MECCANO MAGAZINE

MAY 1925.

PRICE 3D

VOL. X
Nº 5

SHIPPING LOCOS OVERSEAS (see page 213)

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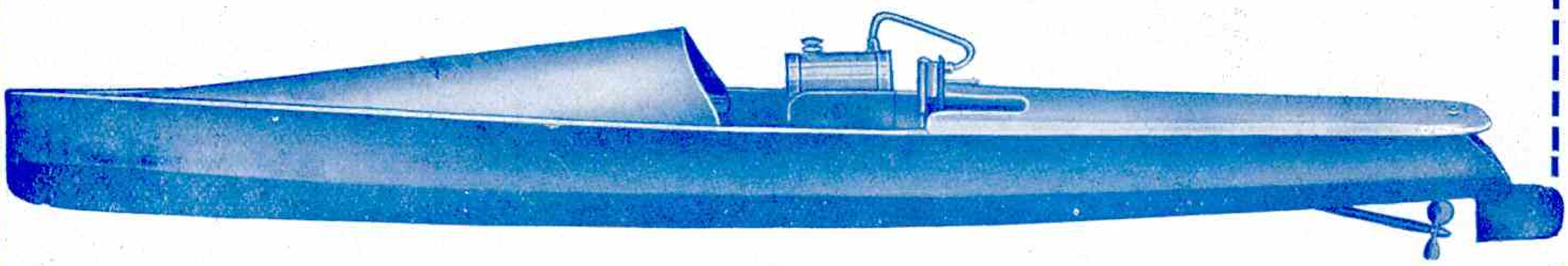


MISS AMERICA—30 inches Long, 3½ inches Beam—THE BRITISH WONDER

NEXT MONTH: FRENCH, SWISS AND ENGLISH RAILWAYS COMPARED.

EDITORIAL OFFICE
Binns Road,
LIVERPOOL

MECCANO MAGAZINE

PUBLISHED
IN THE INTERESTS
OF BOYS

Vol. X, No. 5.

May 1925

With the Editor

Our Million Ancestors

During the past few months I have been greatly struck by the number of wonderful discoveries that have recently been made in connection with our ancestors. I am afraid that we do not often think of our ancestors in these busy times. I do not mean our fathers, our grandfathers or even our great-grandfathers, but our ancestors of thousands of years ago, of whom we have a vast number. For instance, we each have a father and mother—that is two. They each also had fathers and mothers, and they—our grandfathers and grandmothers—had fathers and mothers, making altogether fourteen ancestors for us. Taking it only one step further, we find that each of us had sixteen great-great grandfathers and grandmothers, so that altogether, to this point only, we have accounted for thirty ancestors in all.

It thus becomes quite easy to understand that our ancestors are very numerous. Indeed, only the other day I read that every person has at least a million ancestors—in other words, it has required a million ancestors to make us what we are to-day! Try to imagine this long line of ancestors behind each of us—a line stretching back through the Middle Ages, far beyond the days when the Romans ruled Britain—back to the time of primitive man, even before the time when the mammoth or hairy elephant, the great woolly rhinoceros and the sabre-toothed tiger roamed at large in the forests that covered Britain.

Recent Wonderful Discoveries

We know little of the people who lived in those far-off days, but every year new discoveries add to our knowledge. Every year we learn more and more of the hidden secrets of the remote ancestors of mankind and of ancient civilisations that have long since passed away. During the past few months discoveries seem to have been more than usually numerous and interesting.

Recently, for instance, a fossil skull, unearthed at Taungs in South Africa, has created quite a sensation among scientists, for, on account of its very great age, it must have belonged to one of the earliest men. We have heard also of wonderful prehistoric wall-paintings discovered by three boys in Western Europe. More recently the tomb of an ancient ruler in Egypt has been found which dates back to a time as far removed from the days of Tu-tank-hamen as the days of "Tut" are from King George V. In the Far East the forgotten capital of a lost empire has been unearthed and a library of 2,500 books in seven languages, including a dictionary of an unknown and mysterious tongue. In another part, ancient silk-lined tombs have been discovered 50 ft. below the earth, containing the bodies of Chinese princes buried thousands of years ago.

Rock Pictures of Ancient Red-Men

The recent discoveries are not confined to what is generally called the "Old World." In the west more than one expedition is now exploring Central America, where last year wonderful discoveries were made of relics of ancient nations that flourished thousands of years ago. Pyramids and rock carvings resembling those of ancient Egypt were found, along with the ruins of great cities, with huge palaces, temples, and other buildings. The explorers had to hack their way through a dense jungle and all the ruins are buried in an undergrowth so dense that it completely covers them and renders them invisible.

In Nevada, strange rock pictures have been revealed. These are believed to be the work of Red Indians who lived thousands of years ago, and it is claimed that the carvings are of an age more ancient than those of Egypt. Many of these ancient rock pictures are found on the rocks of the "Hill of a Thousand Tombs," which forms part of the burial ground of an extinct race. It is believed that the rock pictures are the work of these people or their ancestors.

East and West

Probably you will wonder what possible connections there could be between Red Indian rock carvings of thousands of years ago and you and me to-day. Yet there is a connection—although it certainly is very remote—and the several ways by which we know this is one of the most wonderful stories of science. To deal with these at length would be out of place here, but perhaps one instance may be mentioned, more especially as it is directly connected with the rock carvings already described.

With the exception of one, none of the signs can be interpreted, and so their message remains hidden. The single exception has been explained to scientists by the Chief of the Piute Indians, who said that this particular sign was used by his tribe as a charm to keep away the devil. One day recently the carvings were seen by an educated Chinese, who is a student at the University of Nevada. A sign at the entrance of the valley in which the rock pictures occur first attracted his attention, and after carefully examining it he declared it to be identical with the sign used in China to-day to charm away the devil!

He examined more of the rock pictures and found many other signs that corresponded with Chinese characters in an ancient dictionary that he was able to obtain. With this dictionary, which contains characters in use before the time of the Chin dynasty, more than 3,000 years ago, he was able to identify seven of the "world pictures" and translate them with certainty. The characters he translated mean:—a thousand, sky, earth, wooded vale or valley, mountain, centre, and wolf.

A Common Ancestry

The Chinese student believes that the secret of the rock pictures can be discovered in time, but it will be a slow and laborious undertaking, for his dictionary contains over 50,000 Chinese characters! This is very interesting and we shall all look forward to the time when the meaning of the rock pictures is revealed to us.

In the meantime, however, the story has a great and wider interest. The fact that an illiterate Red Indian and a highly educated Chinese student, neither of whom had ever heard of the other, within a few weeks each interpreted a thousands-of-year-old sign to have an identical meaning, shows a direct connection between the Chinese and the Red Indians.

Similarly it is believed that connections exist between all the races of the earth. In many cases the connections are comparatively easily traceable, in others they are more difficult and remote. Gradually we are coming to believe that if we could look far back, to long before the time of the mammoth and sabre-toothed tiger, we should find that all nations came from one common ancestry who had their home in Asia—perhaps India—and who spread from there to all parts of the Earth.

Lives of Famous Engineers

XVI Isambard K. Brunel and the GREAT WESTERN RAILWAY

THE success of the Liverpool and Manchester Railway, which was opened for traffic in 1830, drew general attention to the superiority of the railway over road and canal. In 1825 the merchants of Bristol had attempted to form a railway company, but without success, and for the time being the idea was abandoned. In 1832, however, another attempt was made, and a committee was set up to work out a scheme for a railway from Bristol to London.

The committee's first task was to select an engineer to carry out the preliminary survey and prepare an estimate of the cost of the project, and Brunel was among the candidates for the post. He was well known in Bristol as the engineer of the Clifton Suspension Bridge, and although many of the other candidates had strong claims, he obtained a majority of votes and was appointed engineer in March 1833.

House of Lords Reject the Bill

Brunel spent the next three months in making his survey, and in July a meeting was held at which the scheme was brought before the public. A month later a company was formally constituted and the Parliamentary survey begun. By the end of November it became evident that subscriptions were not coming in as fast as had been hoped, and the directors realised that they would not be in a position to lodge a railway Bill for the whole line. It was determined, therefore, to apply for Parliamentary powers to construct a railway from London to Reading and from Bath to Bristol, leaving the completion of the scheme for a later date.

The Bill was introduced into the House of Commons early in 1834 and after passing the second reading it was referred to a Committee. The investigation occupied 57 days, during which period every possible kind of opposition was brought forward. Brunel's cross-examination lasted no less than 11 days, during which the clearness of his evidence and his ability and knowledge made a great impression. George Stephenson was one of the witnesses and in his evidence he said: "I can imagine a better line, but I do not know of one so good." The Bill successfully passed this stage, but was defeated in the House of Lords and therefore thrown out.

This setback did not discourage the promoters, however, and they lost no time in preparing to bring in another Bill in the following year. By this time sufficient money had been raised to enable the whole line, from London to Bristol, to be constructed.

Bill Receives the Royal Assent

This Bill also met with strong opposition and some very curious objections were brought against it. It was said that the Thames would be choked up for want of traffic, that the drainage of the country would be destroyed and that Windsor Castle would be left unsupplied with water. It was argued that Eton College would be utterly ruined because the most abandoned inhabitants of London would come from town by the railway and pollute the minds of the boys, and the latter would take advantage of their play hours and run up to town, mix in all the dissipation of London life and return before their absence could be discovered! In spite of all this opposition, however, the Bill succeeded and the Royal Assent was given on 31st August, 1835.

Opening of the G.W. Railway

The Great Western Railway was constructed with very few deviations from the line sanctioned in this Bill. The most important alteration was carried out at the London end where, by an Act passed in 1836, the line was taken to Paddington instead of joining the London and Birmingham railway near Kensal Green. This change of route was brought about by a difference that arose between the two companies in regard to the terms of their agreement.

The railway was opened to Maidenhead, a distance of nearly 23 miles, in June 1838 and to Twyford, eight miles further, a year later. The line from Twyford to Reading was opened in March 1840 and from Reading to Chippenham in May 1841. In the meantime the section of line from Bristol to Bath had been opened in August 1840, and by 30th June 1841 the last section from Chippenham to Bath was opened and the railway was thus completed throughout its whole length.

Brunel

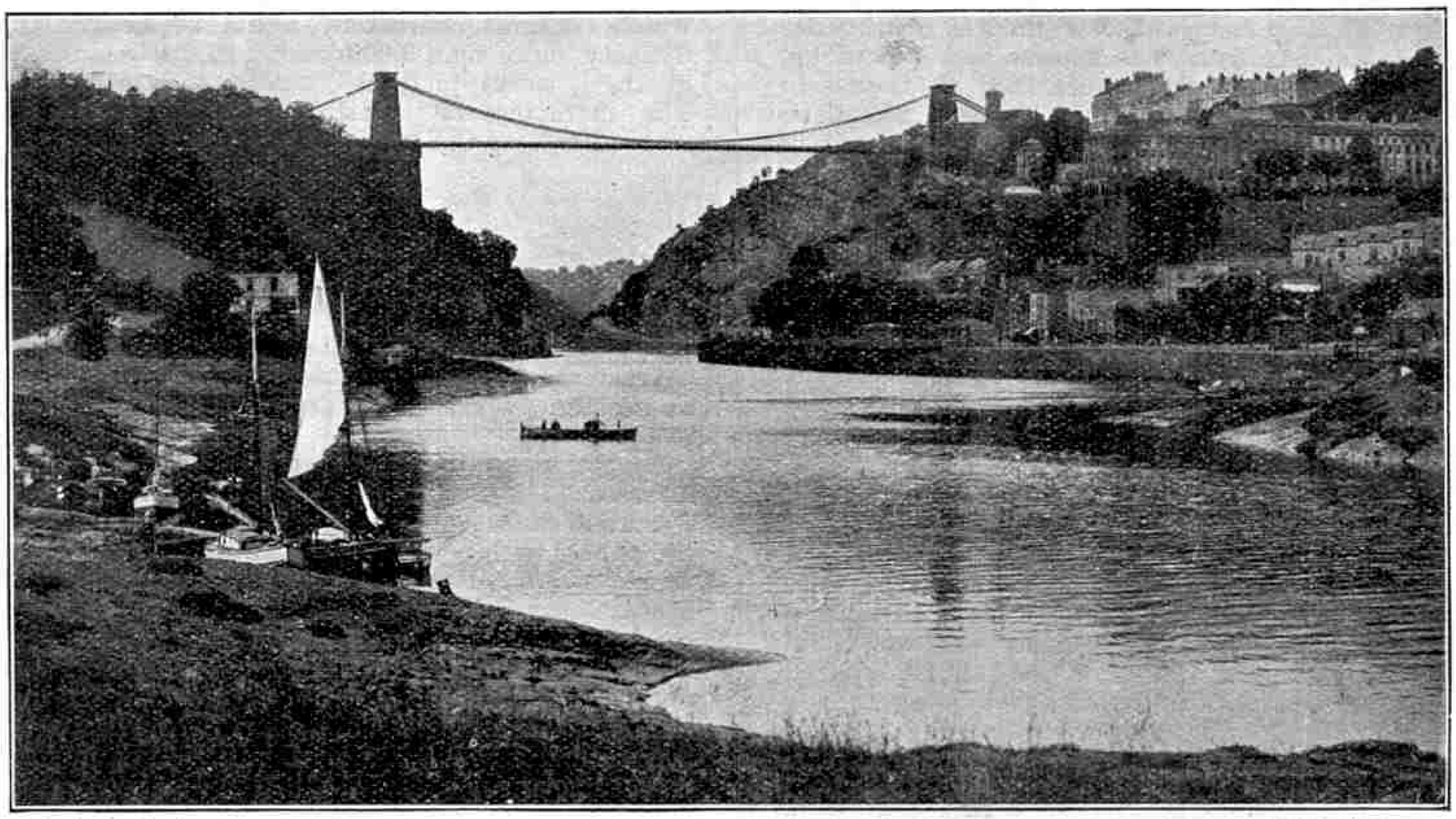
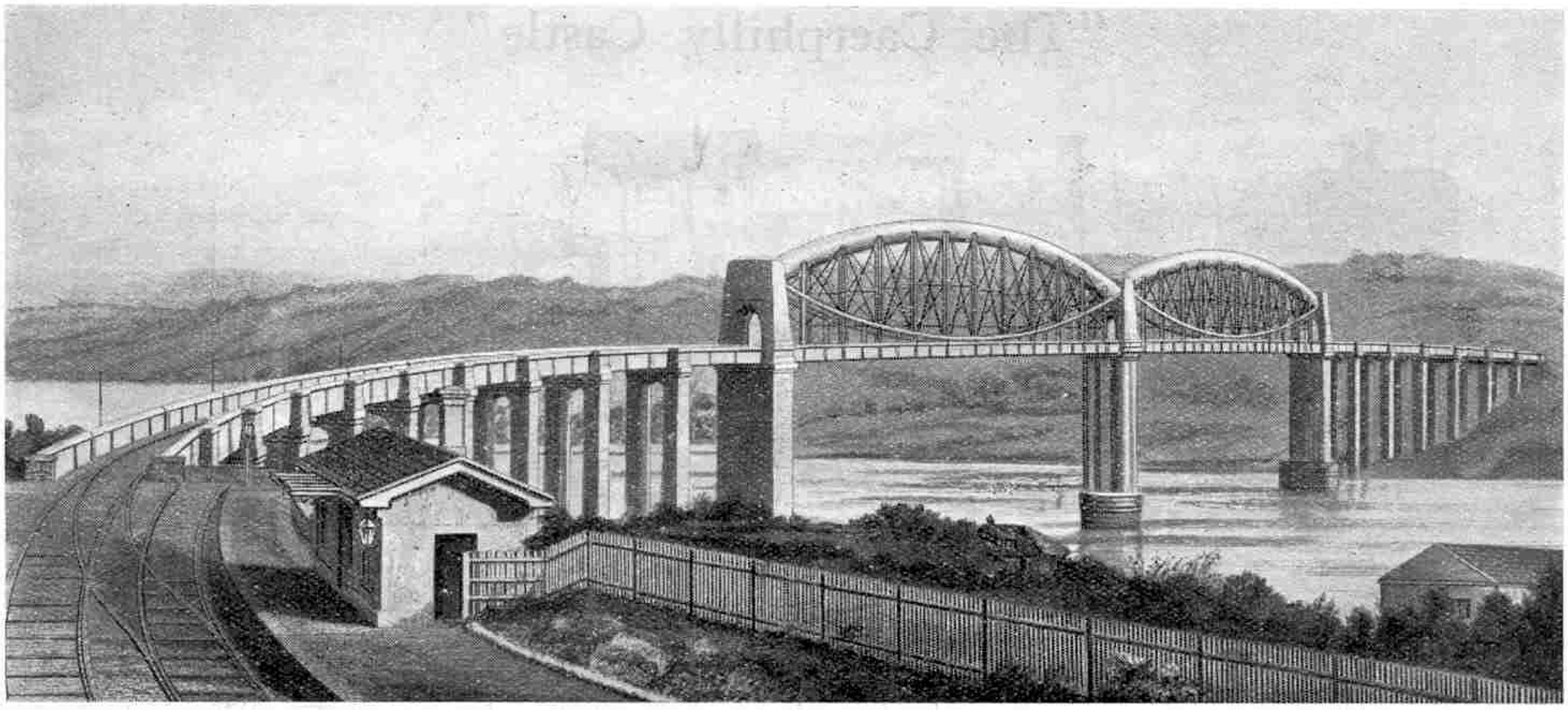


Photo courtesy] [*G.W. Railway*

Clifton Suspension Bridge, designed by Brunel and completed after his death



Saltash Bridge in Brunel's day

subsequently constructed numerous important subsidiary lines connected with the Great Western main line and also acted as engineer to railways in Ireland, Italy and elsewhere. Our space does not permit of a description of these lines and we must now turn our attention to the historic "Battle of the Gauges."

