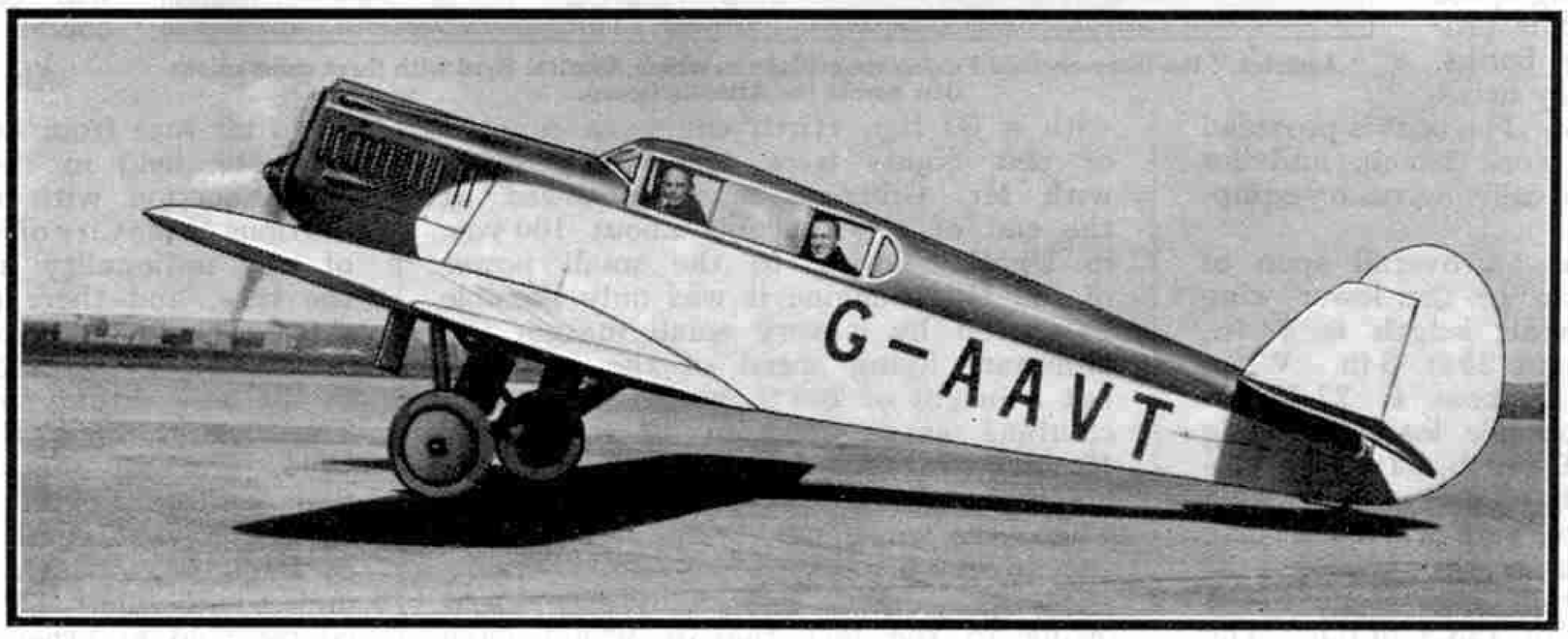
VI.—Low Wing Cabin Monoplanes

ON page 108 of our issue for February 1933 we published an illustrated article describing three modern low wing monoplanes. Among other machines mentioned in the article was the Hendy 302, and this month we describe this aeroplane, the Percival "Gull."

In the previous article we drew attention to the rapid increase in popularity of the low wing monoplane during the last few years. This fact is particularly noticeable in regard to low wing cabin monoplanes, for although when the Hendy 302 first appeared in 1930 it was the only low wing light cabin monoplane then constructed in this country, there are now about eight.

The Percival "Gull," showing how the top of the cabin and a flap on the port side are removed to allow easy access. Photograph by courtesy of the Editor of "The Aeroplane."

The Hendy 302 is a two-seater machine and its design was based upon the Hendy "Hobo," a single-seater low wing monoplane designed by Mr. Basil H. Henderson, and equipped with an A.B.C. "Scorpion" engine. This was constructed in 1929, and its most noteworthy feature was that its wings were built on a new patented principle invented by Mr. Henderson. The little machine was so satisfactory in service that designs for a two-seater incorporating the new method of wing construction were immediately produced.



This two-seater Hendy 302 was the first low wing light cabin monoplane to be built in this country. For the photograph we are indebted to the Hendy Aircraft Company.

The Hendy 302 was completed in time for the 1930 race for the King's Cup. The performance of the machine, which was equipped with a "Cirrus Hermes" engine, was excellent throughout, but owing to the failure of the compass fitted the proper course was not followed and the aeroplane finished 24th, having flown at an average speed of 121.5 m.p.h. The section of the race from London to Manchester was completed in very good time, and if the same speed had been maintained over the whole course, the 302 would undoubtedly have secured second place in the race.

The 302 is a cantilever machine, and although it is provided with a cabin that shelters the two occupants, if desired the hinged top may be lifted off and the machine turned into an ordinary open touring aeroplane. The seats are arranged in tandem, and an excellent view is obtained both by the pilot and the passenger. The machine is almost entirely of wood construction, metal being employed only for the undercarriage, the engine mounting and a few special fittings. The wings, which taper towards the tips in chord and thickness, are attached direct to the bottom of the fuselage and are covered with fabric. The unique feature of their construction is that the two main spars are of equal depth and are placed close together, while thin wooden strips, making up a sort of lattice bracing, are used to take the torsional and drag loads. This type of construction has the effect of enabling very high torsional stresses to be withstood, while the whole construction is exceedingly simple.

The fuselage, also built of wood, is of normal rectangular structure, the "roof" being domed. A normal monoplane tail unit with a rudder of the balanced type is provided, while the undercarriage is of the split type, normal telescopic legs and oleo gear being provided. The wheels are equipped with brakes.

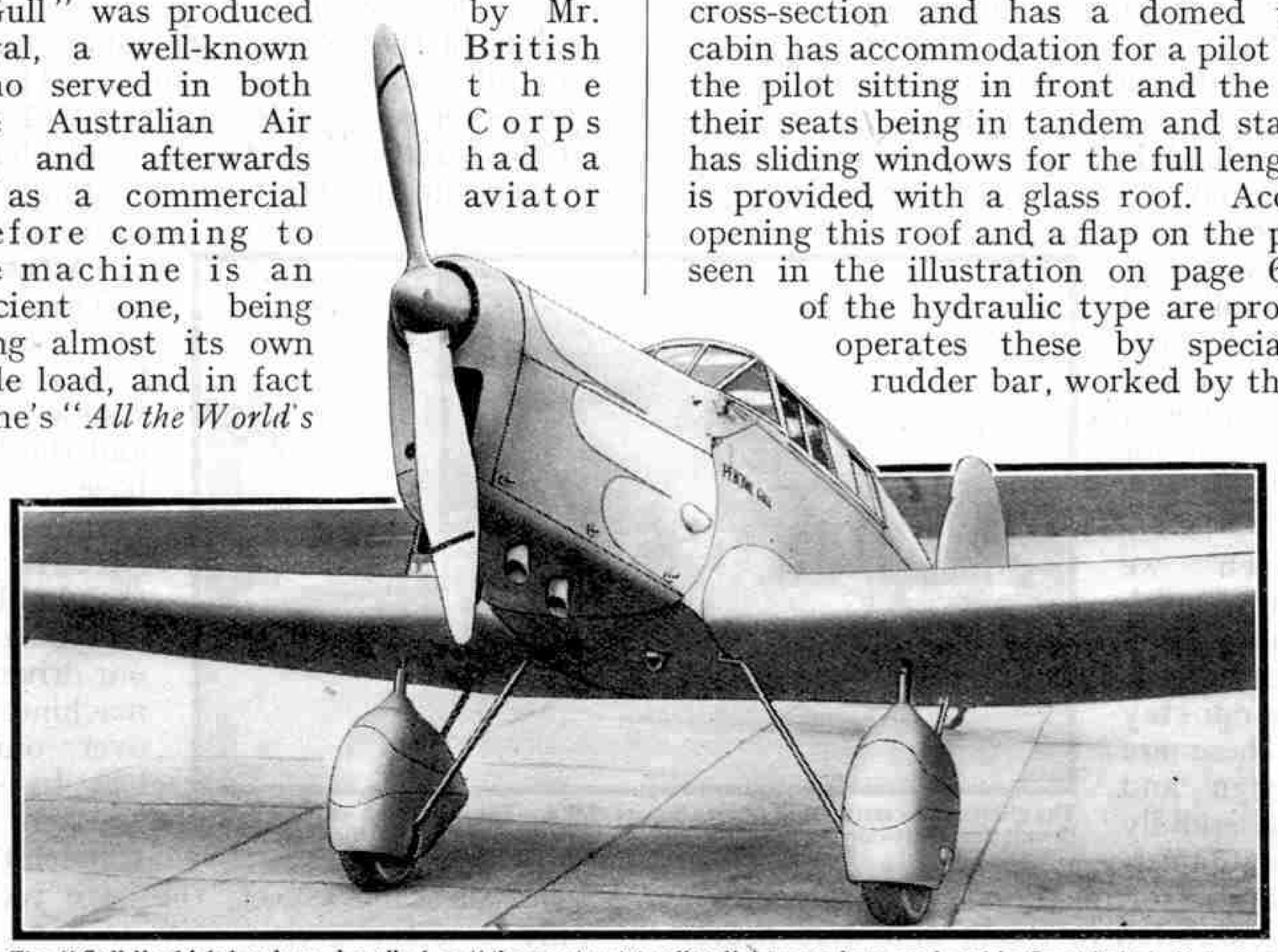
The standard engine used is the four-cylinder-in-line

air-cooled "Cirrus Hermes," which develops between 105 and 115 h.p. The fuel is carried in a tank mounted in the wing, and this has a capacity of 16 gallons but an additional tank capable of carrying nine gallons, and of the gravity feed type, is provided in the fuselage. If required a still further tank with a capacity of 16 gallons may be added. The machine is 35 ft. in span and 22 ft. 10 in. in length, and its wing area is 178 sq. ft. When empty it weighs 1,045 lb. and when fully loaded 1,600 lb.

Side view of the "Gull." The photographs of the "Gull" that appear with this article show the machine fitted with the new Napier six-cylinder-in-line air-cooled and inverted engine that develops 150 b.h.p. at 2,000 r.p.m. For the illustrations on this page we are indebted to Mr. Edgar W. Percival, M.I.Ae.E.

The maximum speed is about 132 m.p.h., the cruising speed is 112 m.p.h., and the stalling speed 37 m.p.h. The aeroplane is capable of climbing at a speed of 850 ft. per minute immediately on taking off from an aerodrome, and it can climb to 5,000 ft. in 7.1 min. The service ceiling is 16,000 ft. The fuel consumption is 6 gallons per hour, which means that at the normal cruising speed of 112 m.p.h. a distance of 19 miles can be covered on a gallon of fuel.

The Percival "Gull" was produced by Mr. Edgar W. Percival, a well-known British private owner who served in both the Corps British and the Australian Air had a aviator during the War, and afterwards successful career as a commercial in Australia before coming to England. The machine is an exceptionally efficient one, being capable of carrying almost its own weight of disposable load, and in fact it is described in Jane's "*All the World's Aircraft*," the standard reference work on new aircraft, as being "probably the most outstanding light aeroplane produced in Great Britain" during 1932. It has also been calculated that the aerodynamic efficiency of the "Gull" is greater than that of the Vickers-Supermarine Rolls-Royce Schneider seaplanes!



The "Gull," which has been described as "the most outstanding light aeroplane produced in Great Britain" during 1932. The machine illustrated has a maximum speed of 165 m.p.h.

Like the 302, the "Gull" made practically its first public appearance in a King's Cup Air Race. This was in 1932, and although no place was secured, the 1,200 miles of the course were covered at an average speed of 142 m.p.h.

The "Gull" is a three-seater cabin monoplane of the low wing cantilever type. The plane is built in two sections or wings, which are attached to special stubs built into the fuselage. The overall span is 36 ft., but when necessary for garaging purposes the wings may be folded back to give an overall width of 12 ft. 10 in. The wings are made of wood, covered with fabric, and are of the same patented Henderson construction that is used in the Hendy 302. Two petrol tanks are carried in the wings at the inner ends, and they have a total capacity of 40 gallons, which is normally sufficient to give a cruising range of about 700 miles. The oil tank, which is carried in the port wing, is capable of holding three gallons, and is situated in the leading edge so that it acts as an oil cooler.

The fuselage is of very simple construction, consisting of a "box" made up of light spruce stringers and struts covered with three-ply. It is rectangular in cross-section and has a domed top. The enclosed cabin has accommodation for a pilot and two passengers, the pilot sitting in front and the passengers behind, their seats being in tandem and staggered. The cabin has sliding windows for the full length of each side and is provided with a glass roof. Access is obtained by opening this roof and a flap on the port side, as may be seen in the illustration on page 602. Wheelbrakes of the hydraulic type are provided, and the pilot operates these by special controls on the rudder bar, worked by the toes. All the rods and cables coming from the controls are carried along the floor of the cabin in a box. The undercarriage is of the divided type, each wheel being carried on a short axle and arranged with two springs on each side.

Early models of the "Gull" are equipped with the "Cirrus Hermes" engine, which gives a maximum speed of 145 m.p.h., a cruising speed of 125 m.p.h., and a landing speed of 42 m.p.h. The latest version, however, uses the new Napier six-cylinder-in-line air-cooled engine, which gives the machine a speed of 165 m.p.h.

FROM OUR READERS

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

My Visit to Denmark

Some time ago I visited Denmark, as one of a party making the voyage across the North Sea from Harwich to Esbjerg in a motor vessel. At first it was rather enjoyable at sea, but the wind rose, and by nightfall our enjoyment had vanished, overcome by the stormy seas! At length we reached Esbjerg, and there were faced with a long railway journey to Copenhagen. We travelled all night by train across land and water, for there are many islands in Denmark, and the crossings were made by means of special train ferries.

The town of Rönne, in Bornholm, a Danish island in the Baltic Sea. Photograph by J. F. Rigg, Sanquhar.

Copenhagen is on Zealand, the largest of the Danish islands, and when we reached the city the sun was shining brilliantly and everything seemed charming and beautiful. The Danish capital is clean and tidy in appearance and its splendid roads are well-planned and spacious. Single-decked electric tramcars running in pairs provide an easy means of transport, but I was surprised by the large number of bicycles to be seen in the streets. In many cases it seemed as if every member of the family used a bicycle for afternoon shopping and visiting.

From Copenhagen we travelled to other Danish towns and cities, and entered many wonderful cathedrals and churches during our stay in the country. These are magnificent in design and their interiors are splendidly decorated. We were interested also in ancient Danish fortifications and the paintings of Danish warriors exhibited in them, and were nearly lost in the huge dungeons of some of these castles.

The gharrys, or carriages, in Gharry Square, Jaffa. The policeman on point duty is thoughtfully provided with shelter from the burning heat of the Sun's rays. Photograph by H. H. Marsh, Kirkby.

The countryside and other cities and towns in Denmark are as attractive as Copenhagen itself. The country is flat, and hedges and walls are absent from the fields, which are intensively cultivated. Great use is made of electricity, and even farms at considerable distances from populous centres are well supplied with power, which is employed to great advantage.

J. F. Rigg (Sanquhar).

A Trip from Jerusalem to Jaffa

One sultry afternoon I suddenly resolved to leave the heat of Jerusalem and to enjoy myself for a time in the salt waters of the Mediterranean Sea. I boarded an omnibus on which I could travel to Jaffa for the small sum of 16 piastres, or about three shillings, taking with me only a bathing costume, a towel and a small camera.

It was splendid to breathe the clear fresh air on the road from Jerusalem, but the temperature rose as we descended towards the plains. After we had negotiated a series of formidable road bends, known locally as the "Seven Sisters," the sea became visible in the distance, the shore-line being marked by sandhills and a line of mist. The road then passed through a gorge named Bab el Wad, which means "Gate of the Valley," into the plain of Sharon. There camels grazed on the stretches of stony land, their keepers drowsily resting in the shade of cactus and palm trees.

The omnibus now ran quickly along a straight road to Ramleh, which was just visible behind clumps of firs, and the hangars of a R.A.F. base. I obtained a splendid view of an Imperial Airways liner as it rose from the landing ground before the hangars, and for a time our driver kept pace with the machine. Then it passed over our heads and was lost to sight.

After passing through Ramleh the scenery took on a more pleasant aspect, the bare rock and sand of the hilly country giving way to long stretches of green on each side of the road. These stretches were orange groves, and in them were Jews planting young trees in the sandy soil in order to form new groves. The young trees were brought in baskets in a cart, and were simply thrust into freshly-dug holes, ready to be more firmly planted on the following day.

Eucalyptus trees now lined the road, with masses of prickly pear at intervals, and soon I could see the

palms of Jaffa itself, their fronds nodding in a sea breeze that to me was very welcome. A few minutes later the omnibus pulled up in front of a large building between Jaffa itself and Telaviv, its more modern suburb, and I stiffly descended. I did not stay long in the town, for it was extremely hot. Instead I entered an omnibus that was starting for Campbell's Pools, a popular swimming place on the beach, and very soon was immersed in salt water, the heat forgotten.

H. H. MARSH (Kirkby).

Fox Cubs as Pets

A Somersetshire farmer recently found five fox cubs in a hollow in a tree and decided to capture them. He barricaded the opening of their lair and went to prepare for their housing in captivity. When he returned, the wily mother fox had managed to assist three of the cubs to escape.

Jack and Jill, two fox cubs that were on friendly terms with the fox terriers shown in our illustration. Photograph by V. Chamberlain, Bath.

The remaining cubs were taken to the farmhouse, and were given the names "Jack" and "Jill." They made excellent progress, with the assistance of a feeding bottle, and soon began to romp about the kitchen in which they lived, and even to climb up the old-fashioned chimney. The most astonishing development was the formation of a firm friendship with two fox terriers, one of which was renowned for its prowess in killing foxes. Needless to say the terriers were greatly interested when Jack and Jill arrived, and had to be told very plainly that they must restrain their natural instincts. They quickly learned their lesson, however, and the baby foxes had nothing to fear from them. The accompanying photograph shows that the terriers became quite accustomed to their strange acquaintances.

As the foxes grew they became increasingly restless, and spent much time looking wistfully out of the window. It was clear that they were not satisfied with life, and were longing to run in the fields and woods. It became impossible to keep them on the farm, and they were given a comfortable home in a private zoo.

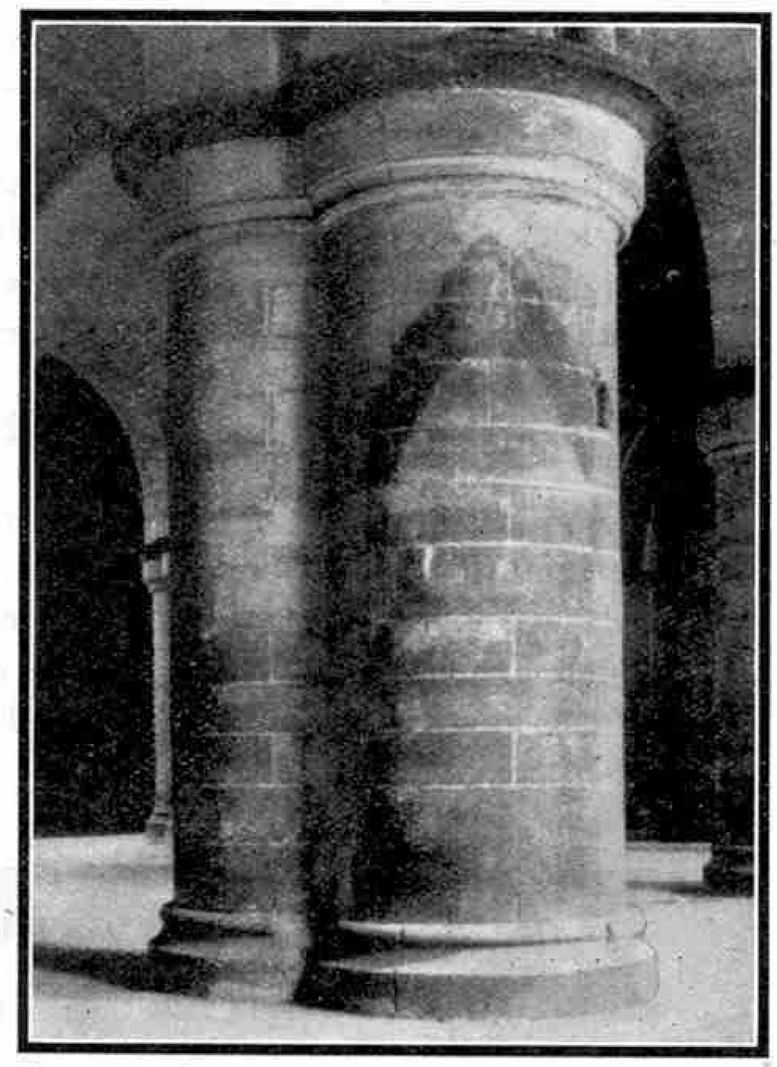
When I wished to photograph the cubs, they and the terriers were placed in a circular pen of netting, and a rabbit's paw was thrown in. The terriers merely sniffed this, but after a tussle with Jill, Jack seized it and ran triumphantly round in order to exhibit his trophy.

V. CHAMBERLAIN (Bath).

Traditions of Canterbury Cathedral

The crypt of Canterbury Cathedral is claimed to be the finest in England. It is about 200 ft. in length and is built in two sections. The part under the Choir is Early Norman, and the eastern extremity is in the Early English style, and is much loftier than the Norman portion, for it supports the Corona, which was specially built behind the High Altar and at a higher level than the Choir, in order to provide a suitable resting place for the relics of St. Thomas a'Becket.

For centuries pilgrims made offerings at the shrine of the murdered Archbishop, hoping that in return they would be relieved of some infirmity; but this came to an end with the dissolution of the monasteries in 1536, when 20 wagon-loads of gold and other riches were removed, and the relics destroyed or, as some think, secretly removed and concealed in the crypt.



The ghostly form of Archbishop Becket on a pillar in the crypt of Canterbury Cathedral. Photograph by D. M. Smith, Hampstead.

After his cruel murder on 29th December, 1170, the Archbishop was hastily buried in the eastern part of the crypt. A few feet from his grave is a rounded pillar, and when seen from a particular spot, markings on this pillar take the form of a representation of the Archbishop himself. It seems as if the martyred Primate refuses to desert his burial place. The floor of the crypt at this point is always damp, and tradition has it that the moisture represents tears of penance shed by Henry II, whose rash words led to the murder, for he allowed himself to be scourged there by the priests and monks of Canterbury.

The Black Prince, one of the most romantic figures in history, was closely associated with the Cathedral. When he married Joan, the Fair Maid of Kent, he built a special chapel in the crypt, and in it two priests were to pray for his soul during his life, and also after his death. When travelling to [illegible] from France, the Prince always visited the Cathedral in order to pray in the Chapel of Our Lady Undercroft in the Norman crypt, and at his own wish he was buried in the Cathedral on his death. His helmet and shield, and the sheath of his sword, hang over his tomb, which is near the position once occupied by Becket's shrine.

D. M. SMITH (Hampstead).

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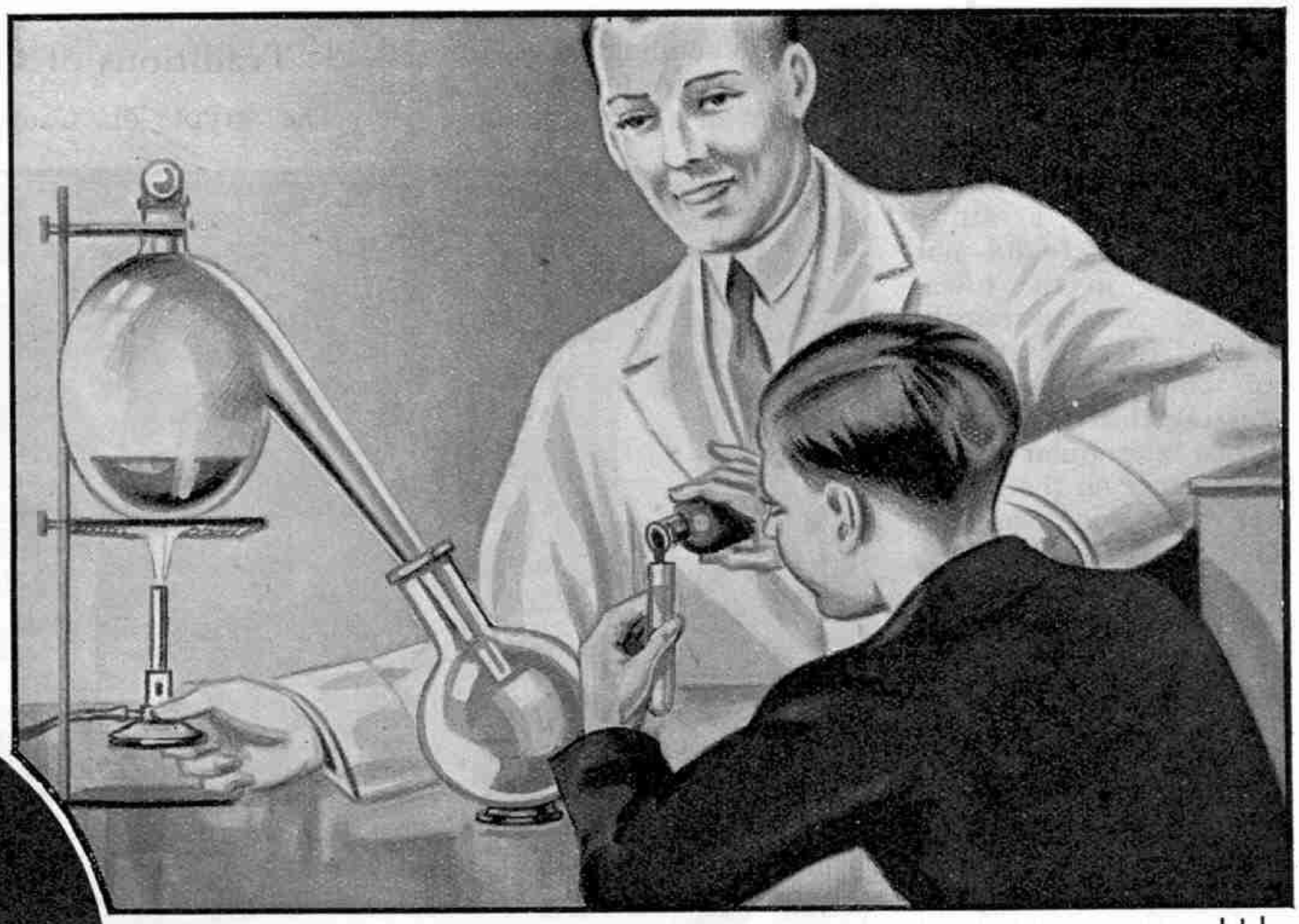

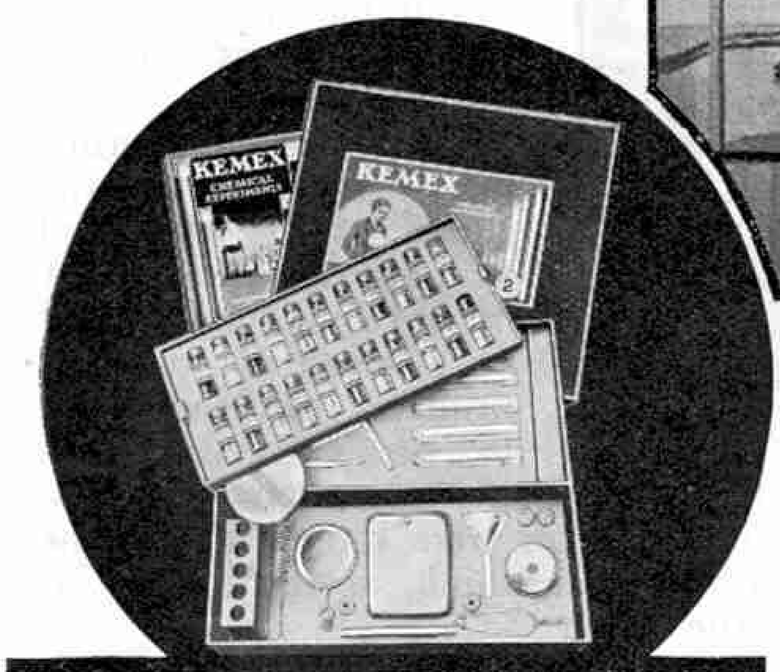

Nº2 KEMEX CHEMICAL OUTFIT

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130 Experiments

This Outfit contains a supply of specially selected chemicals, packed in airtight containers, together with a length of Magnesium Ribbon, sufficient to perform 130 attractive and varied experiments. The apparatus provided in the Outfit includes Test Tubes and a Test Tube Holder, a Glass Funnel, Filter Papers, and Glass Delivery Tubes, with a simple and highly-efficient Spirit Lamp that makes the Outfit completely self-contained.
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The contents of the new Kemex Chemical Outfits will provide many hours of fascinating fun. With the apparatus and materials contained in them a boy can make inks and soaps ; dye wool, cotton and silk, and bleach fabrics that are already dyed ; test foodstuffs for impurities ; analyse air and water ; grow crystals ; write with electricity ; smelt metals from their compounds ; make invisible inks and a chemical garden ; prepare gases, and perform a host of other interesting chemical experiments.

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The Outfits include everything necessary, and the hundreds of experiments that may be made are described in a simple manner in an attractive Manual that is included in each Outfit. The Manuals are illustrated with a series of actual photographs showing how the apparatus required is fitted up, and the manner in which each experiment is carried out.

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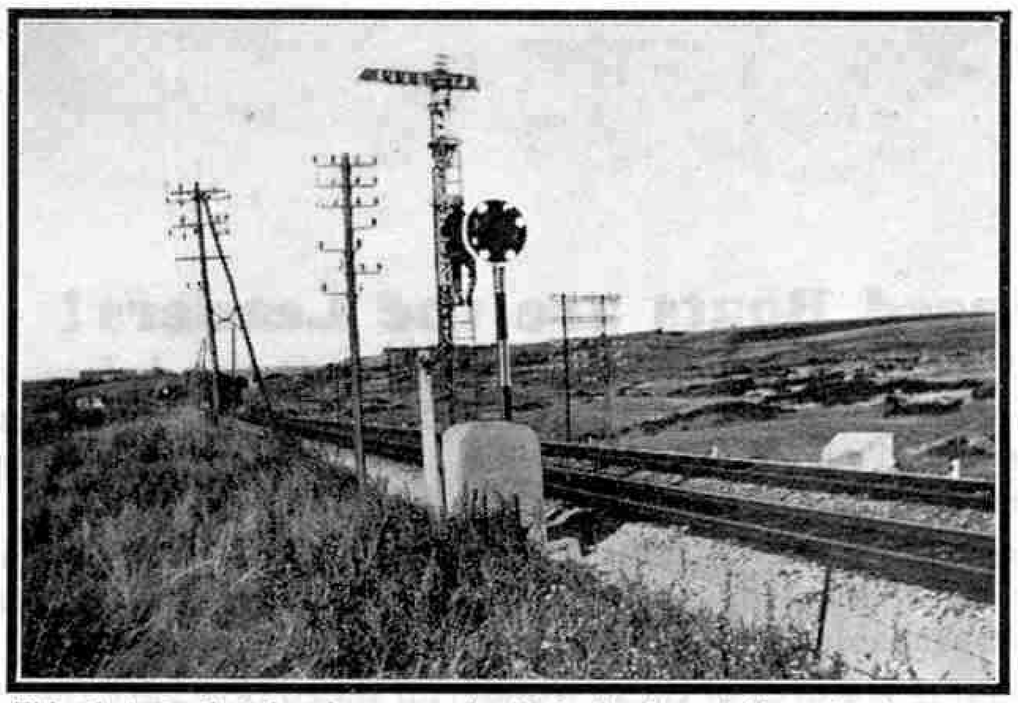
Railway Signalling in France

Varied Principles and Appliances

A BRIEF description of the signalling system in use on French railways will be of interest to our readers. This will apply particularly to those who possess Hornby Riviera "Blue Train" Sets, and possibly some of the French type rolling stock in the Hornby Series, and who may be keen to know what principles and appliances are involved in French signalling practice.

In the early days in France there was little or no uniformity in the signalling systems or appliances in use, until in 1885 a "*Code des signaux*" was drawn up. Although the companies were required to conform to this as regards the system of signalling, they were left to please themselves as to appliances, so that divergences in practice between one line and another were quite possible. This Code, in the main, has continued in force, but a reformed system is now prepared in substitution for it. Under the Code disc and rectangular board signals are largely used. These, when facing the oncoming train, as in the case of the disc signal in the accompanying illustration, are interpreted by the driver according to their various meanings. When turned parallel to the track, and thus edge-on to the view of the approaching engineman, "line clear" is indicated, for the French principle is that when no indication is actually visible—as would be the case when such boards are edge-on—"line clear" is implied. Definite "caution," "reduce speed" or "stop" indications are given by the numerous boards of various shapes and sizes.



This photograph, taken by our reader H. L. Comben of Abergele, shows two types of French railway signals. The disc signal is the "disque rouge" mentioned in this article, and the semaphore signal is the "palette annonciatrice" introduced by the Nord system to supplant it.

The oldest signal of any kind in France is the round red disc, and this has no counterpart in British practice. It is a "deferred stop" signal, in that when observed at danger or facing the driver, it calls for a stop at the next station or signal cabin, even though the signals at those points may all be showing "line clear." Certain railways commenced to use this "*disque rouge*" as a distant signal, and owing to the confusion that resulted, a special signal—outside the Code—was introduced, known as "*le damier*." This was of green and white "chess-board" design, and its function was to act as a repeater and show the position of the semaphore at the next block point. This step was evidently only a beginning, for the various companies began to disregard in details the Code as officially drawn up, and even obtained permission from the authorities to do so.

The "absolute stop" signal is a square red-and-white "chess-board," the principles of its operation being the same as for the "*disque rouge*." When it is facing the train "danger" is indicated, and when parallel to the track "line clear" is implied.

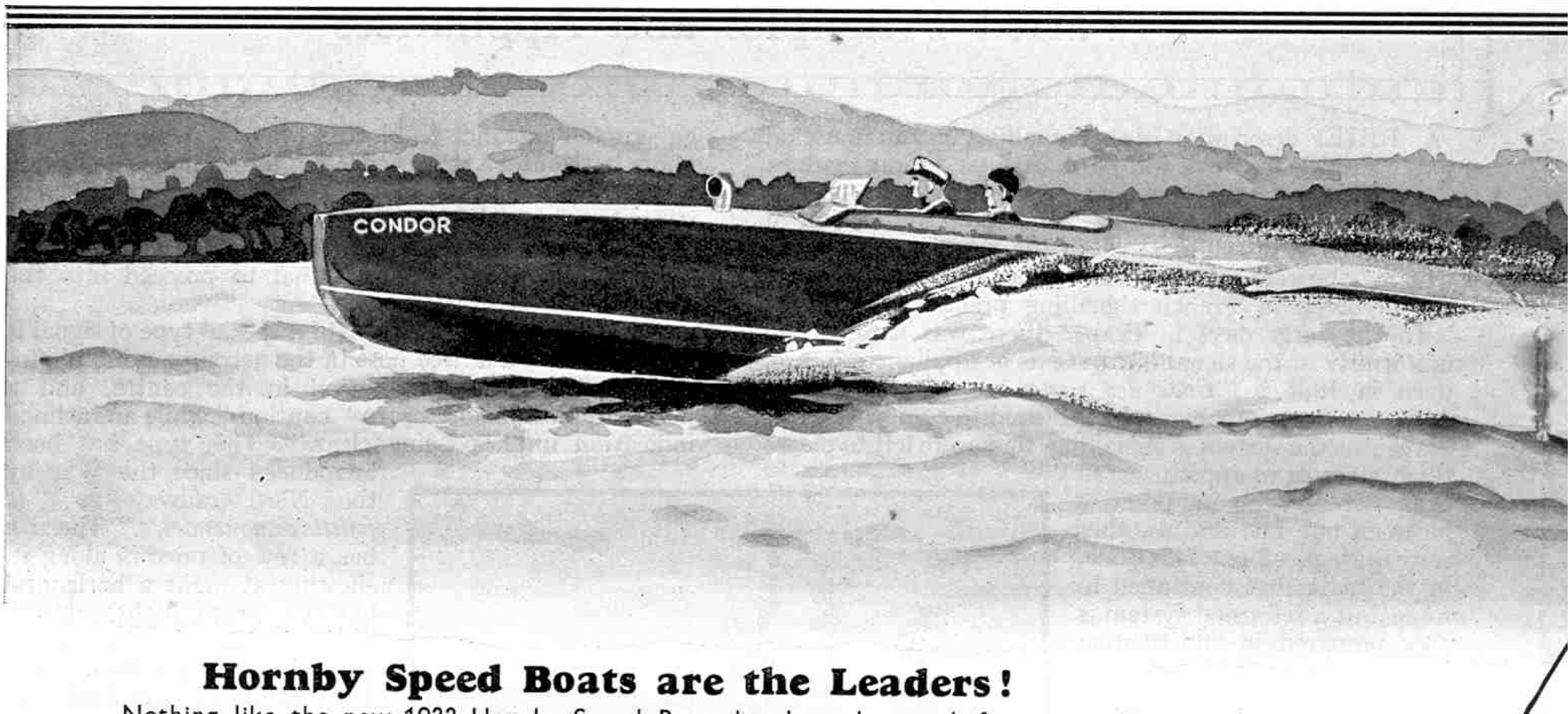
The particular function of semaphore signals is to govern the entrance to block sections. With the semaphore horizontal a stop is ordered, the section ahead being blocked by some obstacle; but provided that section is not entered, a train may overshoot the signal. When the semaphore hangs vertically downward, and is thus virtually out of sight, the signal to proceed into the next section is implied.

A very interesting example of a special type of signal is that shown on a lattice post in the accompanying photograph. The arm is balanced in the centre, and a horizontal indication means "caution" while an inclined indication implies "line clear." This type has been introduced since the War by the Nord railway as "*la palette annonciatrice*." The arm has a row of mirrors along it, showing at night a horizontal bar of green light, or an inclined bar of white light, according to its position. It was introduced to supplant the "*disque rouge*," but in the photograph the two types are shown used in conjunction. The use of green as a "warning" light will be noted, and the use of a white light—corresponding to the "edge-on" position of a "*disque rouge*"—appears strange when compared with the British system.

With a view to doing away with such duplication and overlapping, a committee was appointed after the War to examine the French signalling system. As a result a reform programme has been drawn up, which provides some degree of standardisation, both as to the shapes of the signals and their meanings. Previously similar shapes of signals, differently painted, varied as to their significance. The lights displayed at night are also included in this standardisation, and the use of colour-light signals is to be extended. This reform has become particularly necessary, as in Alsace-Lorraine the signalling system is arranged on German principles. This generally simple system, and the use of green as a "clear" signal, has caused some trouble to the French drivers of the Est railway, who since the War have run through over Alsace-Lorraine metals.