The early railways were little more than adaptations of the old wooden tramways which, in their turn, were developed from the ordinary road carts. In consequence the gauge or distance between the rails of the first railways was based upon the distance between the wheels of the carts employed in the northern counties of England. When George Stephenson came to lay down the track for the Stockton and Darlington line he saw no reason to change this gauge—4 ft. 8½ in.—and later the same gauge was adopted for the Liverpool and Manchester railway, the Grand Junction railway and the London and Birmingham railway. In this manner the gauge of 4 ft. 8½ in., subsequently known as the "narrow gauge," became established.

Brunel decides on a 7 ft. Gauge

In the first Bill for the Great Western Railway the gauge was mentioned as being 4 ft. 8½ in., but in the second and successful Bill Brunel secured the omission of any mention of the gauge at all, thus leaving the question open for future consideration.

Brunel was convinced that there were many advantages to be gained by an increase in the gauge and he finally decided that the Great Western gauge should be 7 ft., and proceeded to lay the track accordingly. He thought that the wider gauge, with the corresponding greater width of base of the coaches, would give increased steadiness and smoothness of running and also greater safety, particularly at high speeds. He also hoped by adopting this gauge to keep the west and south-west of England exclusively for the Great Western Railway.

On this matter George Stephenson took a longer and wiser view. At one time it was proposed to adopt a special gauge for the Leicester and Swannington Railway, but Stephenson replied: "I tell you the Stockton and Darlington, the Liverpool and Manchester, the Canterbury and Whitstable and the Leicester and Swannington must all be 4 ft. 8½ in. Make them all the same width; though they may be a long way apart now, depend upon it they will be joined together some day."

Committee's Tribute to Brunel

In 1845 the gauge question was referred to a Royal Commission. The Commissioners sat from August to December, during which time they examined 48 witnesses, 38 of whom directly advocated the narrow gauge, eight favoured gauges of from 5 ft. to 6 ft., and the remainder, including Brunel, championed the broad gauge. Early in 1846 the Commissioners reported that the gauges were equal in regard to the safety and comfort of the passengers; that the broad gauge had the advantage in point of speed; that the narrow gauge was more convenient for goods traffic; that the broad gauge involved a larger outlay and that, as far as they could see, there were not sufficient compensating advantages to set against this greater first cost. They therefore recommended that 4 ft. 8½ in. should be declared to be the gauge to be used on all public railways built in Great Britain.

In face of this decision it is interesting to note that in one part of their report the Commissioners said: "We feel it a duty to observe that the public are mainly indebted for the present rate of speed and the increased accommodation of railway carriages to the genius of Mr. Brunel and the liberality of the Great Western Railway Company."

As the result of the report of the Commissioners an Act for the regulation of the gauge of railways was passed, rendering it unlawful to construct new lines in Great Britain of other than 4 ft. 8½ in. gauge without first securing special Parliamentary sanction. From that time the standardisation of the narrow gauge became inevitable.

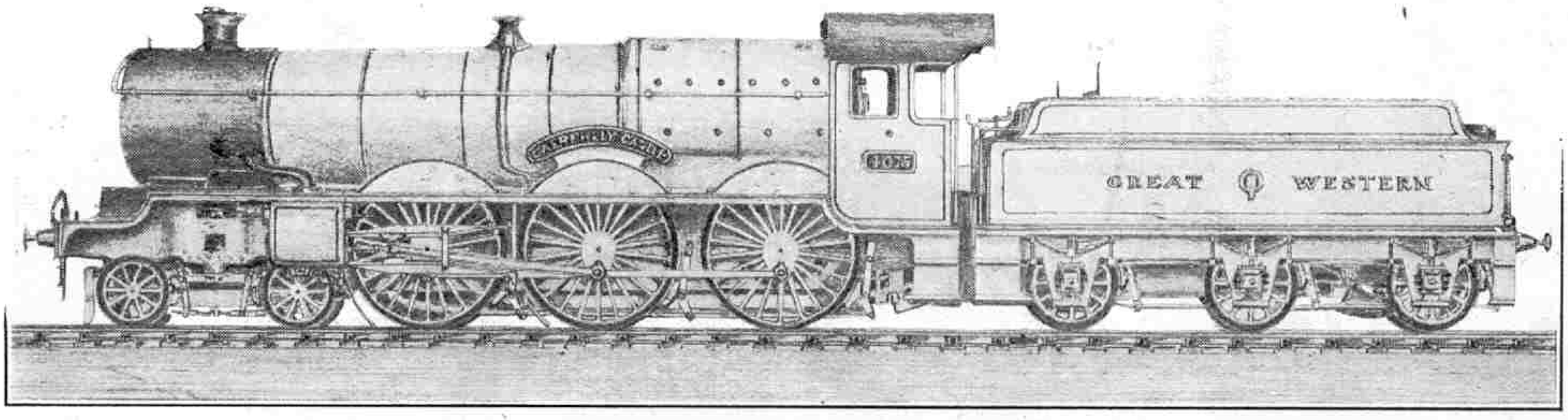
On a considerable portion of the broad gauge track a third rail was laid down in order that the line might be used by vehicles of either gauge. Then began the conversion of the broad gauge to the narrow gauge, a process that occupied 24 years. The final conversion took place on 21st and 22nd May, 1892, and it provided a remarkable example of perfect organisation.

Changing to Narrow Guage

Preparations for the change had been taking place for years previously in the building of narrow gauge locomotives and coaches and placing them temporarily on wheels with widened axles so that they could run on the broad gauge track as long as might be necessary. When the time for the final conversion drew near, these hybrids were converted to true narrow gauge vehicles in a very ingenious manner, which was well described in the souvenir number of the Great Western Railway Magazine issued in June 1913. The writer of the article said:—

"In two of the roads of the repairing shop four drop pits were provided in each of which was a table fitted with trollies, which could be lifted and lowered by hydraulic pressure. A subway gave access from one pit to another. To change the bogies, the carriage was shunted on to the table on the first road until the bogies rested on the trollies, and the tables were then raised so as to bodily lift the carriage, which was then dropped. The various connections having been disconnected, the tables were lowered, taking with them from each end of the carriage the bogies, which were transferred by means of the trollies to the tables in the opposite pits and lifted to rail level by hydraulic power, thus being free to run out of the shop, leaving a second set of tables to take a new set of narrow gauge bogies. The tables bearing the latter were then lowered and the bogies transferred to the tables of the first pit, where they were lifted above rail level in order to re-make the connections between the frame of the coach.

"The Caerphilly Castle"



G.W. Loco. No. 4073 (4–6–0)

Drawn by R. W. Tippett, Acocks Green, Birmingham (Age 16), and awarded First Prize (tie) Class A in our Second Drawing Competition.

When this was completed the coach was shunted out. In this manner as many as 20 coaches were completed in a single day."

The result of all this careful preparation was that narrow gauge locomotives and coaches were available for service immediately the gauge change was completed. The whole conversion, including the alteration or scrapping of the old stock, is estimated to have cost the company nearly £800,000.

The final conversion of the G.W.R. brought to a close one of the most remarkable engineering controversies in railway history.

Brunel's Ambition

Although Brunel was thus beaten in the "Battle of the Gauges," his ambitious broad gauge scheme proved of great value in speeding up railway development in general. The position is well summarised in the following extract from Samuel Smiles's book on the two Stephensons:—

"Mr. Brunel, however, determined that the Great Western should be a giant's road, and that travelling should be conducted upon it at double speed. His ambition was to make the best road that imagination could devise; whereas the main object of the Stephensons, both father and son, was to make a road that would pay. Although, tried by the Stephenson test, Brunel's magnificent road was a failure so far as the shareholders in the Great Western Company were concerned, the stimulus which his ambitious designs gave to mechanical invention at the time proved a general good. The narrow-gauge engineers exerted themselves to quicken their locomotives to the utmost; they were improved and re-improved; their machinery was simplified and perfected; outside cylinders gave place to inside; the steadier and more rapid and effective action of the engine was secured; and in a few years the highest speed on the narrow-gauge lines went up from thirty to about fifty miles an hour.

"For this rapidity of progress we are in no small degree indebted to the stimulus imparted to the narrow-gauge engineers by Mr. Brunel. And it is well for a country that it should possess men such as he, ready to dare the untried, and to venture boldly into new paths. Individuals may suffer from the cost of the experiments, but the nation, which is an aggregate of individuals, gains, and so does the world at large."

The Saltash Bridge

In the course of his railway work Brunel built a large number of bridges and viaducts, using at different times brickwork and masonry, timber, cast iron and wrought iron. Many of these works have been demolished and replaced by modern structures, and of those that still remain the finest is the Royal Albert Bridge that carries the railway over the river Tamar at Saltash. At this point the river is 1,100 ft. in width with a depth in the middle of about 70 ft. at high water.

It was first proposed to construct the bridge with one span of 255 ft. and six of 105 ft., with superstructures of timber-trussed arches. In order to comply with the requirements of the Admiralty the design was altered to two spans of 300 ft. and two of 200 ft., with a clear headway of 100 ft. This plan would have required three piers in deep water, but Brunel subsequently decided to have only one pier in deep water and to have two spans of 465 ft.

As finally constructed the Saltash Bridge consists of two main spans of 455 ft. with 17 smaller spans of about 69 ft. 3 in. each, making a total length of bridge of 2,240 ft. The single arched rib of each large span is built up of wrought iron plates forming a hollow tube, oval in shape and about 17 ft. in width and 12 ft. in depth. In addition there are two suspension chains each consisting of two tiers of links, each tier being formed of 14 and 15 links alternately. The links are 7 in. in depth and about 1 in. in thickness. The ribs and chains are so braced together as to form what is in effect a bowed trussed girder from which the bridge deck is hung. The depth from the top of the arched tubes to the bottom of the longitudinal girders is 56 ft.

The main trusses of the bridge were floated into position on pontoons and then lifted, in a similar manner to the tubes of Robert Stephenson's Britannia and Conway bridges. When Stephenson was ready to undertake the floating of these tubes he asked Brunel for assistance. Brunel took an active share in most of the subsequent proceedings, particularly in regard to the Conway bridge, and the knowledge he then gained was of great use to him in the erection of his Saltash bridge. At Saltash there was not the same difficulty with regard to swiftness of the tide as there had been at the Britannia floatings.

The Saltash Bridge was opened by the Prince Consort on 3rd May, 1859. Unfortunately Brunel was not able to be present as he was in poor health and was away on the Continent at the time. The total cost of the bridge was £225,000.

Photo by] [*John Stark*

"The Kobenhavn"

A five-masted auxiliary barque, the largest sailing ship in the world and built at Leith

NEXT MONTH:—

Brunel and the "Great Eastern"

Shipping Locos. Overseas

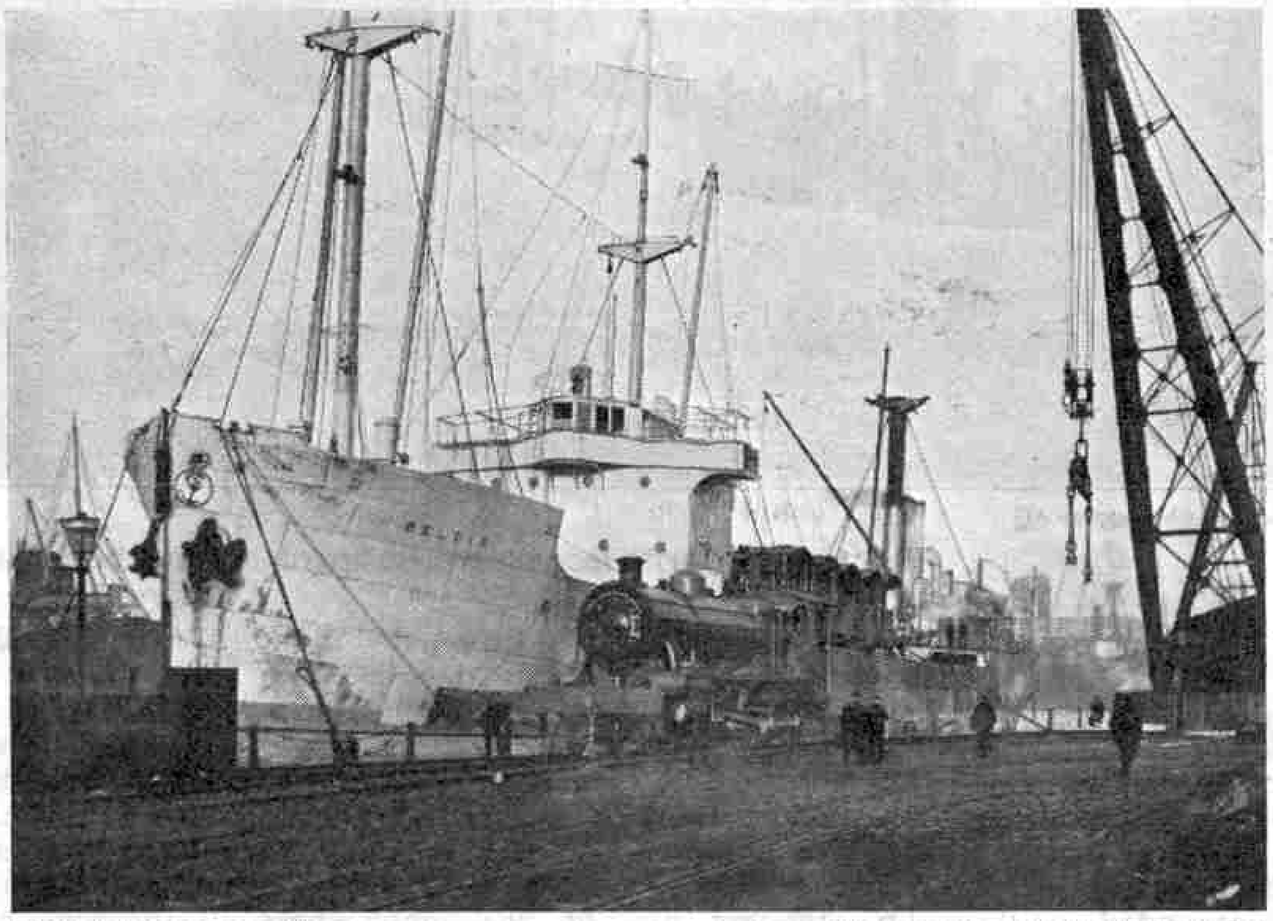
British Engines for Queensland, India and Belgium

ON account of their unsurpassed excellence, the products of the British engineering firms have long been in demand in all parts of the world. Overseas orders have included cranes, turbo-generators, hydraulic and electrical equipment, all kinds of engines, lathes, and other forms of similar machinery and even extend to locomotives and rolling stock. In fact, the export of locomotives is becoming so considerable and frequent that a special ship has been built for the sole purpose of shipping locomotives overseas.

Shipping Locos. in the Clipper days

Locomotives have been exported from this country for many years. Records show that locomotives were being shipped to Queensland as early as 1872 in the days when the Clipper ships were at the height of their fame. Of course, the handling of such bulky cargoes in those days was a very different matter from what it is to-day. There were, for instance, no giant cranes to sling the locos. on board. Instead, the shippers were lucky if they had at their command such primitive devices as shear legs and steam cranes. Even these comparatively crude appliances were rare and only to be found at the busiest ports in this country. The larger ports in our colonies had no such facilities.

The shipping of locomotives on one particular vessel, the "*City of Agra*," has been described for us in detail.* The "*City of Agra*" (1,074 tons) was built at Sunderland in 1860 and was one of the first iron clippers to be engaged in the Australian wool trade. Early in 1872 she arrived in London with wool from Melbourne, and having unloaded her cargo she was fitted out for the accommodation of emigrants, who were flocking in vast numbers to Queensland as a result of the discovery of gold in that colony.