An interesting point is that except in Alsace-Lorraine the "caution" indication at night is to be changed from green to yellow, so that the green light will disappear, leaving the more or less negative white light for a clear signal. Then after a time green is to be reintroduced, but this time as a clear signal, as in British and German practice. The white light will then have been replaced by green, except for siding signals. It may be noted that in Holland also green is to replace white for "line clear," with yellow for the "caution" indication

Boys! Now is the time to g



Hornby Speed Boats are the Leaders!

Nothing like the new 1933 Hornby Speed Boats has been known before in model speed boat construction. They are superb! Each model follows closely the design and general characteristics of the world's famous speed boats. All possible skill and ingenuity has been employed in the manufacture of these new speed boats.

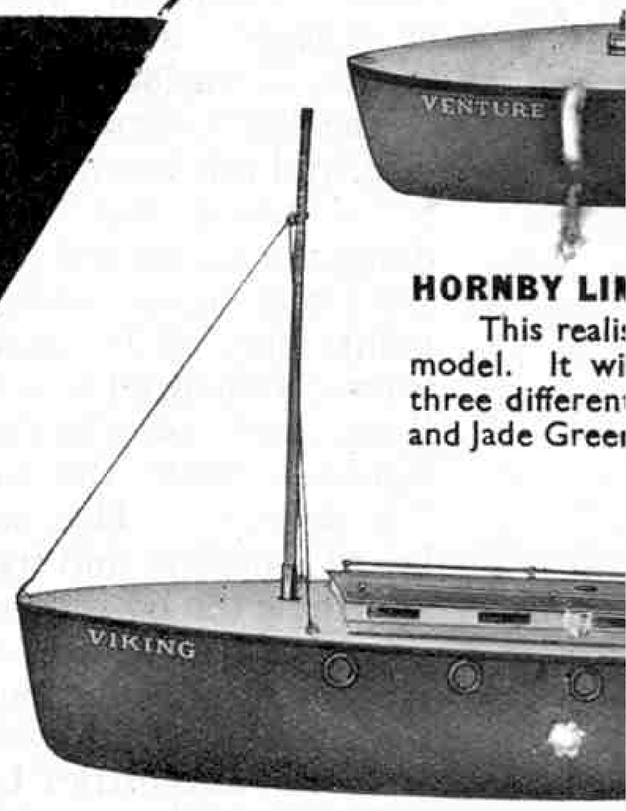
Boys who insist on speed and efficiency, plus power and sustained length of run, will choose a "Hornby." There are five splendid models, ranging in price from 3/11 upwards, each attractively finished and available in three different colour combinations.

Perhaps the most outstanding features of these wonderful speed boats are the excellent streamlined hull and fine entry lines of bow giving greater speed. No less important is the amazing length of run due to the fine mechanism by which the boats are propelled, and the unique methods of construction of the hull. A specially designed propeller ensures that turn of speed so vital when competing in local speed boat races.

Ask your dealer to show you the 1933 Hornby Speed Boats.

PRODUCT of MECCANO LIMITED LIVERPOOL

HORNBY SPEED BOATS



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This realis
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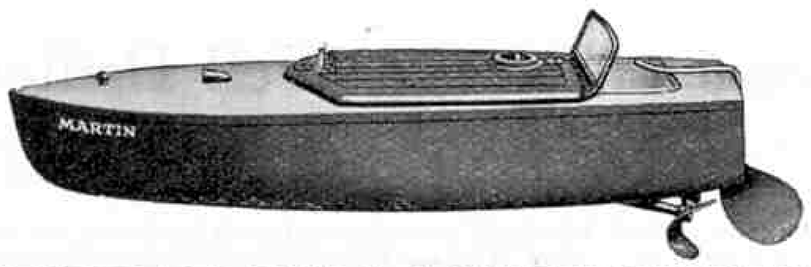
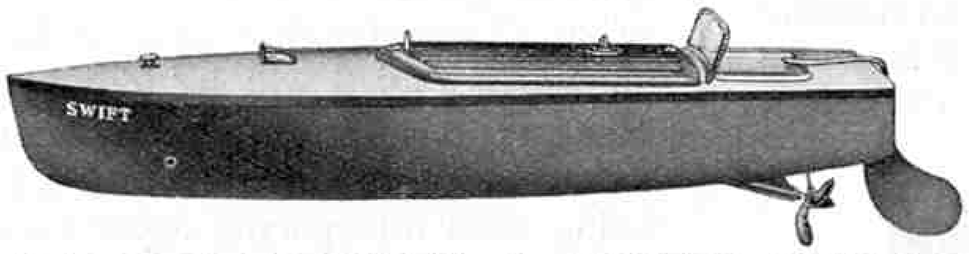
HORNBY CABIN CRUISER No. 5.
The perfect design and handsome
Cruiser Speed Boat No. 5 makes it a
It will travel over 500 feet on one windi
colour combinations—Red and Cream
Green and Ivory. Dimensions: Leng

get a Hornby Speed Boat!



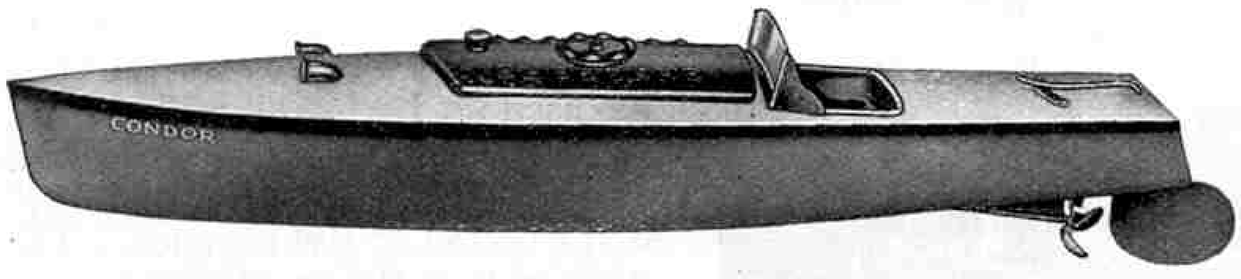
HORNBY SPEED BOAT No.1. "MARTIN." PRICE 3/11

Hornby Speed Boat No. 1 is a very efficient model, measuring 8½ in. in length and 2⅜ in. in beam. It will travel over 160 feet on one winding. Finished in three different colour combinations—Red and Yellow, Blue and White, and Orange and Green.



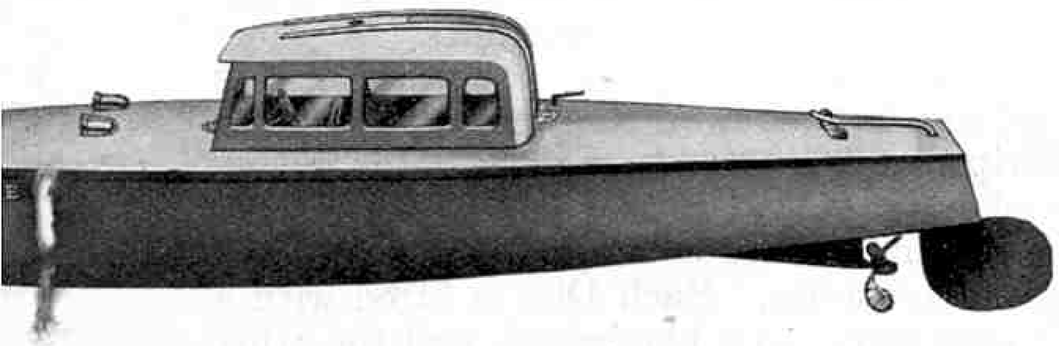
HORNBY SPEED BOAT No. 2. "SWIFT." PRICE 7/6

The exceptionally fine performance of Hornby Speed Boat No. 2 makes it one of the most popular of the Hornby models. It will travel over 300 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Yellow and White. Dimensions: Length, 12½ in. Beam, 3 in.



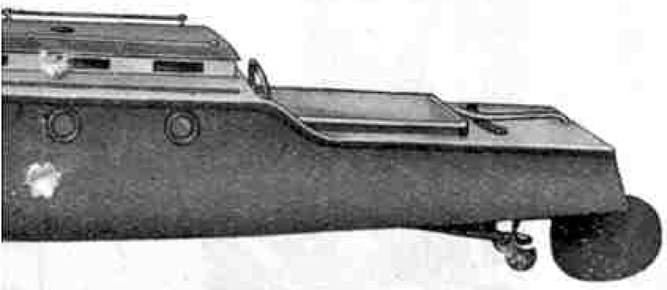
HORNBY SPEED BOAT No. 3. PRICE 12/6

Hornby Speed Boat No. 3 has already established itself as a great favourite. It will travel over 500 feet on one winding. Available with three different names and in three different colour combinations, as follows:—**"Condor"** (Red and Cream), **"Gannet"** (Blue and White), **"Curlew"** (Green and Ivory). Dimensions: Length, 16½ in. Beam, 3½ in.



BY LIMOUSINE BOAT No. 4. "VENTURE." PRICE 15/6

s realistic Hornby Limousine Speed Boat No. 4 is a magnificent It will travel over 500 feet on one winding. Finished in ifferent colour combinations—Red and Cream, Blue and White, Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in.



No. 5. "VIKING." PRICE 16/6

dsome appearance of Hornby Cabin es it a model of outstanding merit. winding. Finished in three different Cream, Blue and White, and Jade Length, 16½ in. Beam, 3½ in.

This is an illustration of the Hornby Speed Boat Club Badge. You may purchase one of these badges from your dealer, price 6d., or direct from us price 6d. post free.

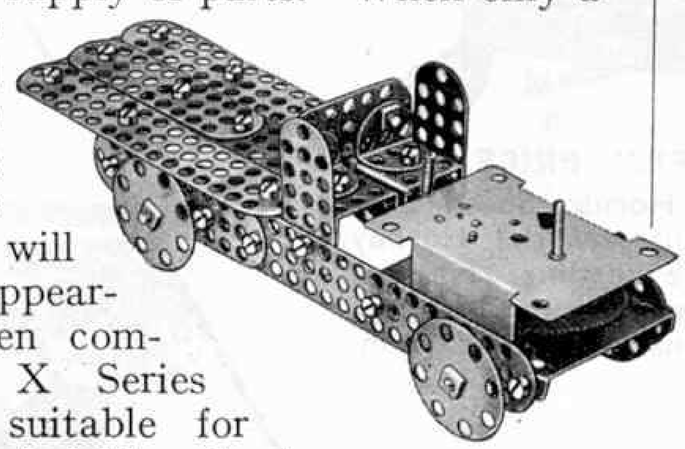
MECCANO LTD.
BINNS ROAD
LIVERPOOL 13

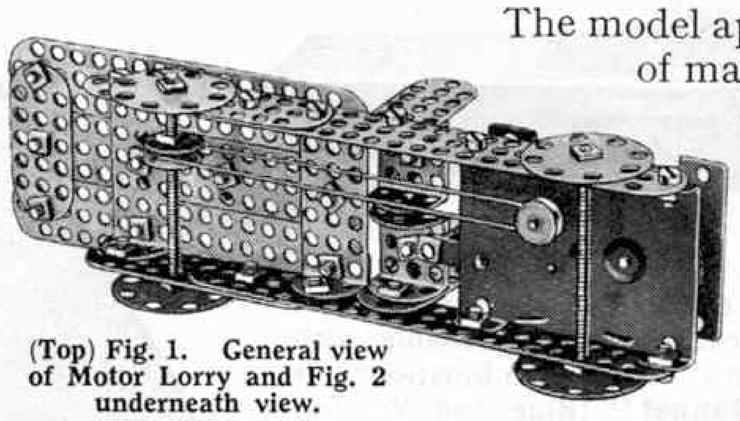
Meccano X Series Models

Motor Lorry—Baggage Truck—Well Driller—Guillotine, etc.

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

THERE is a great deal of fun to be derived from the construction of small simple models. Many constructors frequently overlook the fact that to build a small but realistic model from a limited number of parts can be just as interesting as the building of a large model from a large supply of parts. When only a few parts are available each one must be used to the best possible advantage, and if a little thought is given to the design of a new model it will be well repaid by the appearance of the model when completed. The Meccano X Series Outfits are especially suitable for building small models of fairly simple design, and the illustrations on these pages show that some very interesting results can be obtained with only a small number of parts.





(Top) Fig. 1. General view of Motor Lorry and Fig. 2 underneath view.

Motor Lorry

The model shown in Figs. 1 and 2 is driven by a Meccano X Series Clockwork Motor that serves to represent the bonnet at the front of the lorry. The first step in constructing this model is to bolt a $5\frac{1}{4}$" Strip at each side of the Clockwork Motor. The Strips are extended by $2\frac{3}{4}$" Strips, and two $1\frac{3}{4}" \times \frac{1}{2}"$ Double Angle Strips serve as spacing members and also carry the platform body. This body is built up of two $4\frac{1}{4}$" Strips spaced apart at one end by a $1\frac{3}{4}$" Strip, and with two $2\frac{3}{4}$" Strips filling up the space between them. The platform is bolted to the two Double Angle Strips. The driver's seat is made by fixing two $\frac{3}{4}" \times \frac{1}{2}"$ Double Angle Strips to $1\frac{3}{4}$" Strips, and bolting a $1\frac{3}{4}$" Strip to Angle Brackets to form the back.

The wheels consist of $1\frac{1}{4}$" Discs, each fixed to its axle by two nuts. The rear axle carries the special pulley supplied with the Clockwork Motor, and the rubber driving band is passed round this and round the Motor Pulley. To finish the model a 1" Screwed Rod is fitted to the brake lever on the Motor to facilitate control. This can be seen in Fig. 1 immediately in front of the driver's seat.

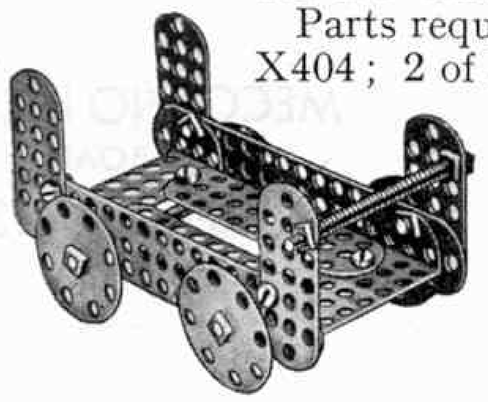


Fig. 3. Baggage Truck.

Parts required for Motor Lorry :—2 of No. X404 ; 2 of No. X405 ; 4 of No. X407 ; 4 of No. X409 ; 2 of No. X421 ; 2 of No. X435 ; 1 of No. X438 ; 2 of No. X455 ; 2 of No. X457 ; 4 of No. X475 ; 37 of No. 37a ; 26 of No. 37b ; 1 Clockwork Motor complete with special Pulley and rubber Driving Band.

Baggage Truck

This type of hand truck is frequently to be found in railway goods stations, factories, etc., where quantities of small merchandise have to be handled. The model shown in Fig. 3 will be found very useful by Hornby Railway enthusiasts. Its construction is quite clear from the illustration, two $1\frac{3}{4}" \times \frac{1}{2}"$ Double Angle Strips being used for spacing apart two $4\frac{1}{4}$" Strips to each of which two $1\frac{3}{4}$" Strips are bolted. Two $2\frac{3}{4}$" Strips are used to fill in the bottom of the truck.

Parts required for Baggage Truck :—2 of No. X405 ; 2 of No. X407 ; 4 of No. X409 ; 3 of No. X435 ; 2 of No. X455 ; 4 of No. X475 ; 20 of No. 37a ; 8 of No. 37b.

Well Driller

The model appearing in Fig. 4 represents the type of machine used for boring oil wells. Each side of the model is composed of a vertical $4\frac{1}{4}$" Strip with two $2\frac{3}{4}$" Strips bolted at right angles. The other ends of the shorter Strips are connected by a $1\frac{3}{4}$" Strip, and the two sides are held together at the base by $1\frac{3}{4}" \times \frac{1}{2}"$ Double Angle Strips. A $2\frac{1}{2}$" Screwed Rod is journalled near the top of the vertical Strips and carries two $1\frac{1}{4}$" Discs with two $\frac{3}{4}$" Discs placed between them. The Discs are held together by two nuts. A short length of cord is passed over the pulley so formed, and is tied at one end to a $2\frac{1}{2}$" Screwed Rod, and at the other end to a $1\frac{3}{4}$" Strip that is pivoted to the side of the model. A Screwed Rod is journalled in the side frames at the rear of the model and carries two $1\frac{1}{4}$" Discs, one inside and one outside the frames. Each Disc is fitted with a nut and bolt ; one serves as a handwheel, and the other is arranged so that as it rotates a bolt strikes the pivoted $1\frac{3}{4}$" Strip and forces it down. This movement raises the drill, and as the Disc continues to rotate, the Strip and the Drill descend.

Parts required for Well Driller :—2 of No. X405 ; 4 of No. X407 ; 3 of No. X409 ; 3 of No. X435 ; 2 of No. X455 ; 4 of No. X475 ; 2 of No. X477 ; 21 of No. 37a ; 9 of No. 37b ; 1 of No. 38 ; short length of cord.

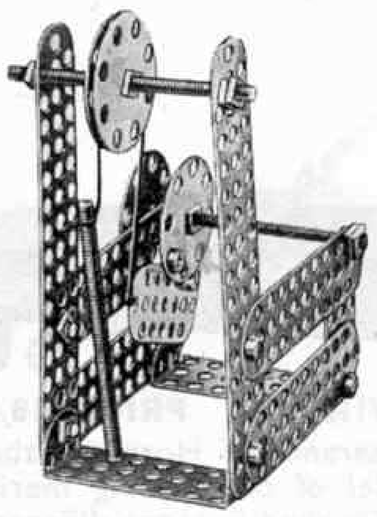


Fig. 4. Well Driller.

Porter's Truck

A simple model of a porter's truck is shown in Fig. 5. Two $4\frac{1}{4}$" Strips are spaced apart by a $1\frac{3}{4}" \times \frac{1}{2}"$ Double Angle Strip, and a $2\frac{1}{2}$" Screwed Rod secures two $1\frac{3}{4}$" Strips in position for handles. Two further $1\frac{3}{4}$" Strips

are fitted at the other ends of the side members, and are spaced apart by a second Double Angle Strip. These Strips form journals for the Rod carrying the wheels, and Angle Brackets support two $2\frac{3}{4}''$ Strips that complete the truck.

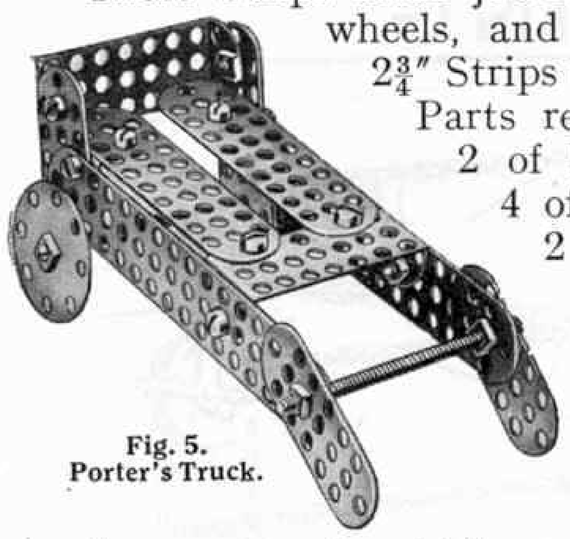


Fig. 5. Porter's Truck.

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

Guillotine

The somewhat gruesome model shown in Fig. 6 recalls the manner in which people were put to death during the French Revolution. The Guillotine is still used in France as a means of capital punishment.

The two vertical posts serving as slides for the " knife " are bolted at top and bottom to $1\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strips, and a base is formed from pairs of $5\frac{1}{4}''$ Strips and $4\frac{1}{4}''$ Strips. The knife is represented by a $1\frac{3}{4}''$ Strip carried in a frame formed by connecting two $2\frac{3}{4}''$ Strips at each end by a $\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strip. An Angle Bracket is bolted to the centre of one of these Strips, and a second Angle Bracket, tied to a length of cord, is placed under this for raising the knife. The cord passes over a pulley formed from two $\frac{3}{4}''$ and two $1\frac{1}{4}''$ Discs, and is tied to a Screwed Rod fitted with a handwheel. When the frame is raised the Angle Bracket is released as soon as it reaches the Pulley Wheel, so that the knife suddenly descends, with unpleasant results for the unfortunate victim !

Parts required for Guillotine :– 2 of No. X404 ; 2 of No. X405 ; 4 of No. X407 ; 2 of No. X421 ; 2 of No. X435 ; 1 of No. X438 ; 1 of No. X455 ; 2 of No. 457 ; 3 of No. X475 ; 2 of No. X477 ; 28 of No. 37a ; 15 of No. 37b ; short length of cord.

Derrick Crane

Although only two complete outfits are included in the X Series, it is possible to build quite large models by combining the contents of several Outfits. Fig. 7 shows an example of the results that can be achieved in this way, three No. 2 X Outfits being necessary to build this model.

The jib is made of two pairs of $5\frac{1}{4}''$ Strips spaced apart by means of $\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strips, and extended at the top by $4\frac{1}{4}''$ Strips and at the bottom by $2\frac{3}{4}''$ Strips. The $2\frac{3}{4}''$ Strips are bolted to $1\frac{3}{4}''$ Strips, and these are pivoted to the vertical member of the crane, for which two $5\frac{1}{4}''$ and two $1\frac{3}{4}''$ Strips are connected at top and bottom by $\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strips. Near the base of this vertical post are two additional $1\frac{3}{4}''$ Strips bolted at right angles and carrying a $2\frac{1}{2}''$ Screwed Rod to which the hoisting cord is fastened. The luffing cord is tied to a second Screwed Rod journalled in the two $5\frac{1}{4}''$ Strips of the vertical post. Both cords are passed over pulleys consisting of washers on each side of which are $\frac{3}{4}''$ Discs. A single Pulley made in the same way is placed at the jib head for the hoisting cord.

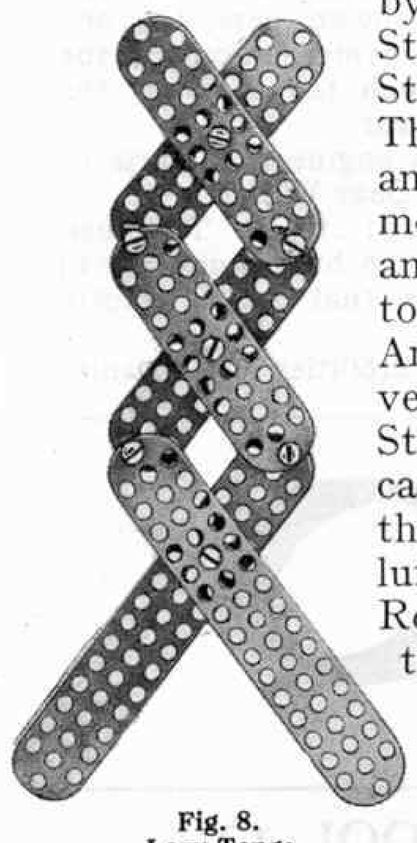


Fig. 8. Lazy Tongs.

The lower end of the vertical member is pivoted to a $1\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strip that is carried in a frame of $1\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strips and $1\frac{3}{4}''$ Strips. The upper end pivots about a bolt locked by two nuts to two Angle Brackets to which the tension arms are fixed. These retain the centre post in a vertical position, and each arm is made up of two $5\frac{1}{4}''$ Strips and one $1\frac{3}{4}''$ Strip, their lower ends being attached to a framework of Strips. Angle Brackets are provided for screwing the model down to a baseboard to prevent it from overturning when handling heavy loads.

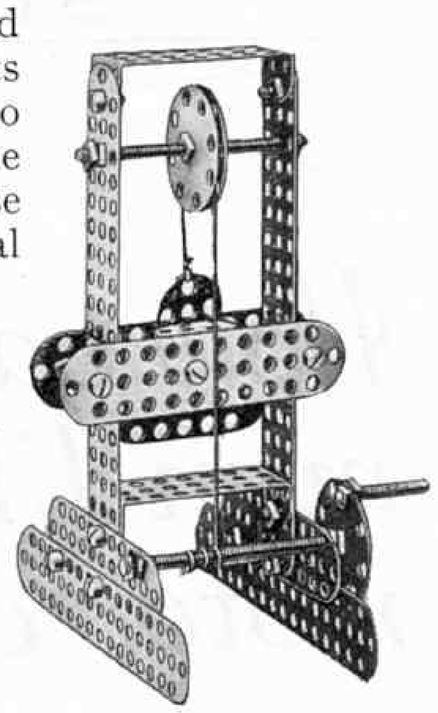


Fig. 6. Guillotine.

Cranes of this type are used extensively in building operations, and are frequently seen mounted at the top of structures in course of erection. Here they raise the building materials from ground level, and by means of the slewing and luffing gear deposit them where they are required, within the working radius of the crane.

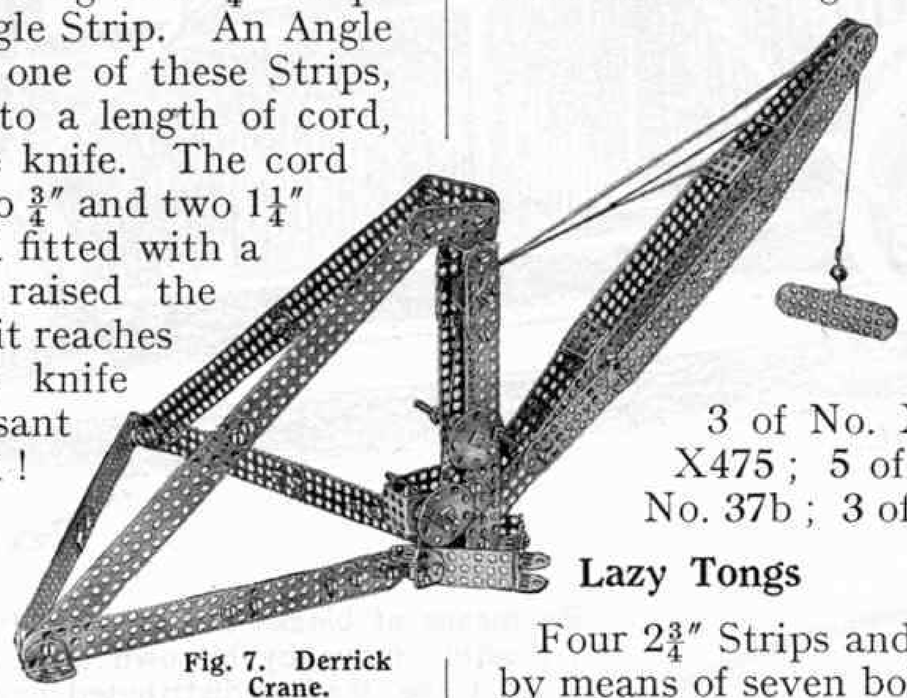


Fig. 7. Derrick Crane.

Parts required for Derrick Crane :—12 of No. X404 ; 3 of No. X405 ; 8 of No. X407 ; 12 of No. X409 ; 14 of No. X421 ; 2 of No. X435 ; 6 of No. X438 ; 3 of No. X455 ; 5 of No. X457 ; 2 of No. X475 ; 5 of No. X477 ; 97 of No. 37a ; 67 of No. 37b ; 3 of No. 38 ; 1 of No. 57c ; cord.

Lazy Tongs

Four $2\frac{3}{4}''$ Strips and two $4\frac{1}{4}''$ Strips are pivoted together by means of seven bolts in the positions shown in Fig. 8. The bolts are inserted through the upper Strips, and a nut is then threaded on the shank of each. The lower Strips are placed in position and a second nut on each bolt holds them in place. The two sets of nuts should be locked tightly against the lower Strips, but the upper set of Strips should be allowed a little play so that by moving the two $4\frac{1}{4}''$ Strips together, the frame extends.

Parts required for Lazy Tongs :—2 of No. X405 ; 4 of No. X407 ; 14 of No. 37a ; 7 of No. 37b.

High Wing Cabin Monoplane

To construct the fuselage of the model monoplane illustrated in Fig. 9, a $\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strip is bolted to each end of a $5\frac{1}{4}''$ Strip. This Strip forms the top of the fuselage, and each side is made up of two $2\frac{3}{4}''$ Strips, one $4\frac{1}{4}''$ Strip and one $1\frac{3}{4}'' \times \frac{1}{2}''$ Double Angle Strip. A $1''$ Screwed Rod holds the $4\frac{1}{4}''$ Strip to the Double Angle Strip and a $1\frac{1}{4}''$ Disc is free to rotate between two sets of lock nuts that hold it in position.

Parts required for Monoplane:— 4 of No. X404 ; 2 of No. X405 ; 4 of No. X407 ; 4 of No. X409 ; 4 of No. X421 ; 1 of No. X435 ; 2 of No. X438 ; 2 of No. X455 ; 2 of No. X457 ; 2 of No. X475 ; 2 of No. X477 ; 30 of No. 37 ; 14 of No. 37b.

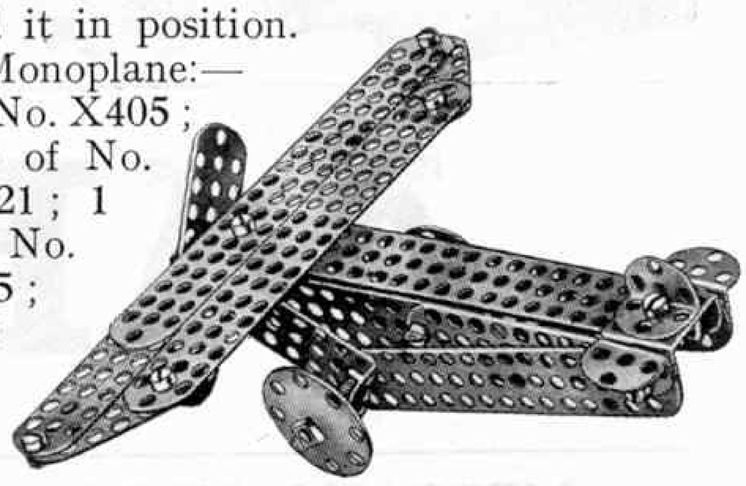
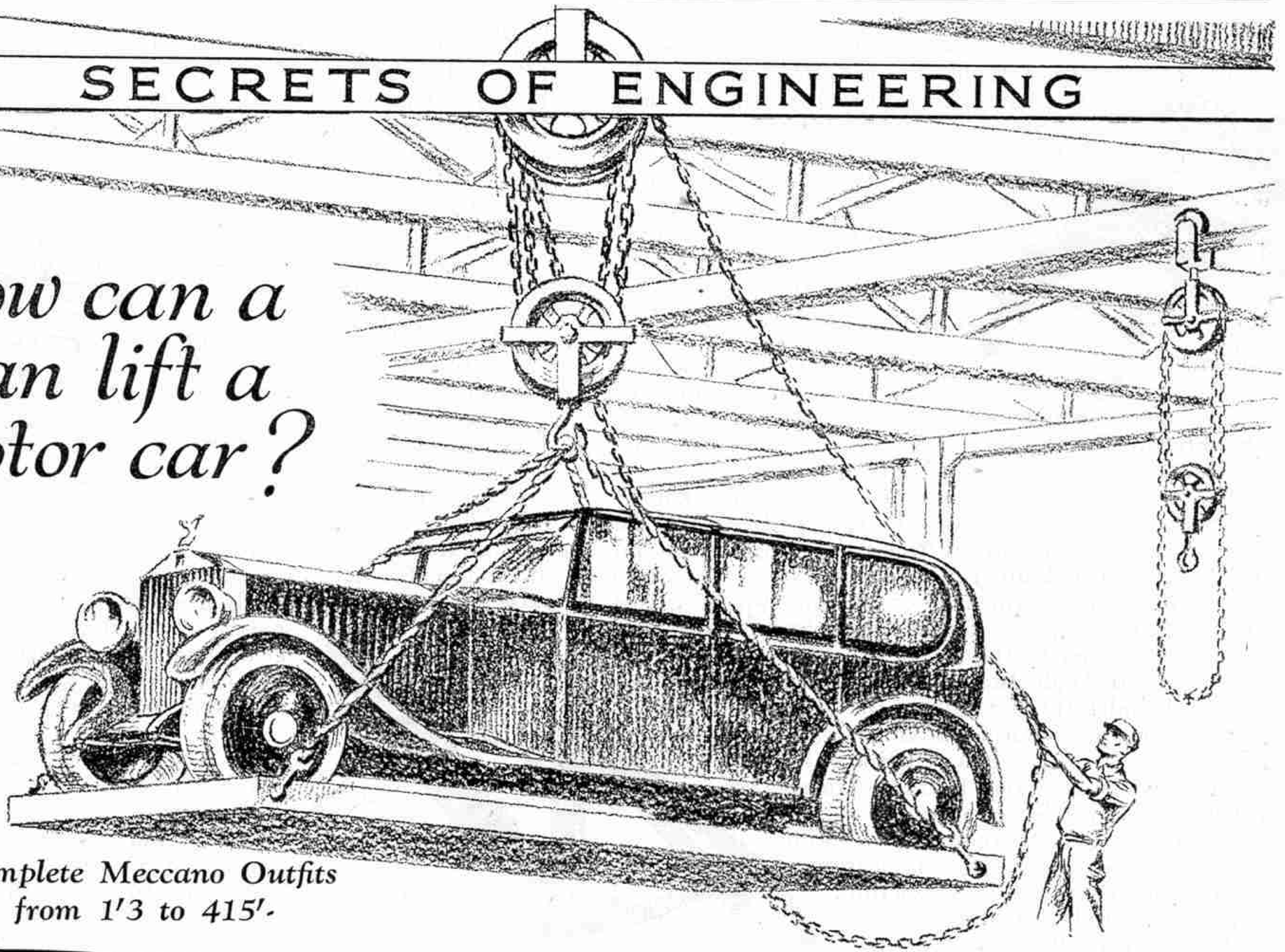


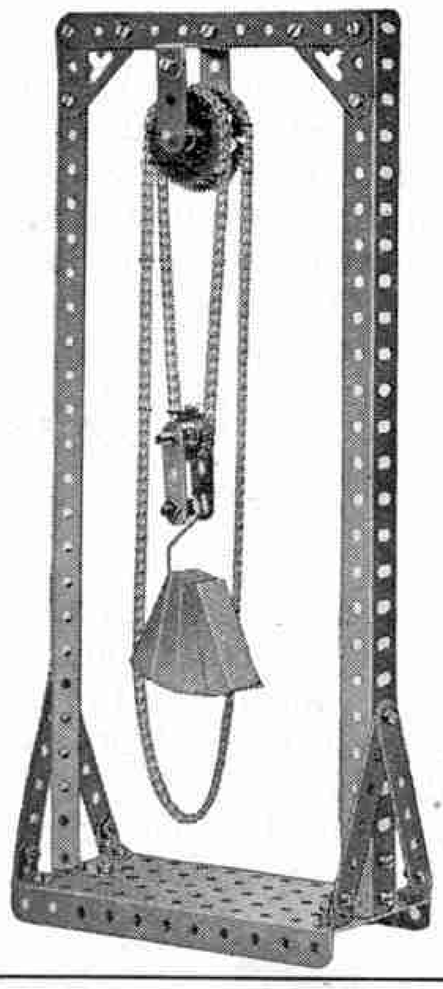
Fig. 9. High Wing Cabin Monoplane.

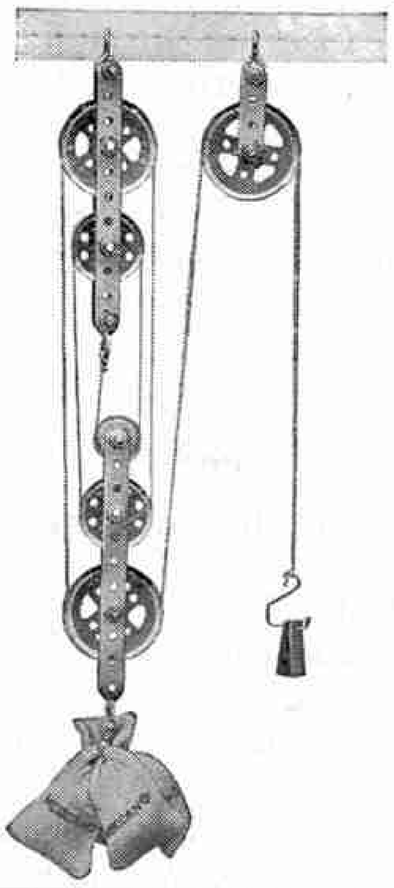
SECRETS OF ENGINEERING

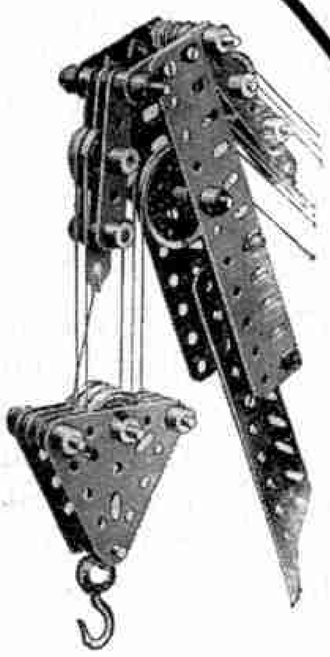
How can a man lift a motor car?



Complete Meccano Outfits from 1'3 to 415'-







By means of blocks a man can lift without difficulty weights that he could not possibly move by his own unaided strength. The secret lies in the fact that the load is distributed over a number of sections of the chain or rope that passes continuously round the pulleys in the blocks. Power applied to the free end of the chain causes the lower pulley block and its attached load to rise, but only through a small fraction of the distance travelled by the free end of the chain. This decrease in speed is accompanied by a corresponding increase in power.

The illustration above shows the differential pulley block, or chain hoist, in which the chain is endless. This device has the important advantage of being self-sustaining, that is the load remains in position when the man ceases to haul on the chain.

Meccano Pulleys and Pulley Blocks may be used to demonstrate every possible arrangement of pulleys. Three examples are shown here, the one on the left being a perfect reproduction of the chain hoist by means of which the man in the top illustration is lifting the car.

All Meccano parts are real engineering parts in miniature—Girders, Pulleys, Gear Wheels, Pinions, Cranks, Couplings and scores of others. They can be used over and over again to build hundreds of different engineering models that work exactly as the real thing.

There is no limit to the possibilities of Meccano.

MECCANO

The Toy that made Engineering Famous

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

Holiday Prizes for Readers

"Most Useful Meccano Parts" Voting Contest

In order to provide Meccano model-builders with a contest that will enable them to keep in touch with their hobby, and yet be free to spend as much time as possible out in the open air, we have decided to arrange another of the special summer competitions. This time it is a voting contest of an entirely new type, and it is of such a nature that competitors can just as easily prepare their entries on the seashore, or in the country, as at home. The only things needed are a pencil and a postcard. There is no model-building to do, or any other work that necessitates staying indoors.