Photograph courtesy of [*Messrs. The Vulcan Foundry Ltd.*

The special locomotive-carrying ship "Beldis" lying at the West Float, Birkenhead, with the 70-ton crane "Hercules" on the right.

The loco. in the foreground is about to be shipped and four more locos. are seen in position on the deck of the vessel aft.

Landing Locos. with Capstan and Tow Rope

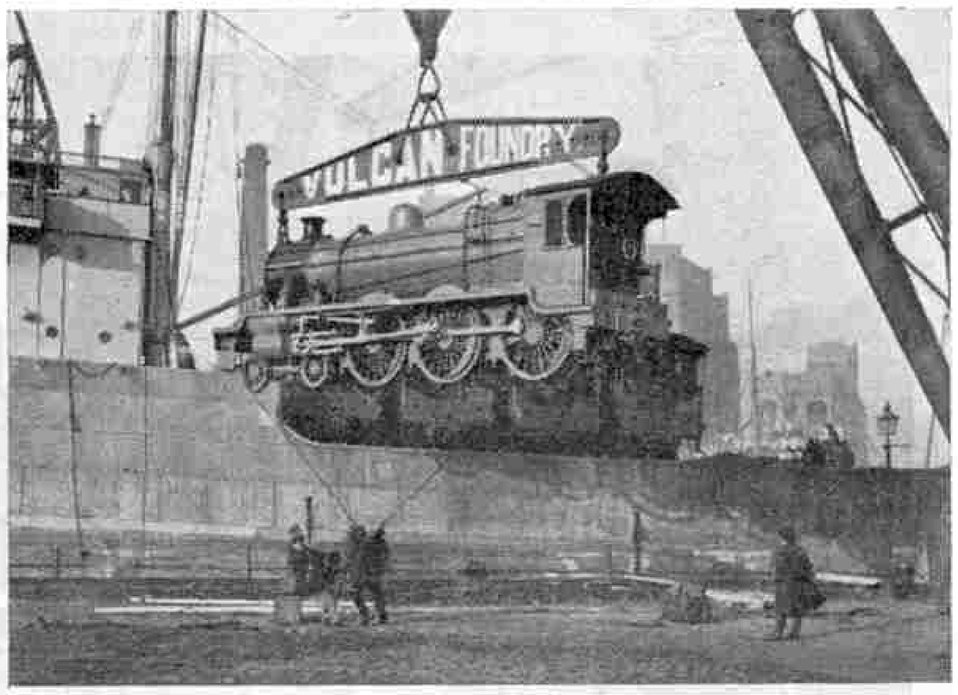
On this voyage, which was completed without incident, she also took across three locomotives, each weighing 25 tons and built for the 3 ft. 6 in. gauge railways of Queensland.

Arriving at Brisbane the captain was confronted with the problem of discharging the cargo of locos., which were stored in the main hold. The question of landing them must, indeed, have caused the ship's officers and the harbour authorities some hard thinking, and it is surprising to learn that all the locos. were ultimately unloaded from the ship into lighters with no other appliances than those that were part of the ship's gear.

This successful accomplishment is all the more remarkable when we remember that there were no steam cranes or winches, either on board or on shore—in fact there was not even a steel hawser! The available gear consisted only of a couple of coils of 5-inch Manila rope, four 30-inch four-fold blocks, two single blocks of the same size, and four 18-inch three-fold blocks, and a number of single blocks also 18-inch.

"The tow line was passed round the fore and main topmast heads," says Mr. Smith, "a preventer forestay and cap backstay being rigged at the main. The main yard was untrussed and lashed securely to the mast, a double purchase to the main-topmast head acting as a preventer lift. A spar was then lashed two-thirds out on the main yard. One big block was lashed to the tow rope above the main hatch, and another at the junction of the spare spar and the main yard, and the tackles rove. The engines were hove up by the capstan windlass; and a rare lot of shantying must have been required to get them up and into lighters!"

(*Continued overleaf*)



Photograph courtesy of [*Messrs. The Vulcan Foundry Ltd.*

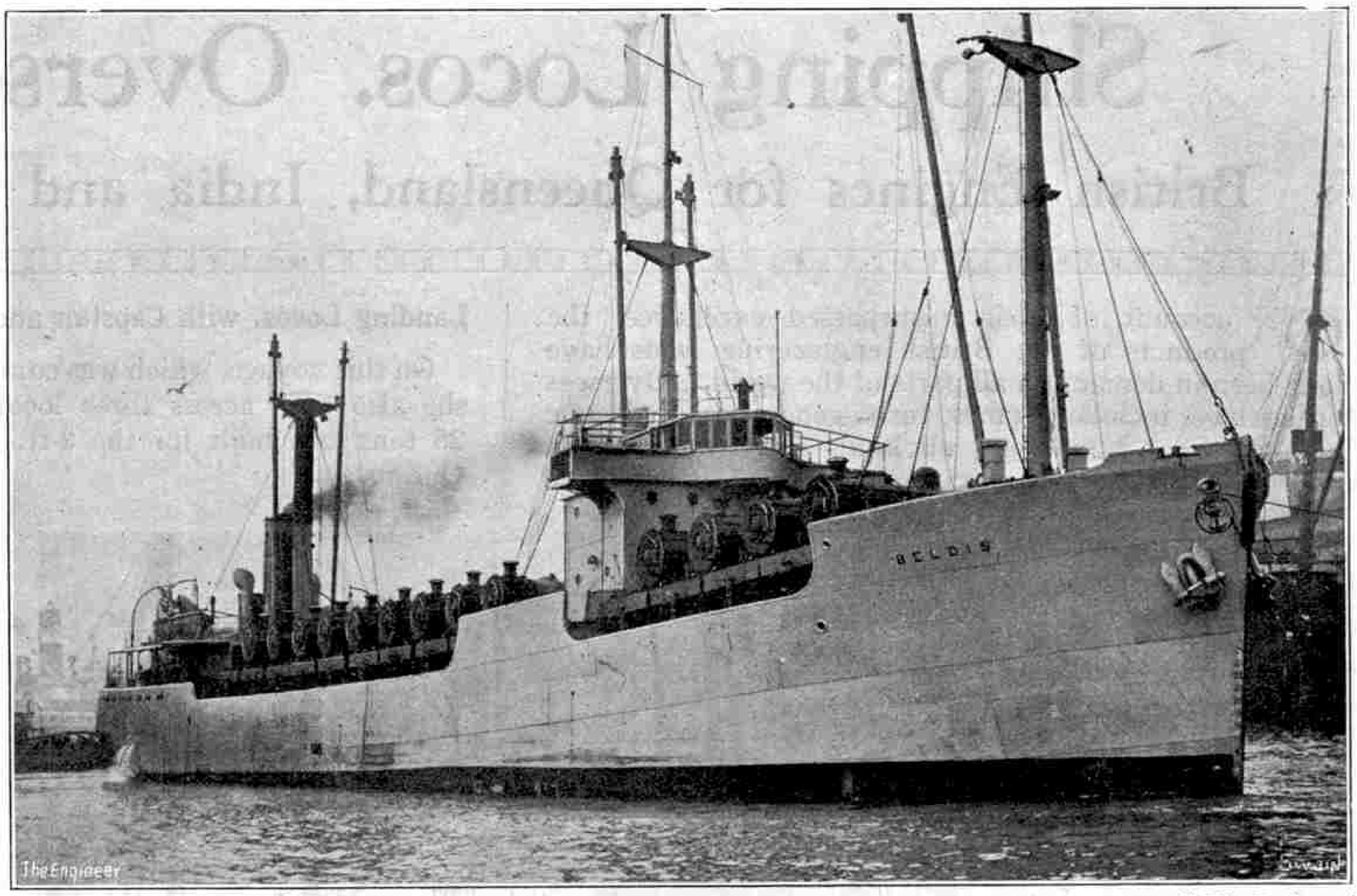
A loco. being lifted on board

* By Mr. C. F. Smith in his "*Book of Famous Ships.*"

Locos. for India

It is difficult to describe the great changes in equipment and practice that have taken place since these early locomotives were shipped to Queensland on the "*City of Agra.*" To-day the handling of large numbers of locos. for shipment overseas is a matter of comparative ease. Already this year a large batch of 4–6–0 locomotives with eight-wheeled tenders have been made by the Vulcan Foundry Limited, of Newton-le-Willows, Lancs., and shipped to the East Indian Railway Company.

These locos. were consigned on the motor ship "*Beldis,*" which left Birkenhead on Christmas Day last, bound for Calcutta, with thirteen assembled locos. stowed on her deck. Four other locos. and the tenders for the whole seventeen were stowed below. The locos. were part of an order of the East Indian Railway Company for forty similar locos. Two additional locos. are being built for the Madras and Southern Mahratta Railway, and two more for the Nizam's State Railway. These latter four are of the same design as those of the larger order, except that they have slight modifications to suit the requirements of the respective railways for which they are intended.



Photograph courtesy of] ["*The Engineer.*"

The "Beldis" with locomotives on board, leaving the dockside

Details of the Locos. for India

All the locomotives are of the 4–6–0 type and are fitted with underhung springs, the last pair being compensated. The driving wheels are 6 ft. 2 in. in diameter at the tread, the centre diameter being 5 ft. 8 in. The bogie wheels are 3 ft. in diameter. The total wheelbase of the engine is 27 ft. 3 in. and of the engine and tender 56 ft. The brakes are of the automatic vacuum type and operate on the wheels of both engine and tender. In addition there is a hand-brake fitted on the tender.

The cylinders are placed outside the frames and have a diameter of 20½ in. × 26 in. stroke. They are equipped with piston valves on top, actuated by Walschaerts valve gear and of the trunk type with inside admission.

The boilers, 15 ft. 6 in. in length and 4 ft. 9⅞ in. inside diameter, have a working pressure of 180 lbs. per square inch and are fitted with four safety valves of 3½ in. diameter. The elements of the Marine and Locomotive pattern superheaters are joined to the header with ball and socket attachment.

The fireboxes, which are made of copper, are 7 ft. 5⅜ in. in length, 4 ft. 5¼ in. in width, 6 ft. 6 in. in depth at the front and 4 ft. 9½ in. in depth at the back. All fireboxes are equipped with steam-operated rocking motion and drop grate.

The grate area measures 32 sq. ft., there being ninety-one tubes of 2¼ in. diameter and twenty-two smoke-tubes of 5¼ in. diameter with a length between tube plates of 15 ft. 10½ in.

The total heating surfaces is 832 sq. ft. made up as follows. Firebox, 152 sq. ft. Tubes, 850 sq. ft. Smoke-tubes, 478 sq. ft. Super heater, 352 sq. ft.

The tenders are of the eight-wheel bogie type with wheels of 3 ft. 7 in. diameter. The capacity of the tender is 4,500 gallons of water, and 10 tons of coal. The total weight of the engine is 73 tons, 52¼ tons being distributed on the driving wheels and 20¾ tons on the bogies. The tender weighs 61½ tons laden, so that the total weight of the engine and tender in working condition is just over 134 tons.

The Specially-Designed Motor-Ship

The motor ship "*Beldis*" was specially built for S. A. S. Christen Smith's Rederi, of Oslo, Norway, by Messrs. Sir W. G. Armstrong Whitworth & Co. Ltd., at their Walker shipyard on the Tyne. She made her maiden voyage from the Tyne to South America in July last, carrying a large consignment of oil-burning locomotives intended for the Buenos Aires Great Southern Railway.

The vessel has a total dead weight carrying capacity of 3,440 tons, which includes stores, fuel, water, and spare gear. Her draft is 18 ft. 8½ in., overall length 303 ft., breadth 45 ft. and depth 21 ft. 6 in. She has a single deck with poop, bridge, and forecastle, and is constructed on the transverse system of framing, with upright stem, elliptical stern, and deep bulwarks. She is fitted with a flat plate keel, and bilge keels run for about half her length amidships. Oil fuel and water ballast are carried in the double bottom, and other water ballast tanks are provided in the space between the upper and the bridge decks, and in the large forward and aft peaks.

Living accommodation for the Captain is arranged in a steel house on the bridge and on the upper deck, the chart-room and wireless cabin being situated on the flying bridge. The officers and engineers are accommodated abreast of the engine-casing in the fore-end of the poop. The seamen and other members of the crew find accommodation at the after end of the upper deck.

There are two cargo holds, each served by a large hatchway, and specially arranged to be clear of obstruction. Six 3-ton derricks, each operated by a steam winch, are so arranged that the cargo is discharged with a minimum delay. A complete outfit of stockless anchors, cables, steel wire, and manila hawsers is also carried and the mooring arrangements are well designed for expeditious cargo working.

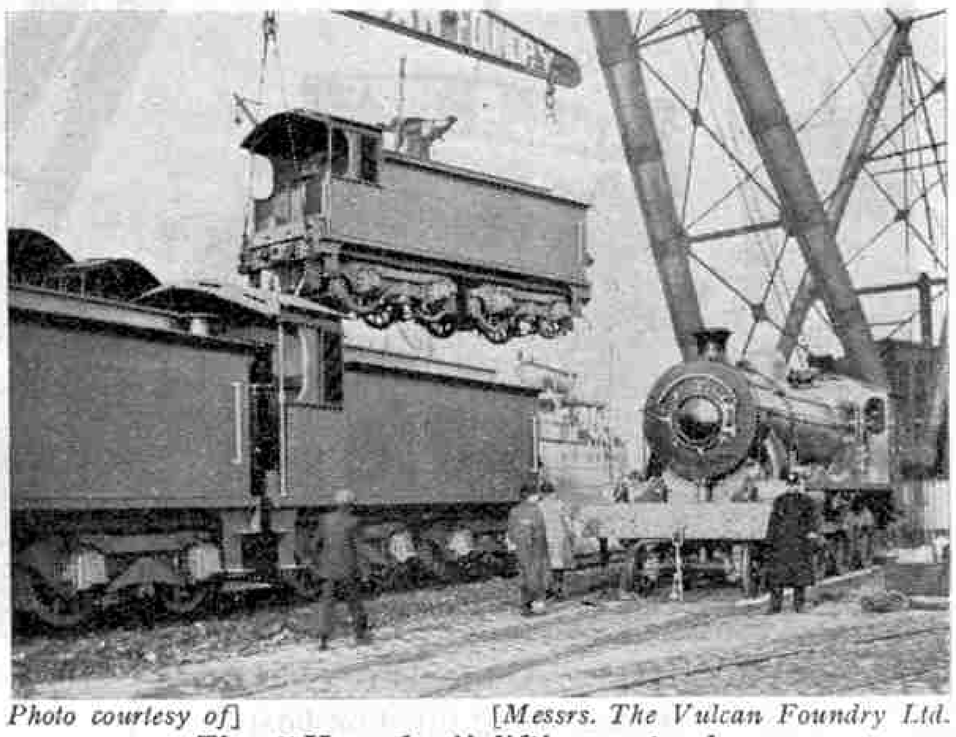
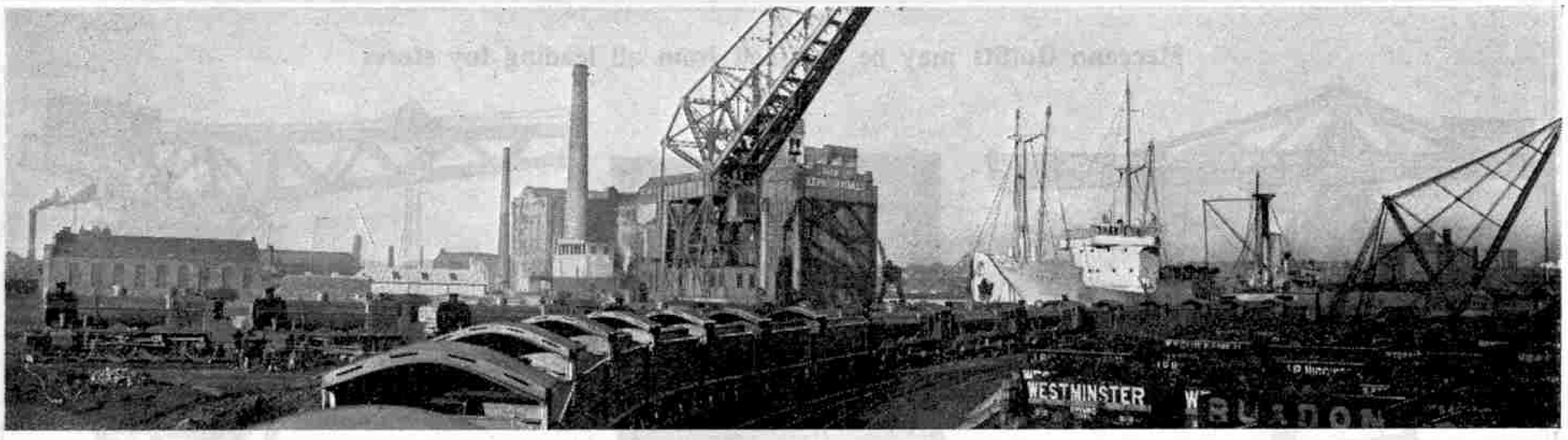


Photo courtesy of] [*Messrs. The Vulcan Foundry Ltd.*

The "Hercules" lifting a tender



Photograph courtesy of] **Some of the engines and tenders on the West Float Dock at Birkenhead** [*Messrs. The Vulcan Foundry Ltd.*

The motor ship "Beldis," which conveyed them to Calcutta, is seen in the background. In the centre is seen the Floating Crane "Mammoth" which was the subject of our cover illustration in March. It was not, however, engaged in loading these locomotives.

Propelling Mechanism Details

The "*Beldis*" is propelled by a single-screw Armstrong-Sulzer Diesel engine of the inverted four-cylinder type, situated aft and capable of developing 1,350 h.p. continuously. It is direct-acting and works on the two-cycle principle with port scavenging, the latter being effected through ports arranged circumferentially in the cylinders opposite the exhaust ports.

The upper row of ports is controlled by means of multiple-ring valves so arranged that they open after the pressure of the exhaust gases in the cylinders has reached its lowest point. They do not close until after the piston, on its upward stroke, has entirely covered the exhaust ports, whereby it is possible to deliver a surplus charge of fresh air into the cylinders.

The engine is fitted with a double-acting air pump and there is a three-stage air compressor, driven by cranks and connecting rods from an extension on the main shaft. A complete electric generator and lighting plant supplies the ship with current.

Making Light Work of 70-ton Locos.

The loading of the seventeen engines and tenders on to the "*Beldis*," which was undertaken at the West Float Dock at Birkenhead, was carried out without a hitch by the Mersey Docks and Harbour Board, whose 87-ton steam crane "*Hercules*" was employed in the work.

The locomotives and tenders were brought in parts from the Vulcan Foundry at Newton-le-Willows to the Birkenhead docks. Here they were assembled on the quay of the Gilbrook basin on a special track, the rails of which were of the same gauge as those of the Indian Railways for which the locos. were intended. After the locos. were assembled they were lifted on board by the 87-ton crane, as shown in our illustrations.

As we have already mentioned, each locomotive weighed about 70 tons but the "*Hercules*"—as befitted a crane so appropriately named—made light of this and the locomotives were shipped with ease. The "*Beldis*" had an uneventful voyage and the locos. were safely landed at Calcutta and all are now working on the Indian Railway.

200 Locos. for Belgium

On page 239 there is a short description of the splendid hydraulic crane illustrated on our cover this month. The crane is shown shipping 2–8–0 locos., part of an order for 200 locos. that are being built for the Belgian State Railways by Messrs. Sir W. G. Armstrong-Whitworth Ltd., at Newcastle-on-Tyne.

These Belgian locos. are of very powerful design and are fitted with either the Marine and Locomotive Superheater or the Robinson pattern superheater.

Each loco. is fitted with two cylinders, 24 in. in diameter and 28 in. stroke. The boiler pressure is 200 lbs. per square inch, at 85% of which the tractive force works out at 45,820 lbs. The boiler barrel is composed of three rings, 5 ft. 6½ in. in diameter outside the largest ring, and is 14 ft. 9½ in. in length; the length between the tube plates being 14 ft. 9 in.

The fireboxes are of the Belpaire type, the inner boxes of copper being 10 ft. 6 in. in length and 3 ft. 3⅜ in. in width at the bottom. They are designed for burning briquettes, and fitted with a special grate, which has only very small air spaces. The back head of the boiler slopes forward and the grate is also sloped considerably.

Belgian Loco. Details

The locos. are designed to pass over curves of 120 metres radius. At the front end of each is a pony truck, centred at the back of the cylinder box stay. The truck and two front pairs of driving wheels are equalised in the usual manner.

The coupling rod pins for the trailing wheels are spherical and at the trailing end the rear axle 30 m.m. (1.2 in.) side play is given in the boxes to either side. The axle loading is moderate, the heaviest load—on the main drivers—being 18 tons 17 cwt.

The following table, giving the principle dimensions, will no doubt be of interest :—

Locomotive

CYLINDERS: two; diameter 24 in.; stroke 28 in. WHEELS: diameter 4 ft. 11.84 in.; wheelbase 28 ft. 1⅛ in.; wheelbase fixed 12 ft. 1 in. BOILER: diameter 5 ft. 6½ in.; length of barrel 14 ft. 9½ in. FIREBOX: length 10 ft. 6 in.; width 3 ft. 3⅜ in. TUBES, BOILER: number 174; diameter 1.969 in. SMOKE: number 28; diameter 5.236 in.; length 14 ft. 11⅜ in. HEATING SURFACE: boiler tubes 1,323.9 sq. ft.; smoke tubes 565.2 sq. ft.; firebox 202.5 sq. ft.; total 2.091.6 sq. ft. SUPERHEATING SURFACE: 479 sq. ft. WORKING PRESSURE: 200 lb. sq. in. GRATE AREA: 35.1 sq. ft. LENGTH (frame): 38 ft. 2 in. WEIGHT in working order: 80 tons 4 cwt.

Tender

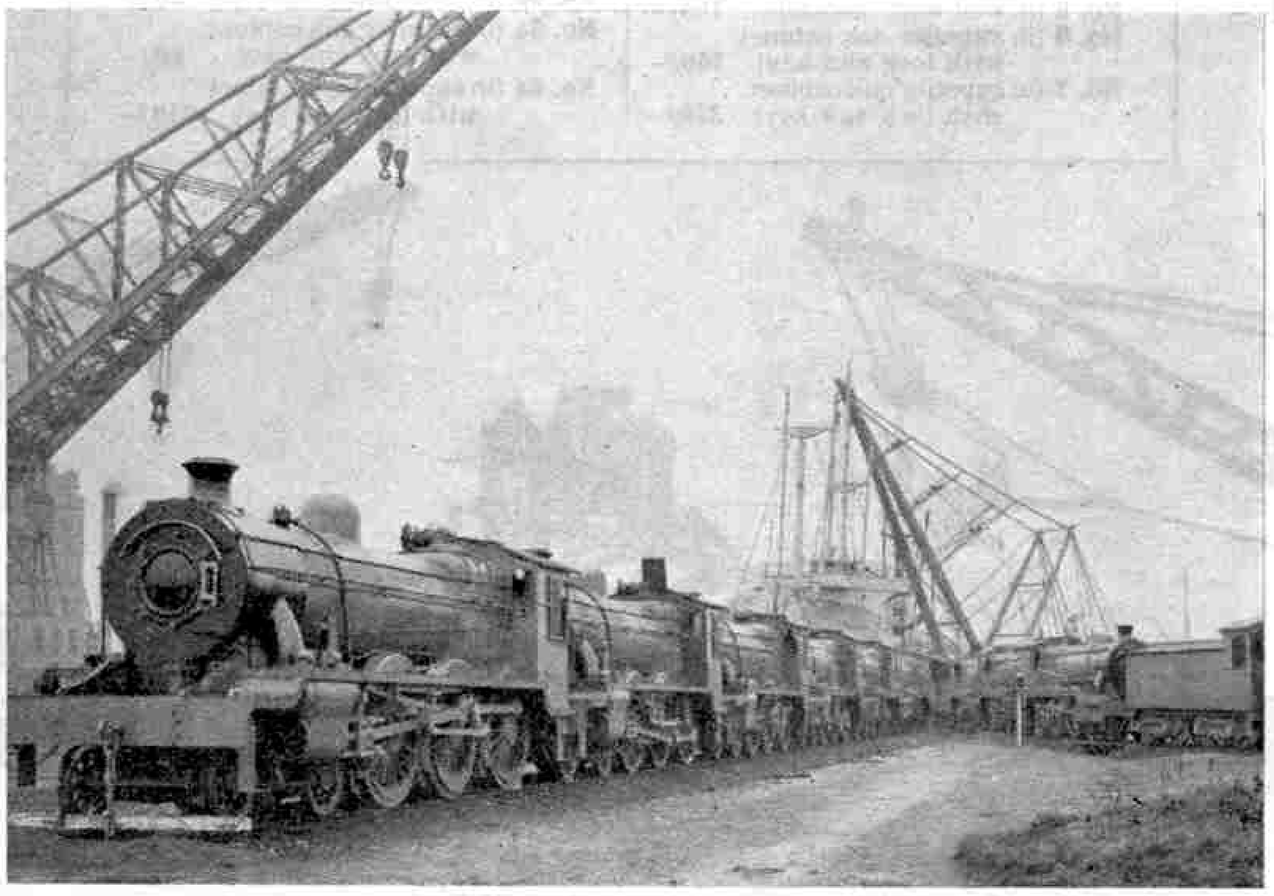
CAPACITY—COAL: 6 tons 17 cwt. WATER: 23 tons 12 cwt. WEIGHT: 52 tons 16 cwt. TOTAL WEIGHT: Engine and tender, in working order, 133 tons.

It is interesting to note that the potential output of Messrs. Armstrong Whitworth's Scotswood Works is 450 main line locomotives per annum, or practically 1½ per day. These locomotives are in use on British, Colonial, and Foreign railways all over the world, and the fact that they are giving satisfactory service is evidenced by the numerous repeat orders that the firm constantly receive.

A Royal Saloon

From so important a port

(*Continued on page* 239)

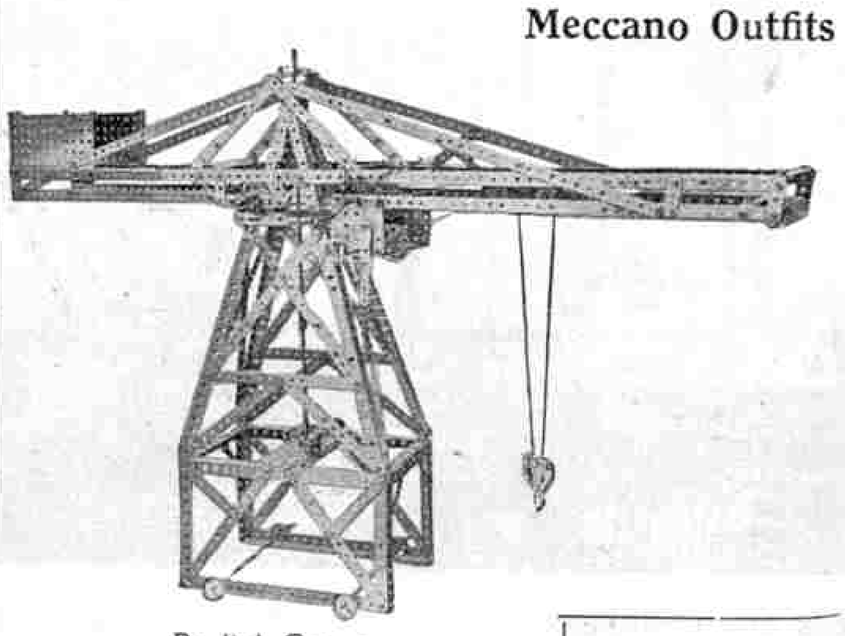


Photograph courtesy of] [*The Mersey Docks & Harbour Board*

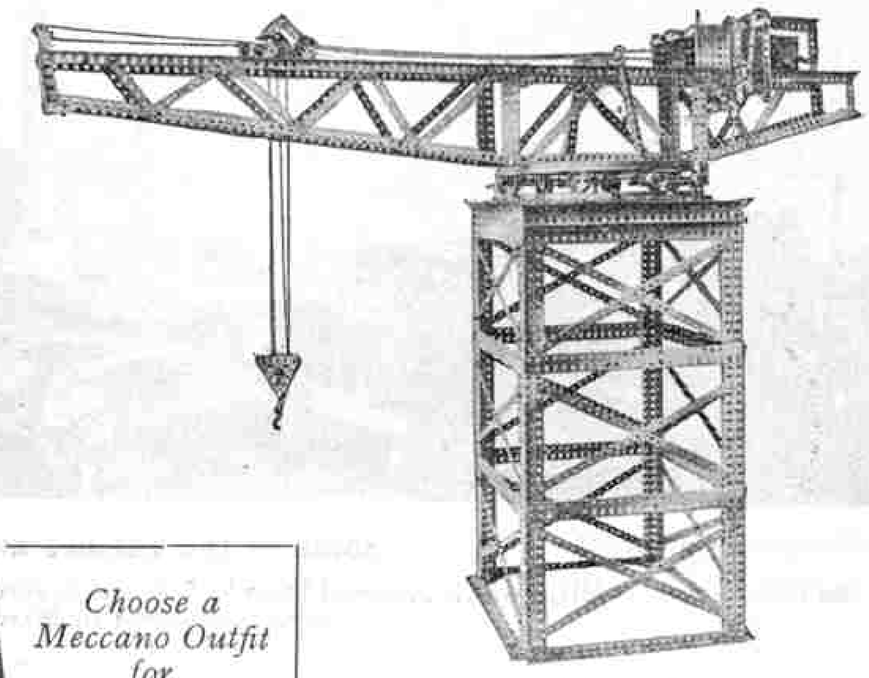
Some of the locos. waiting to be shipped

The crane "Hercules" and ship "Beldis" on the right, the "Mammoth" on the left.

Meccano Outfits may be obtained from all leading toy stores



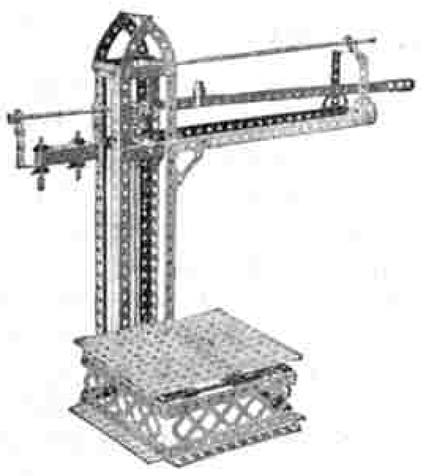
Radial Crane



Hammer-Head Crane

This No. 2 Outfit costs 15/- and builds 163 Models.

Choose a Meccano Outfit for Your Next Present



Platform Scales

MECCANO

ENGINEERING FOR BOYS

You can build hundreds of working models with Meccano: Cranes of all types, Big Wheels, Motor Chassis, Lathes, Clocks, Looms that weave real fabric, and hundreds of others all equally interesting. No study is needed, you can commence building immediately you open your Outfit. The big illustrated Book of Instructions that goes with each Outfit makes everything easy.

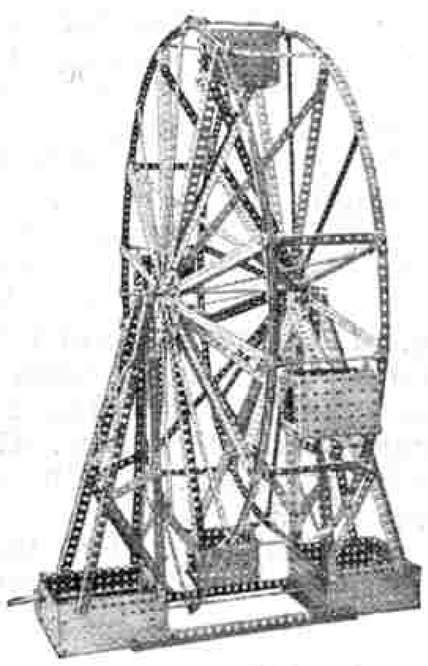
Meccano is sold in nine Outfits of varying sizes, numbered 00 to 7, and each Outfit may be converted into the one higher by adding the next Accessory Outfit. Thus if a No. 2 Outfit is bought it may be converted into a No. 3 by purchasing a 2a; a No. 3a would then convert it into a No. 4, and so on up to No. 7.