In the panel on this page will be found a list of 12 parts taken from the complete Meccano range. Competitors are asked to study the list carefully and then to choose (A) the part that they think is the most useful and that can be used in the greatest variety of ways in model-building; and (B) the four parts that they think will receive the most votes when the "A" votes of all competitors are added together. When they have made their final selections, competitors must write the names of the parts, together with the Meccano catalogue numbers, on a postcard, which must also bear their full name and address.

The prizes will be awarded to the competitors who succeed in correctly forecasting the four parts that will receive the highest votes. If no competitor succeeds in placing the four parts in the correct order, the prizes will be awarded to the competitors whose entries are most nearly correct, in order of merit. There will be one Section only, and the Contest is open to competitors of all ages living in any part of the world.

"Most Useful Meccano Parts" Voting Contest

Select your parts from this list

1.	Part No. 62B	Double Arm Crank.
2.	Part No. 133A	Corner Bracket.
3.	Part No. 113	Girder Frame.
4.	Part No. 115	Threaded Pin.
5.	Part No. 163	Sleeve Piece.
6.	Part No. 10	Flat Bracket.
7.	Part No. 50A	Eye Piece.
8.	Part No. 11	Double Bracket.
9.	Part No. 136	Handrail Support.
10.	Part No. 102	Single Bent Strip.
11.	Part No. 120B	Compression Spring.
12.	Part No. 137	Wheel Flange.

The prizes are as follows:—First, Meccano or Hornby goods to the value of £2-2s.; Second, goods value £1-1s.; Third, goods value 10/6. Five prizes of goods value 5/–. There will also be a number of consolation prizes.

The closing date for the receipt of entries from both Home and Overseas competitors, is 31st October, 1933. The time allowed will permit readers on holiday, or who live in distant countries, ample opportunity to submit their entries. Entries received after that date will be disqualified.

No competitor may submit more than one entry, and care must be taken to see that the sender's name and address is written clearly on the postcard. Entries should be addressed "Meccano Parts Voting Contest," Meccano Ltd., Binns Road, Liverpool 13.

All prizewinners will be notified by letter as soon as possible after the closing date of the competition, and it is a condition of entry that the judges' decision must be accepted as final.

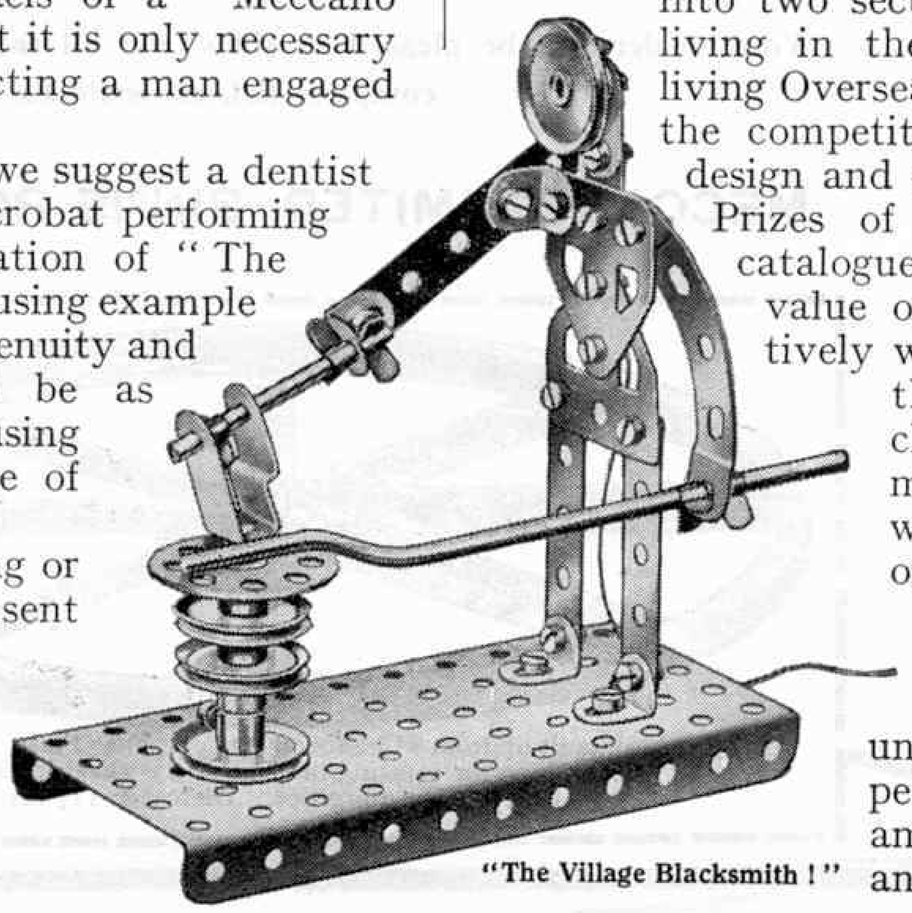
A Novel "Meccanitian" Contest: Open to all Young Readers

In this simple competition prizes are offered for the most humorous and original models of a "Meccano man!" To take part in the contest it is only necessary to build a simple little model depicting a man engaged in some everyday task.

As examples of what is required we suggest a dentist "at work" on his patient, or an acrobat performing tricks. The accompanying illustration of "The Village Blacksmith" is a further amusing example of what can be done with a little ingenuity and very few parts. Entries should be as humorous as possible; the more amusing the effect, the greater the chance of winning a prize.

When the model is built, a drawing or photograph must be made of it, and sent in an envelope addressed to "Meccanitian" Contest, Meccano Ltd., Binns Road, Liverpool 13. Entries must bear the competitor's age, full name and address.

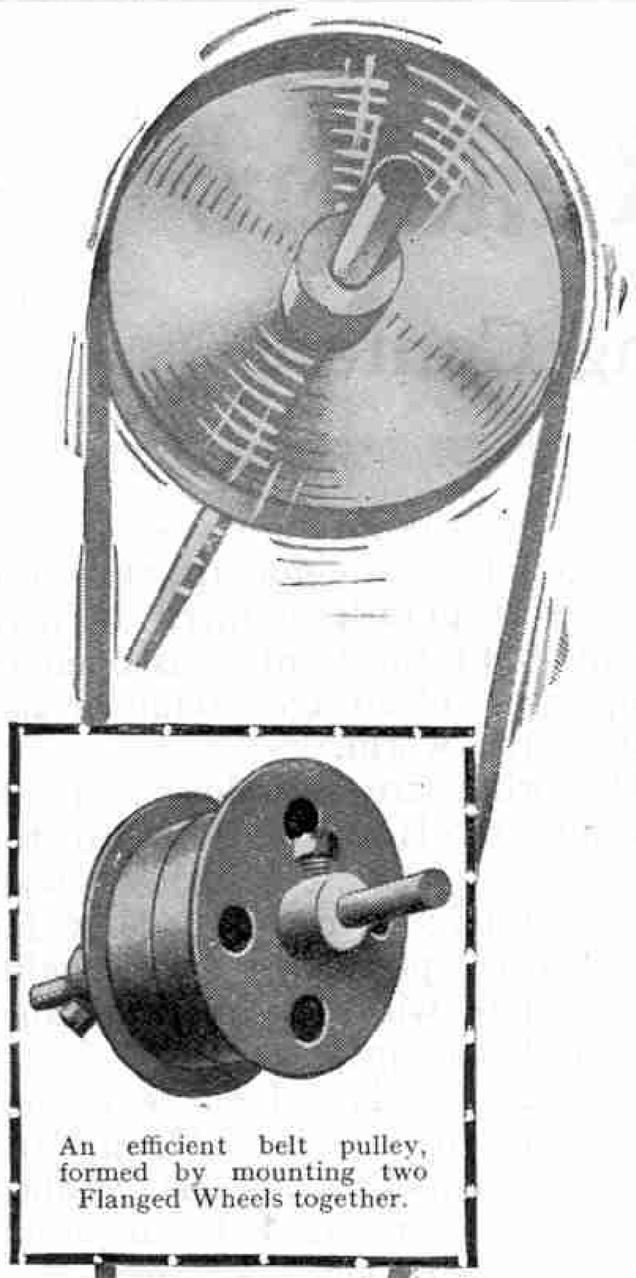
The contest is open to all readers under the age of 16. Entries will be divided into two sections, as follows: (A) for readers living in the British Isles; (B) for readers living Overseas. Any model submitted must be the competitor's own unaided work, both in design and construction.



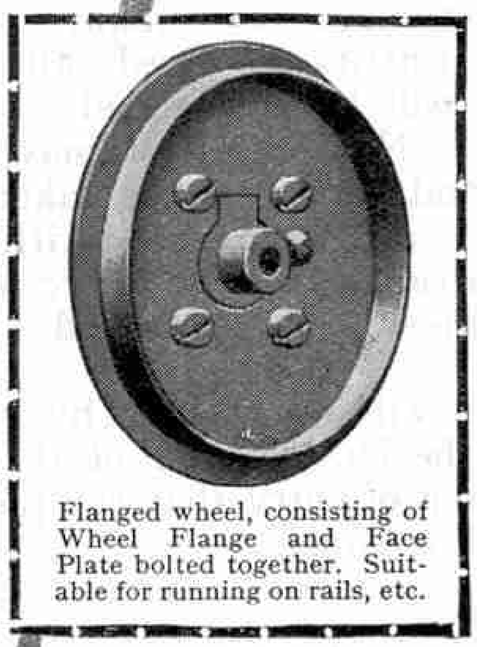
"The Village Blacksmith!"

Prizes of goods (to be chosen from our catalogues by the winners themselves) to the value of £2-2s., £1-1s., and 10/6 respectively will be awarded in each Section to the senders of the three most cleverly constructed and amusing models, in order of merit. There will also be 10 prizes of Meccano or Hornby goods value 5/–.

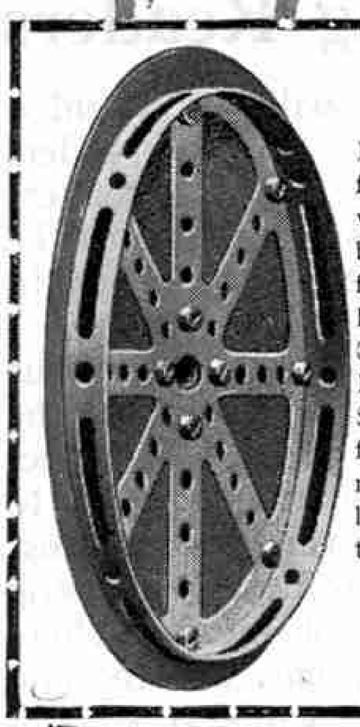
The closing date for Section A is 30th September, 1933. Section B will remain open until 30th November so that competitors living Overseas will have ample time to construct their models and post their entries.



An efficient belt pulley, formed by mounting two Flanged Wheels together.



Flanged wheel, consisting of Wheel Flange and Face Plate bolted together. Suitable for running on rails, etc.



Larger flanged wheels built up from Hub Disc and Circular Plate. Suitable for large models of locomotives, etc.

MECCANO PARTS & ACCESSORIES

3—*WHEELS*

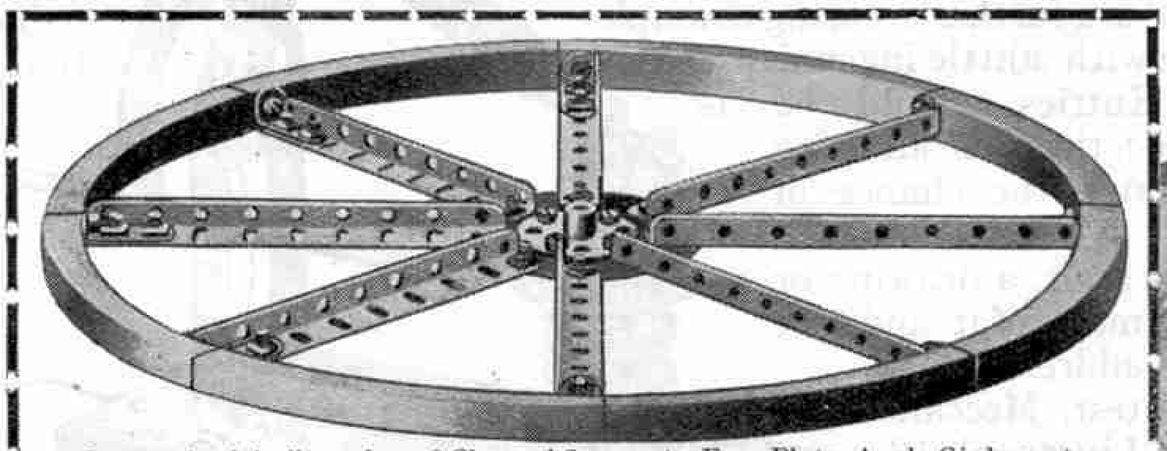
SOMEBODY has said that the wheel is the world's greatest invention. However much truth there may be in this statement it is safe to say that from a remote period—when prehistoric man made the first steps towards its evolution by discovering the use of log rollers—to the present day, the wheel has proved to be one of the greatest assets in engineering.

Wheels take an important place in the Meccano system, of course. There are about fifty parts that may be placed under the category of Wheels, ranging from ½″ to 12″ in diameter, while other parts readily lend themselves to the construction of still larger or different types of wheels. The list printed below contains particulars of a number of such Meccano parts. Gear and other toothed wheels are not included. The smaller pulleys are made of solid brass while the larger are of steel, and all exhibit the splendid finish and perfect accuracy of manufacture for which Meccano parts are noted and appreciated throughout the world.

No.		s.	d.
19a.	Wheels, 3″ diam. with centre boss and set-screw. 10 spokes, for use as road-wheels ... each	0	6
20.	Flanged Wheels, 1⅛″ diam. For use as belt pulleys or rail wheels ... ... „	0	5
20b.	„ „ ¾″ „ „ „ „ ... ... „	0	4
19b.	Pulley Wheels, 3″ diam. with centre boss and set-screw, V-grooved ... ... „	0	7
19c.	„ „ 6″ „ „ „ „ „ „ ... ... „	2	0
20a.	„ „ 2″ „ „ „ „ „ „ ... ... „	0	5
21.	„ „ 1½″ „ „ „ „ „ „ ... ... „	0	4
22.	„ „ 1″ „ „ „ „ „ „ ... ... „	0	3
22a.	„ „ 1″ „ without „ „ „ „ ... ... „	0	2
23.	„ „ ½″ „ „ „ „ „ „ ... ... „	0	2
23a.	„ „ ½″ „ with „ „ „ „ ... ... „	0	3
24.	Bush Wheels, ⅜″ diam., perforated 8 holes ... ... „	0	4
109.	Face Plates, 2½″ diam. For use in lathes, etc. Perforated and slotted ... ... „	0	4
118.	Hub Discs, 5½″ diam., 8 spokes; outer rim perforated and slotted ... ... „	1	3
119.	Channel Segments (8 to circle, 11½″ diam.) Channel section ½″ × ½″ ... ... „	0	4
123.	Cone Pulleys, 3 V-grooves "in steps," 1½″, 1″, and ¾″ diameters ... ... „	1	3
132.	Flywheels, 2½″ diam. Grooved round circumference and small pulley at centre ... „	2	0
137.	Wheel Flanges, 2½″ × ½″. May be bolted to any of the larger pulleys ... ... „	0	3
142.	Rubber Rings (round section). May be used to represent pneumatic tyres ... ... „	0	3
142a.	Dunlop Tyres to fit 2″ diam. Pulley Wheels ... ... „	0	4½
142b.	„ „ „ 3″ „ „ „ ... ... „	0	6
142c.	„ „ „ 1″ „ „ „ ... ... „	0	3
142d.	„ „ „ 1½″ „ „ „ ... ... „	0	4
143.	Circular Girders, 5½″ diam., L-section. Slotted and perforated ... ... „	1	0
145.	Circular Strips, 7½″ diam. over all, perforated ... ... „	0	9
146.	Circular Plates, 6″ diam. May be used as flywheels, etc. ... ... „	1	0
151.	Pulley Blocks, Single Sheave } ... ... „	0	8
152.	„ „ Two „ } For use in Cranes, Derricks, etc. ... ... „	0	9
153.	„ „ Three „ } ... ... „	1	0
155.	Rubber Rings, ⅛″ (round section) may be used to represent pneumatic tyres ... ... „	0	1
167.	Geared Roller Bearings } The component units of these accessories may be obtained {	20	0
168.	Ball Bearings, 4″ diam. } separately. See complete Parts List. {	3	0

Your dealer will be pleased to show you all the Meccano Parts. Ask him for a complete list, or write for one direct to

MECCANO LIMITED, BINNS ROAD, LIVERPOOL 1



Large wheel, built up from 8 Channel Segments, Face Plate, Angle Girders, etc. May be used as base for rotating models, or fly-wheel in Beam Engines, and many other purposes. Diameter 11½ ins.

Model-Building Contest Results

By Frank Hornby

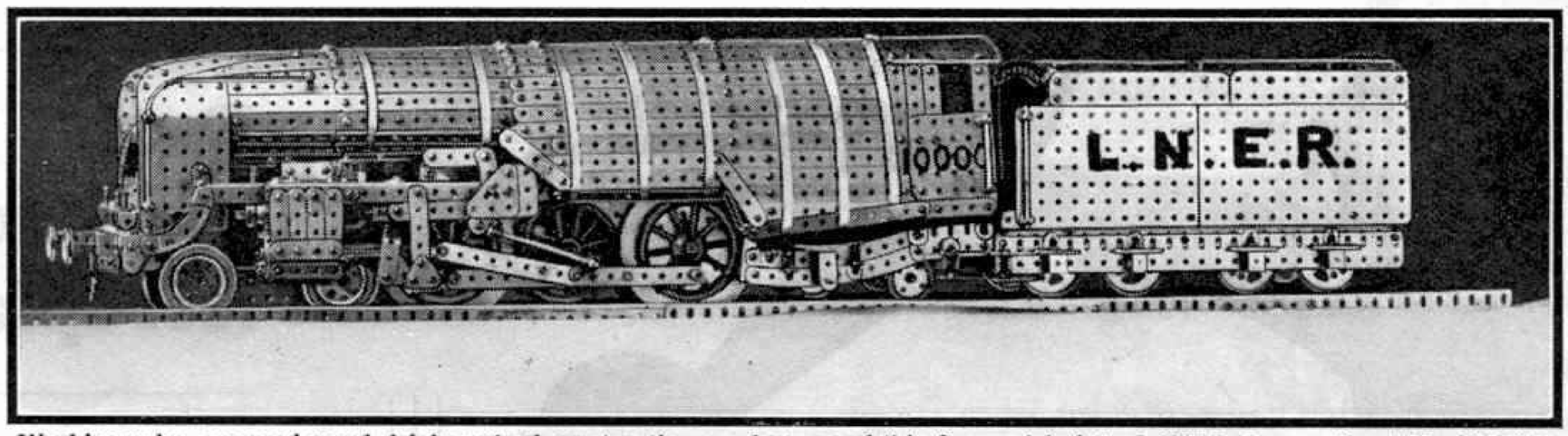
"New Year" Competition

The results of the judging and allocation of prizes in this Contest are as follows :—

Section A. (Home Competitors over 14)

FIRST PRIZE, Cheque for £3-3s.: M. Powley, Sunderland. SECOND PRIZE, Cheque for £2-2s.: L. Sawtell, Sheffield. THIRD PRIZE, Meccano or Hornby goods value £1-1s.: H. J. Lockett, Stafford.

PRIZES of Meccano or Hornby goods value 5/–: W. R. Lee, London, S.W.11; W. Hicken, Mansfield; H. Humphreys, Padiham, Lancs.; N. R. Marshman, Sheffield 11; J. Wilkins, Llandrindod Wells; B. G. Simons, Torquay; J. D. Thompson, London, N.14; T. Robson, Scarborough; R. A. E. Wright, Shenley, Herts.; E. R. Hall, Middlesbrough.



Working valve-gear and novel driving wheel construction are features of this fine model of the L.N.E.R. Locomotive "No. 10000" by J. Ringnalda, Leeuwarden, Holland.

PRIZES of "*Famous Trains*": R. A. Farr, Norwich; J. C. Phillips, North Thoresby, Lincs.; F. L. Sawyer, Burwash, Sussex; V. C. Kaile, Mayford, nr. Woking; B. G. Shearing, Southampton; R. Lawford, Bexley Heath, Kent; R. Adams, Bristol; J. C. Prosser-French, Tonbridge; D. Holloway, Squirrels Heath, Essex; W. M. Fairfield, Bowdon, Cheshire.

Section B. (Home Competitors under 14)

FIRST PRIZE, Cheque for £2-2s.: L. J. Hughes, Walsall; SECOND PRIZE, Meccano or Hornby Goods value £1-1s.: E. Brett-Harris, Weston-super-Mare. THIRD PRIZE, goods value 10/6: A. Maclaren, Motherwell, Glasgow.

PRIZES of "*Famous Trains*" by C. J. Allen: T. A. Bird, Tynemouth; W. P. Phillips, Sheffield; J. W. Smith, Derby; J. W. Beck, Norwich; D. Head, Beckenham, Kent; J. Twyman, Orpington, Kent; A. Gammie, Banff, Scotland; R. E. Pack, Rushden, Northants; H. M. Hiscock, Coulsden, Surrey; B. Fowler, Bristol.

MECCANO ENGINEER'S POCKET BOOKS: G. H. Toft, Oldham; F. J. Wallace, Liverpool; K. Hopson, Harrow Weald; E. Burns, Wembley; J. P. Laidlaw, St. Boswells, Scotland; D. W. Pethybridge, London, S.E.26; O. Briscoe, Southwick, Hants.; A. Tellam, Okehampton, Devon; H. Cohen, Hendon, N.W.4; F. Bower, Wembley; R. Keay, Richmond, Surrey; A. E. Breeze, Cannock, Staffs.; T. Lawton, Sutton Coldfield; H. Leete, London, S.E.18; K. M. Tankard, Guiseley, Yorks.; J. R. Ashford, London, S.E.14.

Section C (Overseas Competitors)

FIRST PRIZE, Cheque for £3-3s.: A. W. Boeke, Baarn, Holland. SECOND PRIZE, Cheque for £2-2s.: E. C. Stonyer, Temuka, S. Canterbury, N.Z. THIRD PRIZE, Meccano or Hornby goods value £1-1s.: D. B. Burne, Durban, S.A.

PRIZES of goods value 5/–: J. D. Skinner, Sydney, N.S.W.; L. Cole, Melbourne; B. Gledhill, Carentan, France; C. Borg, Malta; C. Vermande, Baarn, Holland; J. Araganes, Barcelona; J. Ringnalda, Leeuwarden, Holland; R. Pascaud, Chaumont, France; J. Rombach, Groningen, Holland; C. Blackbeard, Johannesburg.

PRIZES of "*Famous Trains*"; D. Hill, Pietermaritzburg, Natal; D. McDowall, Otakuku, Auckland; P. Callister, Wairarapa, N.Z.; D. Swan, Oak Bay, B.C.; A. Thornton, Bulawayo, S. Rhodesia; I. Ellefsen, Plumstead, S.A.; M. F. Wilding, Prince Rupert, B.C.; D. Franklin, Victoria, B.C.; D. Ambler, Waihato, N.Z. R. Cain, Durban, S.A.

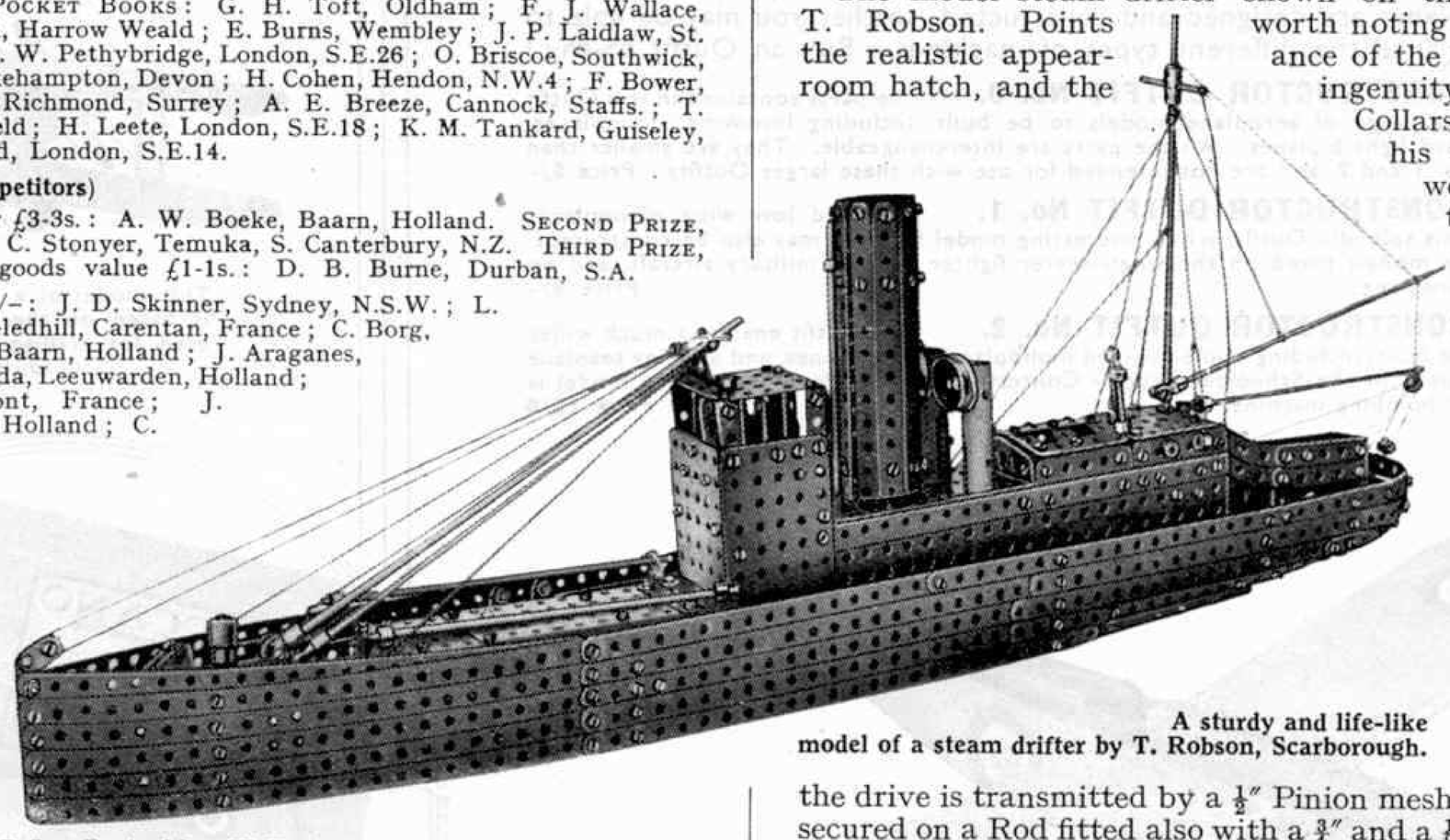
One of the most interesting entries in the contest is a front-wheel drive three-wheeler motor car by M. Powley, and owing partly to its originality and partly to the ingenious manner in which the constructional difficulties that present themselves in this kind of work were overcome, it was awarded First Prize in Section A. The model consists essentially of a twin-cylinder air-cooled engine, three-speed and reverse gear box, clutch and electric motor drive. On first gear the total ratio between the driving motor armature shaft and the road wheels is about 55 to 1. A novel clutch is made from a ¾" Flanged Wheel fitted with a Rubber Ring and a Bush Wheel, in the holes of which bolts are fixed. The result of the arrangement is that the Rubber Ring fits closely inside the ring of Bolt Heads, and these prevent it from coming out of position.

A model of a boot repairer's combination finishing machine won Second Prize in Section A. It is fitted with setting irons, naumkeag, breast scourer, bottom scourer and emery wheel, the various pads and brushes being made of felt, cardboard and emery.

H. J. Lockett's model is a Barnett and Foster "Niagara" soda water machine, comprising pumping mechanism and aerating cylinder, a heavy fly-wheel built from Channel Segments, and a gas saturator. The model cannot be put to actual use, of course, but in outward appearance it is a perfect reproduction of the actual machine.

A perpetual calendar and stationery cabinet was sent by J. D. Thompson. Behind this competitor's success lie many weeks of patient and painstaking work, for its builder, unfortunately, is an invalid. I am glad to think that Meccano is a help to him in overcoming his physical disabilities, and I hope that he will long continue to derive pleasure from the hobby. His success in this Contest is one of the many instances in which invalids have found in Meccano an outlet for their inventive abilities, and an instructive pastime for their enforced days indoors.

The model steam drifter shown on this page was sent by T. Robson. Points worth noting in its construction are the realistic appearance of the bridge and the engine-room hatch, and the ingenuity shown in the use of Collars as pulley blocks. By his work in building the well-shaped curved stern this competitor shows that he has considerable manipulative ability.



A sturdy and life-like model of a steam drifter by T. Robson, Scarborough.

L. J. Hughes has the satisfaction of knowing that his success was achieved against the work of competitors older than himself. As his subject he chose the 100 ton M.R.S. lorry, which was described in the "*M.M.*" some months ago. The model is driven by a Clockwork Motor, and the drive is transmitted by a ½" Pinion meshing with a 1½" Contrate secured on a Rod fitted also with a ¾" and a ½" Pinion. By sliding a centrally placed gear-change rod to the right the ¾" Pinion is brought into mesh with a 50-teeth Gear fixed to the change rod, and at the same time a 1" Pinion on this latter rod engages a further 1" Pinion on the transmission shaft. From here the drive is taken to the differential by means of a ¾" face Pinion on the end of the transmission shaft. Bottom gear is obtained by sliding the change rod to the left, thus bringing the ½" Pinion into mesh with a 57-teeth gear on the change rod. The two 1" Pinions previously mentioned remain in constant mesh.

A well-built model of a travelling crane won Second Prize (Section B) for E. Brett-Harris. I have examined the photographs very carefully and I find that the gear

(*Continued on page 617*)

MECCANO

AEROPLANE CONSTRUCTOR OUTFITS

Build your own model Aeroplanes!

Boys, Meccano Aeroplane Outfits are great! They enable you to build wonderful models of aeroplanes—the most realistic you ever saw.

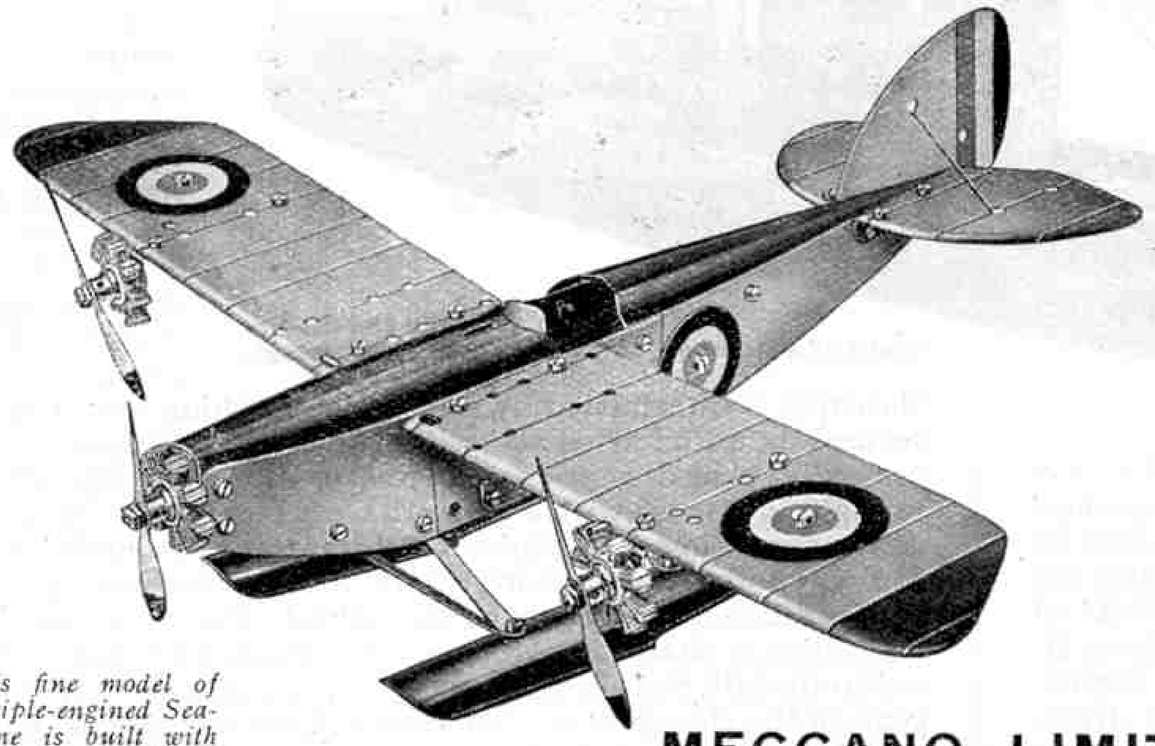
A beautifully illustrated Manual is included in each Outfit showing how to build a number of different types of machines, both monoplanes and biplanes. Many other splendid models may be built by varying the position of the parts, which are all interchangeable on the famous Meccano principle. The parts in the Nos. 1 and 2 Outfits can be used in conjunction with the standard Meccano parts.

If you want to know something about aeronautics the first step is to understand how aeroplanes are designed and constructed, so that you may be able to recognise at a glance the different types of machines. Buy an Outfit to-day!

AEROPLANE CONSTRUCTOR OUTFIT No. 0. The parts contained in this Outfit enable an interesting range of aeroplane models to be built, including low-wing monoplanes, seaplanes and standard light biplanes. All the parts are interchangeable. They are smaller than those in Outfits Nos. 1 and 2, and are not intended for use with these larger Outfits. Price 5/–

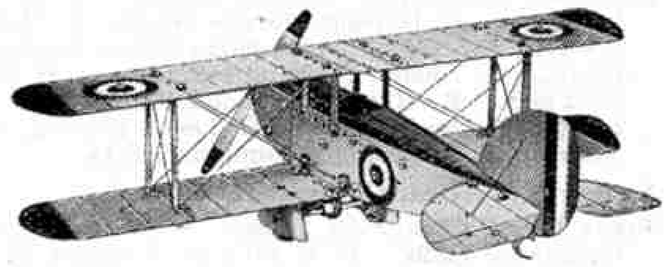
AEROPLANE CONSTRUCTOR OUTFIT No. 1. High and low wing monoplanes may be built with this splendid Outfit, while interesting model biplanes may also be constructed. The biplanes include models based on the single-seater fighter type of military aircraft, and on the popular light aeroplane. Price 9/–

AEROPLANE CONSTRUCTOR OUTFIT No. 2. This Outfit enables a much wider range of models to be built, including triple-engined monoplanes and biplanes, and a racing seaplane of the type that is used in the Schneider Trophy Contests. A particularly interesting model is that of a giant Italian bombing machine. Price 16/6

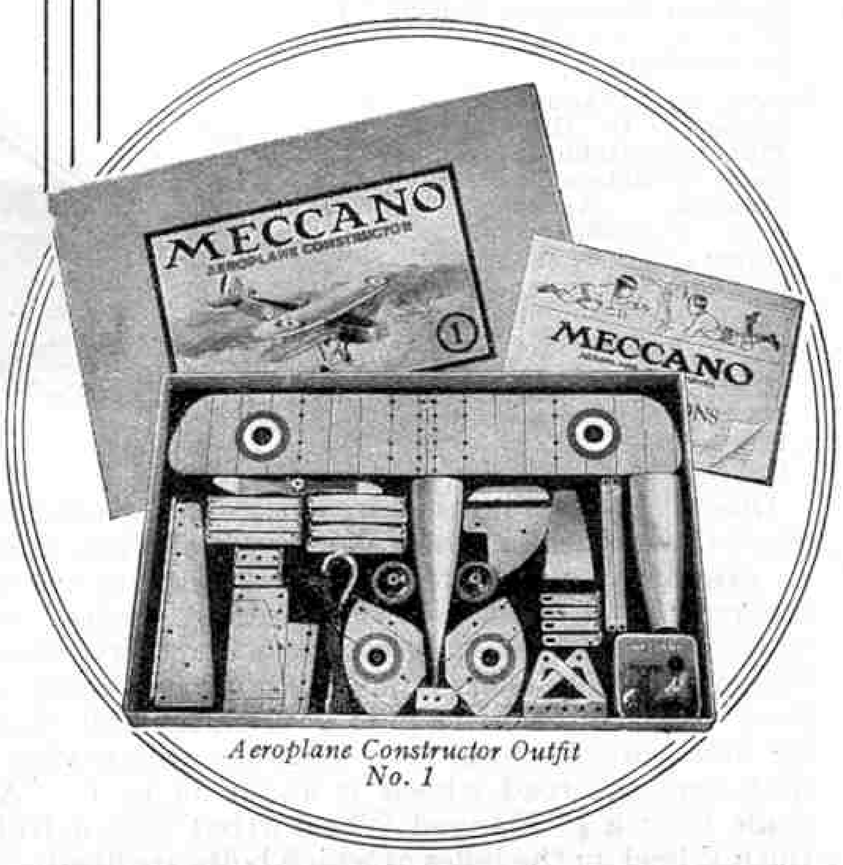


This fine model of a triple-engined Seaplane is built with Meccano Aeroplane Constructor Outfit No. 2.

The above illustration shows a model of a Biplane built with Meccano Aeroplane Constructor Outfit No. 0.



This model of a Standard Light Biplane is based on the type that is generally used for civilian flying. It is a No. 1 Outfit model.



Aeroplane Constructor Outfit No. 1

MECCANO LIMITED
Binns Rd., Liverpool 13

Ancient Treasure Port—(*Continued from p. 598*)

ammunition, and about $10,000 in coin. Eighty iron cannon were spiked and dismounted, and the fortifications were otherwise rendered useless. They were rebuilt a decade later, but by the middle of the 18th century they were no longer needed. It was no longer safe to send the treasure of the Incas and of the Peruvian mines across the Isthmus, for marauders waylaid convoys, slaughtered their guards and made off with the gold. Nor was it longer safe for the cumbersome treasure fleets to sail through the West Indian seas en route to Spain. Too many English and French rovers were about; galleons were attacked even in sight of Porto Bello. Some new route must be devised, and in the end Spain sent her dwindling fleets of treasure ships around Cape Horn. The ever trespassing jungle was closing in on the old Road of Gold, and Porto Bello began its long sleep.

Americans finally roused the old treasure port with their rock blasting on the Cape. On the completion of the Canal, great steamers began to ply in a new lane of world traffic, just over Porto Bello's westward horizon, engaged in quests no less romantic than that of the ancient galleons.

Presently there came airmen from the United States Army and Naval bases in the Canal zone to fly over Porto Bello. For a time these Government aviators had the aerial views of Porto Bello to themselves, but before long came the era of commercial aviation, and now it is possible for ordinary travellers to fly over this historic region.