COMPLETE OUTFITS

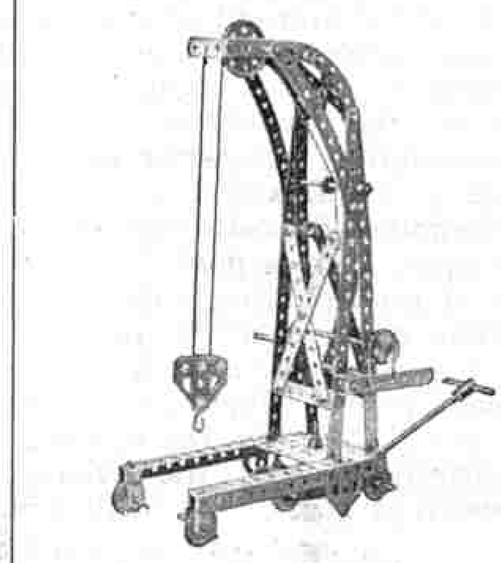
No. 00	**3/6**
No. 0	**5/-**
No. 1	**8/6**
No. 2	**15/-**
No. 3	**22/6**
No. 4	**40/-**
No. 5 (in well-made carton)...	**55/-**
No. 5 (in superior oak cabinet with lock and key)	**85/-**
No. 6 (in well-made carton) ...	**105/-**
No. 6 (in superior oak cabinet with lock and key)	**140/-**
No. 7 (in superior oak cabinet with lock and key)	**370/-**

ACCESSORY OUTFITS

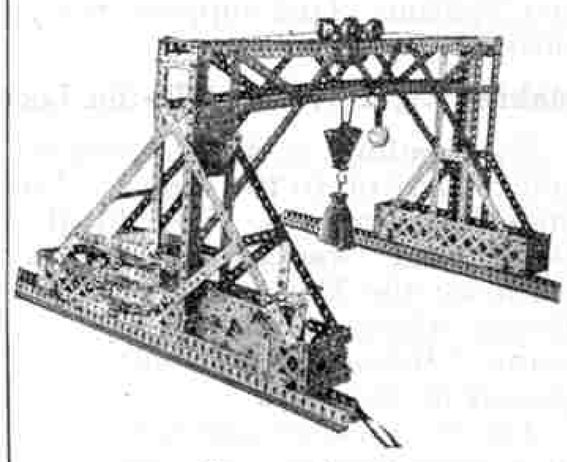
No. 00a	**1/6**
No. 0a	**4/-**
No. 1a	**7/6**
No. 2a	**8/6**
No. 3a	**18/6**
No. 4a	**15/-**
No. 5a (in well-made carton)	**50/-**
No. 5a (in superior oak cabinet with lock and key)	**80/-**
No. 6a (in superior oak cabinet with lock and key)	**210/-**



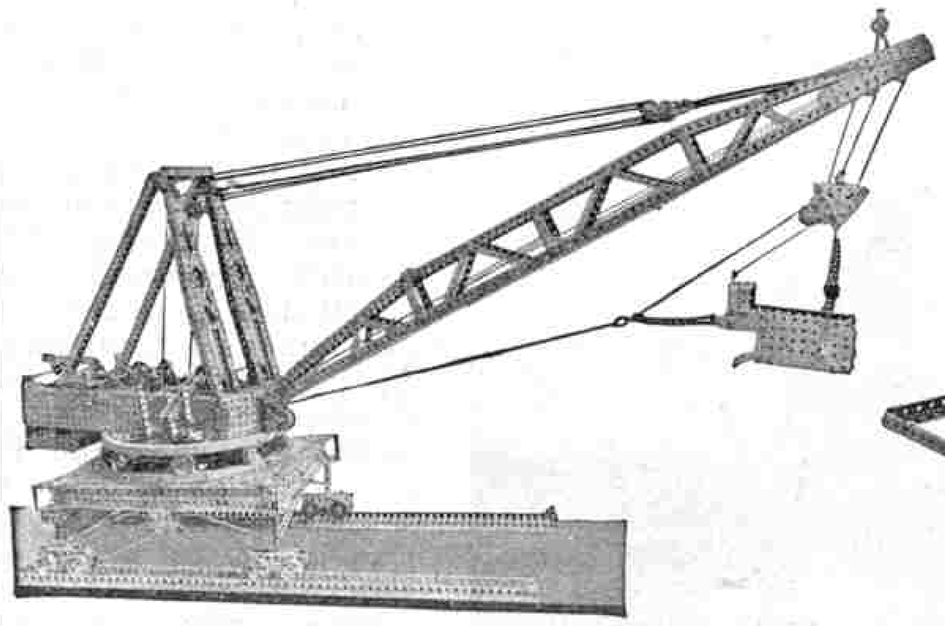
Big Wheel



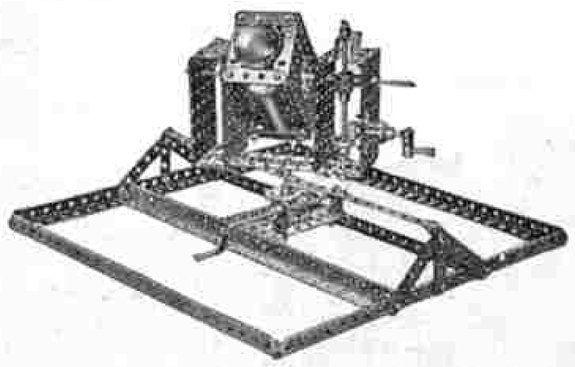
Platform Crane



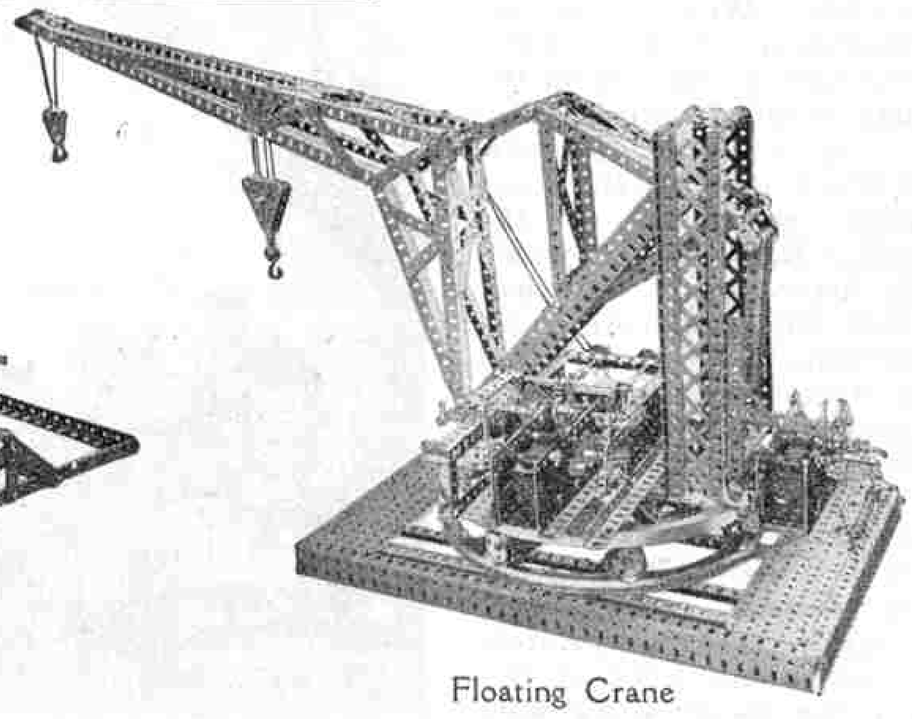
Gantry Crane



Dragline



Searchlight



Floating Crane

MECCANO LTD. BINNS ROAD LIVERPOOL

A NEW MECCANO MODEL

Model No. 623. Platform Weighing Machine

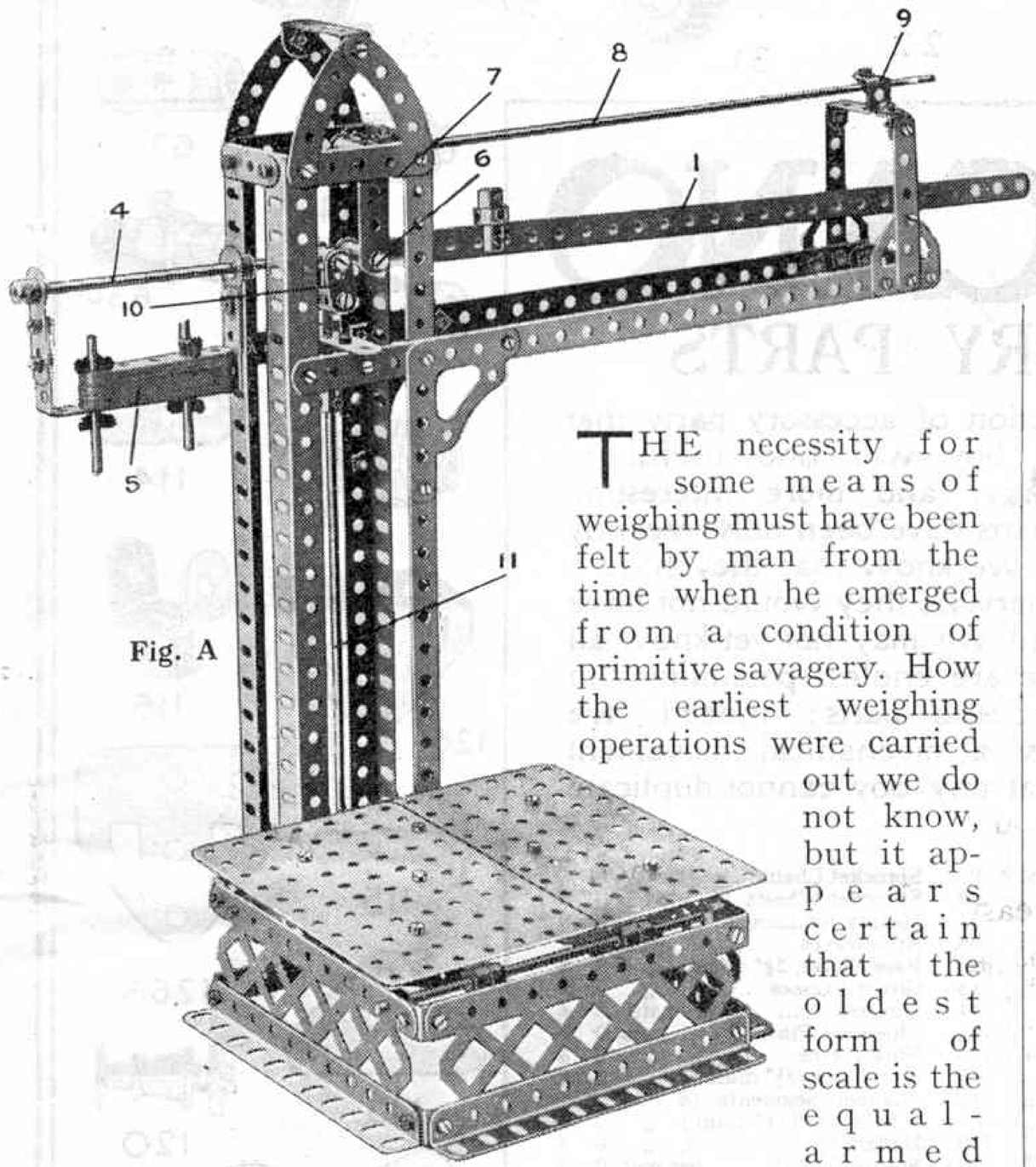


Fig. A

THE necessity for some means of weighing must have been felt by man from the time when he emerged from a condition of primitive savagery. How the earliest weighing operations were carried out we do not know, but it appears certain that the oldest form of scale is the equal-armed balance. From drawings still in existence it is clear that this form of balance was used by the ancient Egyptians, and no doubt the balance referred to frequently in the Bible was of the same type.

Importance of the "Knife-Edge"

The ordinary balance consists of a lever of the first order called the beam, supported at its centre on a fulcrum. At each end of the beam is hung a scale pan, one of these pans being for the weights and the other for the object that is to be weighed.

It is necessary that the beam should be able to swing quite freely on its support and in order to ensure this, the fulcrum consists of a steel or agate prism or "knife-edge," with its sharp edge at right angles to the direction of the beam and resting upon a plane of polished steel or agate. This construction reduces friction to the minimum. A pointer fixed to the centre of the beam indicates—by coming to rest in the line of direction from the fulcrum to the centre of gravity of the beam, or by swinging evenly on each side of that line—when the balance is horizontal, which occurs when the weights in one scale pan exactly balance the object in the other.

The Roman Balance

A very important modification of the equal-armed balance is the steelyard or Roman balance. This consists essentially of a bar of steel suspended near one of its ends from which hangs the object to be weighed. A weight used as a counterpoise moves along the longer arm of the bar. The result of placing the counterpoise on the longer arm is to enable a small weight to balance a very heavy object, thus doing away with the necessity for using heavy weights.

A simple model of a Roman Balance may be constructed with an 0 Outfit, as shown in Fig. E. For the construction of this little model the following parts are required:

1 No. 2	2 No. 10	3 No. 22	1 No. 44
1 No. 5	1 No. 17	3 No. 37	1 No. 57

Roman Balance in its Modern Form

From the simple steelyard has developed the modern commercial platform weighing machine, which is so familiar an object in the warehouses of our industrial towns.

In this type of balance the object to be weighed is not hung directly from the steelyard, but rests upon a low platform. This arrangement enables heavy and bulky objects, such as sacks full of various materials, to be weighed quickly and with the greatest ease. The whole machine is mounted on wheels and thus can be moved about a warehouse as required.

A typical high-class platform weighing machine is shown in the accompanying photograph. Such machines are made in various sizes having capacities of from 3 cwt. to 20 cwt. For weighing certain kinds of material the back rail of the platform shown in the photograph is apt to be inconvenient, and therefore machines may be obtained without this rail.

The same type of machine is used in railway stations, and in other places, without the wheels. Sometimes the machine is mounted in position on a low platform but generally the weighing platform is sunk until level with the station platform. It is generally used in the parcel offices,

(Cont. on page 219).

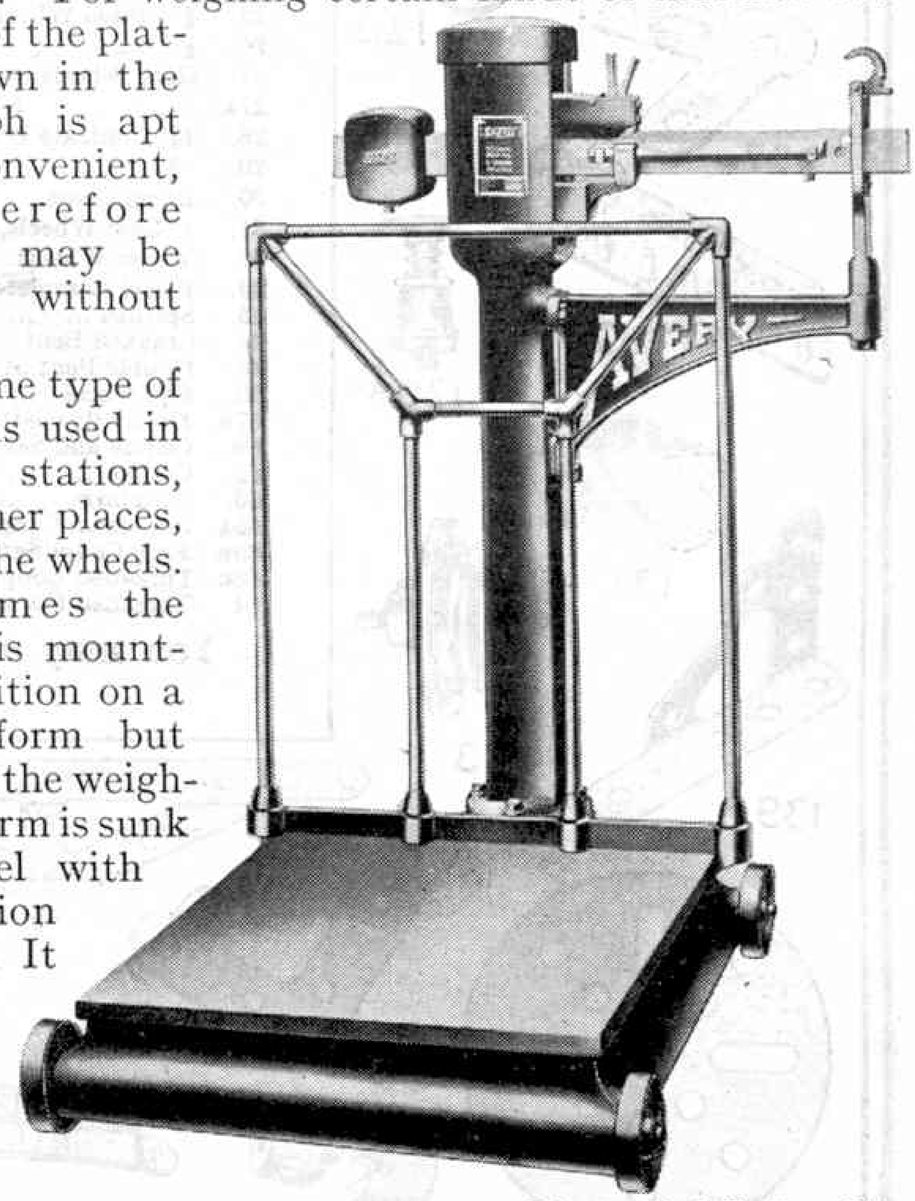


Photo courtesy] [*Messrs. W. & T. Avery Ltd*

Portable Platform Weigher

MECCANO

ACCESSORY PARTS

WE illustrate a selection of accessory parts that every Meccano boy will find useful in building the larger and more interesting models. Many of these parts have been only recently introduced, and although we know that they have a universal use (were it otherwise they would not have been added to the system) we may not yet know all their applications. There are endless possibilities in the employment of Meccano parts; indeed, we wonder if there is now a mechanical movement known to engineering that any boy cannot duplicate with Meccano.

			s.	d.
10.	Flat Brackets	½ doz.	0	2
11.	Double Brackets	each	0	1
12A.	Angle Brackets, 1" × 1"	"	0	1
19A.	Wheels, 3", with set screw	"	0	8
20.	Flanged Wheels	"	0	6
	Pulley Wheels:			
19B.	3" dia., with set screw	each	0	8
22.	1" " " "	"	0	4
22A.	1" " without set screw	"	0	2
24.	Bush Wheels	"	0	6
25.	¾" Pinion Wheels ...	"	0	6
26.	½" " " ...	"	0	4
27.	Gear Wheels, 50 teeth...	"	0	9
27A.	" " 57 " ...	"	0	9
28.	1½" Contrate Wheels ...	"	0	9
29.	¾" " " ...	"	0	6
30.	Bevel Gears	"	0	10
31.	1" Gear Wheels, 38 teeth	"	1	0
32.	Worm Wheels	"	0	6
33.	Pawls (complete) ...	"	0	4
43.	Springs	"	0	2
44.	Cranked Bent Strips ...	"	0	1
45.	Double Bent Strips ...	"	0	1
50.	Eye Pieces	"	0	2
57B.	Hooks (loaded)	"	0	5
59.	Collars and Set Screws	"	0	2
62.	Cranks	"	0	3
63.	Couplings	"	0	6
63A.	Octagonal Couplings ...	"	0	8
63B.	Strip Couplings	each	0	8
63C.	Threaded Couplings ...	"	0	6
64.	Threaded Bosses ...	"	0	2

			s.	d.
94.	Sprocket Chain	per length	0	6
96.	Sprocket Wheels, 1" ...	each	0	3
101.	Healds, for Looms ...	doz.	0	9
108.	Architraves	each	0	2
109.	Face Plates, 2½" diam.	"	0	4
113.	Girder Frames	"	0	2
114.	Hinges...	per pair	0	4
115.	Threaded Pins	each	0	2
116.	Fork Pieces	"	0	3
118.	Hub Discs (5½" diam.)	"	1	3
119.	Channel Segments (8 to circle, 11½" diam.)	"	0	4
120.	Buffers	"	0	2
120A.	Spring Buffers ...	per pair	0	8
123.	Cone Pulleys	each	1	3
124.	Revsd. Angle Brackets, 1"	½ doz.	0	10
125.	Revsd. Angle Brackets, ½"	"		6
126.	Trunnions	each	0	3
126A.	Flat Trunnions	"	0	2
127.	Simple Bell Cranks ...	"	0	3
128.	Boss Bell Cranks ...	"	0	4
129.	Rack Segments, 3" diam.	"	0	6
130.	Triple Throw Eccentrics	"	1	3
131.	Dredger Buckets ...	"	0	2
132.	Flywheels, 2¾" diam....	"	2	3
133.	Corner Brackets... ...	"	0	3
136.	Handrail Supports ...	"	0	3
137.	Wheel Flanges	"	0	4
138.	Ship's Funnels	"	0	4
139.	Flanged Brackets, Right	"	0	2
139A.	" " Left	"	0	2
140.	Universal Couplings ...	"	0	9
144.	Dog Clutch	"	0	6

You may obtain Meccano Parts from your Dealer

and machines of larger but similar type are employed in the goods yards and in the yards of mills and factories also.

The Meccano Model

The construction of the three principal sections of this model—namely, the main upright column, which supports the steelyard and balance lever, the base, and the weighing-platform—may be followed by referring to the general view of the model and Figs. C and D. The last two illustrations detail the base and weighing-platform respectively.

The steelyard (1 Fig. A), consisting of a $12\frac{1}{2}''$ Strip, is bolted to two Couplings, one at either end at the rear, as shown at (2 Fig. B), by means of bolts passing through the Strip and entering the threaded borings of the Couplings. Washers placed on the bolts between the Strip (1) and the Couplings ensure that the former is held firmly in position.

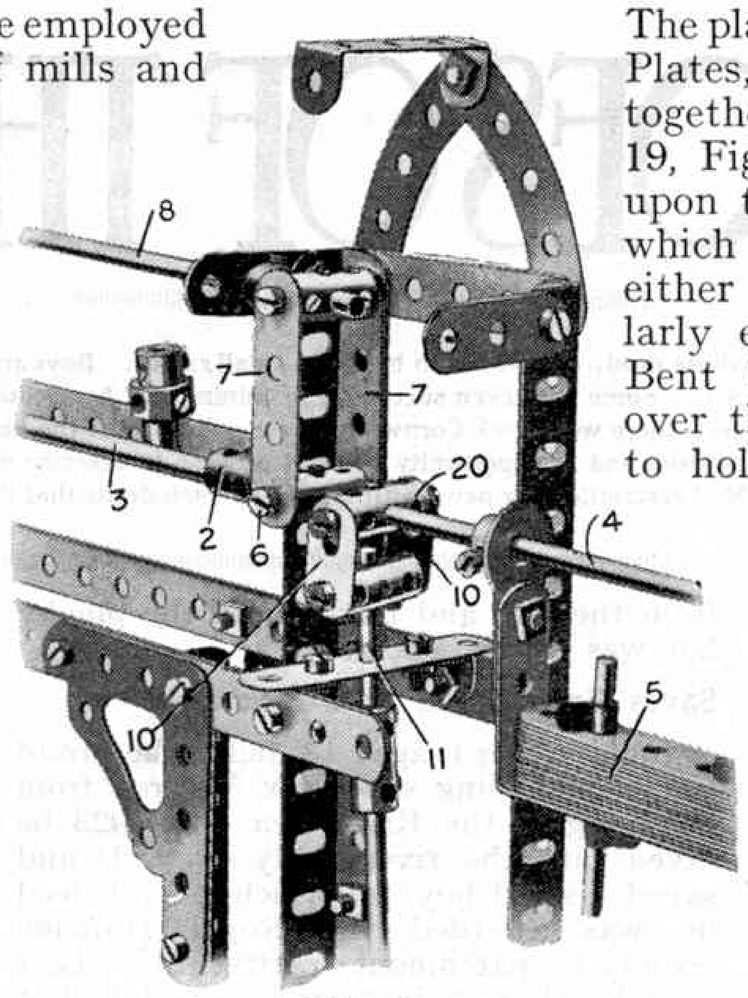


Fig. B

A 6″ Rod (4) also enters the Coupling (2 Fig. B.) and carries the balance weight (5) made of $2\frac{1}{2}''$ Strips carried in a Double-angle Strip secured between two Cranks. The fulcrum (6), through which the Rod (4) passes, consists of a Coupling suspended from two 2″ Strips (7) carried from another Coupling at the end of the $11\frac{1}{2}''$ Rod (8). The latter is journalled through the centre hole of a $1\frac{1}{2}''$ Strip secured to the top of the frame, and its outer end must be engaged beneath the Reversed Angle-Bracket (9) when weighing.

A Coupling (20), secured to the Rod (4) is loosely connected by means of Flat Brackets (10) to a further Coupling mounted on a vertical member (11) which consists of a $1\frac{1}{2}''$ Rod and an 8″ Rod coupled together.

Constructing the Platform

This vertical Rod (11) carries at its lower end a 2″ Rod (21), a Coupling secured to which carries two further 2″ Rods journalled through the end holes of the Strips (13). The latter in turn are pivotly mounted on a 6″ Rod (14) carried in the base of the model. Two $2\frac{1}{2}''$ Strips (15), connected in a similar manner to a further 6″ Rod (16) and held in place by Collars and Spring Clips, carry a 5″ Rod (17) resting upon the Strips (13).

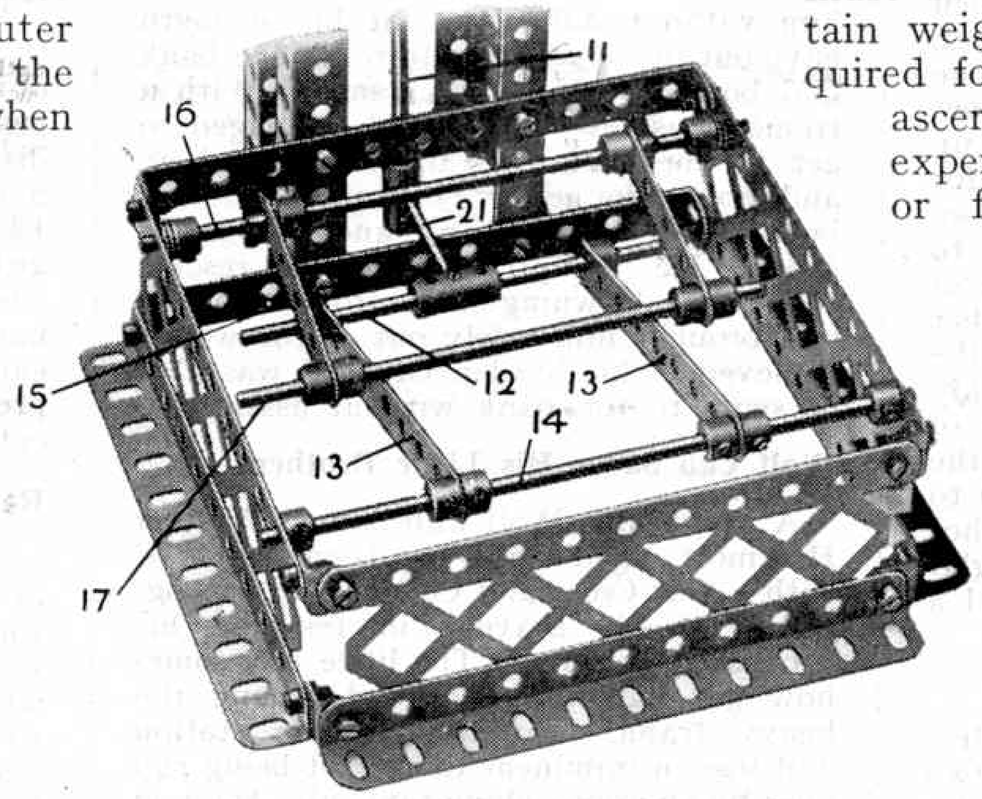


Fig. C

The platform is composed of two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates, overlapped one hole and secured together by $4\frac{1}{2}''$ Angle Girders (18 and 19, Fig. D). The angle Girder (18) rests upon the Strips (15), while the Girder (19), which is mounted upon two Washers at either end to ensure proper contact, similarly engages the Strips (13). Two Single Bent Strips (20) bolted to the plates fit over the centre rod (17), so forming guides to hold the plates in position. The platform is suspended in order to weigh when the Rod (8) is passed beneath the Bracket (19).

Graduating the Scales

In constructing the model care should be taken that the weight (5) is sufficient to exactly balance the lever (1) when the adjusting piece—a Strip Coupling sliding along the Strip (1)—is placed against the Coupling (2 Fig. B) at the fulcrum end of the steelyard.

If a weight is placed on the platform, the outer end of the steelyard will rise, and its horizontal position can only be regained by sliding the Strip Coupling away from the fulcrum through a distance proportional to the load being weighed. A piece of plain cardboard may be attached to the steelyard, and on this points should be marked at which the Strip Coupling must be placed in order to balance certain weights. The various positions required for this purpose may be readily ascertained in the first place by experimenting with weights of two or four ounces, or other known amounts.

The efficiency of the scales is improved by carefully oiling all the moveable parts.

Prizes for Suggestions

In actual use a little difficulty may be found in weighing very small amounts, such as an ounce or half an ounce, owing to the amount of friction existing in the model. We have ourselves improved the model in this respect, since the accompanying photographs were taken. This provides an excellent test of ingenuity and resourcefulness, and in order to encourage our readers to solve the problem of reducing the friction to the absolute minimum, we have decided to award a prize of one guinea and a second prize of half a guinea for the two best suggestions received. Models should not be sent in, but photographs or sketches. Entries must be sent in before 30th June (Overseas : 30th September).

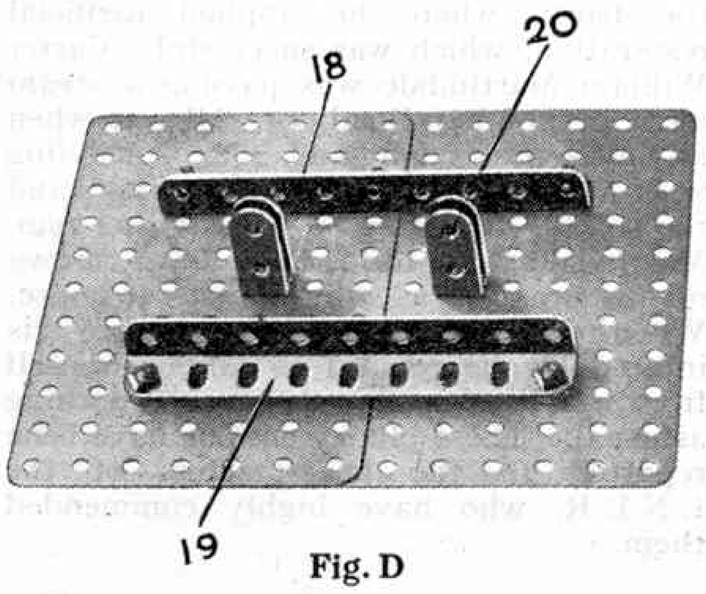


Fig. D

Parts required :

3	No.	1	2	No.	13	4	No.	48D
2	„	2A	1	„	13A	18	„	59
2	„	4	3	„	14	2	„	62
21	„	5	1	„	15	9	„	63
2	„	6	3	„	17	2	„	63B
4	„	6A	3	„	18A	2	„	70
4	„	8	6	„	35	4	„	90
3	„	9	74	„	37	3	„	100
2	„	9A	10	„	38	2	„	102
2	„	10	1	„	47A	2	„	108
6	„	12	3	„	48	1	„	125
			2	No.	126A			

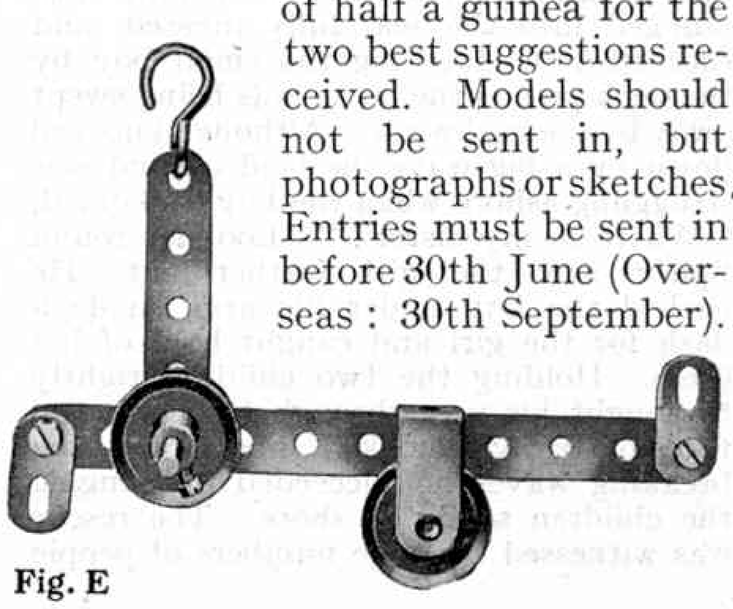


Fig. E

BOY HEROES OF THE MONTH

In every community there are boy heroes whose deeds are unknown beyond a small radius. Boys are but men in the early stages and their personal courage does not lose anything by comparison with that of men. Some boys even succeeded in joining the Army during the war by all manner of daring expedients and acquitted themselves like men in France and elsewhere—there were Jack Cornwalls in every branch of the Service.