Taking off at Balboa—the American town at the Pacific end of the Canal—the tourist can fly first over the ruins of Old Panama, and look down on all that was left by fire when Morgan and his men departed with their loot in February, 1671. Thence a few minutes will take him out over the islands of Tobago and Tobagilla, in the bay of Panama, where ambitious freebooters who emulated Morgan made their base, and laid unsuccessful siege to the new city of Panama. Thence the plane wings across the Isthmus in half an hour. Following the broad ribbon of the Canal and crossing Gatun Lake, it speeds down the lower valley of the Chagres, silent and wooded, to the river's mouth, seven miles from the lake, where lie the ruins of old Fort San Lorenzo. It was here Morgan landed for his march across the Isthmus to attack Old Panama, and it was here that the first of the Fortyniners were put ashore on the beach from the 1,000-ton New York steamer, to make the best of their way, by canoe and afoot, to the shores of the Pacific.

From the mouth of the Chagres the plane swings to the right, speeds across Colon bay and over the city of Colon, and thence Northeastward twenty miles along the coast—densely covered with forest, as with a tufted green carpet—to the old treasure port.

Three or four circles over the harbour and town are enough to show the utter and eloquent desolation of the place.

Then heading into the brisk trade wind, the plane wings back to Colon, and picking up the Canal, heads for the Pacific side. After less than two hours in the air it is back at its starting point, having covered land and water that in the age of romance would have called for days of wearisome travel.

Vasco Nuñez de Balboa, discoverer of the Pacific, was a month cutting his way across the Isthmus. Morgan and his men were ten days making the march from the mouth of the Chagres to Old Panama. The Fortyniners were sometimes a week getting from one side of the Isthmus to the other, by boat up the Chagres to Las Cruces, and thence by trail across the mountains. A fast plane to-day skims above their route, from end to end, in about twenty minutes. The distance is less than forty miles.

It should not be inferred that many tourists as yet make air excursions at the Isthmus. The majority prefer sightseeing, motoring about the Canal Zone's spotless towns, Uncle Sam's forts, through bright and saucy Panama, and past grass-grown savannas to Old Panama.

But in adventure outside the beaten path of travel, in which one turns back the page of history, those few who take wing to Porto Bello, slumbering in the Sun at the end of the old Road of Gold, find themselves well rewarded.

This interesting article was contributed to the "*Ocean Ferry*," the publication of the International Mercantile Marine, New York, by Winfield M. Thompson, Field Agent for the Panama Pacific Line. By courtesy of the Editor of that paper we are able to reproduce the article and the illustrations.

H.R.C. Junior Section—(*Continued from p. 623*)

If the paper is red, so much the better; if not, it may be painted when secured in position. The name may then be put on with yellow or gold paint, and the edges of the plate picked out at the same time. It is not a bad plan to get the name typewritten on beforehand in capital letters to serve as a guide, and if the red paint used for colouring the label is thin, the letters will show through sufficiently well to enable them to be finished easily. Alternatively the type contained in the cheap printing outfits that many boys possess may be made use of. There is plenty of selection in the matter of names, all of them being places served by the line, and a typical one is given in the lower illustration on page 623.

For coaches the No. 1 vehicles will be quite suitable, as many four-wheelers are in use in the island. The service also boasts a named train bearing the title "*East and West Through Train*," which runs from Shanklin to Freshwater in the morning and returns in the evening. This is a feature not to be missed in the operation of a miniature Isle of Wight railway system. The standard No. 2S Roof Clips may be adapted to fit the No. 1 Coaches by reducing the width of the central portion of the Clip attachment. This may be done with a pair of old scissors, as the metal is fairly thin.

If the coach roof is removed it will be noticed that the top edges of the coach sides are turned over, except for the portions immediately against the ends. This fact is taken advantage of in the attachment of the roof Clips, which are laid in these little gaps from side to side. The centre part of the Clip attachment is pressed gently down between the sides, so that the right-angle bends at the ends of the centre portion are made to correspond with the top edges of the coach sides. The roof may now be sprung into position and the ends of the Clips turned up into place. The preparation of name boards will be simple, as the standard Hornby Train Name Boards exactly fit in the Clips mounted in this manner. Strips of white card of the same dimensions should be suitably lettered, and the boards are then ready for use.

One of the photographs on page 623 shows the impression of importance attaching to a train arranged as suggested. Apart from this special application of the Roof Clips, they may be made use of where No. 1 Coaches are attached to important expresses to provide a through service to some branch line, when of course the destination should be displayed on the coach concerned.

The Emir of Katsina and his two grandsons in a happy scene on the football field at the works of Lines Bros. Ltd., Merton, London. The two boys are driving Lines Bros. electric motor cars and their concentration on their pleasant task is evidently a source of considerable amusement to the onlookers.

Railways and Coal Traffic—(*Cont. from p. 585*)

good use of large wagons. Double-bogie vehicles of 30 or 40 tons' capacity for locomotive coal were in use as long as 30 years ago on several railways. The Caledonian in 1901 put into service a number of all-steel bogie wagons of 30 tons' capacity, and trains of these fitted throughout with the Westinghouse brake regularly brought coal from the Lanarkshire fields. They were hauled by the remarkable "long-backed" 0-8-0 locomotives of the McIntosh "600" class, one of which could deal with 60 of these vehicles. The North Eastern also in 1901 had a train of 32-ton wagons in service, and in the following year 50 wagons of 40 tons' capacity and of patented double hopper design were added. These are still in use between Ashington and Blyth Harbour. Special arrangements were incorporated to control the rate of discharge through the hoppers, a great convenience when loading coal for shipment. Another 50 wagons of the same capacity but of different design were also put into use in 1902, and could discharge coal at the rate of one ton per second if required.

The possibilities of the use of such wagons for point-to-point traffic in the export coal trade so impressed the North Eastern management of the time that large orders for high capacity wagons were contemplated. This progressive move did not meet with the approval of the colliery owners and port authorities, however, so that an agreement was arrived at limiting the wagons to be used to 20 tons' capacity for a number of years. In such cases as this, therefore, criticism of the railway companies is without point, and moreover unfair, when the facts are borne in mind.

The side-discharging steel hopper wagons recently put into service on the L.M.S.R. must not be forgotten. These are used to bring coal to the company's electrical power station at Stonebridge Park, near Willesden, where current for the L.M.S.R. electric suburban services is generated.

Model Building Contest—(*Continued from p. 615*)

box construction is particularly neat and compact. Unfortunately details of the gears used are not available and I am unable to describe its working here.

Andrew MacLaren sent a break-down crane that he copied from an interesting machine described in the November 1931, "*M.M.*" Among the many novel ideas embodied in its construction are two brake drums, each of which is made from a Flanged Wheel with Boss Bell Cranks for the shoes. The Cranks are pivoted through their bosses, and to one end of each of them is attached an End Bearing that in turn is connected to a Small Fork Piece. Each of these is joined to the spider of a swivel bearing by means of a short Rod. The free ends of the Boss Bell Cranks bear against the insides of the Flanged Wheels, and are withdrawn or applied by rotating a Threaded Rod that is screwed into the spider, thus causing the latter to travel up and down the Rod, and so move the Boss Bell Cranks about their pivots.

Probably the finest and most intricate model of all the many wonderful examples submitted in this Contest is an electric gramophone fitted with automatic record changing mechanism, which was sent by A. W. Boeke. This model is of such general interest that I intend to describe it fully in a special article in an early issue of the "*M.M.*"

Second and Third Prizes in the Overseas Section were awarded for an electric locomotive of the type used on the Swiss Federal Railways, and a travelling crane fitted with main and auxiliary hoists, respectively.

J. B. G. Ringnalda built the beautiful model of the L.N.E.R. "*No. 10000*" shown on page 615. The boiler is built up of strips and is smoothly rounded and streamlined as in the prototype. A novel feature is to be seen in the driving wheels, which are made from Circular Plates and Artillery Wheels. The tender and driving-cab are particularly neat, and the unbroken lines of screw heads round the boiler add considerably to the appearance of the model.

New L.M.S.R. "Pacific"—(*Continued from p. 583*)

spring arrangement. In view of the long wheelbase of this bogie, 7 ft. 6 in., bar frames are provided as a means of keeping down the weight. The trailing truck is of a specially designed Bissel type.

On each side of the cab two sliding windows are provided, and on the left, or driver's side, on the outside of the cab a small window is fitted to act as a draught protector when the driver is looking out beyond the cab side. A steam brake is provided on the engine, the power being applied to the six coupled wheels only. The brake power is controlled from the driver's brake valve in the cab, which also automatically operates the vacuum brake on the train. Hand or gravity sanding is applied to the front of the leading coupled wheels, and at the front and back of the middle coupled wheels. Behind the trailing wheels is fitted a water jet that automatically comes into action when the leading sanding jets are in operation, so that after the engine has used the sand the rails are cleaned with hot water.

The new enlarged type of tender carries nine tons of coal and 4,000 gallons of water, and is fitted with "Timken" roller bearings. The intermediate buffing gear is of special design with a view to improving the riding of the engine.

As we go to press we learn that this fine locomotive is to be named "*The Princess Royal.*"

The Meccano Guild

A Great Fellowship of Boys

Summer Activities

August usually seems to be the least active time of the year among Meccano Clubs. Appearances are very deceptive in this respect, however, for in this month there is always great activity of a special kind in which both officials and members take important parts. The outward signs of this healthy club life are the excursions and visits usually arranged for the holiday month. These include tours of works, locomotive sheds and railway centres, for Meccano boys never forget their chief interests, but in addition there are social events ranging from trips to the seaside, or to some inland place of interest, to extensive camping holidays, as well as various forms of recreation carried on nearer headquarters.

Reports from all quarters show how thoroughly all members of the various clubs are enjoying themselves this summer, each club following the plan best fitted to its circumstances. Few clubs have a mountain practically within sight of the club room. This is the case with the "Twenty-eight" (Edinburgh) M.C., which has its headquarters almost under the shadow of Arthur's Seat, and members take full advantage of the opportunity by arranging climbs to the summit of this remarkable height. There they are rewarded by a wonderful view of the Firth of Forth and its famous bridge, and in clear weather can see the distant Grampians.

The members of the Greenock Academy M.C. are even more enthusiastic and ambitious in regard to mountain climbing and a trip to the Highlands is an annual event in their programme. This year Callander was visited in order to enable Ben Ledi to be climbed. This peak is 2,875 ft. in height, and the ascent was made in misty and rainy weather. Fortunately the mist cleared when the party reached the summit—a kindly act that may be looked upon as a tribute to the determination of the Meccano boys who were not deterred by the unfavourable conditions!

Meccano Club Secretaries

No. 27. N. B. Underwood

N. B. Underwood is secretary of Bridlington School House M.C. The formation of the club was chiefly due to his enthusiasm and energy and affiliation was secured in October, 1931. Model-building Competitions and Lectures are the principal indoor activities, and members are keen cricketers.

Camping Trip Memories

It is particularly gratifying to learn that memories of enjoyable camping trips of the previous summer have resulted this year in an extension of this method of making the summer programme as attractive as possible. Special reference is made to this point in the news that reaches me from the Ipswich M.C. Last year the members of this club, in conjunction with those of the Clacton and District M.C., maintained a camp at Aldeburgh during part of the summer, members staying there as long as possible while the camp was open. The experiment was so successful that it is being repeated this year, and those who are able to stay under canvas, if only for a few days, will benefit from the experience.

Meanwhile, much active work is going on behind the scenes, for officials who are eager to create records during the coming winter sessions recognise the value of a good start and already are planning campaigns for brighter and better meetings.

Detective Stories at Club Meetings

During the summer it is sometimes necessary to abandon an open air event of some kind owing to wet weather. The club room is then the refuge of members, who can indulge in games, overhaul their Outfits, or take part in a rapidly organised meeting.

On an occasion of this kind an ingenious plan introduced by The Very Reverend E. Rogers, Dean of Bocking and President of the St. Mary's (Bocking) M.C. would ensure an exciting time for members. This is to arrange a detective meeting. The Leader gives members the details of a detective problem, taking care to include at least one fairly obvious clue. Members then work out their solutions of the problem, and each in turn is allowed five minutes in which to place his ideas before the others.

The scheme proved very popular with members of the St. Mary's (Bocking) M.C. It was found necessary to prevent the stories from becoming too complicated and to keep a sharp look out for impossibilities, but the President was greatly impressed with the general intelligence that members brought to bear on the knotty points in the problems placed before them. The plan is one that could be adopted with advantage at ordinary meetings during winter sessions.

The Correspondence Club

Although it is now holiday time, it will not be long before the evenings become longer and members of the Guild return to their customary indoor occupations of the winter months. One of these occupations is that of corresponding with fellow enthusiasts overseas in order to exchange news and opinions on Model-building, Stamp Collecting and other common interests and hobbies; and I strongly urge those members who have not yet joined the Correspondence Club to do so at once in order that I may be able to find correspondents for them in good time for the coming season.

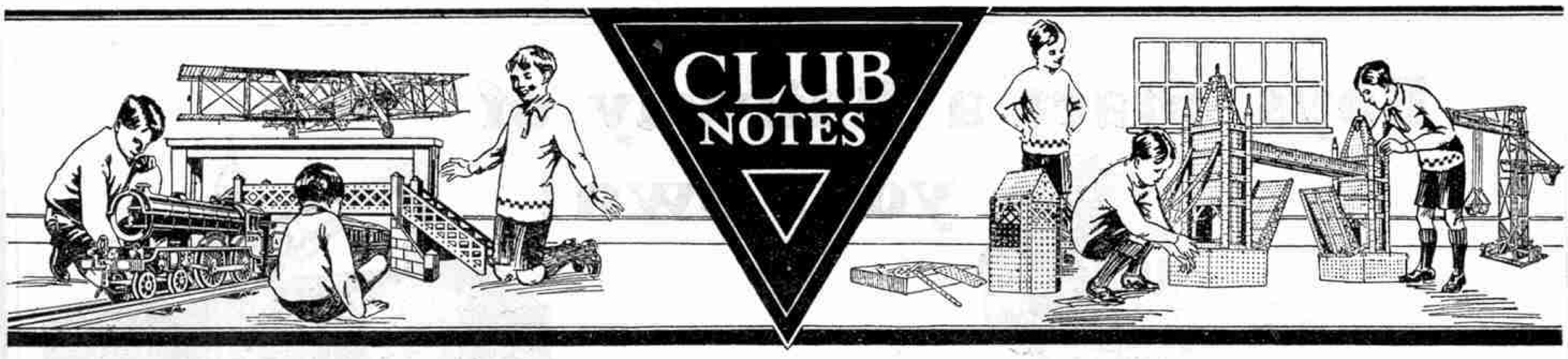
Correspondents are required particularly in France, Canada, South Africa, and the United States. Members are waiting for pen friends in practically every country into which the Guild movement has penetrated, however, and those who wish to take advantage of the splendid facilities afforded by the Correspondence Club should write to me immediately for an application form. I should like also to remind members of the Hornby Railway Company that a similar club has been established for their benefit, and full details of this may be obtained from the secretary.

Proposed Clubs

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

COVENTRY—R. I. Yardley, 371, Allesley Old Road.

POOLE—K. Chapman, 64, Denmark Road, Poole, Dorset.



Middlesbrough M.C.—Mock Trial Evening gave rise to great excitement and the Court Constable had difficulty in subduing unruly prisoners! Speed trials of Hornby locomotives have been held. These included a hill-climbing test, in which the engines made their way up the steep gradient in excellent style. Mr. T. D. Allick, Vice President, gave an enjoyable Lantern Lecture. Club roll: 36. *Secretary:* R. E. Rowlatt, 3, Blenheim Villas, Longlands Road, Middlesbrough.

Greenock Academy M.C.—Special attention has been given to outdoor events. These have included a walk to Largs, a distance of 14 miles, and the annual mountain climb. This year members climbed to the summit of Ben Ledi, 2,875 ft. in height. The excursion was open to non-members, and a party of 51 made the ascent in misty, rainy weather. Fortunately the mist cleared as the climbers neared the summit. The proceeds of the last Exhibition have been devoted to charitable purposes. Club roll: 75. *Secretary:* D. M. R. Steel, 25, Margaret Street, Greenock.

St. Peter's (Wolverhampton) M.C.—An outdoor railway track is very popular in good weather. The Rector of Wolverhampton has generously placed part of his garden at the disposal of the club for this purpose, and an excellent track, 30 ft. in length, has been laid out. An interesting feature is a tunnel 8 ft. in length. Club roll: 13. *Secretary:* V. Biddulph, c/o Westminster Bank, Lichfield Street, Wolverhampton.

Harlesden Methodist M.C.—Mr. Bowman, a local Meccano dealer, judged entries in a Model-building Contest, and afterwards kindly presented Hornby Train material to the club. The Exhibition was very successful, visitors being specially interested in the airport, which was provided with searchlights for night work. The hangars contained eight model aeroplanes. The Exhibition was repeated at Wembley, where the Hornby Train layout was greatly extended. Other interesting events have included a visit from Mr. Johnson, Assistant Leader of Holy Trinity (Barnsbury) M.C., who took control of railway operations for an hour, and a visit to the Exhibition of the Holy Trinity M.C., described in last month's "*M.M.*" Outdoor layouts are operated in favourable weather, and a Tennis Fete has been arranged. Club roll: 10. *Secretary:* J. Ford, 139, Wakeman Road, Kensal Rise.

Mallow M.C.—The anniversary of the Club's affiliation was celebrated by a combined Exhibition and Cinematograph Show. A fine selection of films was shown, and great interest was taken in a spectacular display of various types of model bridges. Members are keen on electricity, and the secretary reports that the club room is a veritable network of wires. Every available corner is adequately lighted, and the experts have paid special attention to the Club's Hornby Train layout. Club roll: 12. *Secretary:* W. J. Roche, 8, Spa Walk, Mallow, Co. Cork.

Clacton and District M.C.—A Lantern Lecture on a visit to Switzerland was given by a local architect. This was the finest Lecture yet delivered in the club room, a new lantern giving splendid service. Members visited the Gasworks in order to inspect newly-installed vertical retorts provided with modern systems of charging. A successful Model-building Exhibition and Competition attracted splendid models of Automatic Machines, Sports Cars, Cranes, Tractors, and a Bombing Game. Special attention is now being given to the construction of model aeroplanes, including realistic reproductions of early machines. With the Ipswich M.C., a joint camp has been organised at Aldeburgh. Club roll: 16. *Secretary:* M. H. Carter, 12, Wellesley Road, Clacton-on-Sea.

Twenty-Eight (Edinburgh) M.C.—Models prepared for display at the annual Social Evening included a lighthouse with a revolving turret that was placed in suitable scenic surroundings. These models also were on view at the Club's Exhibition, at which a special attraction was a large model of the Forth Bridge. The secretary gave a Lantern Lecture on "*Britain's Greatest Railway*," slides for which were kindly lent by the L.M.S.R. Great interest was taken in a special Model-building Contest in which the parts required for selected models were issued to the entrants. Book prizes were given to those who showed the greatest skill and speed in construction. A further Lantern Lecture on "*From the Grampians to the North Sea Shores*" was given by Mr. Thomson. Outdoor meetings are now being held and members greatly enjoyed the annual climb to the summit of Arthur's Seat and the games and sports that followed. Club roll: 25. *Secretary:* Mr. J. M. Ferguson, 7, Roseneath Terrace, Edinburgh.

Ipswich M.C.—Members were keen to repeat the previous year's successful camping enterprise, and a club camp was again organised at Aldeburgh. Members of the Clacton M.C. also took part in this scheme. Officials and members continue to be enthusiastic and have welcomed Mr. W. Shepherd as their new Leader. Club roll: 15. *Secretary:* P. Samson, 3, Bank Street, Foundation Street.

A cheery group of members of the Sid Vale M.C. Our photograph was taken after an enjoyable visit to H.M.S. "Norfolk." The Rev. J. W. Dickson, Leader of the club, is seen at the back of the group, and with him are Mr. Gliddon, senior member of the committee, Mr. J. R. Foyle, President, and Mr. Brooks, Treasurer.

St. Nicholas (Sevenoaks) M.C.—Members worked hard in preparation for their recent Exhibition. In addition to models built by them, the display included a Hornby Train layout to which a realistic appearance was given by the inclusion of scenic effects modelled in clay. The "*Sevenoaks Publicity Guide*" announced the Exhibition, which was well attended. Other events included a Bridge-building Contest and visits to the local Gas Works. Club roll: 15. *Secretary:* J. Kemp, 2, Bosville Road, Sevenoaks.

Elm Road (Beckenham) M.C.—At a private concert each member had to contribute an item, or be excluded from the tea that followed. The Secretary remarks that there was a full attendance at tea! At other meetings plays have been read and Lectures given on photo-electric cells and rectifiers. Outdoor events have included a visit to the Cunard liner "*Franconia.*" Club roll: 22. *Secretary:* R. S. FitzPatrick, 17, Blakeney Road, Beckenham.

Whitgift School M.C.—The Fourth Annual Exhibition, held in conjunction with the Whitgift School Branch of the H.R.C., was very successful. Special features were a display of models worked by means of electric motors and transformers, and a Lecture on "*How London's Tubes are Made*," given by Mr. Ewen. Both Exhibition and Lecture attracted a record number of visitors. Visits have been paid to the Davis Theatre, Croydon, and to the local Electricity Works. Club roll: 51. *Secretary:* M. M. Young, "The Corrie," Manor Way, Purley, Surrey.

Fulstow Junior M.C.—Members travelled to Grimsby by train in order to visit the Ice Factory, in which the engineer explained the processes involved. The trip concluded with a visit to a picture house at which an exceptionally interesting aeroplane picture was being shown. Outdoor events have included Cricket, Sports Meetings, a Paperchase and a Treasure Hunt. Club roll: 11. *Secretary:* S. Doe, The Stores, Fulstow.

Dagenham M.C.—The club has been reorganised, with Mr. W. H. Bond as Leader, and the members of the various sections are keen competitors in Model-building Contests and other competitions, charts exhibited in the club room showing the progress of each section. The Club Concert attracted more than 300 visitors, who formed a long queue an hour before the commencement! The proceeds were devoted to an excursion, at which sports were held, prizes then being presented by Mr. A. E. Pashley, President of the club. Other meetings have included Mock Trials and Cinematograph Shows. Club roll: 70. *Secretary:* S. Pashley, 84, Holgate Road, Dagenham, Essex.

East Hull M.C.—Visits have been paid to the Corporation Omnibus Garage and the Central Fire Station. On the first of these visits the special fire alarm was demonstrated, employees turning out in full equipment, and a special omnibus was provided to take members to the Tramcar Workshops. The visit to the Fire Station was equally interesting, and at its close the Inspector in charge told stories of exciting fights with the flames in which the Hull Central Brigade had taken part. Club roll: 15. *Secretary:* H. Acklam, 103, Newcomen Street, Hull.

CANADA

Rosemount (Regina) M.C.—Members were very successful in the "Boys' Fair" organised by the Regina Y.M.C.A., taking four first, four special and four extra prizes. The models entered included a Meccano Safe and an Electric Mobile Crane. Model-building has been very actively pursued and a remarkable array of models was constructed for the club's recent demonstration. Club roll: 29. *Secretary:* J. Watson, 974, Athol Street, Regina, Sask., Canada.

DENMARK

Copenhagen M.C.—Model-building Contests have included one in which cranes were to be built. Talks have been given on "*Technical Electricity*," by Mr. J. E. Pedersen, and on "*Motor Car Mechanisms*," by the secretary. The Fifth Exhibition attracted 35 interesting models, including the Loom, the Workshop and a Henderson Dragline. Other events have included a Lecture by the secretary on wireless, at which various types of receivers were demonstrated, and enjoyable cycle runs. Club roll: 28. *Secretary:* Frode Severin, Rud. Berghsgade 17, Copenhagen, Denmark.

NEW ZEALAND

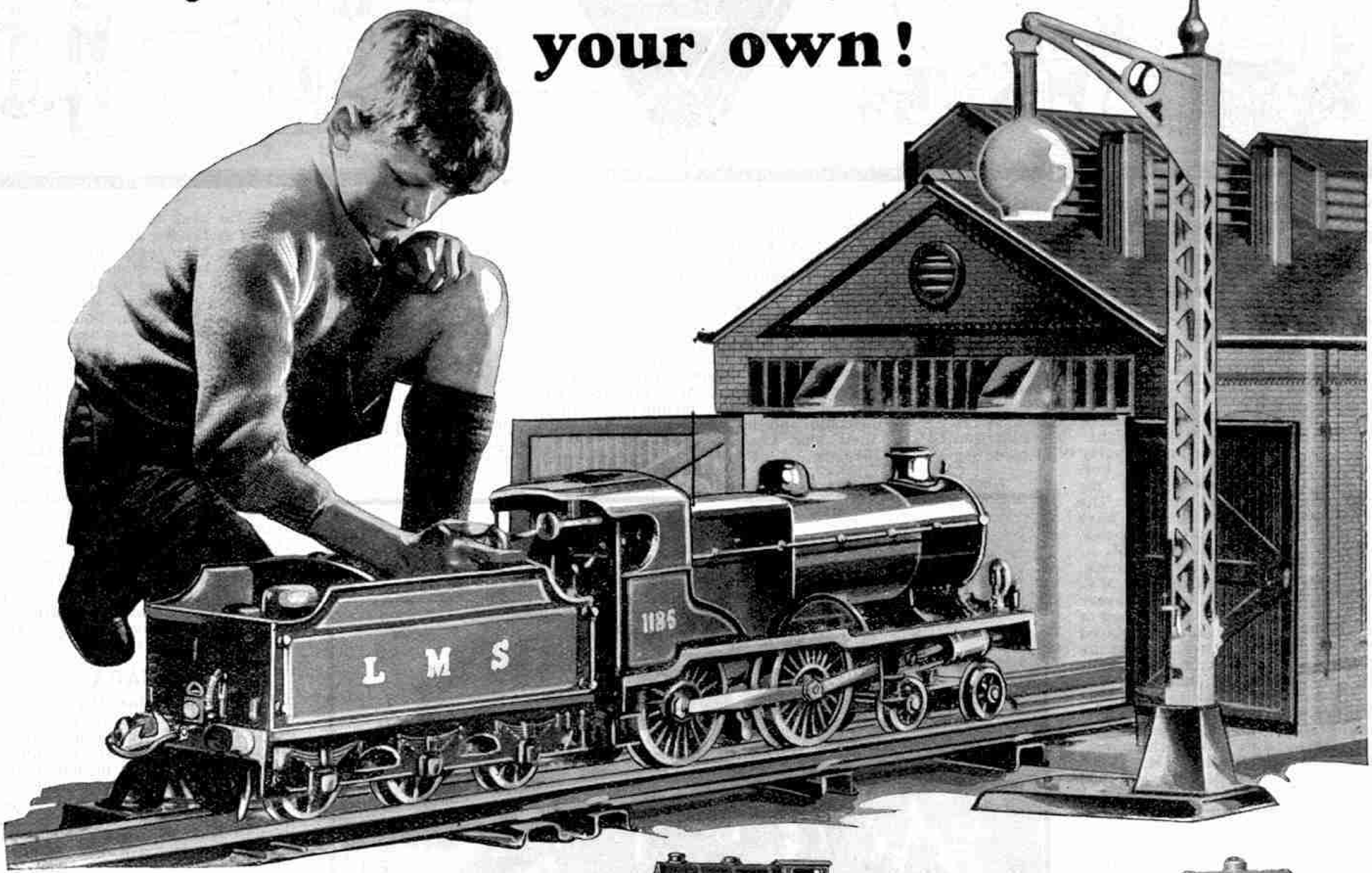
Blenheim M.C.—Boxing Night has been added to the programme, and other Games Nights have been devoted to Table Tennis. Models have been built for a window display and an Exhibition, in addition to those entered in Model-building Contests. Stamp Competitions are arranged regularly, and sessional points are allotted to competitors. Club roll: 18. *Secretary:* K. J. Orams, Redwood Street, Blenheim, New Zealand.

Wellington Boys' Institute M.C.—Travel talks continue to be popular, and have included an attractive description by a member of a voyage to Sydney and Melbourne. A special display was given at the Easter Show, the models built for this purpose including the Big Wheel and the High Speed Coaler. An interesting News Sheet has been introduced in order to keep members in touch with coming events. It is hoped that this will develop into a regular club magazine. Club roll: 15. *Secretary:* E. Speers, 70, Cuba Street, Petone, Wellington, New Zealand.

SOUTH AFRICA

Western Province Preparatory School M.C.—Model-building Contests, Competitions and Talks by members are chief attractions at ordinary meetings. The Talks have included an attractive account of "*The Progress of Engineering*," by P. K. Wiener. A visit has been paid to the factory of the United Tobacco Company. Members planned a model dock, equipped with cranes, for their Exhibition, and models of liners and other vessels were included in the scheme. Club roll: 49. *Secretary:* B. B. Strickland, "Engwood," Doris Road, Claremont, Capetown, South Africa.

Boys, Start a Railway of your own!



You have spent many happy hours watching real trains; now start a railway of your own and have the thrill of operating Engines, Rolling Stock, Signals and Points on actual railway principles. Everything under your own control!

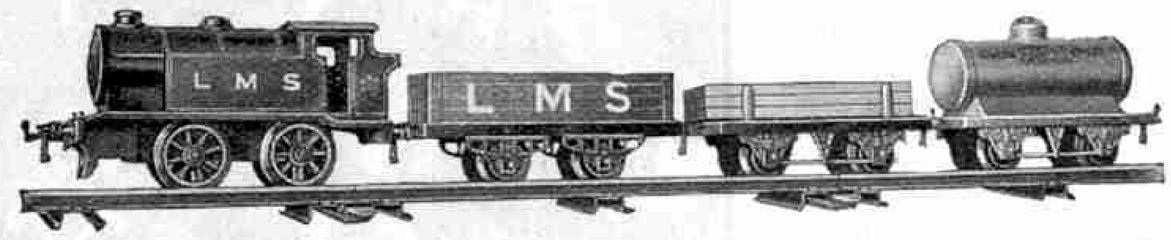
Almost every operation in modern railway practice can be carried out with a Hornby Railway. The Locomotives are the best in the world for length of run and hauling power; the Rolling Stock includes every type in general use and the Accessories provide the final touch of realism. There is an endless variety to choose from.

If you do not possess a Hornby Railway, now is the time to start. Ask your dealer for a copy of the latest Hornby Train Price List.

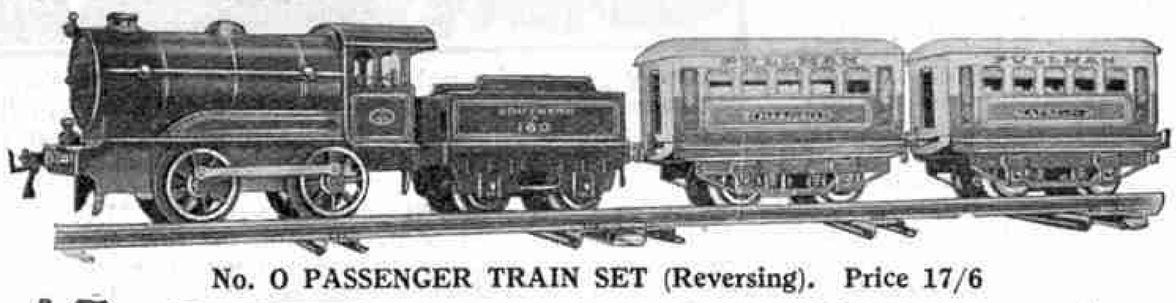
Prices of Hornby Clockwork Train Sets

MO Goods Set ...	5/–	No. 1 Tank Goods Set	25/–
MO Passenger Set	5/9	No. 1 Passenger Set	28/6
M1 Passenger Set...	9/3	No. 1 Special Goods Set	32/6
M1 Goods Set ...	10/–	No. 1 Special Passenger Set ...	35/–
M2 Passenger Set...	10/9	No. 2 Mixed Goods Set	40/–
M3 Tank Goods Set	15/–	Metropolitan Train Set C ...	45/–
No. O Goods Set ...	18/6	No. 3C Riviera "Blue" Set	62/6
No. O Passenger Set	17/6	No. 2 Special Pullman Set ...	67/6
No. 1 Goods Set ...	25/–	No. 3C Pullman Set	67/6

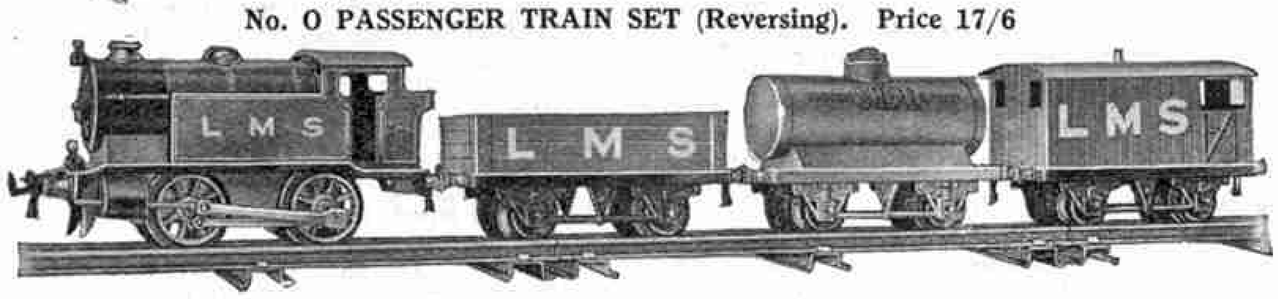
Electric Models from 40/– to 85/–



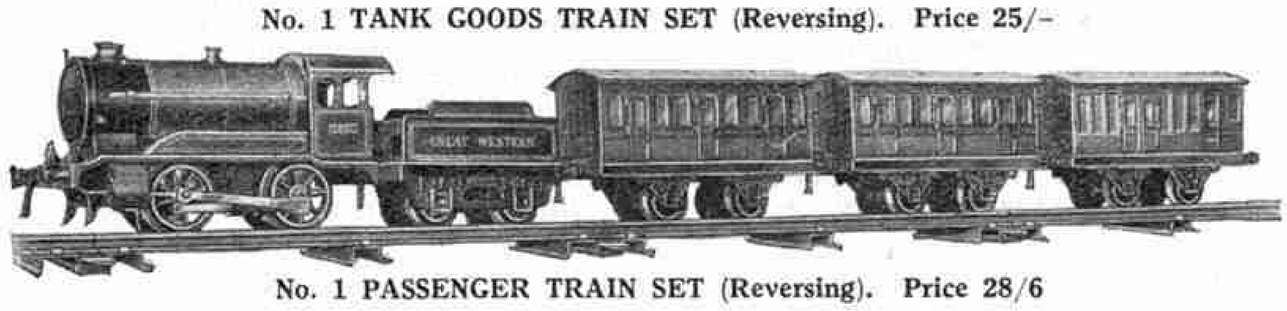
M3 TANK GOODS TRAIN SET (Reversing). Price 15/–



No. O PASSENGER TRAIN SET (Reversing). Price 17/6



No. 1 TANK GOODS TRAIN SET (Reversing). Price 25/–



No. 1 PASSENGER TRAIN SET (Reversing). Price 28/6

HORNBY TRAINS

MANUFACTURED BY MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

Branch News

WHITGIFT SCHOOL.—At the Fourth Annual Exhibition, clockwork and electric layouts were run to timetable, and visitors were greatly interested in the realistic operations carried out. Visits have been paid to the local Fire Station and the "*Star*" Printing Works. During the summer months the two sections of the club have held joint meetings for track operations and interesting new timetables have been worked out. Secretary: M. M. Young, "The Corrie," Manor Way, Purley, Surrey.

ELMSIDE (EXETER).—Membership has increased to such an extent that meetings have been overcrowded, and schemes for the division of the Branch into sections are being tried in order to overcome this difficulty. Two new locomotives, named "*Exeter*" and "*Torquay*" respectively, have been received from Mr. Rush, Accrington, and introduced into service after undergoing trials. Special types of train services are run at each meeting, including express services, goods trains, ordinary services and special "speed up" programmes. Marks for good work are awarded to those taking part in track meetings. Secretary: D. Legg, 25, Chute Street, Exeter.

ILKESTON AND DISTRICT.—An excellent Branch room has been rented and subscription rates fixed in order to enable expenses to be met. Stock has been taken and Branch material brought up to date. Members are now busily engaged in decorating the Branch room and in the construction of a shelf on which to lay down the Branch track. Secretary: F. B. Caddick, Woodthorpe, Catherine Avenue, Ilkeston.

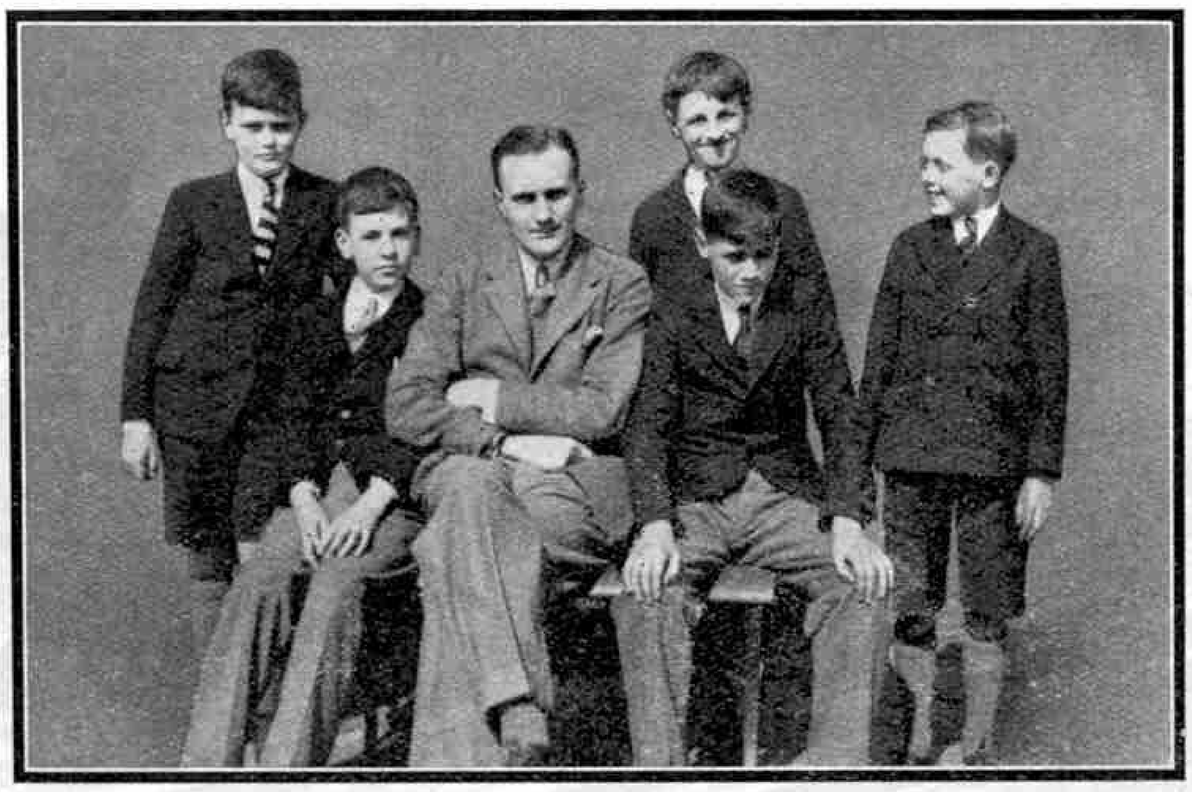
MAIDSTONE.—The Branch layout has been greatly improved by the construction of a new terminus. This is on a baseboard, and thus is semi-portable; and electric signals with central control have been installed. A talk has been given on "*Travel in Africa*," by the Rev. F. Williams, and Mr. Evernden has demonstrated an 0–6–2 tender engine of 5 in. gauge, with explanations of the manner in which he built it. The Bekonscot model railway and village has been visited, non-members being invited to take part in this event. Secretary: W. Hills, "The Orchard," Lord Romney's Hill, Maidstone.