In time of peace there is no dearth of boy herosim and as opportunity allows I propose to describe on this page any brave deeds that come to my notice. I shall be pleased to receive from readers of the "M.M." descriptions or news cuttings of any such deeds that they consider will be of general interest.—*The Editor.*

Burglar Arrested Through Boy's Presence of Mind

The pluck and presence of mind of a London schoolboy recently led to the arrest of a burglar. The boy, who lives with his parents, Mr. and Mrs. Ring, at West Norwood, was awakened early one Sunday morning by a light in his bedroom. He saw that the light came from an electric torch carried by a man who was moving stealthily towards the dressing table. The boy did not call out, but lay perfectly still and pretended to be asleep, meanwhile watching closely the man's movements. After examining the dressing table and apparently concluding that there was nothing there worth further search, the burglar left the room, locking the door after him. The boy immediately jumped out of bed, threw on a few clothes and a pair of shoes, got out through the window and descended to the ground—some 20 ft. below—by means of the fall pipe. He then scrambled over two garden walls to reach a neighbour's house from where a telephone message was sent to the police station. Without waiting for the police to turn up the boy set off to find a policeman for himself, and soon succeeded in doing so. The constable accompanied him back to the house and saw the burglar in one of the rooms searching a desk. Other policemen soon arrived in response to the telephone call, and the house was quickly surrounded. The burglar caught sight of the policemen in the garden, ran to the top of the house and made his way on to the roof through a trap-door. The police followed, and in a short time the burglar was discovered crouching down behind a chimney stack and was arrested.

Children Saved from the Sea

A 16-year-old Deal boy named Walter Spicer, the son of a boatman, saved two children, aged 6 and 8 respectively, from drowning in the sea, into which they had fallen. Spicer was walking along the shore one day when he heard screams and caught sight of a boy's head in the water. There was a strong wind blowing at the time and a heavy sea was running. Spicer did not hesitate an instant, but plunged into the sea, fully dressed, and succeeded in clutching the small boy by the neck just as the latter was being swept away by the backwash. Although knocked down by a big wave, he held on and was struggling ashore when the boy exclaimed, "Where is my sister?" Looking round Spicer saw the girl further out. He tucked the boy under his arm, made a dash for the girl and caught hold of her dress. Holding the two children tightly he fought his way through the surf, and though badly knocked about by the breaking waves he succeeded in bringing the children safely to shore. The rescue was witnessed by large numbers of people from the pier and parade and the plucky lad was loudly cheered.

Saves Six Children from River Lea

John Orchard, aged 13, holds the proud record of having saved six children from drowning in the River Lea. In 1923 he dived into the river, fully dressed, and saved a small boy, for which gallant deed he was awarded the Royal Humane Society's parchment certificate. Last year he plunged in to rescue a child but found that the child was entangled in something on the river bed. He made another attempt and succeeded in fastening drags to the child's clothing. The little one was quickly brought to the river bank, but sad to say it was too late, and life was extinct. For this brave effort the Royal Humane Society awarded their vellum certificate. A more recent exploit nearly proved disastrous to this brave boy. He dived in after a small boy and reached him without difficulty, but his strength gave out in the struggle to reach the bank and both he and the boy sank. With a tremendous effort Orchard managed to get to the surface again with the boy, and shouted for help. Fortunately another boy was close at hand and heard the shout. He promptly went to the rescue, took the drowning boy from Orchard and brought him safely out of the water. Relieved of his burden Orchard was able to swim to the bank without assistance.

Wolf Cub Saves His Little Brother

A Weybridge Wolf Cub named William Hickmott, aged eight, has been presented with a Gilt Cross and Certificate in recognition of his bravery in rescuing his brother aged three. The little boy somehow got out into the road among the heavy traffic near the railway station and was in imminent danger of being run over by an approaching taxi-cab. William saw the danger from the footpath, rushed out into the road and pushed his little brother clear of the vehicle. He failed to get clear himself, however, and received considerable injuries to his face and one leg.

Heroic Attempt Fails

On a recent afternoon two boys went bathing in a reservoir near Wellington, Salop. One of them, Frederick Wainwright, aged 18, who was a very poor swimmer, unfortunately tried to get across the reservoir. On reaching deep water he got into difficulties and his friend, Isaac Bradburn, aged 15, went to his rescue. Wainwright clutched him round the neck and both disappeared. Twice Bradburn released Wainwright's hold by diving and attempted to get him to the bank, but this was beyond his powers, and eventually he himself had to be rescued as he was utterly exhausted. At the inquest on Wainwright the coroner highly commended Bradburn upon his heroic conduct.

Courage and Endurance in Gale

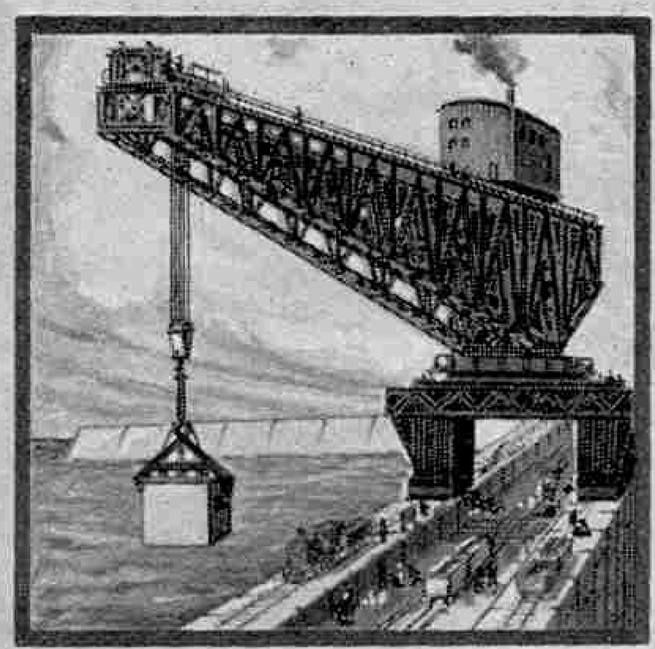
During a severe gale on the west coast of Scotland, a large motor boat got into difficulties. The boat was tossed about for many hours and the crew had given up all hope of reaching land. The captain's son displayed great courage and endurance in this terrible position. He climbed up the rigging and held a lighted torch until it burned out. Afterwards he fired a rocket and worked at the pump. No assistance came, but by great good fortune the crew's sufferings were ended by their boat being thrown ashore on the sands between Irvine and Giles. The boat was lost, but the crew, though utterly exhausted, were able to scramble into safety.

A Midlands Heroine

The latest awards made by the Trustees of the Carnegie Hero Fund recognised a number of brave deeds of remarkable distinction, but none of them is more noteworthy than that of Evelyn Neale, 12 years of age, of Smethwick. This small girl, at great risk to herself, rescued a boy from drowning in the Birmingham-Wolverhampton Canal at Smethwick, and her gallant action has been recognised by the presentation to her of an honorary certificate and a sum of £25.

Railwaymen's Pluck

Three deeds of bravery and presence of mind have recently been reported on the L.N.E.R. Mechanic Fitter Ridgway was waiting at Finsbury Park Station when a boy about 10 years of age fell on to the permanent way in front of the 5.55 p.m. train just approaching. The locomotive of the train was only 20 ft. away from the boy when Ridgway jumped down and pulled him clear of the line, thus saving the lad's life. J. C. Lowe, a goods Guard, pluckily rescued a little girl who had fallen into the river near the Bridge of Allan. Lowe plunged into the water fully clothed and carried the girl to the bank, where he applied artificial respiration, which was successful. Carter William Martindale was passing a steam lorry in London Road, St. Albans, when his horse took fright and bolted, colliding with a motor and breaking one rein and the shafts. Hanging on to the other rein, Martindale stuck to his horse until thrown off his dray by a collision with a house. When the staff doctor attended to his injured leg he refused to absent himself from work and was on duty next morning as usual. These plucky actions have been reported to the headquarters of the L.N.E.R. who have highly commended them.



Giant Block-Setting Cranes

Their Work in Constructing Harbours and Breakwaters

(*Concluded*)

APART from the designing, constructing, and the erection on the site of the cranes themselves, there are many other details to which the engineer must give attention. Take, for instance, the question of slinging the huge concrete blocks into position in the breakwater.

The least complicated form of hoisting arrangement for slinging concrete blocks is, of course, a simple clip or pair of jaws. There is a large number of designs of these, however, each design being suited for some definite purpose or for some particular conditions of work. Clips of this type depend entirely on friction, the general principle being that the direction of pressure between the clip and the block shall make an angle with the normal to the surfaces in contact, which angle is less than the angle of friction.

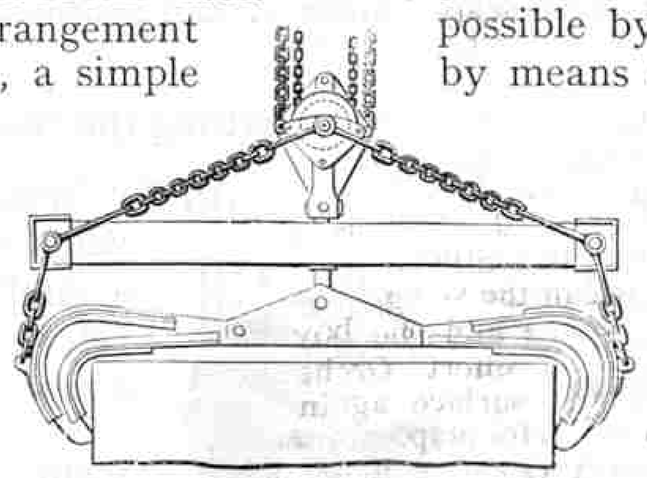


Fig. 1

Simple Friction Clips

In Fig. 1 is illustrated a form of clip that embodies this principle, in a type made by Messrs. Stothert & Pitt Ltd., for the Madras Harbour works. It consists simply of two hooks spanning the block, the hooks being hinged to a central connecting piece. By using connecting pieces of different lengths it is easy to arrange for the same clip to handle blocks of various sizes.

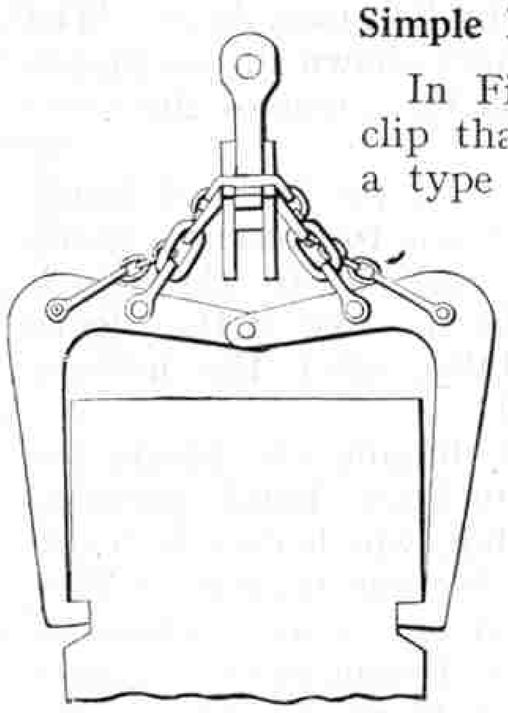


Fig. 2

The releasing apparatus employed with this type of clip consists of a second barrel on the lifting gear, the chain from which is connected to a stretcher frame. This is joined to the clips by short chains that take hold of the outer ends. Whilst the block is being lowered, the brake is applied to the second barrel at a given moment. This arrests the ends of the clips and when lowering is continued the outer chains take the stress, thus allowing the clips to open and slip and leaving the block detached.

A modified form of the same type of clip is shown in Fig. 2. In this form of clip—which, however, does not depend upon friction—the lower ends are hook-shaped, the hooks engaging in special recesses moulded in the blocks.

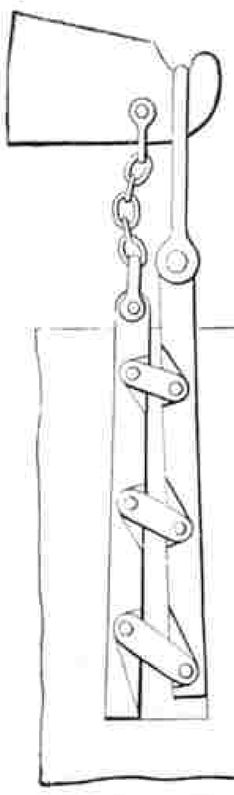


Fig. 4

Rope and Lever Release

A friction clip of different construction, made to a French design and shown in Fig. 3, consists essentially of an arrangement of levers which procure a powerful pinch on the block. Here again adjustment is possible by setting the levers at different distances by means of the holes in the connecting bar, thus permitting blocks of varying sizes to be handled. An adjustment of this kind is very necessary in friction clips, because the actual range of movement of the clipping levers is not great, as the direction of pressure between the clip and the block alters considerably for a small motion of the levers.

Another effective block clip, illustrated in Fig. 7, was specially designed for placing in position the apron blocks at the harbour works at Mormugao. In this model the clips are released, and the block detached, by means of a rope controlling a lever, as shown in the side elevation in Fig. 8. This form of clip is shown in actual operation in the illustration of the giant Titan published on page 163 of our last month's issue.

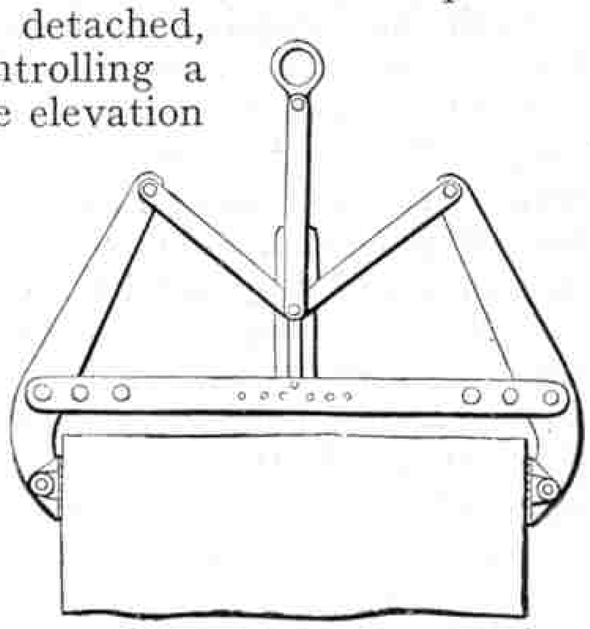


Fig. 3

The Use of Lewis Bars

Another method of laying concrete blocks is the employment of two Lewis bars, provided with T heads at their lower extremities and loops at their upper extremities. The concrete block is suspended by them from a lifting beam, which is shackled to the lower eye of the bottom swivel of what is called a "Snatch Block."

In Fig. 5 is illustrated one method of carrying out this arrangement. The bars are shown passing through vertical holes cored out of the blocks, the T heads taking a bearing on pieces of hard wood placed in position when the block was moulded.

In the case illustrated the lifting beam has been made double so that the eyes of the Lewis bars may pass between the plates. Pins pass

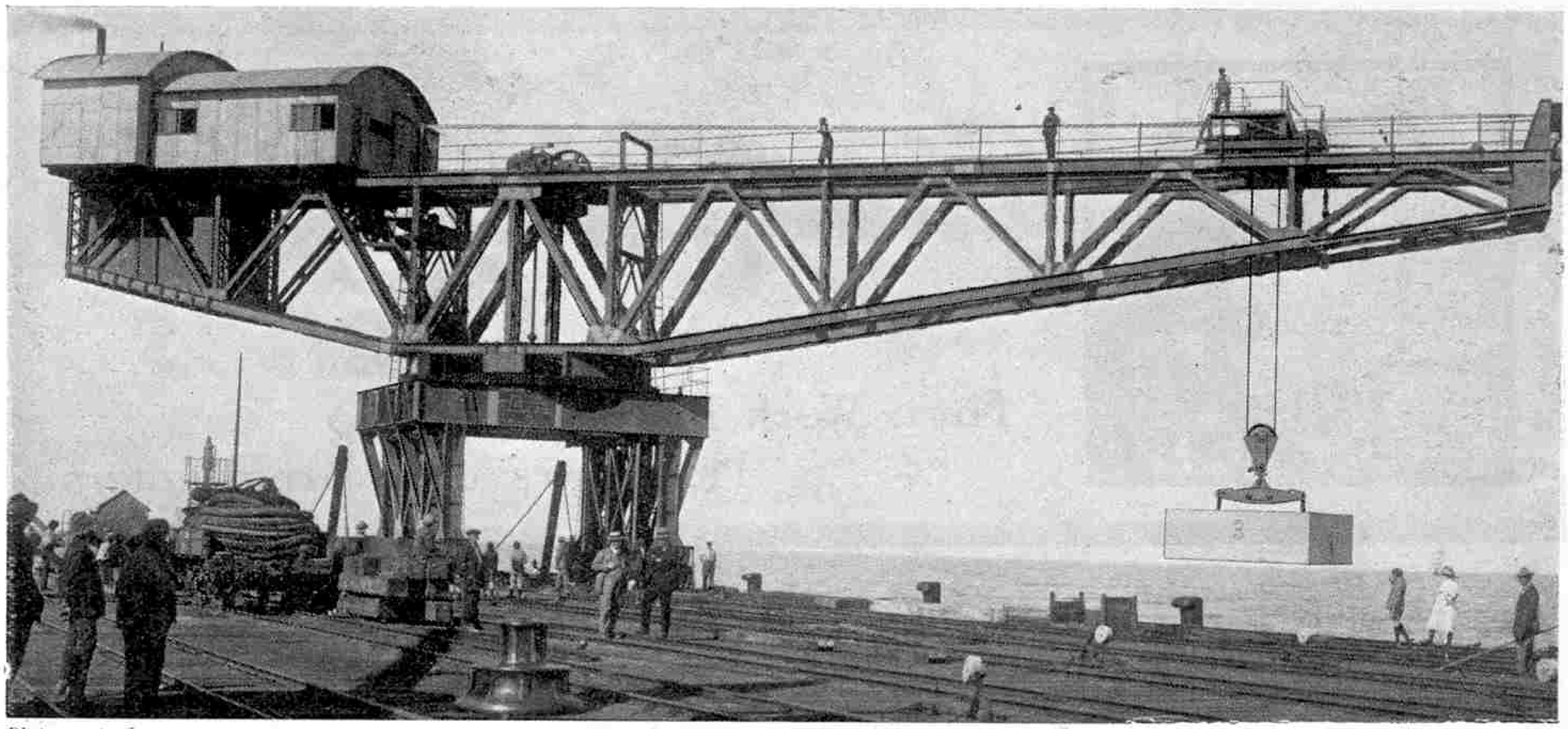


Photo courtesy] [*Messrs. Stothert & Pitt Ltd.*

A 50-ton Titan Block-setting Crane at East London, South Africa

through the eyes and are borne in notches in the top edges of the side plates of the beam. The pins are retained sideways by shoulders and are chained to the lifting beam to prevent them from being lost.