SEFTON (LIVERPOOL).—Locomotive speeds have been tried in order to enable timetables to be worked out. A preliminary timetable was tried on two different tracks laid down out of doors, and much useful experience was gained. Track meetings of this kind are to continue as the Branch layout is enlarged. Secretary: J. Mather, Appleby, Carnatic Road, Liverpool 18.

ST. SAVIOURS (RAYNES PARK).—A new layout has been planned, and in early running on it each driver carried an official "pass" in order to avoid confusion in the absence of published timetables. Only four passes were issued, and drivers without these were forbidden to run engines on the track. A length of experimental track has been included in the Branch layout. This is fitted with an elaborate system of colour-light signals operated by the trains themselves. Junior members have been formed into a "Repair and Breakdown Gang," and under the supervision of a senior member they deal with casualties and accidents on the track. Secretary: D. J. Fielden, 117, Bushey Road, Raynes Park, London, S.W.20.

STREATHAM COMMON.—The Second Annual Exhibition attracted an attendance of 200, and members and visitors thoroughly enjoyed themselves. The exhibits included a 5 in. gauge railway, included by kind permission of Mr. R. Gosnell, and trips on this were highly appreciated. Other features of the display included locomotives made by members, some of which revealed the details of construction, and an excellent model layout on which regular services were run. Members resumed constructional activities immediately after the Exhibition, and every member of the club is now making a locomotive, a coach, or interesting railway material. Secretary: L. J. Ling, Brooke House, Rotherhill Avenue, Streatham, London, S.W.16.

LORDSHIP LANE.—A new experimental track represents the L.N.E.R. lines from Liverpool Street to Woolwich, via Stratford, and Enfield, via Seven Sisters. The track is being made as realistic as possible, and a timetable to correspond with the working of its prototype is eventually to be put into operation. Visits have been paid to the L.N.E.R. engine sheds at Stratford, and the Nine Elms depot of the S.R. Secretary: R. L. Carrington, 49, Russell Avenue, Noel Park, Wood Green, London, N.22.



Members of the West Dulwich and Herne Hill Branch, No. 194. Mr. E. P. Fisher, Chairman, is in the centre with J. Nunn, secretary, on his right. This branch was incorporated in August 1931. An Efficiency Badge is awarded monthly to the member who does the most creditable work, and there is keen competition for this award between the "Baltics" and the "Pacifics," the two sections of the Branch.

AUSTRALIA

MELBOURNE.—The outstanding recent event was the Second Annual Exhibition, held in conjunction with the Melbourne M.C. Clockwork and electric layouts were displayed, and the interest of visitors was largely centred on the electric track, practically all the controls of which were concentrated on centrally placed switchboards. At ordinary meetings track work has been continued, and the introduction of scenery has greatly improved the appearance of the Branch layout. An interesting event was a lecture on "*Aerial Photography in the War*" given by Mr. R. H. Faulkner, President of the club. Photographs from Mr. Faulkner's collection were projected on the screen. Secretary: L. Ison, 8, Hayes Street, Northcote, N.16, Victoria, Australia.

SYDNEY.—Clockwork and electric services have been run on specially laid tracks, one layout being designed for the purpose of testing the hauling powers of electric locomotives. A series of interesting Railway Contests has been organised, prizes to be given to those earning most marks over the entire series. In one of these Contests competitors were required to describe a railway journey of not more than 20 miles in the Sydney Metropolitan area. Secretary: W. J. T. Watson, 595, Parramatta Road, West Leichhardt, N.S.W.

Proposed Branches

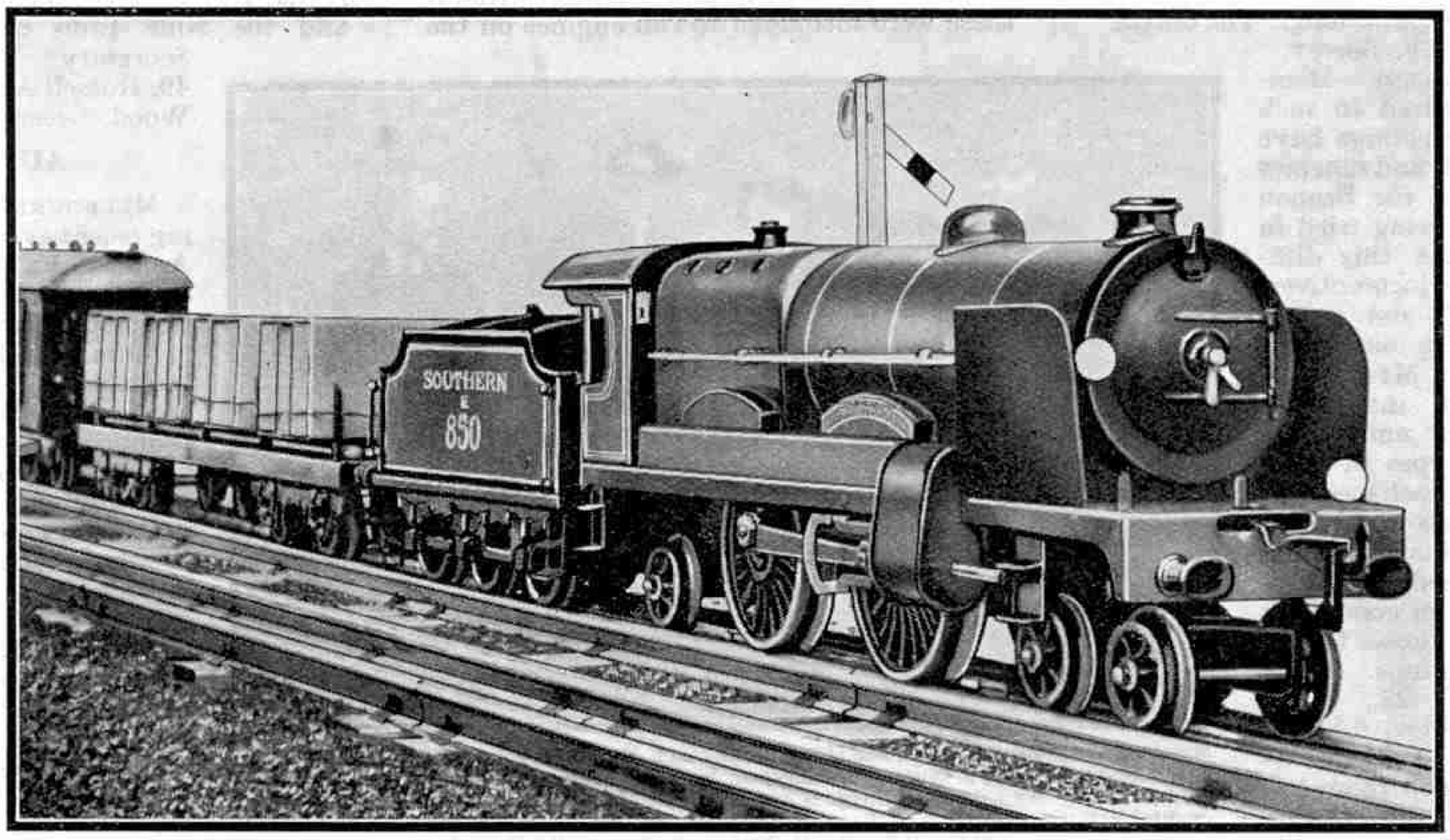
BIRMINGHAM—G. E. Bartlett, 152, Clements Road, S. Yardley.
BRADFORD—N. Barker, Hutton Modern School, Eccleshill.
BRISTOL—N. Hewett, Hightorpe, The Crescent, Henleaze.
CHEAM—Alan H. Love, 117, Mulgrave Road.
KINVER—P. Genner, 8, James Street, Kinver.
TRURO—F. Hubbard, 30, Lemon Street.

LVI.—SOME SOUTHERN SUGGESTIONS

IN the February "*M.M.*" of this year we made a number of suggestions regarding train operations and similar matters for the benefit of those interested in the Southern Railway. The article proved useful to many of our readers, for the Southern is a popular line, and as a result we are offering further hints of a similar kind. The article mentioned dealt more particularly with the Western Section or old L. S. W. R., so that we now intend to deal with the Eastern and Central Sections, as the former South Eastern and Brighton systems are now known.

The Eastern Section is specially notable for the Continental traffic passing over its metals to Dover. As these trains start from Victoria Station, London, which also accommodates the Brighton Section, interesting possibilities for station working are instantly suggested. A miniature Victoria may be the starting and terminal point for a twin kind of layout with two more or less separate main lines representing each Section. Alternatively, while both Eastern and Central Section trains may be found at once in the terminus, but only one main line is available, the trains of one Section alone might be operated over it at one time. This is a point to be determined by the resources of the miniature railway owner, and the space at his disposal.

Pride of place in the Continental services must be given to the splendid all-Pullman "*Golden Arrow*" that runs down to Dover in the morning and up in the afternoon, connecting with the Calais cross-Channel steamer. We have referred several times to possible all-Pullman services for Hornby railways, but there is a special feature about the "*Golden Arrow*" that makes it distinctive and therefore more interesting from a miniature railway point of view. There is special accommodation for registered luggage in the shape of "luggage boxes," or containers, which can be transferred directly from train to steamer, and vice versa. They are carried on flat trucks, and form a conspicuous feature in the make-up of the train.



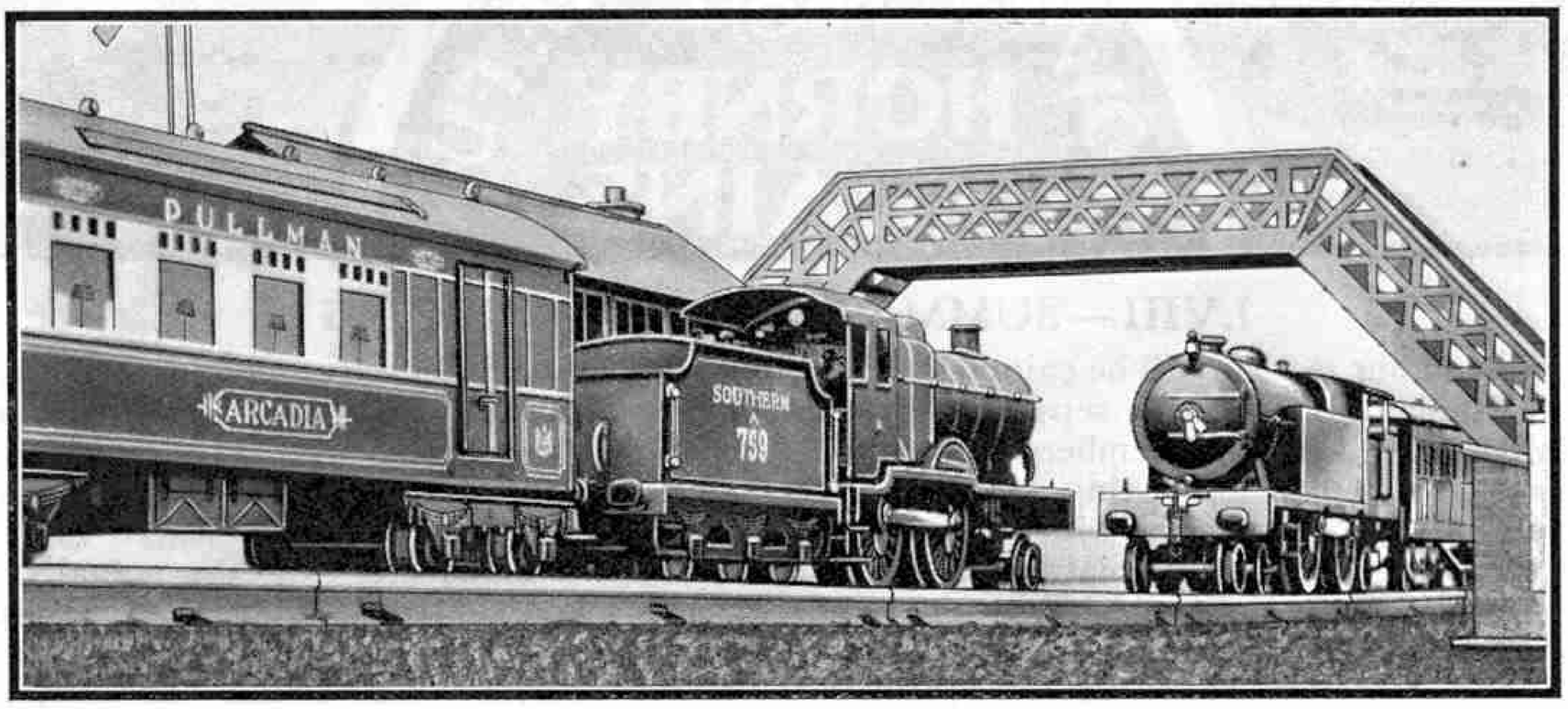
A Hornby "Lord Nelson" hauling the "Golden Arrow" Continental Express. The No. 2 Timber Wagon next to the engine is carrying luggage containers made up of empty matchboxes.

A miniature "*Golden Arrow*" composed of Hornby No. 2 or No. 2 Special Pullmans may therefore have a No. 1 or, for preference, a No. 2 Timber Wagon, attached for conveying the luggage boxes. The latter do not require to include any great detail in order to give sufficient effect, and miniature railway owners may make them up themselves of card or thin wood, or else make use of a number of small boxes or cartons that are usually to be found at home. Three ordinary matchboxes stuck together face to face, and then painted, will do quite well for each container. They should be loaded across the Wagon and will then look quite realistic, as one of our photographs shows. They may be secured in position by an elastic band slipped round them and over the stanchions provided on the Timber Wagons. Those keen on detail may attach suitable slings made of string, with a small ring connecting them for hoisting purposes.

Although a Hornby "Lord Nelson" is the obvious selection for a weighty Continental Express of this kind, other engines may be used for second portions, relief trains, or in an emergency on the main train. The next

choice in the Hornby Series is the 4–4–0 No. 2 Special "L1" class engine, representative of a type that does consistently fine work. Although their design is based upon the more recent Maunsell engines, they are similar in some respects to the rebuilt Wainwright locomotives, and in miniature might be used as such.

Although they formerly did much work on the Continental trains, the latter locomotives are now more particularly associated with Kent Coast trains, and those interested should turn up the September, 1929, "*M.M.*," where a typical "Kent Coast Express" run was described. Those who prefer to run a Pullman train on these services may reproduce the special Sunday service to Margate, known as the "*Thanet Pullman Limited.*" This is a heavy train, and its 90-minute timing over a hard route gives the engine plenty to do.

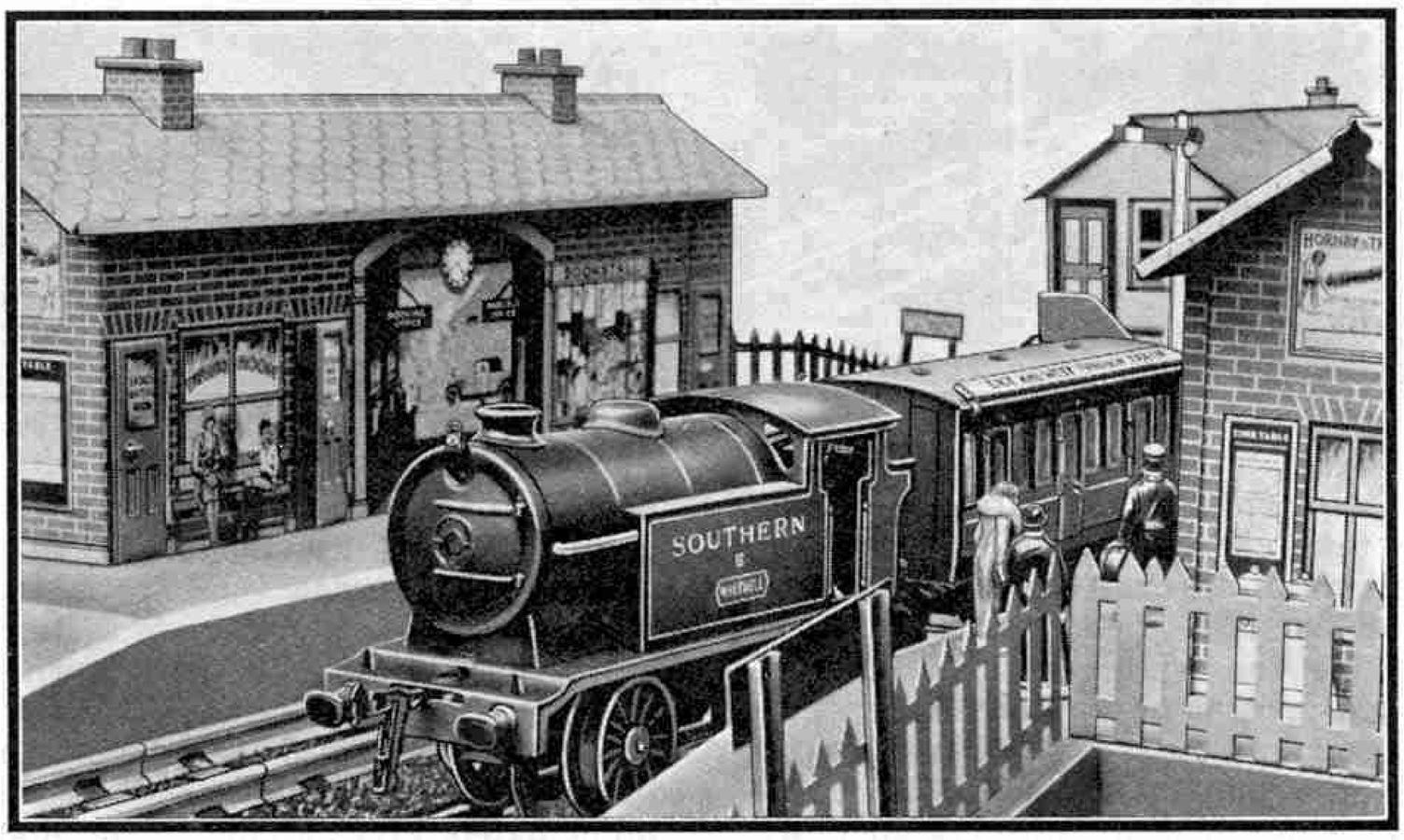


A miniature Pullman express passing a slow train. The S.R. "L1" class locomotive on the express is a true-to-type model of the real engines of this class, which are used on fast trains on the Eastern Section.

This year has been remarkable in witnessing the operation of the first British main line electrification scheme, the S.R. Brighton route. Hornby Railway enthusiasts have not been slow in suggesting that a miniature electric "*Southern Belle*" would be distinctly attractive in the Hornby Series. With this we agree, but for the time being those who operate miniature Southern systems may work their electric trains by means of independent locomotives in the absence of trains of motor and trailer coaches. A "*Southern Belle*" can be made up with Pullmans as in the steam days, and hauled by one of the Hornby Electric-type engines, LE1/20 or LE2/20, suitably finished in green. Although not absolutely correct, the green colour of the locomotive will help to give the impression of Southern Railway practice. Again, there is no reason why the former steam operation of the train should not still be continued in miniature, a clockwork No. 2 Special Tank or the No. 2 Electric Tank Locomotive being used.

There is still plenty of work for Brighton engines to do, however, such as on the Eastbourne trains. Hornby Special Tanks, therefore, as representing the large Brighton main line tank engines, may be correctly used, in addition to other locomotives. The Newhaven Continental services also must not be forgotten, and some heavy loads are often taken on these trains.

A very interesting section of the Southern Railway, which so far has not been mentioned in these pages, is that situated in the Isle of Wight. The lines there, originally composed of a number of separate concerns, have been brought up to date by the Southern Railway, and are now of course treated as one section. The layout and equipment at various points is still on a modest scale, so that the Isle of Wight Section is specially suitable for reproduction with Hornby material. Many of the hints that we gave on branch line working in the June "*M.M.*" may be applied with success, for single line working is in operation in certain parts, and the simplicity of the arrangements generally is a characteristic feature.

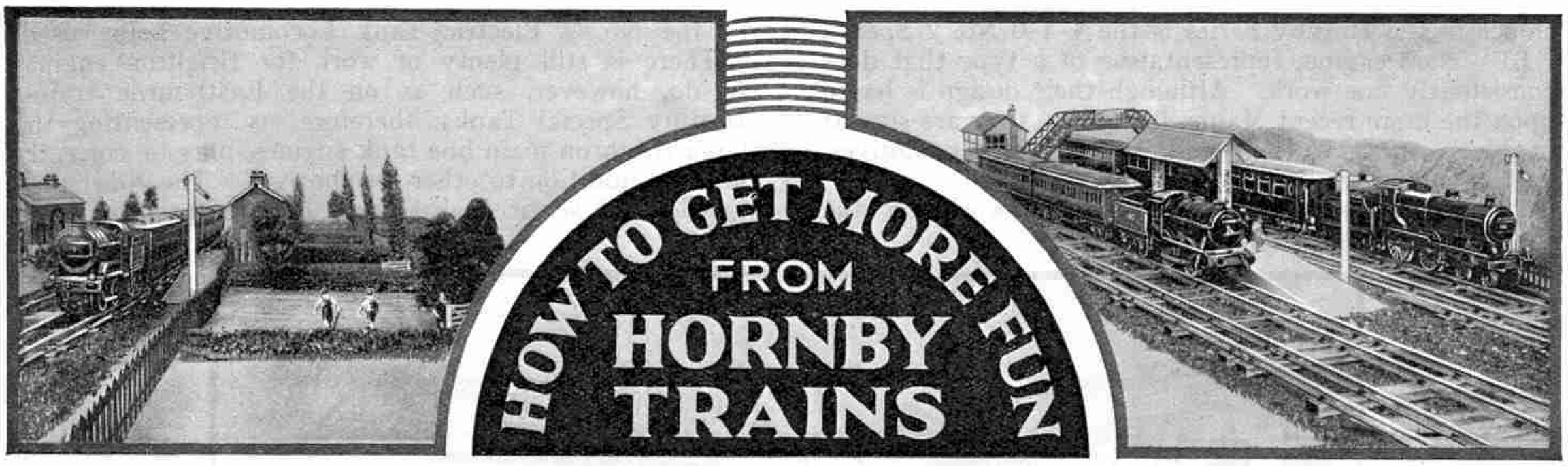


A Hornby M3 Tank Locomotive on a layout representing the Isle of Wight section of the S.R. A suitable name has been added to the engine, as suggested in this article.

The engines used are all rather small, and are of the inside-cylinder variety. Therefore Hornby M3 Tanks will be ideal, and may represent either the famous Brighton "Terriers" and similar larger engines, or the 0–4–4 tanks of the former L.S.W.R., which are at work in the island. All of them bear names, contrary to the usual S.R. practice for tank engines, and this adds considerably to their interest. These names appear on nameplates on the tank sides, the plates having a red background and the brass letters and edges being raised.

The addition of a name to a Hornby M3 Tank might be carried out by preparing a small paper "label" and sticking this on to the tank side.

(*Continued on page 617*)

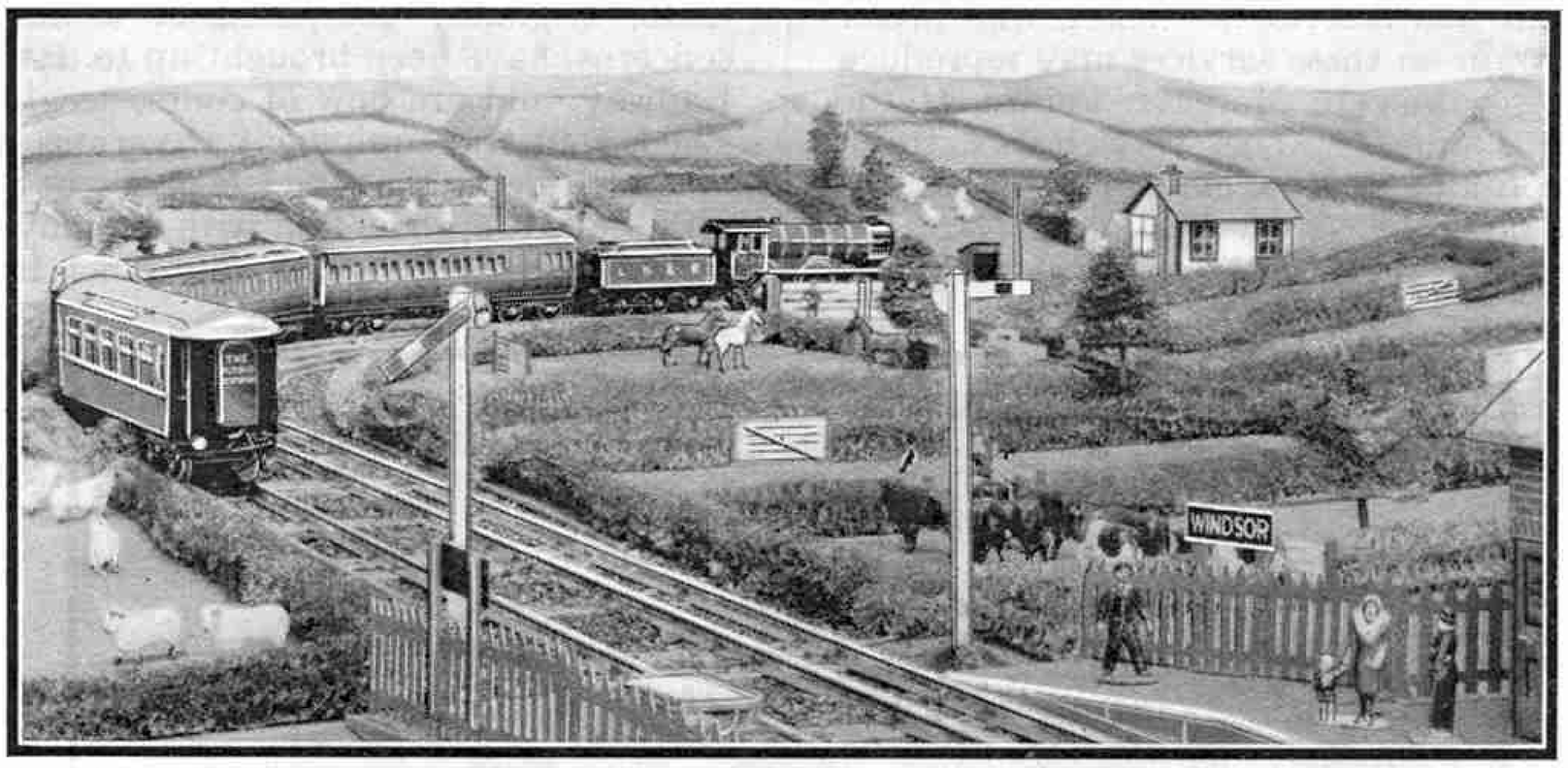


LVIII.—SUMMER TRAIN WORKING

THIS month most of our readers will be enjoying their holidays. Although temporarily separated from their railway outfits, H.R.C. members will quite likely have made a note of interesting features or practices observed on holiday journeys, with the mental resolve to try the same thing in miniature on their return home. Certain types of vehicles, trains or methods of working may be and often are confined to certain districts, and such items have been frequently commented upon in these pages. This month, as a topical subject, we will deal with various suggestions that occur to mind when summer traffic as a whole is being considered.

To the railway enthusiast the introduction of the summer service of trains means that certain long non-stop runs are made, and various accelerations take effect. Again, by reason of certain extra connections or through services afforded, trains that have been pursuing a more or less undistinguished career during the winter become invested with the temporary glory of names! Many interesting methods of working also are in force as a result of special conditions peculiar to the summer season. The reproduction of these features in miniature adds considerably to the interest of the operation of a railway system.

A practice that has considerable fascination for most miniature railway owners is the making of various gadgets such as special nameboards, route indicators, and similar fittings that may be carried by the engines of certain trains. We have dealt with some of these from time to time; for example, the semi-circular nameboards carried on the smoke-box front of the engines of such trains as "*The Flying Scotsman*" and "*The Queen of Scots*" were described in the "*M.M.*" for May, 1932. For another item of similar interest we must turn to the tail of the train. Here occasionally, while the Edinburgh non-stop running is in force, "*The Flying Scotsman*" displays its name on the rear corridor gangway shutter. The lettering is carried out in white on the black usually used for these items, so that no great difficulty will be experienced in reproducing this feature in miniature. On the actual train the words "The" and "Flying" appear on the same line above "Scotsman," but it is hardly possible to do this on a Hornby corridor End Plate. The arrangement of the lettering shown in one of our photographs is therefore the next best thing. This scheme is not a standard arrangement, and is rather reminiscent of American practice, but L.N.E.R. enthusiasts may care to employ it occasionally.

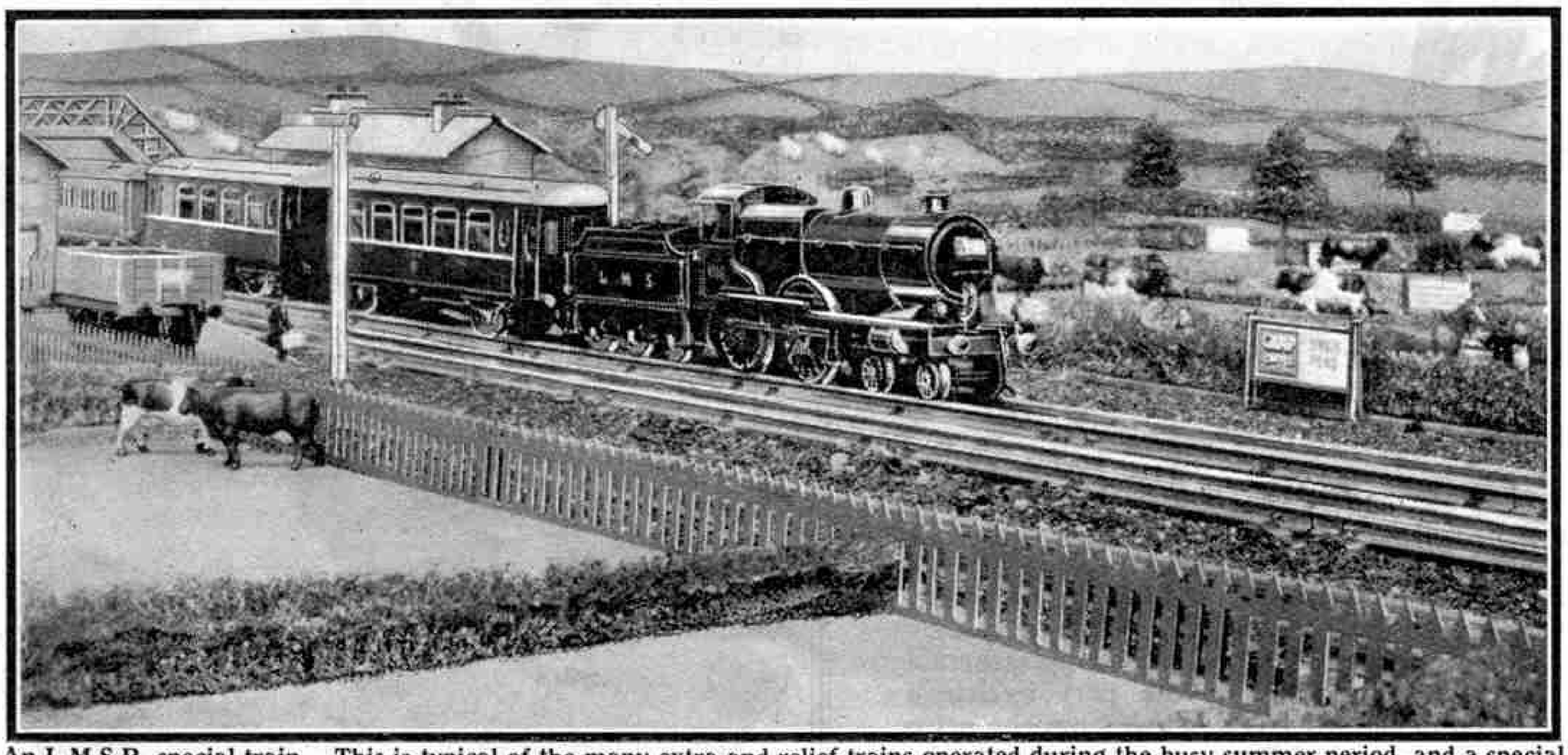


A miniature express train on a Hornby L.N.E.R. system. This represents the non-stop "Flying Scotsman," and displays its name on the end of the train, as mentioned in this article.

While on the subject of train names we must not overlook the titles recently bestowed upon certain Scottish trains by the L.M.S.R. "*The Hebridean*" and "*The Lewisman*" are special summer service trains between Inverness and Kyle of Lochalsh in connection with steamers for Skye and Stornoway, as implied by their names. The famous 10 a.m. from Glasgow to Aberdeen, and the 5.30 p.m. in the opposite direction, bear the imposing name of "*The Granite City*," which immediately gives a clue to the journey. There is also "*The Tinto*," which provides a residential service to and from Lockerbie and Glasgow. The afternoon and evening boat expresses from Glasgow to Stranraer and their corresponding return services are now known as "*The Fast Belfast*" and "*The Irishman*."

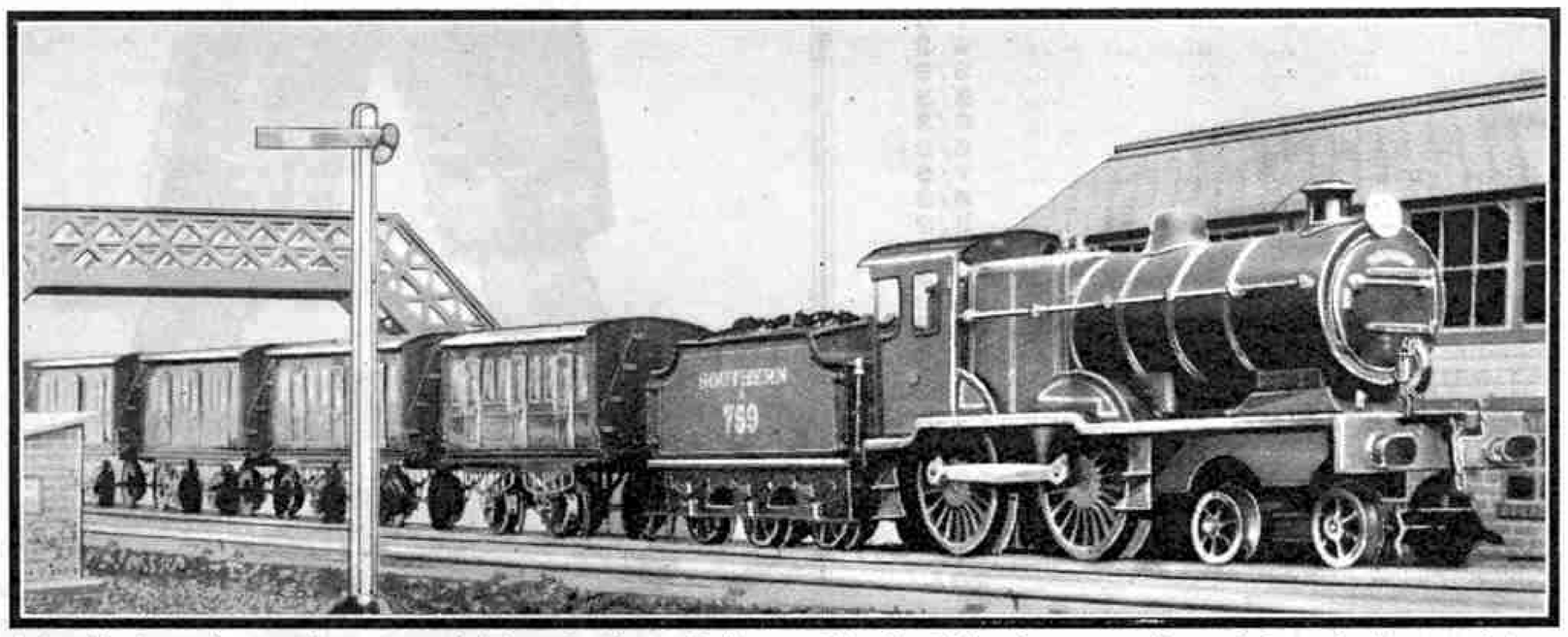
L.M.S.R. enthusiasts who operate miniature railways representing the Highland, Caledonian or G. & S.W. sections of the L.M.S.R. may therefore add some interesting names to their trains. The lettering with Indian ink or black paint of strips of white card is not difficult, and many model railway engineers regularly make special destination and name boards to suit their own requirements.

Another feature of special interest to those who operate Scottish services is the procession of sleeping-car trains from Euston and King's Cross to the Highlands that are run in connection with the grouse shooting season. This commences on the 12th of this month, and for several days, or rather nights, beforehand, special trains may be necessary to cope with the northward rush. These are in addition to the regular "*Royal Highlander*" and "*Night Scot*" of the L.M.S.R. and the "*Highlandman*" and "*Night Scotsman*" of the L.N.E.R. The popularity of these trains affords a proof of the superior comfort and convenience of railway travel for long distances, and it is often the custom of passengers to have carried by rail the cars that they will require when in Scotland.



An L.M.S.R. special train. This is typical of the many extra and relief trains operated during the busy summer period, and a special train number is carried on the locomotive.

Miniature L.M.S.R. and L.N.E.R. systems may therefore cater for their "grouse traffic," the No. 2 Saloon Coaches being useful for making up such luxury trains as may be required. Much of this traffic converges on Perth, where the L.M.S.R. and L.N.E.R. lines meet. Beyond this point the Highland section of the L.M.S.R. is involved, and vehicles working through from Euston and King's Cross are frequently found together in the formation of the Highland train. Working of this kind invariably appeals to Hornby Railway owners, a combined train being unusual in a sense, and therefore interesting. Restaurant facilities may be assumed to be provided for when the centre-corridor No. 2 Saloons are used, and a Pullman may be attached to L.M.S.R. trains from Carlisle. Pullmans are also run between Perth and the Highland station of Aviemore.



A hastily-formed excursion on a miniature Southern Railway. The No. 1 Coaches normally used for suburban work have been pressed into service to cope with the traffic to the coast.

The great variety and scope of the excursion facilities now afforded by the railways may be reflected to some extent in miniature practice. The model railway manager, luckily, has not to bother himself about rates and fares, but he may do a great deal on his own line to reproduce actual working of excursion traffic. First of all due notice must be given to the "public"—Modelled Miniatures No. 3—so that the Poster Boards and Station Hoardings should display announcements of suitable size either specially made or cut from actual timetables, handbills, or newspaper advertisements. Travel generally may be suggested by the use of cigarette cards showing ships, landscapes, locomotives and other items that are portrayed on real posters. The addition of a little suitable lettering is easy, and the "posters" formed in this way are quite convincing.

As regards the trains themselves, the use of standard main line stock is usual nowadays, especially for long-distance trips, and dining or sleeping accommodation is included as appropriate. The centre-corridor stock so popular on the L.M.S.R. and the L.N.E.R. is well reproduced by the No. 2 Saloon Coaches of the Hornby Series, which are finished in the colours of these two railways. Some very fine trains therefore can be made up, their special nature being indicated by the display of train numbers, destination boards, or any similar decoration based upon actual practice that may occur to readers.

It is generally known that each train is given a number in the working timetables for easy reference. Regular trains do not usually display these numbers, for the operating staff are familiar with them from experience. In a similar manner special trains are also allotted numbers, sometimes prefixed by a letter; and these numbers are carried on a board attached to the engine so that each train may be easily identified. The preparation of such miniature boards is extremely simple, and readers may paint suitable figures directly on to thin card, or cut out printed numbers and gum them on. Their attachment to the engine is made easy if a small loop of cotton is fixed to the board. One of our illustrations shows a miniature L.M.S.R. "special" distinguished in this manner.

Many other characteristics of summer train operation no doubt will suggest themselves to readers.

NEW LOCOMOTIVES FOR OLD

Hornby Locomotives are the Longest Running and Strongest Pulling Locomotives in the World

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

First of all, study carefully the latest Hornby Train Catalogue, and select from it the new up-to-date Hornby Locomotive you want. Then pack up your old Hornby Locomotive and send it to us addressed " Special Service Department," Meccano Ltd., Binns Rd., Liverpool 13. Your order for the new Locomotive and the necessary remittance should be enclosed. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the list given below from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase. It is important to note that the catalogue price of the new Hornby Locomotive you purchase **must not be less than double the Part Exchange allowance made for your old Locomotive.**

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

EXCHANGE YOUR OLD HORNBY LOCOMOTIVE TO-DAY !

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES	
MO Locomotive	1/4
M1/2 Locomotive	2/3
M3 Tank Locomotive	3/9
No. O Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
LEC 1 Locomotive (Swiss Type)	7/6
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
LST M3/20 Tank Locomotive (20-volt)	11/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
LST 1/20 Tank Locomotive (20-volt)	12/6
LE 1/20 Locomotive (Swiss Type), 20-volt	13/3
LE 2/20 Locomotive (20-volt)	16/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera " Blue " Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera " Blue " Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/–

OBSOLETE TYPES	
M2930 Locomotive	1/–
George V Locomotive, No. OO Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan H.V. Locomotive	20/–

HORNBY TRAINS

MECCANO LIMITED
Special Service Department
Binns Road
LIVERPOOL 13

H.R.C. COMPETITION PAGE

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

FOURTH LOCOMOTIVE NAME AND NUMBER CONTEST

This month we return to an old favourite among competitions, involving the deciphering of jumbled locomotive names and numbers. Our correspondence shows that H.R.C. members continue to be as keen as ever in collecting locomotive names and numbers, and the remarkable popularity of this type of contest is no doubt due to the fact that it gives such enthusiasts an opportunity of making use of their knowledge.

The accompanying panel contains the names and numbers of 48 locomotives, in which the letters and figures respectively have been thoroughly jumbled up. Competitors are required to re-shuffle these into their correct positions and to make a list of the names and numbers thus obtained.

Many of the names are quite alarming in appearance, and it seems almost incredible that the name of any locomotive can contain such an extraordinary collection of letters. Nevertheless, each of these weird words conceals the name of a well-known locomotive belonging to one or other of the four groups. In solving the contest readers should first decipher the name of the locomotive, and then its number can readily be found.

No.	Name	No.	Name
1160	Yseroosygtarlc	4074	Losspunircsiee
7285	Oyrabad	9648	Hardgonihnoedlrg
9480	Yaekwicdestlll	4039	Tastenuclersd
179	Nusieiawr	3547	Tinlabcerper
1005	Cartsleelstorem	6653	Herpybselseyhylecs
293	Vinrseinsehsre	874	Norenservis
702	Garlyreshil	2015	Boylaspretemocerry
1566	Worteralusbedoshre	2280	Hailwangms
8034	Yotcussatlebabrb	1024	Coiluosngytkfnuiohlpnt
977	Seraciolrgcvne	3922	Topsenhesn
4522	Hertsodevea	4020	Pathniteroiesctsn
2358	Horbgaum	4860	Bonyaltanheybl
447	Toilmastdofaa	7553	Dottesaushbn
6119	Benally	3159	Doolcookwelcoln
5329	Hirstsamwallioims	6252	Gansiliss
7166	Forgeherdhrieremintshett	3228	Cabvelretsoil
8044	Wystbarstyetachel	2342	Leethendes
2609	Siarnwoln	6085	Noelviewr
268	Goodcordloinllw	3014	Trighoickpastfnkt
6041	Burstlagbabeyony	878	Methoeursfoiurtnr
9624	Ronna	5566	Yavbausl
3056	Ganglem	2054	Binspirceteacesr
8365	Bitlumkekakicucecl	480	Sofwodciarorcanrll
1402	Pipnevrioetl	1540	Neelsirpechans

For example, the letters in the first name on the list, if properly arranged, become "*Royal Scots Grey*," and when this name has been settled it is easy to check the number, which should be 6101.

When a competitor has solved all the jumbles, or at any rate as many of them as he is able to manage, he should make a neat list of them on a sheet of paper, together with his name, full address and H.R.C. membership number.

The contest will be divided, as usual, into two sections, Home and Overseas. Prizes consisting of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four best entries in each section. In the event of a tie for any prize, neatness will be taken into consideration in making a final decision.

Envelopes containing entries should be marked in the top left-hand corner "*Name and Number Contest No. 4*," and addressed to the Hornby Railway Company, Binns Road, Liverpool 13. Entries must be posted to reach Headquarters on or before 31st August, or 30th November for Overseas readers.

Railway Photographic Contest

Our monthly H.R.C. photographic contests this summer are being run to provide intending competitors with the widest possible scope, the prizes being offered for the best photographs submitted of any subject of railway interest. The only restriction is that each exposure must have been made by the competitor.

Members may submit as many prints as they desire, but no competitor can win more than one prize. Entries will be judged more on their railway interest than their technical excellence, but in the event of a tie between any two photographs of equal railway interest, the photographic merits of the print will be the deciding factor.

Every print sent in should have on the back the name and address of the sender, his H.R.C. membership number and a short description of the scene of the snapshot. Four prizes will be awarded in each section —Home and Overseas—to the value of 15/–, 10/6, 5/– and 2/6 respectively.

Envelopes containing prints should be marked "*H.R.C. August Photo Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st August. Closing date, Overseas section, 30th November.

Railway Joke Contest

Most H.R.C. members will be familiar with the usual jokes that are made by habitual travellers upon their local railways. Any peculiarity or failing in the services, or the engines or stock employed is immediately made the subject of a jest; and there are also many humorous stories connected with the actual working of a railway. Thus the guard who applies the brakes when going uphill so that the train cannot run away backward, and the porter who employs a different accent according to the class of passengers he is addressing, are well-known characters.

For our contest this month we want members to send up "*The Best Railway Joke*" that they have heard recently. The contest will be divided into two sections—Home and Overseas. Four prizes of Hornby Train material (or Meccano products if preferred) to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded to the senders of the four best jokes in each section.

Entries should be enclosed in an envelope marked "*H.R.C. Railway Joke Contest,*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, by 31st August. Overseas closing date, 30th November.

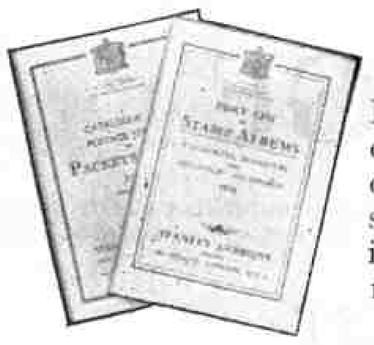
COMPETITION RESULTS

HOME

May "Loco Peculiarities Contest."—First: R. Wood (179), Gorton, Manchester. Second: D. F. T. Arnold (16743), Taunton, Somerset. Third: L. Parish (18054), Coventry, Warwicks. Fourth: D. H. Couzens (32746), Whitchurch, Glam. Consolation Prizes: C. E. Wrayford (6039), Moretonhampstead, Devon; S. Howarth (21914), Delph, Nr. Oldham; H. Smith (2489), Weymouth; W. P. Wiseman (24776), Great Yarmouth; J. A. Barnett (22318), London, N.W.6; J. L. Makin (30933), Penwortham, Preston; C. Lloyd (33495), Ormskirk, Lancs.; G. S. Tucker (31354), Southfields, London, S.W.18; J. Mathewson (34686), Glasgow; J. B. Woodhouse (33452), Eastbourne; G. R. Webb (24865), Leatherhead, Surrey; V. J. Taylor (9814), Louth, Lincs.

May "Railway Photo Contest."—First: J. Bartholomew (34611), Newmarket, Cambs. Second: C. J. S. Walker (26861), Mollington, Nr. Chester. Third: F. J. Christall (25242), Coulsdon, Surrey. Fourth: L. Parish (18054), Coventry, Warwicks. Consolation Prizes: J. Turley (18853), Tunbridge Wells; P. N. Nicholas (27583), Sheffield; G. H. Wood (21541), Halifax, Yorks.; G. T. Porter (10259), New Barnet, Herts.; A. L. Down (17087), Maidstone, Kent; R. Couling (28701), Southall, Middx.; E. C. R. Williams (9517), Holyhead, Anglesey; J. F. Hemmings (29782), Hertford, Herts.; J. Everitt (542), Streatham, London, S.W.16; S. M. Joyce (16686), Tenbury Wells, Worcs.; W. B. Hudson (1733), Westham, Weymouth; W. P. E. Beer (34796), Oundle, Northants.

OVERSEAS

February "Locomotive Problems Contest."—First: F. L. Bingen (28995), Maastricht, Holland. Second: M. Balfe (28661), Vancouver, Canada. Third: H. J. Borgman (29579), Maastricht, Holland. Fourth: E. A. Bunt (24651), Capetown, South Africa.

DID YOU?

Did you notice our fine selection of bargain stamp set offers made in the March number of the *"M.M."* ?

Well, there are thousands more in our new 1933 FREE Catalogue of Stamp Sets and Packets, and if you want Albums, Books, Catalogues or "Gadgets" for Stamp Collecting, write also for the Free List of Albums.

A postcard will bring them both to you.

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Marshall Islands Set & Montenegro Pkt. Free!

A splendid opportunity of acquiring free stamps you have been looking for:—Siam (King), set of Luxemburg, Epirus (soldier), large Air Mail stamp, Syria (view of Nama), over 40 other varieties, a great many in sets. Roumania (new King), British and French Colonials. Set of Old Spain, Montenegro (mausoleum), many pictorials, and finally the beautiful stamp depicting Mandoline player and rare Marshall Islands. EVERY STAMP GUARANTEED GENUINE. Just send 2d. postage requesting approvals.

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FAR EASTERN PACKET FREE 25 Different

Attractive stamps from China **(new issue)**, **F. Malay States** (tigers), Indo-China, **Kouang-Tcheou (overprinted)**, Japan (sets and **earthquake issue**), **Siam**, Straits Settlements, etc. To all stamp collectors sending 1½d. postage (abroad 4d.), I will present this packet **absolutely free !**

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10	Australia ...	3d.	10	Malay... ...	3d.
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5	Brit. Guiana	3d.	5	Mauritius ...	3d.
5	Cape Good Hope	2d.	10	Natal	5d.
10	Cyprus ...	4d.	5	Newfoundland	2d.
4	Fiji	3d.	5	New S. Wales	2d.
5	Gold Coast ...	3d.	10	New Zealand	3d.
5	Hong Kong ...	2d.	5	Nigeria ...	3d.
10	India	2d.	5	North Borneo	4d.
4	Iraq	2d.	5	Orange River	3d.
5	Ireland ...	2d.	5	Palestine ...	2d.
10	Jamaica ...	4d.	10	Queensland ...	4d.
4	Kedah ...	2d.	4	Rhodesia ...	2d.
4	Kenya ...	2d.	5	St. Lucia ...	3d.

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FREE RARE ARGENTINE Catalogue value 25/-

AND OVER 50 OTHER STAMPS

including the large **Belgium Piccard Balloon Commemorative,** set of **unused Brazil pictorials** showing Aeroplane in flight, numerous unused **pictorials** and **surcharged** issues. The **20 Pesos Argentine 1924 large pictorial** is catalogued at **25**/– and is a really rare stamp. This interesting collection will be sent **free** to approval book applicants who enclose 2d. postage and mention packet "M." Our stamps are always priced at the lowest rates and we have hundreds of unsolicited testimonials.

W. BENNETT,
53, Marlborough Road, LONDON, E.8.

1933 JAMBOREE

The Hungarian Postal Authorities are issuing a special set of 5 engraved stamps of striking design to commemorate the World Jamboree at GODOLLO. These interesting stamps will only have a short life and are likely to be good; we offer a complete mint set (10, 16, 20, 32 and 40-fill.) for only **1/9** post free, until end of August only.

Write for our FREE LISTS if you collect stamps.

NORRIS & CO. (Dept. M.), Norwood, LONDON, S.E.19

6 MINT BRITISH COLONIALS FREE 6

ZANZIBAR, KENYA, TURKS and CAICOS IS., MOROCCO AGENCIES, SOUDAN and CAYMAN IS. Ask for the No. 200 Packet.

EDWARD SANDELL,
10, EVELYN GROVE, SOUTHALL.

THE "NEW ISSUE PACKET" FREE

This wonderful packet will be given **FREE** to all who apply for my famous Approval Sheets and enclose 1½d. postage. It contains **FINE PICTORIAL GABOON** (just issued). **NEW ISSUE ANDORRA,** a fine set of newly issued **CANADA,** including the **OTTAWA** Conference stamp; **U.S.A.** Bi-centenary of Washington, 1932; set of **UNION OF S. AFRICA,** pictorials, including re-issue of 2d., with war memorial added; new issue of **STRAITS** and **MALAY,** 5c. brown; a **FINE ICELAND** pictorial (see illustration); **RUANDA-URUNDI,** new pictorial; **TURKEY,** new head issue, etc. 50 Stamps in all. Have you had my 70-page illustrated booklet, price 1d.? Senders of stamp collectors' names receive an extra set free.

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FREE! 100 DIFFERENT BRITISH COLONIALS FREE!

This wonderful offer of the World's most popular stamps, from most of the colonies of our Empire, includes pictorials, commemoratives, high values. Bird, ship and animal stamps, out-of-the-way stamps from Deccan, Charkara, Cochin, etc. Long sets from Ceylon, Canada, Straits, Malay, Australia, War and new issues, etc. ABSOLUTELY FREE TO GENUINE APPROVAL APPLICANTS WHO SEND 2d. FOR POSTAGE.

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THE FIRST ENGLISH PENNY POSTAGE STAMP FREE
The Penny Black 1840. 30 Penny Blacks (Cat. 6/– to 10/– each) given away during August 1933. Send application for a selection of stamps on approval with 2d. for postage, asking particulars of this gift. A set of English stamps including 7 postage stamps issued and used postally in **1841, 1856/8, 1858/79, 1887** and **1902** with 3 other stamps (**5/–, 10/– and £1**), issued and used for a special revenue purpose, will be given free of charge to each applicant.

HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

IN HOT WEATHER

I shall be pleased to receive patrons in the Swimming Pool. Their welcome will be warm, whatever the temperature of the water. If you can't join me, send a card for a selection at 4 a penny.

L. D. MAYNARD,
78, RICHMOND STREET, SOUTHEND-ON-SEA.

VATICAN PACKET FREE!

A fine packet of all different stamps containing a fine **Vatican State** unused, **Jamaica 2/–, Crete Paraguay, Brit. Honduras, Kouang-Tcheou, Turkey, Cameroon, Brit. Guiana, Prussia Official, Ceylon.** Free to all asking to see my famous approval sheets and **enclosing 2d. for postage (abroad 6d. P.O.).** Albums from 1/4 upwards.

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TURKS & CAICOS ISLANDS

FREE! A set of the above to all sending for approvals. A really good class selection sent containing new issues, pictorials, Air Mails and scarce Colonials. SEND TO-DAY.

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95, Christchurch Avenue, Kenton, Harrow.

"DIAMONDS"

MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which contains approx. **1,000 UNSORTED STAMPS** from Convents abroad.
1 pkt. 1/3. 3 pkts. 3/6. 5 pkts. 5/6.
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GIVEN AWAY £2 EVERY MONTH

to purchasers from our world-famed approval Sheets. Send for approval sheets and full particulars to Department 228. *Established 1880.*

ERRINGTON & MARTIN, South Hackney, London, E.9.
Those sending a stamped addressed envelope will receive free three handsome Pictorial new issues.

THIS CASKET FREE to Stamp Collectors.

STAMP CASKET with Pictorial Coloured Hinged Lid, including Watermark Detector, Perforation Gauge, Stamp Tweezers, Transparent Envelopes, Famous Matlock Mounts and Rare Abyssinia Stamp. Just send 3d. postage (Colonial Stamps accepted) or if 4d. is sent a Powerful Magnifying Glass in Folding Metal Case will be included in Casket.

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Every Stamp Guaranteed Genuine: no two stamps alike in any one packet! 20 for 1d, 40 for 2d. 60 for 3d. 125 for 6d, and 24 different 2d packets of separate countries! "XLCR" Stamp Mounts are British Made in my own factory, pure tasteless gum, full size, in transparent envelopes, so that you can see before you buy. 125 for 1d, 300 for 2d. **OFTEN LICKED—NEVER BEATEN!** Be wise—insist on "XLCR" PACKETS and refuse all substitutes which are inferior. Ask your shop, but in case of difficulty drop a line to

THOMAS CLIFFE, COLWYN BAY.

For further stamp advertisements please see page 648.

Stamp Gossip

and Notes on New Issues

The Italian Zeppelin Issue

In keeping with the general standard of recent Italian stamp production, the air mail set issued for use on mail carried from Italy to South America by the Graf Zeppelin on its 1933 cruises is a really beautiful production. There are six stamps of large size, interesting design, and brilliant colouring.

The values and designs are as follows :— 3 Lire (illustrated here), the Gate of St. Paul on the left and the pyramid

surmounting the tomb of Caius Cestius Epulo, a tribune of the reign of Augustus. The pyramid dates from just before the birth of Christ. 5 Lire, the Appian Way, the famous Roman road to Brindisi. 10L. (illustrated), the Mussolini Stadium at Rome. This great sports arena dwarfs the Wembley Stadium and Hampden Park, Glasgow, and, it is stated, is bigger even than the new stadium built at Los Angeles for last year's Olympic Games. The design is an extremely clever piece of propaganda. A complete view in a small picture would not convey an ample impression of the size, and therefore the stamp shows only one corner. 12L., the Bridge and Castel Sant'Angelo built by the Emperor Hadrian in A.D. 136. 15L., the Forum at Rome. 20L., the Colosseum and the new Empire road.

Italy's Mediterranean Colonies, Cirenaica and Tripolitania, also have issued special air sets in the same six values for Zeppelin mail, and we illustrate the 5L. value from the Cirenaica set. It contrasts the ancient galley with the modern dirigible as ocean traders.

* * *

Readers will recall that public opinion recently forced Colombia to withdraw a postage stamp issued simply as an advertisement for Colombian coffee, because its inscription was in the English language. The desired publicity is now being secured by the use of a special postmark bearing an advertising slogan in five languages.

Aden to Issue Stamps

If the control of Aden passes from the Government of India into the hands of the Home Government, as is expected, it is probable that the use of Indian stamps will be discontinued and a special series issued. Since 1839 Aden has been administered jointly by the Government of India and the Provisional Government of Bombay. For postal purposes it has been regarded as a sub-agency of the Bombay Division, and has used the stamps of India. In April last it was formed into a Chief Commissionership, and an early announcement of its change to a Protectorateship may be expected shortly.

Sale of Royal Stamps

A quantity of stamps presented by the King were included in a recent special auction on behalf of the Royal Ear Hospital, and realised a sum of £214. The best item was a mint *tête bêche* pair of the 6d. Transvaal issue of October, 1877. This pair, which was described in the catalogue as "*excessively* rare," fetched £75. A set of the 9d. Royal surcharge of Trinidad, commemorating the visit of the then Duke of York in February, 1891, was sold for £55. There are only four sets known to exist.

* * *

Britain will be represented at the forthcoming International Philatelic Exhibition in Vienna by some 150 exhibits valued at nearly £1,000,000. Included in this group is the first official stamp exhibit ever sent abroad to a Philatelic Exhibition by the British Government, consisting largely of a unique series of plates, essays and proofs of the early Victorian issues.

* * *

The Irish Free State Government have appointed a committee to consider designs for a special postage stamp to commemorate the Holy Year of 1933. The stamp will be a 2d. value, and it is hoped to place it on sale toward the end of the summer.

* * *

Australia has abandoned the practice of using overprinted and initial perforated stamps for official purposes. It is understood that the same course will be followed in all Australian territories.

What Paper Is This?

Young collectors are often troubled to distinguish between the different types of paper on which stamps are printed, laid, wove, pelure, granite and so on. It is interesting to learn therefore that the souvenir label of this year's Philatelic Congress has been printed in seven different colours on seven different types of paper, wove (hand-made), printed in black; wove (machine-made), blue; laid, green; pelure, red; wove *bâtonné*, purple; laid *bâtonné*, orange; quadrille, sepia. The idea is to provide collectors with a guide to the papers commonly used in stamp printing, and the set would be quite an interesting and useful item for mounting on an introductory album page. The design of the label illustrated here, shows an early postman delivering letters. It is a beautiful piece of engraving, and is quite the best Philatelic Congress souvenir yet produced.

Hind Collection to be Sold

Arrangements are already in hand for the disposal of the great collection formed by the late Mr. Arthur Hind, to which we referred in the June "*M.M.*" At the time of Mr. Hind's death his collection was estimated to be worth approximately one million dollars (£250,000), of which the United States section accounted for nearly $400,000 (£100,000).

* * *

The International Scout Jamboree, to be held in Hungary this month, is being commemorated by a special issue of stamps.

* * *

The 50th anniversary of the death of Richard Wagner, the great German composer, is to be commemorated by a special issue of charity stamps. It is probable that the designs will be taken from Wagner's famous operas.

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

Be well groomed not gummed!

- BRYLCREEM does not contain Gum, and cannot cause flake in the hair, or set it hard—yet it controls the hair perfectly.
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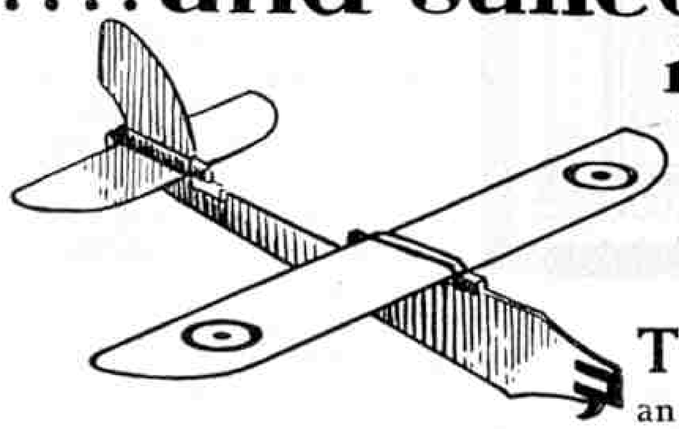
Pratts HIGH TEST PETROL

H.41

....and sailed a full ¼ mile!



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If you cannot obtain locally, send 1/- in Stamps or Postal Order for this Glider and fine Book, illustrated in colours, of all kinds of Toys and Games.

Designed on sound aeronautical principles by an ex-Air Force Officer, this Glider is guaranteed to fly, and with practice to produce many forms of stunt flying by simple adjustment of the planes. Made in sections from special materials, it is virtually crash proof.

Just the Toy for the Holidays—get a Chad Valley Glider and show your friends how flying should be done!

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COMPANY LIMITED,
HARBORNE,
ENGLAND.

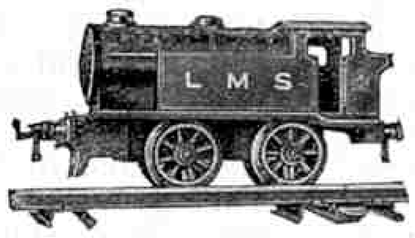
To The Chad Valley Co. Ltd., Harborne, England.
Please send me a Chad Valley Glider (and your Illustrated Book of Toys and Games) for which I enclose 1/-(Stamps). (Postal Order).

Name .....

Address .....

M.M.

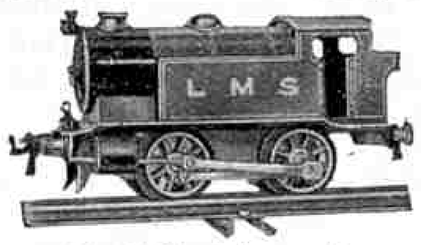
HORNBY TANK LOCOMOTIVES



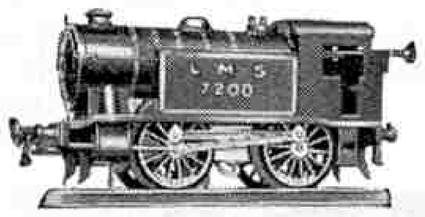
M3 Tank Locomotive

M3 TANK LOCOMOTIVE. This is the powerful Locomotive (reversing) supplied with the Hornby M3 Tank Goods Set. It is a handsome and extremely reliable model that will give long and excellent service. Available in either red or green. **Price, 7/6**

No. 1 TANK LOCOMOTIVE. This strong and durable Locomotive is capable of any amount of hard work. It is fitted with brake mechanism and reversing gear, and is supplied in colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Locomotives. **Price, 13/6**



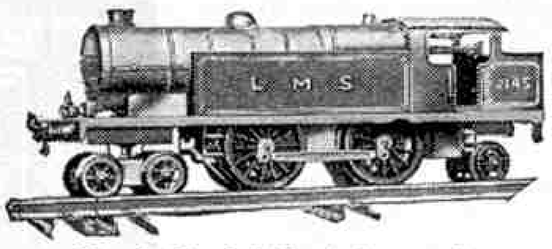
No. 1 Tank Locomotive



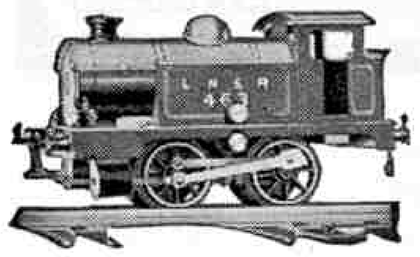
No. 1 Special Tank Locomotive

No. 1 SPECIAL TANK LOCOMOTIVE. This splendid Locomotive which is fitted with brake mechanism and reversing gear, has remarkable power and gives a very long run. It is available in the colours of the L.M.S.R., L.N.E.R., G.W.R. and S.R. **Price, 18/-**

No. 2 SPECIAL TANK LOCOMOTIVE. This Locomotive has great length of run and exceptional pulling power. It is fitted with brake mechanism and reversing gear. In every respect it is a perfect model, beautifully finished in the colours of the L.M.S.R., L.N.E.R., G.W.R. and S.R. **Price, 25/-**



No. 2 Special Tank Locomotive



No. 1 Electric Tank Locomotive

No. 1 ELECTRIC TANK LOCOMOTIVE. This Locomotive is of the permanent magnet type, and may be run from a 6-volt accumulator. It can be stopped, re-started, reversed and the speed varied by the operation of levers at the side of the track. It is supplied with a terminal connecting plate, speed and reverse control switch and 3 feet of flex, and it is available in the colours of the L.M.S.R., L.N.E.R., G.W.R., and S.R. Locomotives.
Price, 32/6
This Locomotive cannot be run from the mains supply.

MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

Aerial Photography with a Kite

Fun for a Breezy Afternoon

AT this time of year many readers are on the look-out for fresh forms of amusement to provide fun and a little excitement in the open air. Nearly all boys know something of photography, and have tried their hands at kite flying, and in this article we shall describe a combination of the two, that is, photography from a kite in the air. As regards the camera, a box-form instrument is the best, and one of even the cheapest type will do all that is necessary. In addition to the camera and a large kite that can be easily made at home, the only other thing required is an alarm clock. This may be an old one, for so long as it will keep going for an hour or so at a time it will serve the purpose.

The best kite for the purpose is one of box form. For photography at heights up to about 1,000 ft., and for weights of not more than 3½ lb. or so, a kite 10 ft. in length is adequate. This may perhaps seem a rather alarmingly large size, but its construction will be found straightforward if the following simple instructions are followed.

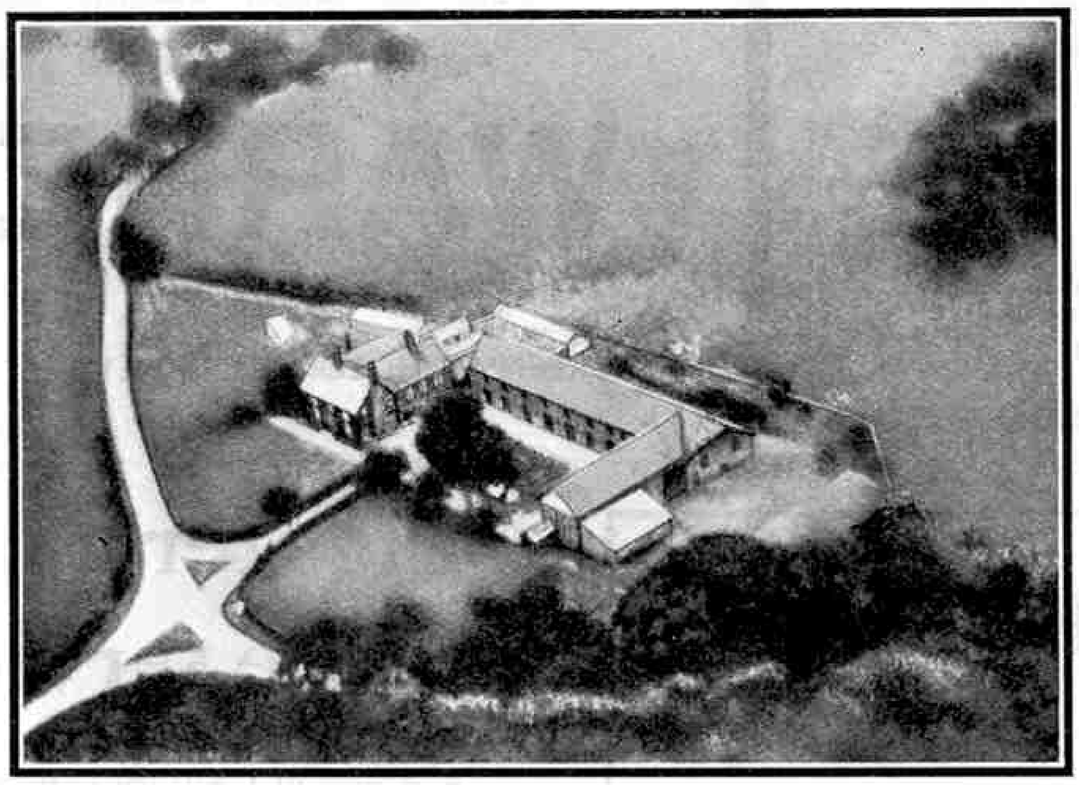
The framework is best made of spruce of the type used for aeroplanes, but almost any other strong and light wood is suitable. Four strips 10 ft. long and about ¾ in. square are required for the main members, and eight pieces 5 ft. long and ¾ in. square for the cross members. The eight short lengths are secured together in pairs, each pair forming a cross with arms of equal length. A long open box is then constructed by attaching the four 10-ft. lengths to the four crosses, one cross being at each end of the box and the other two in between, about 3½ ft. from each end. The connections between the ends of the crosses and the four long side pieces are composed of small pieces of angle iron, or if these are not available, Meccano 1 in. × 1 in. Angle Brackets may be used. Nuts and bolts should be used in place of wood screws for fixing the angle pieces, the kite frame being drilled at suitable points in order to prevent splitting.

When the box is completed it must be strengthened with wire stays fixed diagonally between the cross pieces. This wire has to withstand a good deal of strain, and the best for the purpose is multi-strand brass wire. If this is not available, piano wire, or any other type of light strong wire, may be used.

All is now ready for applying the covering, which consists of 10 yds. of some thin but strong material. Various materials can be used for this purpose, a suitable one being that known as "crash." Whatever the material, the 10-yd. length must be cut to form two pieces each 14 ft. 6 in. in length and 3 ft. in width. These two lengths are passed round the framework at each end of the kite, and stitched firmly round the cross members.

The kite is now complete except for the bridle, which consists of four 10-ft. lengths of wire similar to that used for the wire bracing. They are attached one to each corner of the kite at one side, and their free ends are brought together and fastened to the flying cord.

For flying the kite 1,000 ft. or more of strong cord, or piano wire, will be required, and also a small windlass, which the operator fastens to himself. Cord must not be thinner than No. 4, the best quality being that known as white cotton twine. Piano wire should be about 22 gauge.

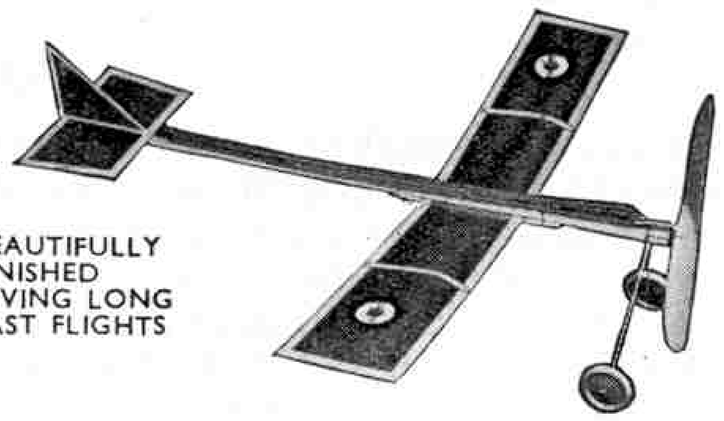


An aerial view of a farm, taken from a height of about 250 ft. by means of a camera attached to a kite, as described in this article.

The picture-taking apparatus consists of the box-form camera and the alarm clock. These are secured to a framework fixed across the lower opening of the kite, the camera being placed in the centre and the clock to one side. The framework consists of four strips of wood, two of which are 3 ft. 6 in. long and ½ in. square, and the other two of similar thickness, but only 2 in. long. The two long strips are first laid 2 in. apart, and parallel, on a flat surface, and the two short lengths are then fitted by means of screws so as to form a 2 in. square in the centre of the space between the two long strips. The camera is held in place lens downward by means of two strong rubber bands, so that the lens occupies a position in the centre of the 2 in. square. The frame is then fitted across the centre of the lower opening of the kite by screwing the ends of the long strips to the side members of the kite. The alarm clock can be fitted in any convenient position on the frame that carries the camera, by means of two strong elastic bands.

The camera is operated by connecting the shutter lever to the alarm winding spindle by means of a length of cotton, after the alarm has been wound up. The alarm is set for a certain time, depending upon the height at which the photograph is to be taken, and when the period has elapsed the winding spindle of the alarm turns, pulling the cotton and actuating the shutter lever. As the alarm winding spindle continues to turn, the cotton is quickly broken by the increasing strain. Unless the day is very favourable it may take some time to get the kite to the required height, and to allow a sufficient margin it is well to set the alarm to go off half-an-hour from the time flying operations commence. Only one exposure can be made at a time, of course, and the kite must be hauled in to reset the mechanism. To allow for movement of the kite at the time of exposure the shutter should be set to 1/100 of a second, or if such a speed is not available, then as fast as the mechanism will allow.

MORE VALUABLE PRIZES THIS YEAR!



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Length 19 in., span 18½ in., fitted patent double bearing and shockproof chassis, 8 in. hand-carved and balanced propeller, covered red proofed silk. A splendid flyer, and beautifully finished. At the price this model is undoubtedly the finest value ever offered.

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Weight, 1 15/16 ounces. Distance, 550 feet.
Speed, 15 m.p.h. Ceiling, 50 feet.

Rises from the ground.

OTHER FINE MODELS 1/6 to 5 gns.

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For Stunting. The "Sports Model"

Weight, 3½ ounces. Distance, 850 feet.
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Some fellows seem to "do things" so easily. But there's no magic in it—it's a matter of keeping fit. Take Kia-Ora, for instance—a glass during the "break" of a game or the day's school-work makes you feel brighter. Your mind works alertly—and your muscles follow suit. And it's not just a matter of a really pleasant drink . . . the pure fresh fruit juices in Kia-Ora are a real tonic—full of health and pep. So take Kia-Ora and "do things" better!

SQUASH 2/- large bottle
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LEMON ORANGE GRAPE FRUIT

Lighter . . . more serviceable

A Bluemel Celluloid Inflator cannot be equalled. It withstands hard knocks; never dents or rusts; is lighter than a metal or metal-lined pump, and requires less exertion to use. Send coupon for complete list.

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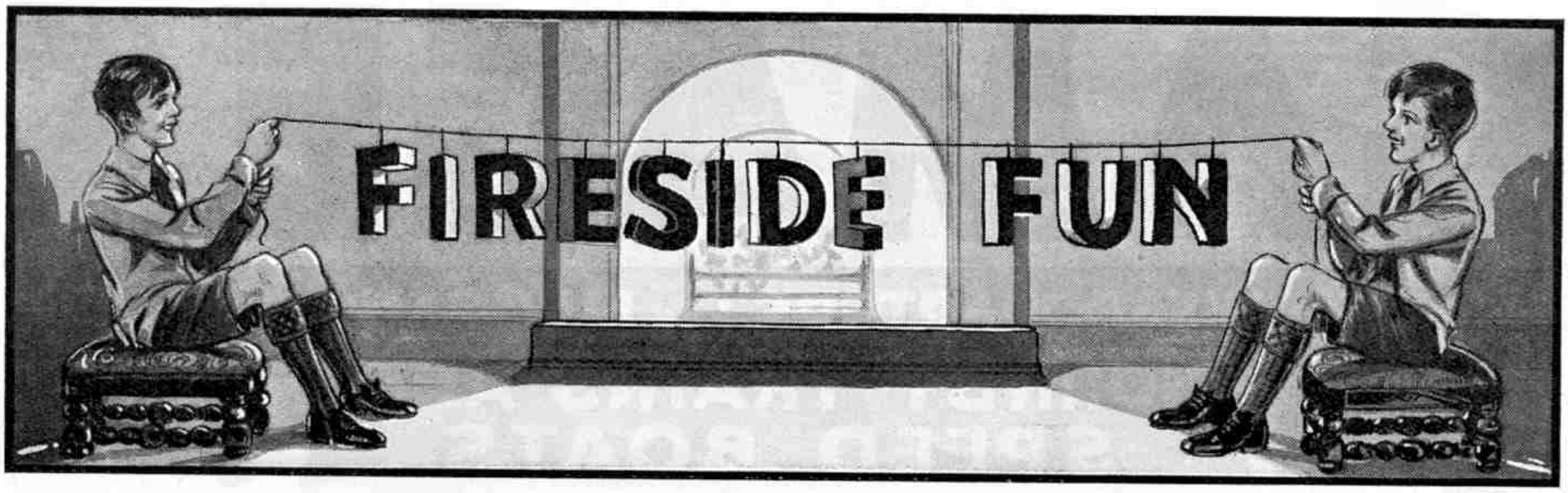


ALL OUT

Unwanted Caller: "Can I see the manager, please?"
Office Boy: "He's out."
Unwanted Caller: "Can I see the under-manager, then?"
Office Boy: "He's out."
Unwanted Caller: "Very well, I'll just wait by the fire."
Office Boy: "It's out."

* * * *

Two sailors had been relieving the monotony of the voyage by talking about various animals, but one day they reached a deadlock when they tried to decide what kind of an animal a heifer was. One said it was a sort of pig, and the other that it was a member of the sheep family.

Finally they called in the boatswain. "Wot's a heifer?" they asked. "Is it a pig or a sheep?"

The boatswain reflected. "Well," he said at last, "to tell you the truth, mates, I dunno much about poultry."

* * * *

The inspector visiting a country school was asking the children questions. After a while he said to the class: "Now, I want one of you to ask me a question I can't answer."

After a few vain attempts, a small boy said: "Please, sir, if you were stuck in a pool of mud up to your neck, and a brick was thrown at your head, would you duck?"

* * * *

The parents of a solemn little boy were worried at his doleful outlook on life. They were sending him off by train to relatives, and told him to write his name and address on a card and put it in his pocket.

The boy did so, beginning: "In case of accident, this was Johnny Smith."

* * * *

Visiting Parson: "What a lot of your congregation have bad coughs!"

Verger: "Bless 'ee, sir, they bain't coughs—they'm time signals."

* * * *

"So you know the fellow who stole your car?"
"Yes! I see him every day."
"Then why don't you have him arrested?"
"I'm waiting until he fits on a new set of tyres."

* * * *

Sailor: "Yes, sir, that's the '*Mary Jane*' that is, bound for Dundee with corfee."
Visitor: "With what?"
Sailor: "With corfee—what you makes tea with."

* * * *

THE COOKER COOKED!

Shipwrecked Cook (to Cannibal Chief): "Don't kill me, and I'll cook your Sunday joint."
Cannibal Chief: "Can't be done; you're the Sunday joint."

THAT'LL LARN HIM!

Murphy: "What's that in your pocket?"
Pat (confidentially): "Dynamite. I'm waiting for Casey. Every time he meets me he slaps me on the chest and breaks me pipe. Next time he does it he'll blow his hand off."

* * * *

"Just supposin' I struck gold drillin' into one of these teeth."

Courtesy, "*Compressed Air Magazine*."

* * * *

"This is a good restaurant, isn't it?" said the customer to the waiter who had brought his order.

"Yes," replied the waiter. "If you order a fresh egg, you get the freshest egg in the world. If you order a good cup of coffee, you get the best cup of coffee in the world, and—"

"Yes, I believe it. I ordered a small steak," was the customer's reply.

* * * *

"Aren't you the thought-reader who was entertaining the company a couple of hours ago by finding needles and other small objects they had hidden?"
"Yes."
"Well, what has kept you here so long?"
"I'm looking for my hat."

* * * *

Farmer Giles could manage figures, but he was unable to read. He became lost one night on a strange road, and rambled about in his car until morning. His friends were curious why one so familiar with the country should have spent so many hours aimlessly, and one of them asked him: "Didn't ye run across any signposts?"

"Aye," replied Farmer Giles, "thar war plenty of them."

"Well," asked the curious one, "didn't they help ye?"

"Not a bit!" replied Giles. "I could read how fur, but I couldn't read whar to."

* * * *

"What kind of fellow is he?"
"Oh, the sort who will pat you on the back to your face and laugh in your face behind your back."

TROUBLE BREWING

"Well, little boy, and what is your name?"
"Shadrach Nebuchadnezzar Brook."
"Who gave you that name?"
"I dunno, but if I find out when I get older they'll be sorry for it."

* * * *

Mother: "Why are you reading that book on the education of children."
Son: "To see if you are bringing me up properly."

* * * *

Manager (to new office boy returning from errand): "Didn't I tell you to hurry?"
Boy: "Yes, sir. You told me to keep on my toes, and I had trouble getting through the crowd that watched me cross the street."

* * * *

A gentleman had a new Irish butler who announced his guests. The first arrivals were Mr. Jones and family. Pat called: "Mr. Jones, Mrs. Jones, Master Jones, Miss Jones."

The host told him to shorten his announcements, such as, "Mr. Jones and family."

The next arrivals were Mr. Penny and his family. Pat opened the door: "Fourpence," he shouted.

* * * *

Mother discovered her three-year old daughter washing the kitten with soap and water.

"My darling," she exclaimed, "whatever are you doing?"

"Washing the kitty, mummie."

"But I don't think kitty's mother would like the way you are washing her baby."

"Well, mummie, I really can't lick it!"

* * * *

Batsman (facing bowler who, in a previous game, had broken some of his teeth): "Guess yer out to get the rest o' me teeth."

Bowler: "No fear! I'm out to git the stumps this time."

* * * *

Caller: "I'd like you to paint a portrait of my late uncle."
Artist: "Bring him in."
Caller: "I said my late uncle."
Artist: "Well, bring him in as soon as he gets here."

* * * *

"Isn't it hard," said the landlady, "to think that this poor lamb was cut down in its youth to satisfy our appetites?"

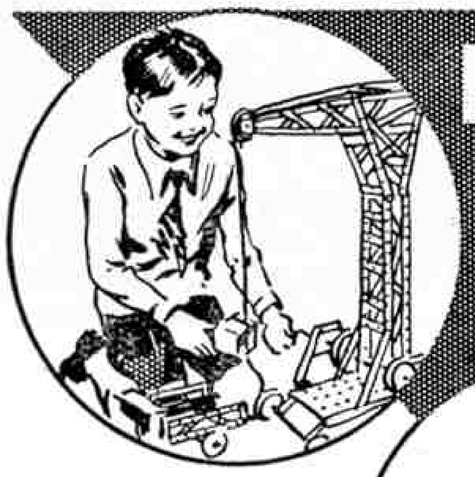
"Yes," replied the unhappy boarder at the other end of the table. "It is tough."

* * * *

AN URGENT JOB

First Gardener: "How long are you going to be trimming that tree, Joe?"
Second Gardener (from top of the ladder): "It'll take me another hour yet."
First Gardener: "All right, but be as quick as you can; the boss has told me to cut the tree down."

GAMAGES



HEADQUARTERS for MECCANO
HORNBY TRAINS AND SPEED BOATS
'LOOPOROO' GOOGLY BALL, 'BIFBAT' ETC.

DEMONSTRATIONS BY EXPERTS DAILY

If unable to call send for full details of these Games

New Hornby Locos for Old!

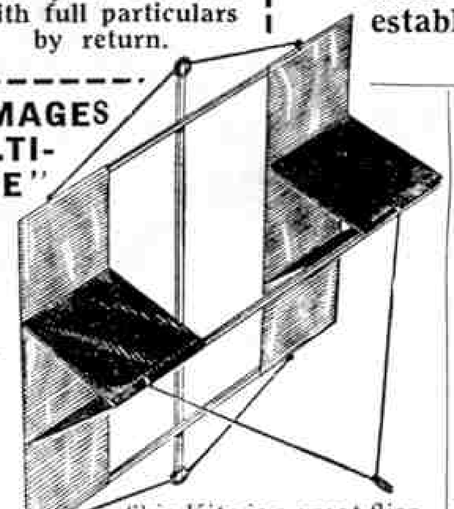
Gamages specialize in the Hornby part exchange scheme for Locomotives. Write and ask us how you can obtain a new Locomotive for an old one—we will post you a leaflet with full particulars by return.

To Model Aeroplane Enthusiasts

Gamages are Model Aeroplane experts and have the most comprehensive stocks in Britain. Flying demonstrations of the "Frog" and Warneford Planes daily.

Always a wonderful place for boys, it is doubtful whether Gamages has ever been quite so absorbingly interesting as now. The new ideas in toys, models, and games which have been so numerous of late are all being displayed and demonstrated together with the established favourites. They make a visit to Gamages—Headquarters for all boys needs—a sheer joy.

GAMAGES "ALTI-KITE"



This Kite is a great flier and has been specially built for Gamages. Note the size, 25 in. × 25 in. It is undoubtedly the best value ever offered at the price. Price **2/-** Post 6d.

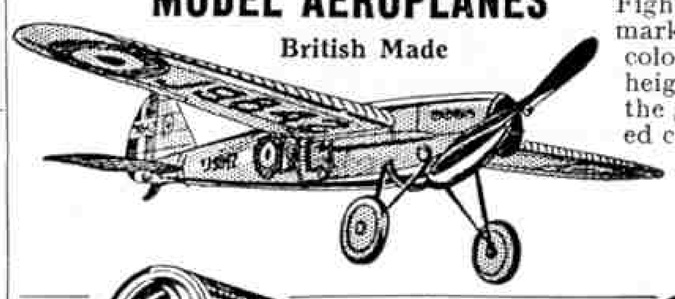
The World's Best Air Gun Value

THE "DIANA"

No. 1 Muzzle Loader. This well made Air Gun will give you all the thrills of more expensive models. We have sold hundreds of these Air Guns. Price **5/6** Post 9d.
Slugs, 9d. 1,000. **Darts, 4½d.** dozen.

THE FAMOUS F.R.O.G. MODEL AEROPLANES

British Made



Illustrated is a "Frog" exact to scale model of the interceptor Fighting Mark IV with R.A.F. markings which are in actual colour. Will fly 300 ft. at a height of 70 ft. Rises straight off the ground. Complete in patented container box.
Price each **7/6** Post 6d.
Also in Various Other National Colourings

The Gamage "Shamrock" Model Racing Yacht

The hull is correct to scale in dimensions and profile of the latest "Shamrock." Deck is cambered, hull carved from best yellow pine, "Bermuda Rig," sails made from spinnaker cloth. Hull is enamelled sea green. Deck is lined and varnished. Stand supplied. Length 27 in.
Price **21/-**

Chemistry and Electrical Sets

Gamages hold the largest stocks of Hornby and Meccano toys including the new range of Chemistry and Electrical Sets.

Ensign 'Cupid' Cameras AT HALF PRICE

Just the camera for your holidays

This famous Ensign Model is the most economical camera to use as it takes 16 pictures ($2\frac{1}{8} \times 1\frac{1}{8}$) on a standard 1/2 film ($2\frac{1}{4} \times 3\frac{1}{4}$), which only gives you 8 pictures. The original ticket price of this magnificent little camera was 21/- (without portrait attachment which we give you **FREE**). Absolutely new and guaranteed. Leather bound waterproof canvas case, 1/6 extra. Price **10/6** Post free.

Model Searchlight

Will throw a beam of light 40 feet in the air. Strongly made and finished in black. Replaceable battery fits in base. Dimensions: Height to top of light, 4½ in. Size of base, 4 in. × 3 in. Diameter of lens, 2 in. Price complete with battery **3/9** Post 6d.

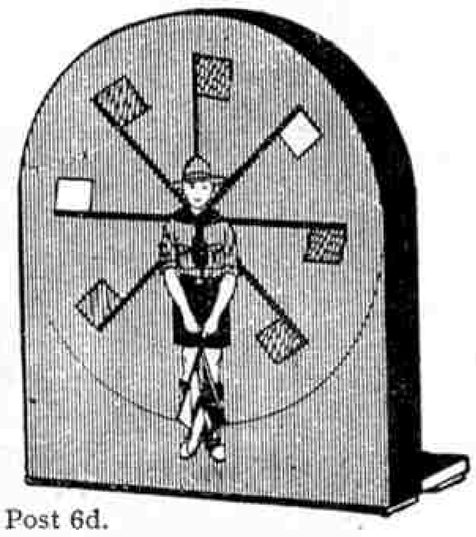
WORKING MODEL TELEPHONE

A replica of the latest type of Post Office Public Telephone. It consists of a polished Bakelite Pedestal and Telephone, and the Signalling Buzzer is housed inside the pedestal. Calling is entirely automatic; immediately the instrument is removed from its base the signal is given by the distant set. Although an ordinary pocket battery is used this wonderful set will give telephone communication up to one mile. Battery 4½d. extra. Price **25/6** Post 1/-

35 ft. Flex is supplied. Extra Flex—50 ft. 4/-; 100 ft. 7/6.

A WONDERFUL NEW ELECTRIC MODEL SEMAPHORE SIGNALLER

It consists of a frame with the figure of a Scout printed upon it. At the back is a board bearing a number of metal studs, each of which represents a letter or symbol in the semaphore code. The operator simply touches with a terminal the stud required which is indicated by a printed letter, and the correct flags are illuminated. An ordinary pocket battery is used.



Price Battery 4½d. extra. **7/6** Post 6d.

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Telephone: Holborn 8484; City Branch: 107, Cheapside, E.C.2

Competition Corner

"POINT WORDS": A NEW WORD PUZZLE

Although our recent crossword puzzles have proved that there is no diminution in our readers' interest in this form of word puzzle, it has been suggested that our policy in deliberately avoiding alternative solutions has resulted in the production of puzzles that are rather too easy, and do not provide a fair test of our readers' knowledge.

We do not agree with this opinion because we have always taken the view that the "*M.M.*" competitions are set solely for amusement. However, readers who are seeking something more difficult have an opportunity to prove their skill this month in a fascinating new competition to which we have given the name "Point Words."

The problem is to take a phrase or sentence containing exactly 25 letters and to re-arrange the letters to form a square 5 letters by 5 letters, so that as many complete words as possible are formed in the vertical and horizontal lines of the square. For each word of five letters in one line 10 points are awarded, for a word of four letters 5 points, for a word of three letters 2 points, and for a word of two letters 1 point. A line containing two words of three and two letters respectively thus scores 3 points. The maximum possible score is 100, but a score of 70 points may be considered good.

It will be understood that the letters may appear in the square only as many times as they occur in the original sentence, and that short words forming part of a longer word in the same line do not count in reckoning up the score. Only English words in current use may be used; proper nouns and coined words are ineligible.

	10	2	10	10	10
10	R	I	G	H	T
2	O	F	I	E	E
10	U	N	B	A	R
10	T	H	E	R	M
10	S	O	R	T	S

Total: 84

Competitors are at liberty to select any suitable sentence or phrase in this issue of the "*M.M.*," but in submitting their entries they must indicate the line and page from which the words are taken. Alternatively they may use any one of the three following specimen phrases :—

Meccano : Engineering for Boys.
Bridges make Splendid Models.
The "M.M." : The Live boy's Newspaper.

It will be understood that each of these specimen phrases is completely separate ; letters may not be borrowed from one for use in completing a square compiled from another.

To make the working clear, we have taken the phrase "the famous Brighton 'Terriers'" appearing in the 58th to 60th lines in the second column on page 623 of this issue of the "*M.M.*" On the outer edge of the square we have indicated the number of points scored in each line of the square.

Prizes consisting of Meccano products to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four best entries and in addition there will be a number of consolation prizes for the next best efforts. In the event of a tie, preference will be given to the entries displaying the neatest or most novel presentation.

Entries should be addressed to "Point Words, Meccano Magazine, Binns Road, Liverpool 13," and must reach this office not later than 31st August. There will be a duplicate set of prizes reserved for Overseas entries, which must arrive not later than 30th November.

August Photo Contest

The prizes this month will be awarded to the best photographs submitted, irrespective of subject, size, make of camera, plate, film or paper. The exposure must have been made by the competitor, of course.

The competition will be divided into two groups, Home and Overseas. Each group will be divided into two sections, A for those aged 16 and over, B for those under 16 ; and prizes of Meccano products or photographic materials (to be chosen by the winners) to the value of 21/– and 10/6 will be awarded in each. Each print must bear on its back the competitor's name, age and address. Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose.

Entries sent this month must be addressed "August Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st August. Overseas closing date, 30th November.

April Crossword Puzzle Contest.—The Overseas section now having closed, the solution to this contest may now be published.

COMPETITION RESULTS

HOME

May Photo Contest.—First Prizes: Section A, S. GARBUTT (Altrincham); Section B, P. T. CLARKE (East Sheen, S.W.14). Second Prizes: Section A, W. M. HUNTER (Lewisham, S.E.13); Section B, D. M. GAUNT (Shrewsbury).

OVERSEAS

Competition Ideas Contest.—Some exceedingly good suggestions were put forward in both the Home and Overseas sections of this competition, and it is hoped to make use of several of them.

The "Point Words" contest announced this month was suggested by Sven Tagerberg of Sweden, to whom the first prize in the Overseas section has been awarded. Other prizewinners are: 2. J. A. RODRIGUEZ (Montreal); 3. R. N. ANLEZARK (Griffith, N.S.W.); 4. A. F. NESS (Port Dalhousie, Ont.).

Public Buildings Drawing Contest.—First Prizes: Section A, W. FIGGINS (Timaru, N.Z.); Section B, L. J. COHN (Kew, Victoria). Second Prizes: Section A, M. S. AYSON (Invercargill, N.Z.); Section B, J. B. EVANS (Sydney, N.S.W.).

Engineering Story.—1. A. W. JONES (Pretoria); 2. L. HADDOW (Naini Tal, India); 3. J. MOORE (Bridgeport, Penna.); 4. N. F. KEITH (Sydney).

Stamp Voting.—1. A. A. NICOLL (New Plymouth, N.Z.); 2. W. J. WATSON (Leichhardt, N.S.W.); 3. J. G. GNANADURAI (Trichinopoly, S. India); 4. I. LANDSMAN (Johannesburg).

FROG

MODEL AIRCRAFT

(INTERCEPTOR FIGHTER MK IV)

BRITISH MADE BY
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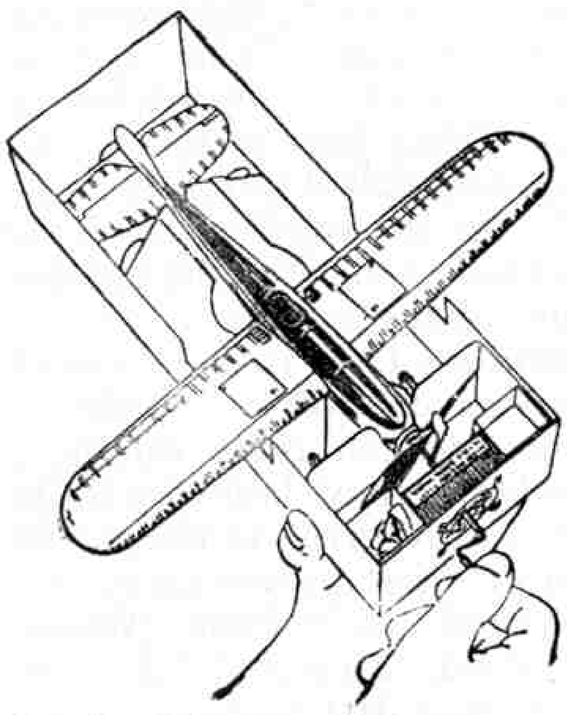
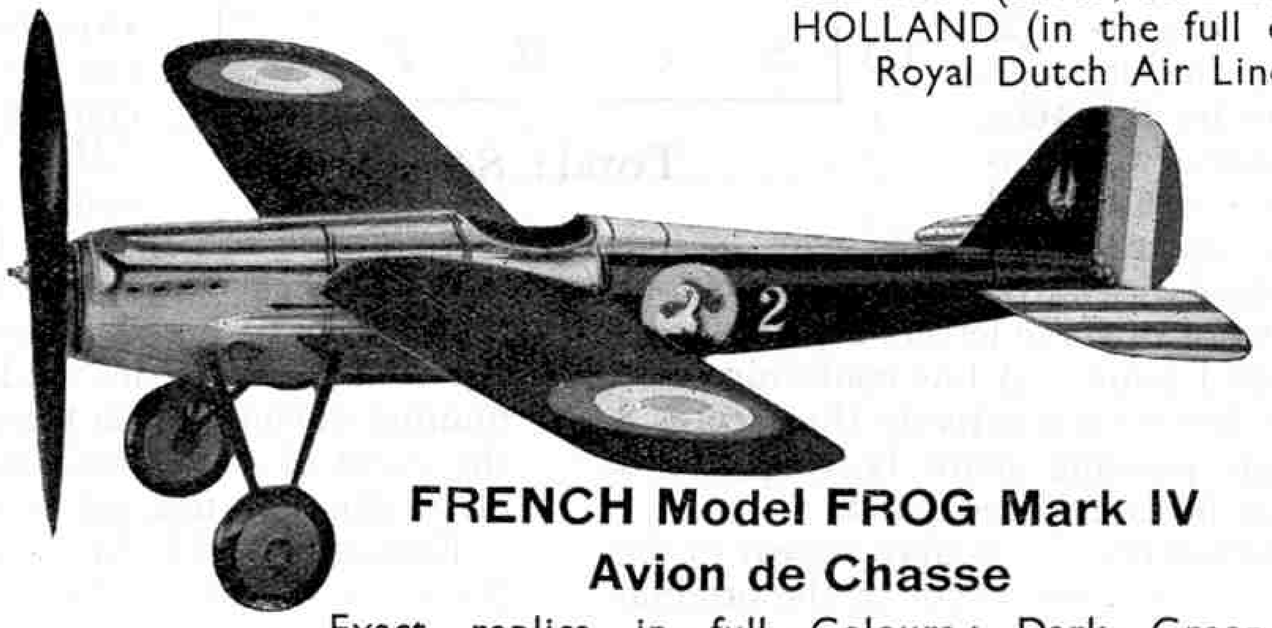
ITALIAN Model FROG Mark IV
Interceptor da Combattimento

A handsome reproduction in full National Colours :—Red, White, Green, Pale Yellow, and Blue with correct Insignia.

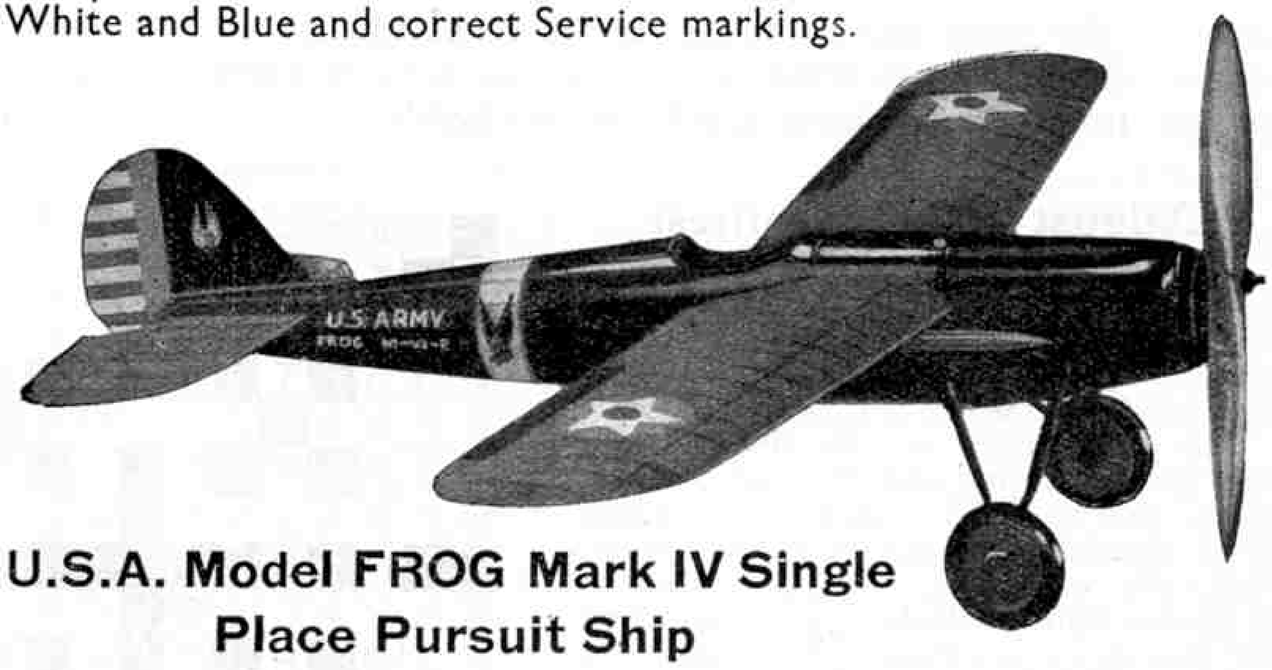


Can be fully wound for flight in patented container box in 15 seconds.



FRENCH Model FROG Mark IV
Avion de Chasse

Exact replica in full Colours :—Dark Green, Red, White and Blue and correct Service markings.



U.S.A. Model FROG Mark IV Single Place Pursuit Ship

A splendid Model of an American Military Aeroplane beautifully produced in the correct Colours and Squadron markings.

TRADE MARK REGD.

A REALISTIC AEROPLANE:— the only true scale model that really flies

Each model is designed to fly ; is already tested in flight, and is delivered in flying trim. With a true to scale speed, equivalent to 236.36 m.p.h., the most interesting experiments in flying can be carried out, and stunts such as looping the loop can be ordered at will.

Overall Length . . .	9½ in.
Wing Span	11¾ in.
Normal Flying Speed . .	650 feet per min.
Length of Flight . . .	300 feet
Height of Flight . . .	70 feet

Patents Granted and Pending in all Countries.

Models not illustrated are :—
BRITISH R.A.F.
ARGENTINE (Silver and Blue).
BELGIUM (Silver, Red and Yellow).
HOLLAND (in the full colours of a K.L.M. Royal Dutch Air Liner).

All Models at New Reduced Price

7/6

Complete with Mechanical Winder Spare Motor Gear Box Oil and Motor Lubricant

—have YOU joined The FROG Club?

The object of the Club is to encourage owners of F.R.O.G. Model Aircraft to obtain best results from their machines.

Handsome badges are given to those who are successful in passing the necessary proficiency tests.

"FROG" PILOT. When you can fly your "FROG" 100 yards hand-launched you have qualified for this attractive enamel badge.

"FROG" ACE. To obtain this beautifully enamelled badge, make your model perform stunts such as looping the loop, etc.

Your dealer will give you full particulars and entry forms, or you can write to us direct for them.

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LINES BROS. LTD., TRI-ANG WORKS, MORDEN ROAD, LONDON, S.W.19

ON SALE AT ALL GOOD TOY SHOPS AND STORES.

Spare Parts of all Models readily obtainable.

You can beat the lot with HOBBIES NORFOLK YACHTS

Don't buy just any old boat for the holiday. You will want one for the pond to beat the other fellows, and you can rely on a Hobbies boat to put up the best performance. They are built on the lines of the famous Norfolk Broads racing type, from well-seasoned timber. The hulls are balanced and well finished in bright enamel, the mast and spars will not break, and the sails are correctly cut for any breeze without upsetting the boat.

Ask plainly for Hobbies

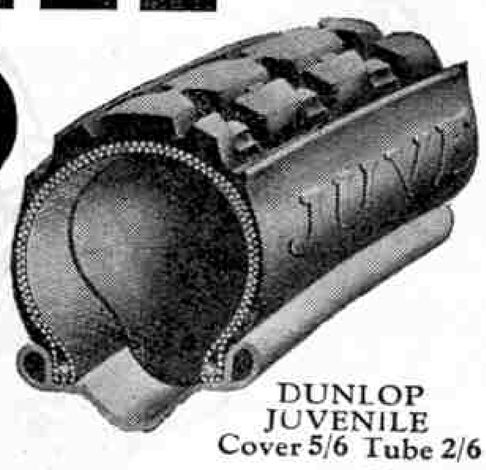
Insist on seeing Hobbies Yachts at any good class store or toyshop. Also obtainable from Hobbies own Branches in London, Glasgow, Manchester, Birmingham, Sheffield, Leeds, Brighton, Southampton. Or direct (postage extra) from Hobbies Ltd., Dereham, Norfolk.

12 in. DECK - 6′6
16 in. DECK - 10′6
21 in. DECK - 21′-
24 in. DECK - 25′-

These "Clipper" Yachts are the large boats you see on ponds—properly built by hand, and beautifully finished. The largest is a 5-metre rater with self-adjusting tiller.

24 in.	30 in.	36 in.
47′6	70′-	90′-

Sir MALCOLM CAMPBELL always uses DUNLOP TYRES



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Cover 5/6 Tube 2/6

You may not drive a 'Bluebird' but you *can* use Dunlop Tyres.

These three tyres have been specially designed and built for you. The Juvenile and the Champion Juvenile are for everyday cycling, and the Sports Juvenile is a speedy tyre for fast road work.

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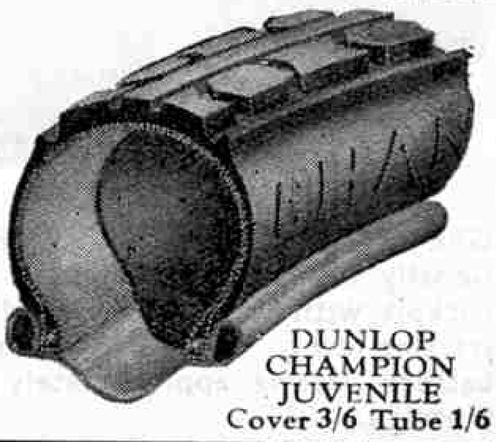
Tyres, Saddles, Toolbags, Inflators, Repair Outfits



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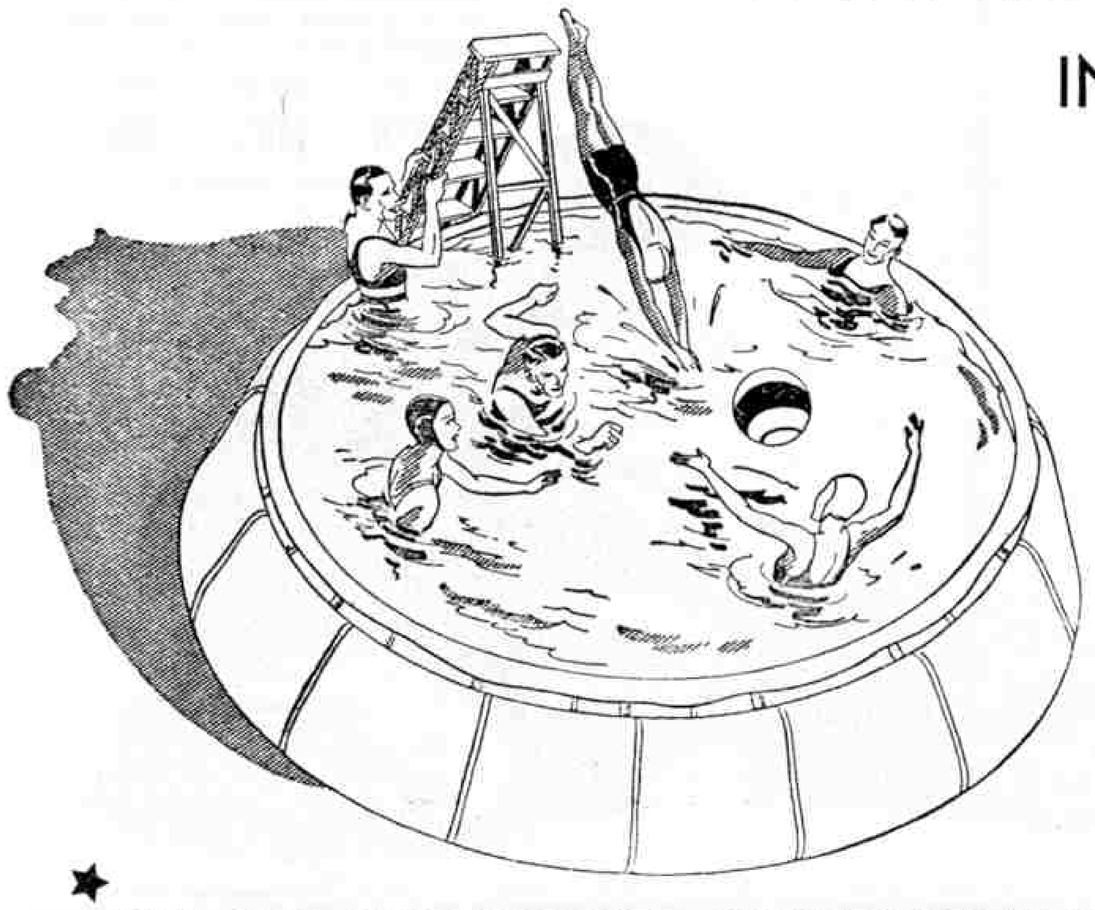
(SPECIAL MODELS AND GAMES SUPPLEMENT)

By appointment.

A SWIMMING POOL IN YOUR GARDEN!

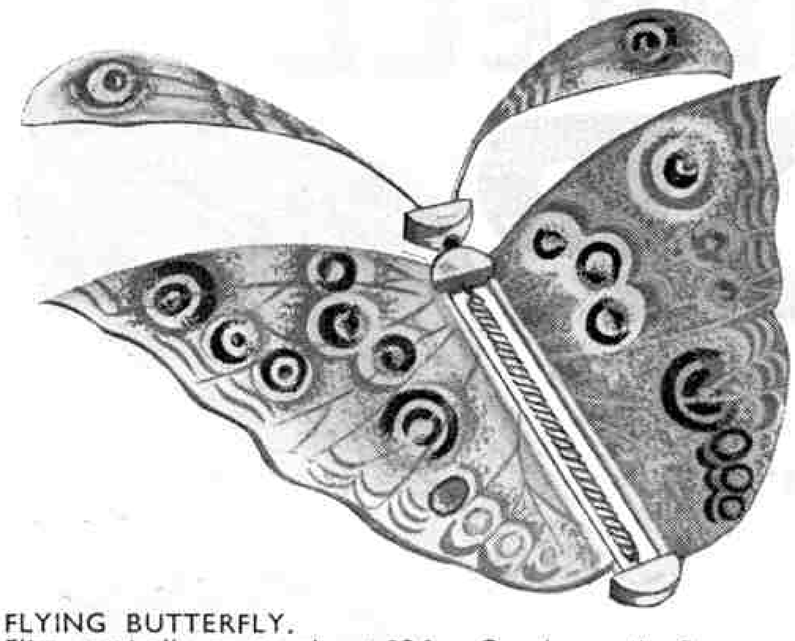


Bathing on your own lawn now. Just run the hose into the SPORTAPOOL, which will expand into a rigid, delightful swimming pool. Sizes range from 6 ft. 6 ins. to 24 ft. across. And deep enough to dive into. How grand to have an early morning dip all through the summer! That's the way to keep fit!

Sizes and Prices of Sportapools

			£	s.	d.
6 ft. 6 in. diameter	1 ft. 3 in. deep		4	0	0
9 ft. ,,	2 ft. ,,		7	10	0
12 ft. ,,	2 ft. 3 in. ,,		12	0	0
15 ft. ,,	3 ft. ,,		15	0	0
18 ft. ,,	3 ft. 3 in. ,,		25	0	0
18 ft. ,,	3 ft. 6 in. ,,		30	0	0
21 ft. ,,	4 ft. ,,		41	10	0
24 ft. ,,	4 ft. 6 in. ,,		54	10	0
Steps and Diving Platform			£4	10	0

SEE THE SPORTAPOOL DEMONSTRATED AT HAMLEYS



FLYING BUTTERFLY.
Flies vertically up to about 30 ft. Can be easily flown indoors without damaging anything. Made of brightly coloured cellophane and printed in gold. Fitted with strong elastic. (Foreign.) Price **1**/–. Postage 3d.

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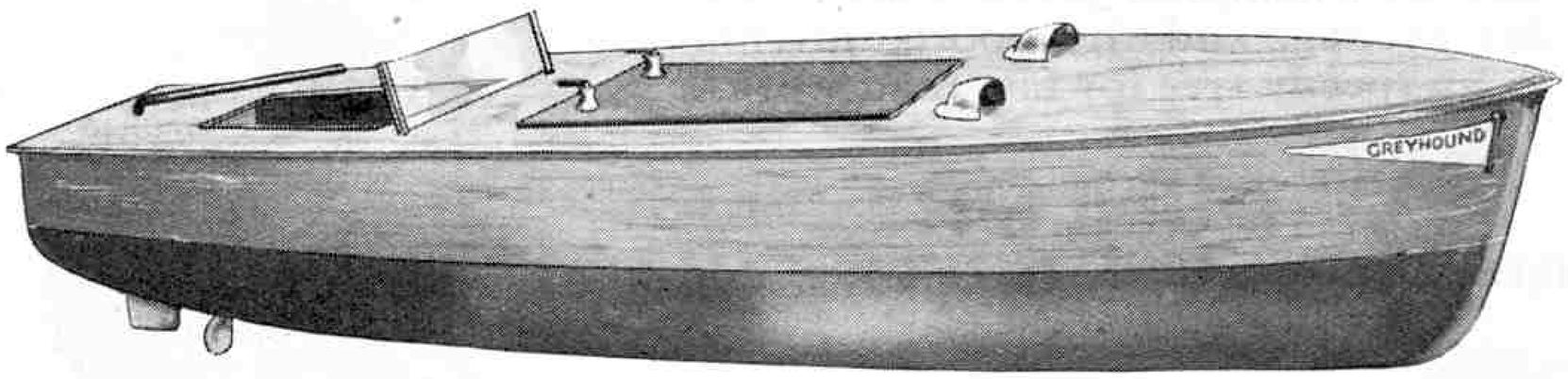
There is a fine selection of Beach Balls and Rubber Animals at Hamleys, all inflated without a pump and at moderate prices. Try riding one of these animals next time you go bathing. It is real good fun. You can see them demonstrated in the Sportapool.

RACING YACHTS. Hulls designed for highest speed by yachting experts. World famous and exclusive to Hamleys. Best quality sails, masts and rigging. Hulls painted in attractive colours. Bermuda Rig in all sizes. Cutter Rig 24" and upwards.

12 inches	...	Price	12/6
15 ,,	...	,,	19/6
18 ,,	...	,,	25/6
21 ,,	...	,,	32/6
24 ,,	...	,,	42/–
27 ,,	...	,,	59/6
30 ,,	...	,,	79/6
36 ,,	...	,,	£6/19/6



GREYHOUND ELECTRIC SPEEDBOAT. Overall length 21 in. Handsome appearance and exceptionally well made. The built-up hull of natural mahogany is fitted with two ventilators. Large cockpit with transparent windscreen, adjustable rudder, two-bladed propeller and stopping and starting lever. Driven by a powerful permanent magnet electric motor, operated by 4½ volt pocket battery, lasting approximately two hours. Price **15/9** including battery. Postage 9d. extra. (Foreign.)

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GOLF LESSONS FOR BOYS AND GIRLS

Hamley's Golf School give special attention to teaching boys and girls how to play the Royal and Ancient Game. Commence tuition now, early booking advisable. Fees moderate.

NEW SCALE MODEL ELECTRIC TRAFFIC SIGNAL
3/3. Postage 6d.

NEW HAMLEY KITE
Guaranteed to fly.
Price **4/6** Postage 9d.

EVERYTHING'S ON THE SQUARE AT HALFORDS

Thousands of Accessories for Cycles at Bargain Prices at HALFORDS' 205 DEPOTS IN ENGLAND AND WALES

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Wired 5/11
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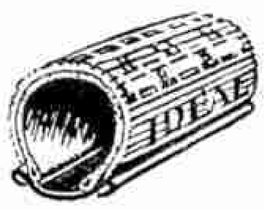
British Covers, Monster Value, from 2/6



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The Finest Translucent Tyre, Wired ... **10/6**

Electric Cycle Lamps
Complete with battery and

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SPEED GEARS
The Sturmey-Archer 3-Speed Hub, **22/6**
The "Trivelox" 3-Speed, from **30/-**

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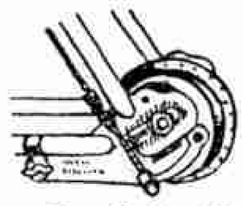
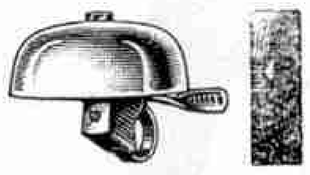
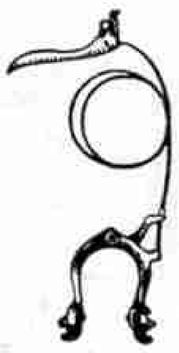


For Solo Machines
Front ... **14/-** each
Rear ... **15/6** each



BELLS
The "Halford Sports." Plated Finish. British Made. **1/-**

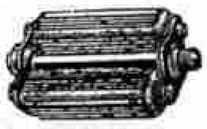


BRAKES
Side Pull Caliper. Wonderful value. British **2/8**
The HALFORD Centre Pull. British, from **3/6**

Sports Handlebar Bends
Latest Models, N.P. from **3/-**
Chromium from ... **4/-**
Handlebar Stems to suit from **2/6**
British Made.

HANDLE GRIPS
The HALFORD Super Sports, sponge rubber **2/-** pair
The Minor Sports ... **1/-** pair
Other models from **6d.** pair
British Made.

HORNS
Pip Squeak
BRITISH MADE **1/-**



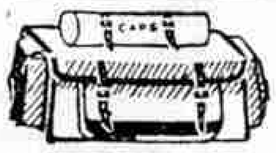
PEDALS
British Made, from **1/6** Pair
Latest Models always first at HALFORDS.

CHAIN WHEELS and Cranks
The Utility set. British made, from **2/9** set. Complete with cotters.

TOE CLIPS from **4d.** pair
British Made

WATCH and HOLDER COMPLETE
Special Purchase —while stocks last (Foreign). Secure yours now **5/6**

MAPS
Or Handbooks for all districts—for Bikers and Hikers, from ... **6d.** each



TOURING BAGS
In Waterproof fabric with 2 end pockets and cape straps ... **4/-**
The Utility Bag in Khaki Twill ... **5/9**

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Large range from **10½d.** with two straps.

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Fine quality wicker — from **1/9**
Large range of sizes and shapes.
British Made.

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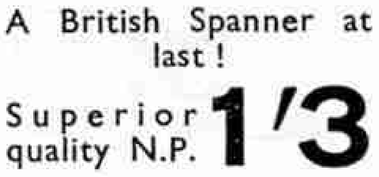
Strong drill material **1/6** each
Waterproof Twill with leather-cloth sides. **3/9**

RUC SACS
Waterproof Twill with outside pocket, **3/-**
Superior quality with pockets for Thermos Flask and Cape. **5/11**



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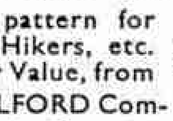
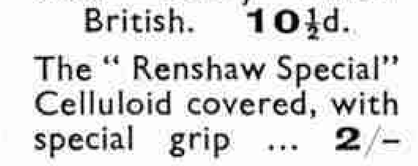
A British Spanner at last!
Superior quality N.P. **1/3**

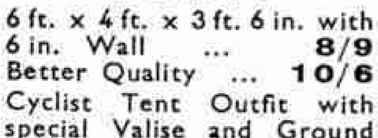


FIRST AID OUTFITS
Wallet pattern for Bikers, Hikers, etc. Monster Value, from **4½d.**
The HALFORD Compactum in tin case **1/9**

Halford Enamels
FROM
Full range of colours for Cyclists, Motorists and Household use, per tin **6d.**
British Made.



INFLATORS
Steel Ebony Finish. British. **10½d.**
The "Renshaw Special" Celluloid covered, with special grip ... **2/-**

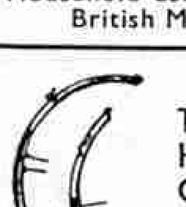


TENTS
6 ft. x 4 ft. x 3 ft. 6 in. with 6 in. Wall ... **8/9**
Better Quality ... **10/6**
Cyclist Tent Outfit with special Valise and Ground Sheet **15/-**

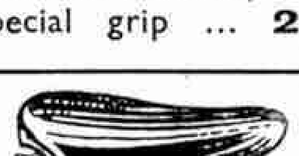
SPORTS JACKETS
Zipp fastening from **12/11**
Halfords stock complete range of Cycling Shoes, Shorts, Shirts, etc.

CYCLE PENNANTS

For Halford, Raleigh, B.S.A., Rudge, Hercules, etc.
Plated Staffs **7½d.** Chromium Staffs **1/-**



Mudguards
The new HALFORD Celluloid **5/-** pair
Metal Mudguards from ... **7½d.**
British Made.



THE HALFORD
Latest Sports type all Spring Saddle, with detachable waterproof top Lady's or Gent.'s **10/6** British Made

THE RENSHAW
3-coil Saddle as shown **4/6**
With 4 wire frame **2/11**
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THE MOST WONDERFUL FORCE OF THE AGE

Commence experimenting in this fascinating Science to-day, and gain a knowledge of the electrical mechanisms that play such an important part in our daily life.

The Elektron Outfits provide you with all that is necessary for a splendid series of experiments in magnetism, frictional electricity and current electricity. They contain the parts required to construct a Reading Lamp, an Electric Bell, an Electric Telegraph, a Shocking Coil and Electric Motors, all of which may be worked from a Bichromate Cell built up from materials included. Both Outfits contain a specially written and fully illustrated Manual of Instructions.

Get one of these fine Outfits now!

Elektron Outfit No. 1 Price 8/6

Elektron Outfit No. 2 Price 25/-

No. 1 ELEKTRON OUTFIT

Magnetism and Static Electricity

The No. 1 Outfit contains two powerful Bar Magnets and a reliable Magnetic Compass, together with everything necessary for the carrying out of a series of fascinating magnetic experiments. In addition there are materials for experiments in frictional or static electricity, and for the construction of an Electric Compass and two forms of Electroscope. There are also parts for making a useful Reading Lamp. Price **8/6**

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No. 1A ELEKTRON ACCESSORY OUTFIT

An Accessory Outfit is also available that converts a No. 1 Elektron Outfit into a No. 2. Price **16/6**

Manufactured by

MECCANO LIMITED,

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ELEKTRON

ELECTRICAL OUTFITS

Every cyclist should have these for safety. The Pifco Horn supersedes bells, has a loud, high-pitched tone, long life, and is completely weatherproof. The Pifco Head Lamp is recognised as the finest value obtainable, and by far the best-looking cycle lamp.

Fit Both the Lamp and the Horn.

Add to your safety and make cycling more pleasurable at the same time.

PIFCO ELECTRIC CYCLE HORN
Fits any Cycle. Complete with 3 battery cells. **7/8**

PIFCO ELECTRIC CYCLE LAMP
Unique features: 90 feet beam. Faceted Lens. 30 hours light. Alternative voltage from 2 pocket batteries, 4 or 8 volt. **5/-**

PIFCO

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Genuine Pifco Products **ARE MARKED** *PIFCO*

NONCLOG
Makes Cycling like Gliding

- Nonclog removes a frictional load which may account for a very considerable amount of your energy caused by wrong lubrication with ordinary cycle oils.
- Nonclog has greater viscosity and is retained longer in slack bearings.
- Because Nonclog has vastly greater lubricating properties, you can use LESS of it.
- Nonclog saves wear and tear . . . lubricates more efficiently at higher speeds and over longer distances. Nonclog saves energy and makes cycling more pleasurable. Ask for a tin of Nonclog to-day—the guaranteed cycle oil, and "*oil more and work less.*"

GRADE A (light) for ordinary use. **6**d. per tin.

GRADE B (Heavy) for long distance riding and speed work. **7**d. per tin.

NONCLOG
the CORRECT Cycle Lubricant

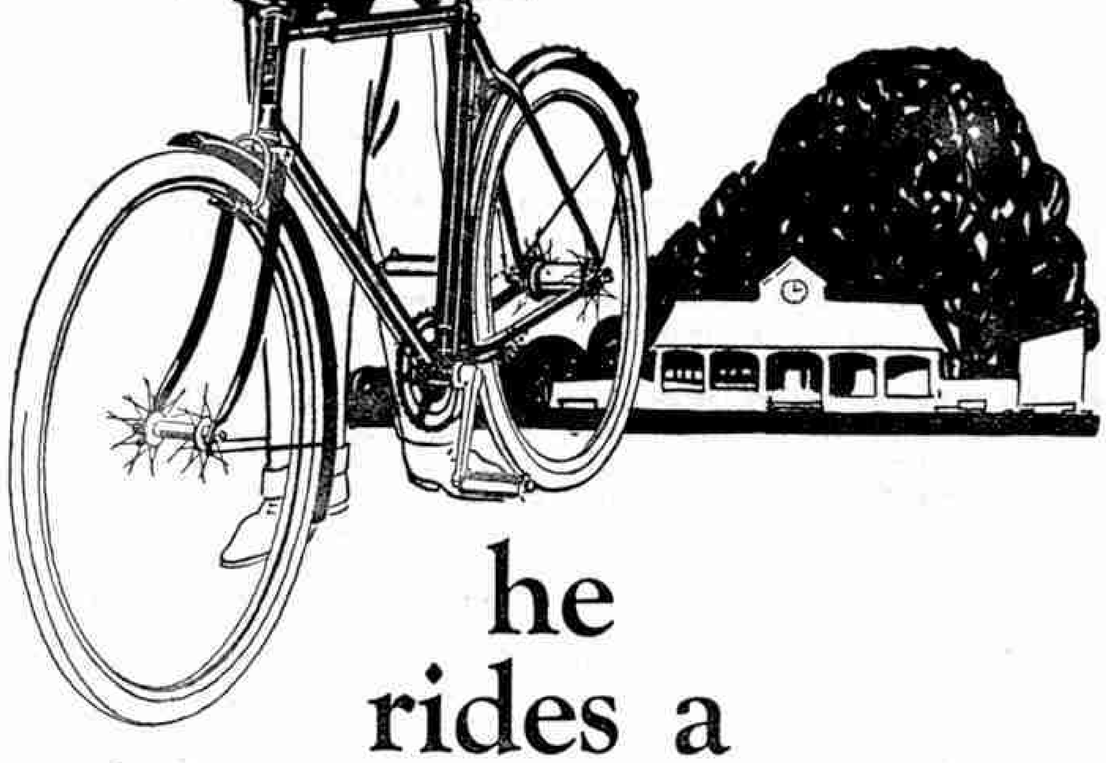
Obtainable from Halford's, Curry's and all cycle dealers.

THE COUNTY CHEMICAL CO. LTD.,
CHEMICO WORKS, BIRMINGHAM 5.

CHEMICO

Sells

Lucky chap!



he rides a

RALEIGH
THE ALL-STEEL BICYCLE

It's a bike he can be proud of anywhere. It never lets him down—it always looks spick and span. He rides faster, too, because it is light, comfortable, and runs more easily. His chums say he's lucky, but really he's just wise. He chose a Raleigh himself.

And what about you?

Make up your mind to follow his lead, and ride a rigid, rapid, reliable Raleigh.

Fitted with Dunlop Tyres, Brooks' Saddle and the best of everything. Specify the Sturmey-Archer 3-speed gear, 20/- extra.

£4 : 12 : 6

(or 12 monthly payments of 8/11)

Send post-card for free copy of "The book of the Raleigh," and name and address of nearest dealer.

THE RALEIGH CYCLE CO. LTD., NOTTINGHAM

LONDON: 41, HOLBORN VIADUCT, E.C.1

LOTT'S CHEMISTRY

There are hours of really interesting experimenting ahead of the Boy who possesses a box of Lott's Chemistry. Each set contains Chemicals, Apparatus, etc., and an illustrated booklet of the experiments which can be carried out. Spare supplies of the Chemicals and Apparatus can be obtained.

Obtainable from all Leading Toy Dealers and Stores

Box 4. Price 15/6

BRITISH MADE

SOME EXTRACTS FROM LOTT'S CHEMISTRY EXPERIMENTS

BOX 3. In this experiment a colourless solution should give a beautiful deep blue colour very suddenly, like a flash, but, as you cannot weigh out exact quantities, you may have to make a few trials, before you can get the colour to appear in a convenient time. . . . When you have got a reasonable time (say 20 to 60 seconds), you will be able to repeat the experiment in front of your friends and surprise them by forecasting the exact time of appearance of the blue colour.

Put one drop of turpentine on a piece of blotting paper and plunge it into the chlorine. It will catch fire and burn with a dense smoke. This is because the liquid and the gas combine so energetically and give out so much heat that the blotting paper catches fire.

BOX 4. Add this solution to the silver solution, shake the mixture, and immerse the tube to below the level of the solution in a mug of hot but not boiling water, rotating the tube at intervals. In a few minutes the solution will go cloudy and a yellow precipitate will begin to form, changing slowly to black, and then depositing in the form of a brilliant mirror.

BOX 4 As illustrated above, contains 38 chemicals, Bunsen Burner, flask with rubber cork and delivery tube, porcelain crucible, glass funnel, three sizes of test tubes, wooden test-tube holder, tin dishes, filter papers, litmus paper, magnesium ribbon, glass tubing, test-tube cleaning brush and booklet of 181 experiments. Price **15/6**

In addition to Box 4 there are other sizes at **3/6**, **6/-**, **10/6**, **21/-**, **31/6**, and **42/-**. Also large cabinets at **73/6** and **105/-**.

These prices apply only in Great Britain and Northern Ireland. Obtainable in South Africa at Stuttaford & Co. Ltd., Capetown; Canada at T. Eaton & Co., Toronto, H. Morgan & Co. Ltd., Montreal.

Write for Illustrated List to Dept. M.M.

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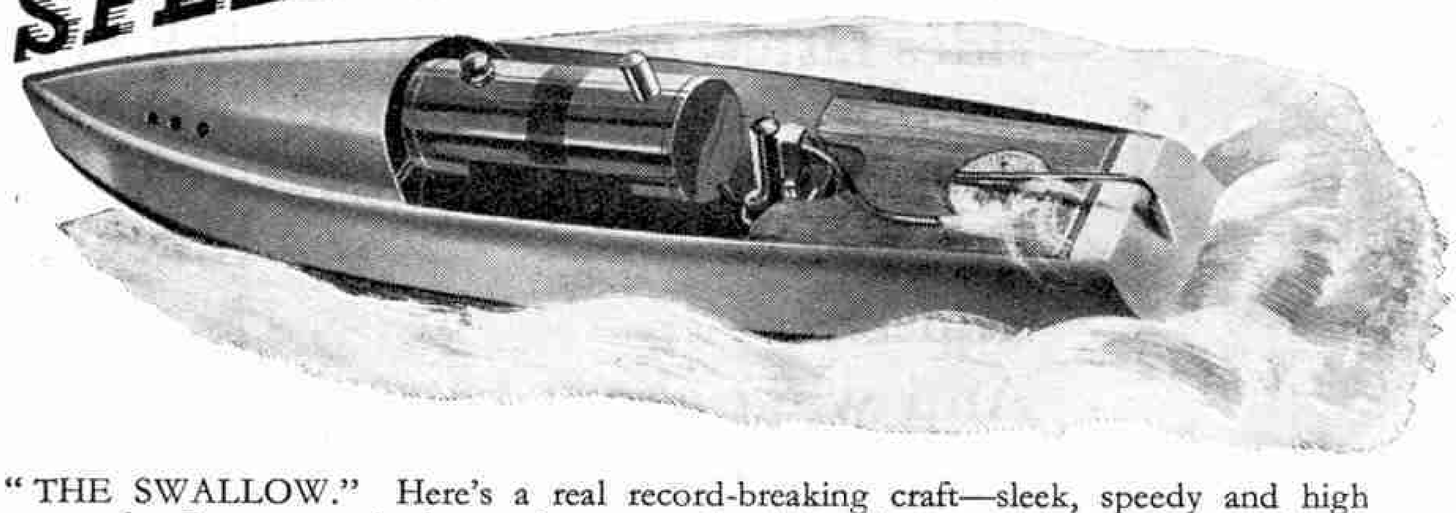

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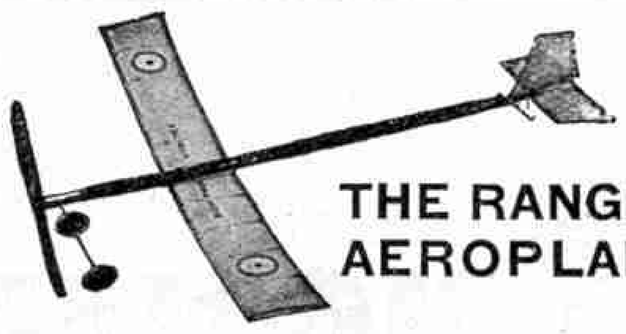

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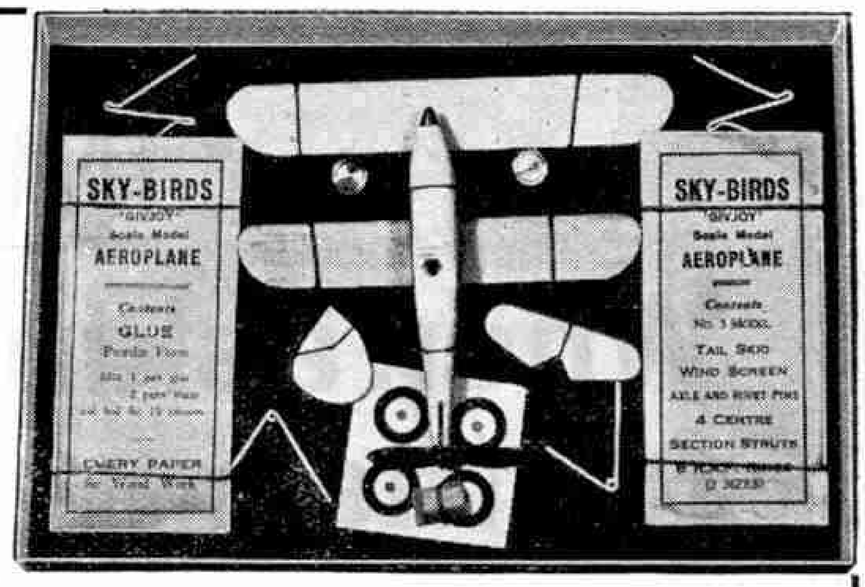

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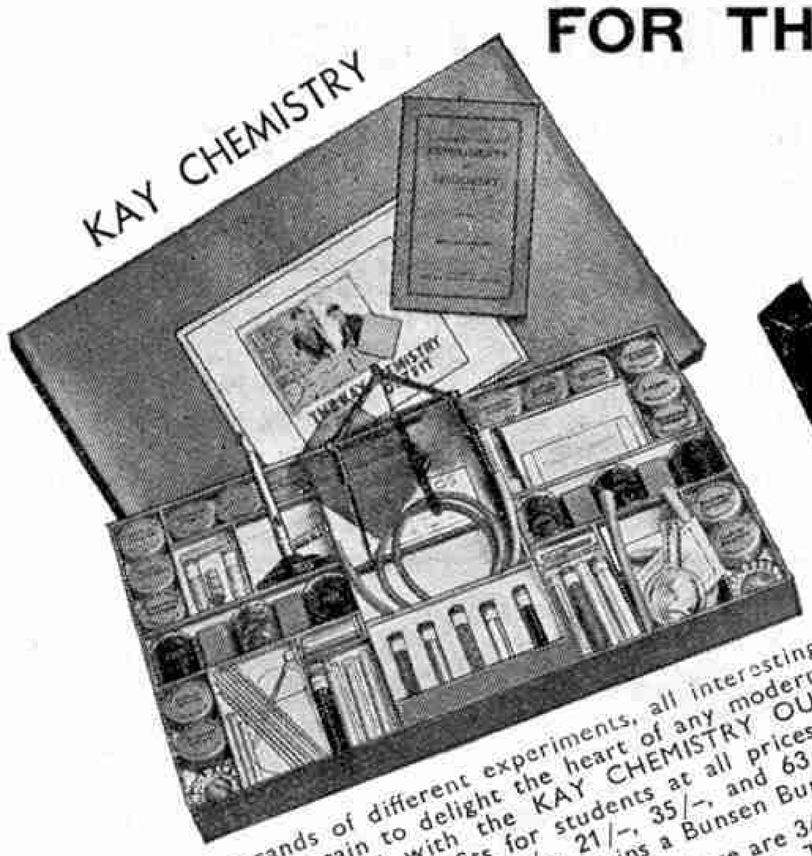

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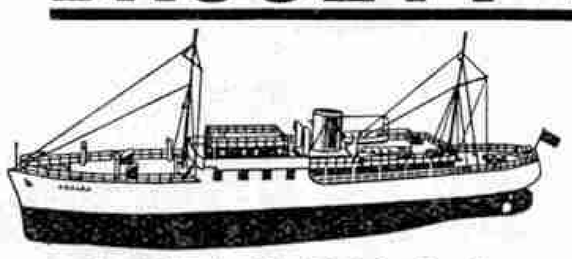

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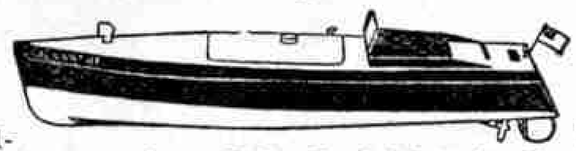

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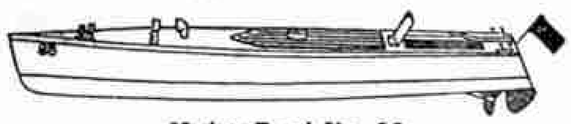

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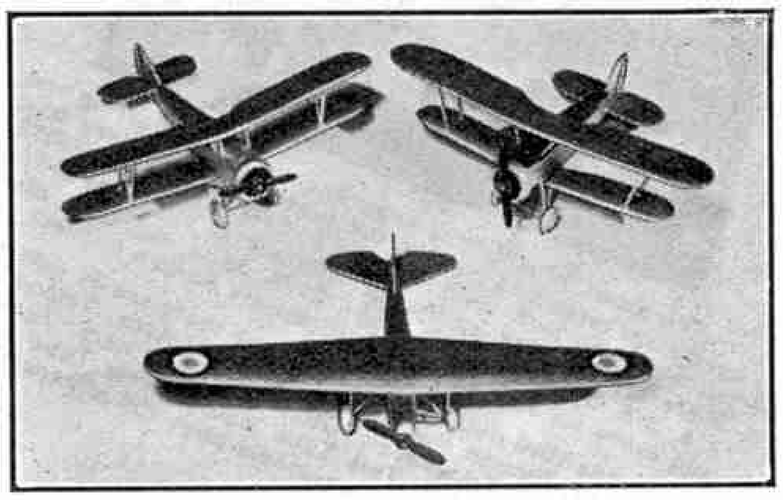

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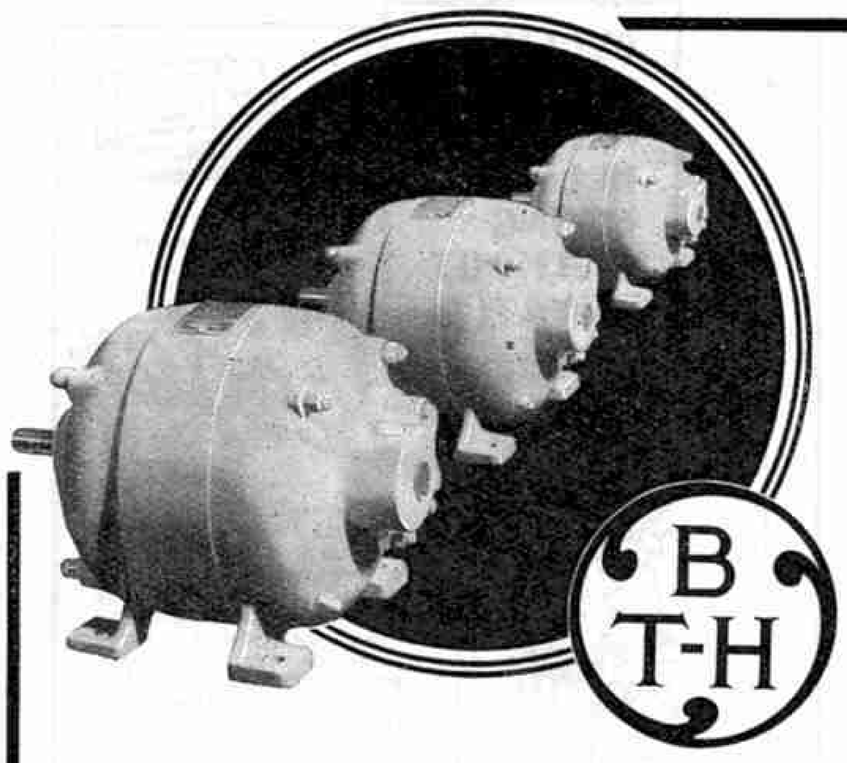

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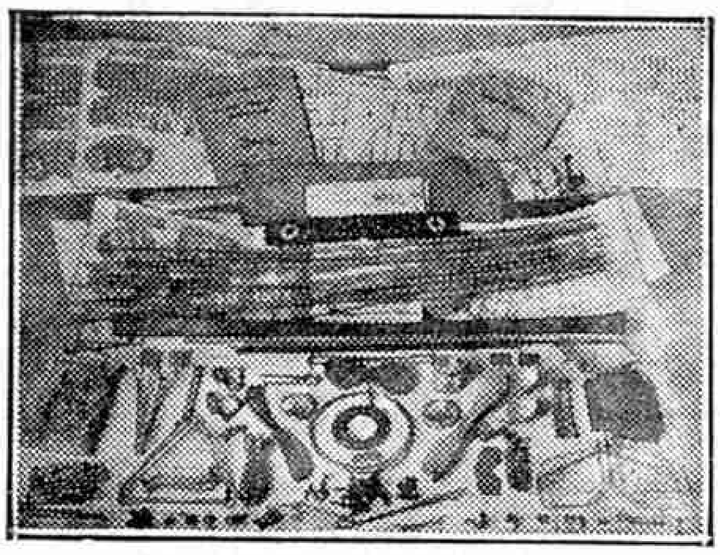

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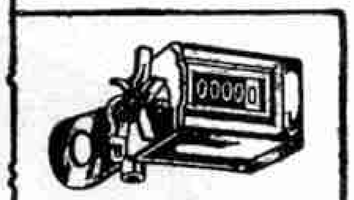

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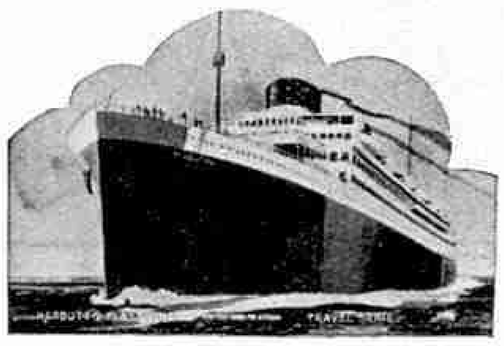

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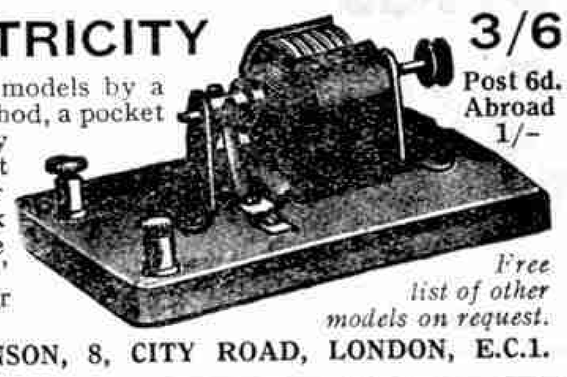

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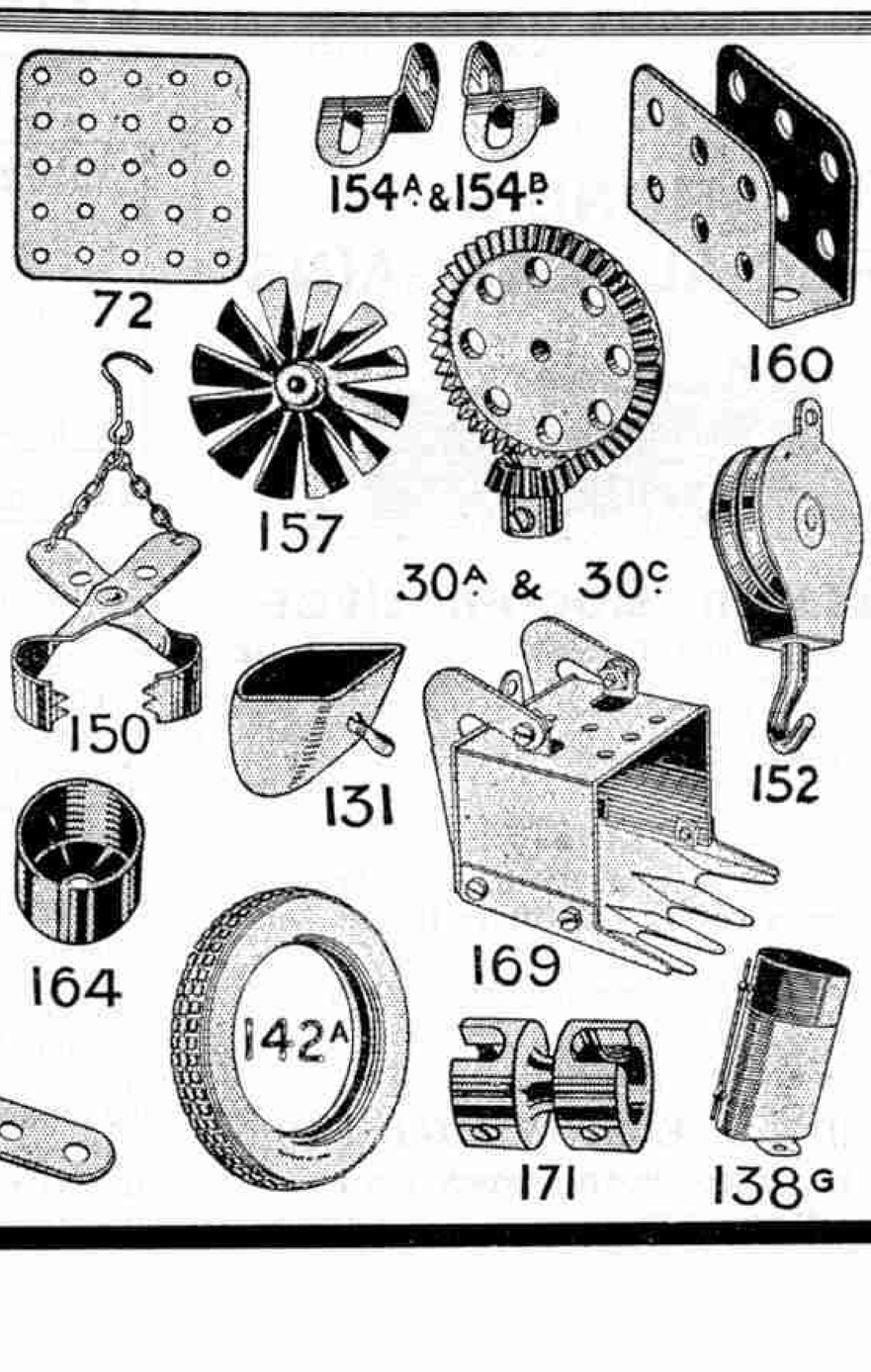

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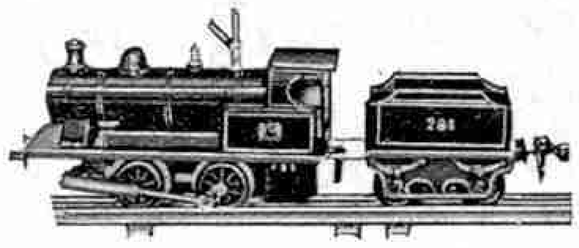

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This Month's Special Articles

	Page
Aerial Photography with a Kite ...	631
Air News	600
Books to Read	594
British Low Wing Cabin Monoplanes	602
British Railways and Coal Traffic ...	584
Coming of the Electrical Age	599
Competition Corner	635
Engineering News	580
Fireside Fun	633
Flame Tracer Cartridge for Shot Guns	579
From Our Readers	604
Great Ports of the World. V—Hull ...	572
Guild Pages	618–9
Hornby Railway Company Pages ...	621–627
Jumping From Aeroplanes as a Career	576
Machining Ships' Propellers	570
Meccano X Series Models	610
Model Building Contest Results ...	615
Model Building Contests	613
Modern Locks and How They Work	575
New L.M.S.R. "Pacific" Locomotive	582
Railway News	586
Railway Signalling in France	607
Rebuilding Napier after the Earthquake	592
Romance of Ancient Treasure Port ...	596
Stamp Gossip	629
Vertical Lift Bridges	588
What Shall I Be?	590

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Stamp Advertisements cont. from p. 628

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What Shall I Be?—(*Continued from page 591*)

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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."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the 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).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

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.
UNITED STATES: Meccano Co. of America Inc., New Haven, Conn. Meccano Co. of America Inc., 200, Fifth Av., New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., P.O. Box 129, Paykel's Building, Anzac Avenue, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Daryanamal and Bros., Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

BIRDS' EGGS, Butterflies, Fish, Reptiles, Collecting Apparatus, etc. Lists free.—Forbes, Clutton, Chester.

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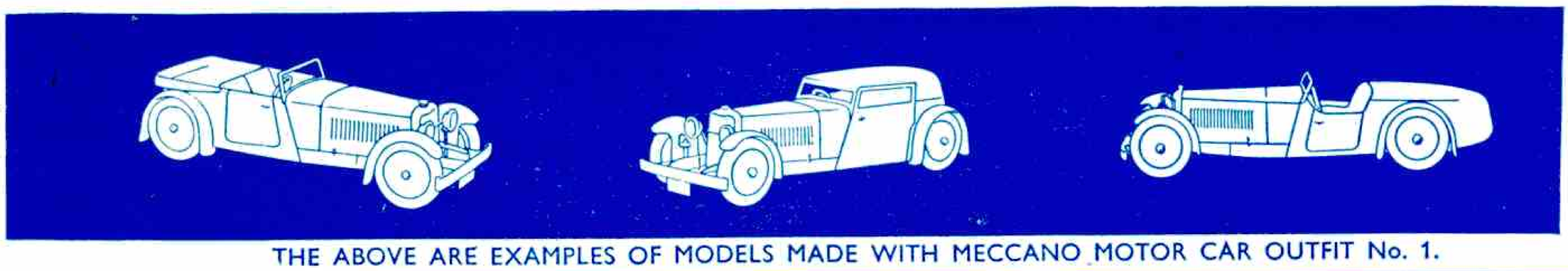

THE ABOVE ARE EXAMPLES OF MODELS MADE WITH MECCANO MOTOR CAR OUTFIT No. 1.

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Meccano Motor Car Constructor Outfit No. 1

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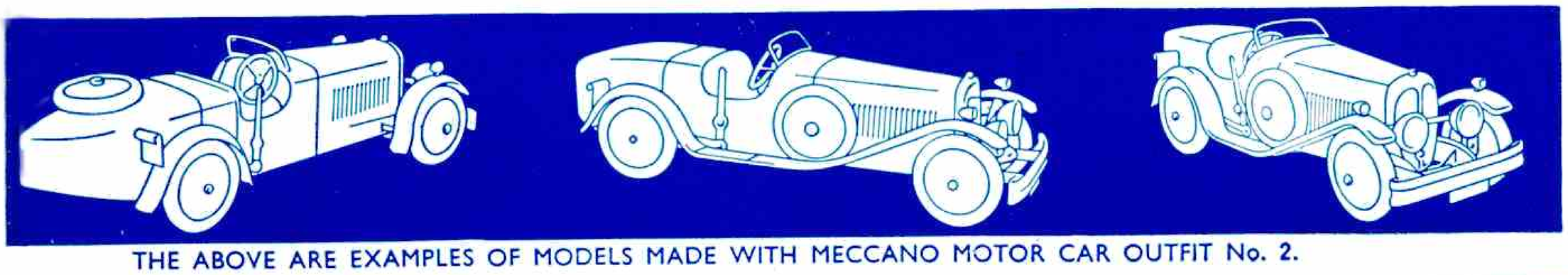

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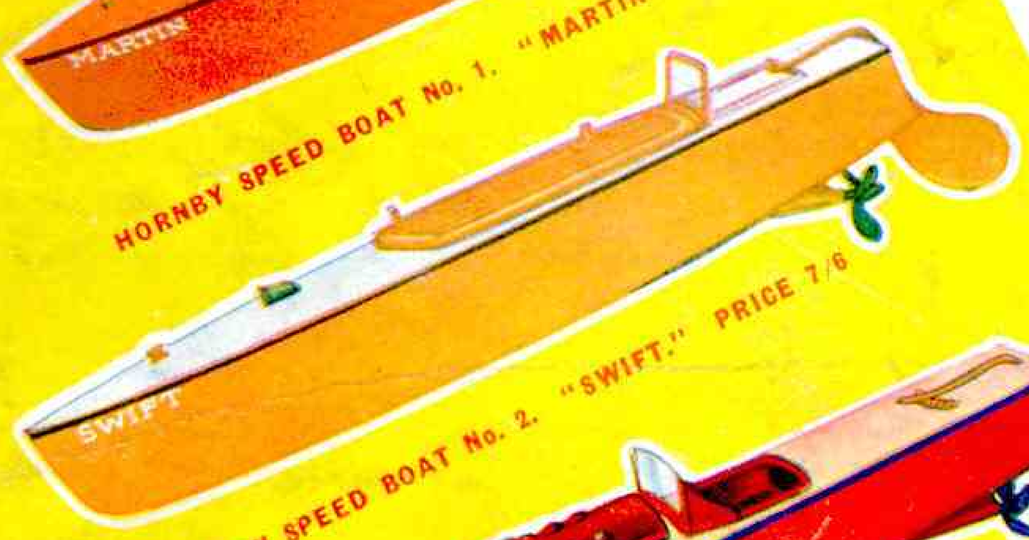

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