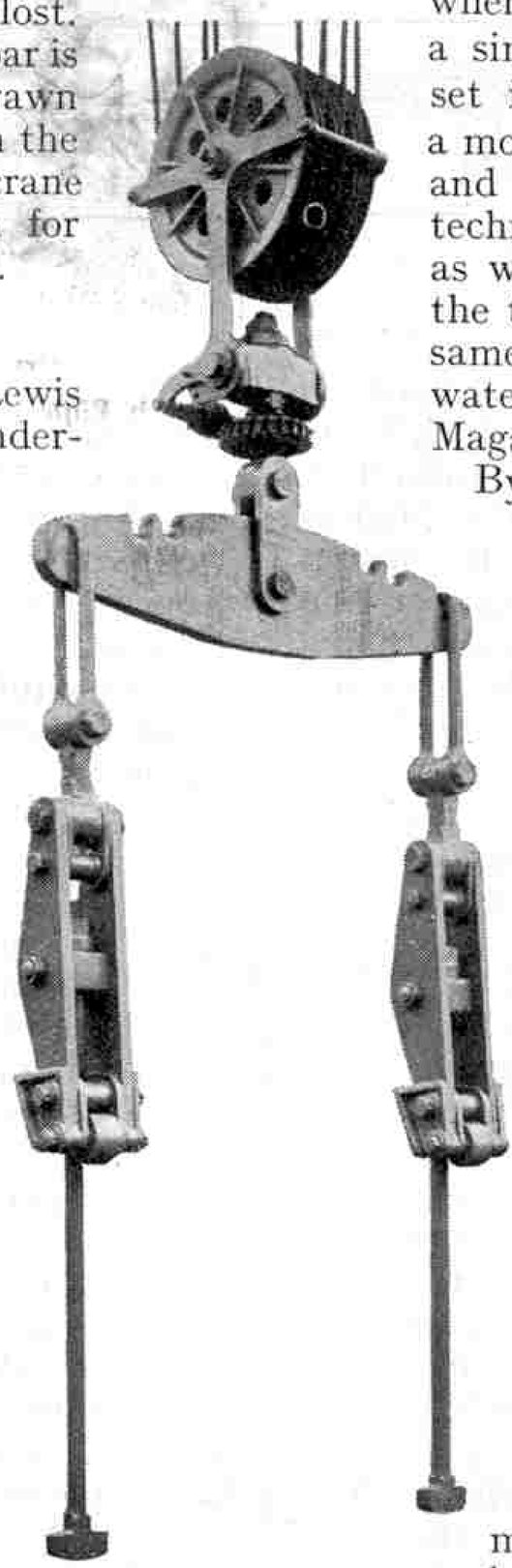
When the block is lowered on to its bed, the bar is relieved of its weight. The pins are then withdrawn by a diver, and the Lewis bars are freed from the beam, which is then raised sufficiently by the crane to allow the bars to be twisted into position for withdrawal, a method now practically obsolete.

Self-Releasing Devices

Both the foregoing methods of employing Lewis bars require the attention of divers for underwater block-setting, or workmen for blocks above the water line. There are other forms of mechanism, however, designed to be self releasing. One of these, illustrated in Fig. 4 and designed by Sir W. Matthews, K.C.M.G., necessitates a tapered hole in the concrete block. This hole is slightly cone-shaped, being narrower at the top than at the bottom. The lifting bar consists of two members, which are joined together, so that, to a certain extent, they resemble a parallel ruler.

When the block reaches the ground, the shackle carrying the weight becomes detached from the hook on the lifting beam and falls over. The crane-man then causes the crane to hoist. The lifting beam is thus raised and the chains pull on the short members of the Lewis. This is then automatically drawn close to the longer member by the closing up of the links recessed in both, and the Lewis is withdrawn from the hole in the block.

In order that the mechanism may be perfectly self-acting it has been found necessary to add a lever and weight to ensure the falling away of the loop from the bar at the critical moment.



Fidler's Patent Gear

Setting the Blocks at an Angle

All the forms of clips hitherto mentioned are employed when the blocks are to be set horizontally in a similar manner to that in which bricks are set in building a wall. In some breakwaters a more complicated setting is required, however, and the blocks are set at an angle—or, as it is technically termed, "on the inclined bond"—as will be clearly seen from the illustration on the top of page 55 in our February issue. The same fact is also strikingly shown in the breakwater in the distance on the cover of the same Magazine.

By setting the blocks on the inclined bond, the breakwater is made to present a much more formidable obstacle to the rough seas than would be the case if the blocks were set horizontally, after the manner of bricks in a wall.

The problem of slinging the blocks for setting on the inclined bond presents some little difficulty, which can be more easily appreciated by our readers if they construct a model of a crane and endeavour to set a small block of stone in the manner described. The problem is sufficiently difficult even with a model, but in actual practice it is more complicated for the blocks must be lowered to within an inch or even less of their exact position, and the movements controlled to a nicety, even though the weather may be stormy and there be heavy seas.

An Ingenious Mechanism

The difficulty is solved by an ingenious piece of Tilting mechanism called "Fidler's Gear," illustrated on this page. This mechanism consists of a massive beam hanging from a swivelling joint, the whole suspended (in the case illustrated) by a special

four-sheaved pulley. The rotating movement of the beam on the swivel is controlled by a special worm gear, which meshes with a pinion wheel on the vertical swivel bar.

A link hangs from the ends of each arm of the beam, which link supports steel cross-heads. From each of these cross-heads there hangs a long Lewis bar with a T end. Two perpendicular holes run completely through the concrete blocks. These holes are of sufficient width across one of their sections to take the T-shaped pieces at the end of the Lewis bars.

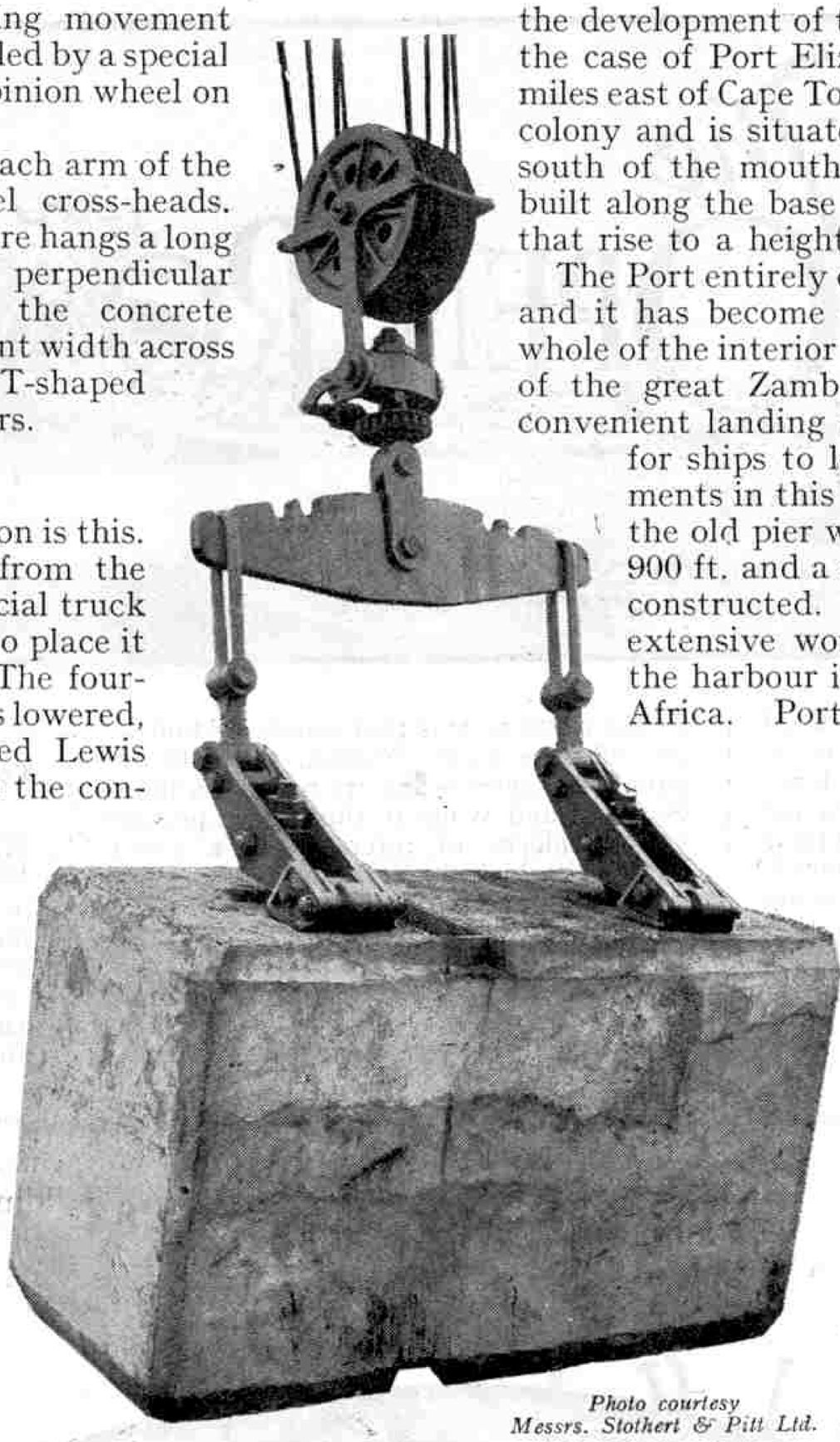


Photo courtesy Messrs. Stothert & Pitt Ltd.

Slinging a Concrete Block with Fidler's Patent Gear

Fidler's Gear in Operation

What happens in actual operation is this. The concrete block is brought from the yard where it was made, on a special truck alongside the Titan crane that is to place it in position on the breakwater. The four-sheaved pulley with Fidler's Gear is lowered, and workmen guide the T-shaped Lewis bars through the vertical holes in the concrete block. When these completely penetrate the full depth of the block, the bars are given a quarter turn, which throws the T-shaped end out of register with the hole and thus prevents the rods being withdrawn. Shortly before the Lewis bars reach the bottom of the holes, the rollers on the steel cross-heads take a bearing on the top of the block and roll across, altering the relative positions of the points of suspension and the Lewis bars.

The signal is now given to the crane-man to hoist, and, the engine being started, the block is lifted at the exact angle at which it is to be set in position. The crane hoists the block, swivels round until the block is over its place in the breakwater, and then lowers it as is necessary. When the block rests on the breakwater, workmen turn the T-shaped rods until they are in register with the hole in the block, and the crane again hoisting, the Lewis bars are easily withdrawn, leaving the block in position set at the correct angle.

How Cranes Help Trade

In our last article we gave particulars of the giant Titan cranes used in the construction of breakwaters, which article followed a description of Goliath cranes similarly employed. We illustrated a huge Titan that was built for the Union of South Africa and was erected at Port Elizabeth for work on the breakwater and harbour there and we gave full particulars of this remarkable machine, including details of the mechanisms. On page 222 we are illustrating another huge Titan, erected and in use at East London, S. Africa.

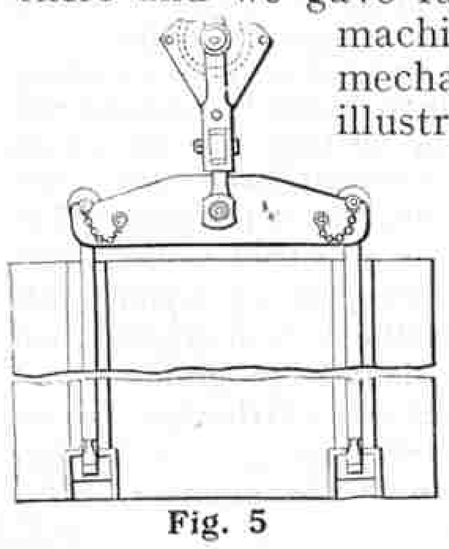


Fig. 5

Fig. 6

Similar cranes of this type have been employed in the construction of some of the best-known harbours of the world, and they have played a very important part in the development of the Empire. Take, for instance, the case of Port Elizabeth, a seaport town some 400 miles east of Cape Town. This is the second city in the colony and is situated on Algoa Bay, about 7 miles south of the mouth of the Zwartkop River. It is built along the base and up the rocky slopes of hills that rise to a height of 200 ft. above the bay.

The Port entirely owes its prosperity to its harbour and it has become the centre for the trade of the whole of the interior of the country lying to the south of the great Zambesi. Previously there were no convenient landing places and so it was impossible for ships to load or unload. Some improvements in this respect were made in 1881 when the old pier was extended to a total length of 900 ft. and a second pier 800 ft. in length was constructed. Since that date even more extensive works have been carried out, and the harbour is now one of the finest in South Africa. Port Elizabeth is only one of dozens of similar instances of how Giant Block-setting Cranes help trade.

This series of articles may well be concluded with a reminder that although progress in engineering has been extremely rapid in all directions in recent times, the development of great sea-works has been one of the most striking features in the history of engineering. We have only to remember that at the beginning of the 19th century London had not a single dock, whereas to-day there are miles and miles of docks; that the docks at Cardiff, Newport, Barrow, Middlesbrough and at many other places did not then exist; that even as late as 1816 Liverpool had only 16 acres of dock area, and that Hull and Grimsby were no better than fishing ports, as far as their dock accommodation was concerned.

Take our survey further afield, we find that the breakwater at Table Bay was not commenced until 1860; that until 1875 Calais Harbour had only 2½ ft. of water on its bar at low water; that Colombo Harbour was not commenced until 1870; that Dover was not selected as a site for a great port until 1845; that the breakwater at Newhaven was not started until 1878—and so we might extend the list indefinitely, showing that during the past century work in connection with harbour construction at home and abroad has gone forward by leaps and bounds, and has played a greater part than anything else in the development of civilisation in general and the world's trade in particular.

More than once it has been pointed out that when he has completed his work, the harbour engineer has not a great deal to show but long sea walls or stone platforms abutting from the shore. Although this may at once be admitted as a fact, we must remember that it is in the skill required for the building of these

(Continued on page 235)

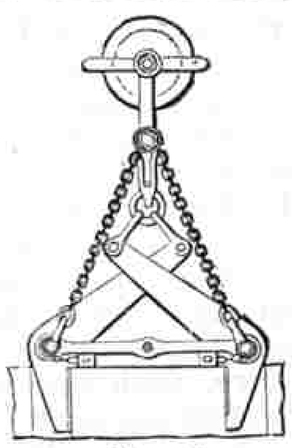


Fig. 7

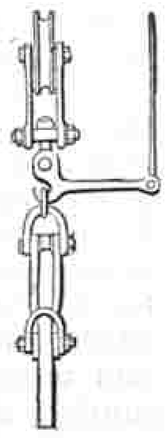
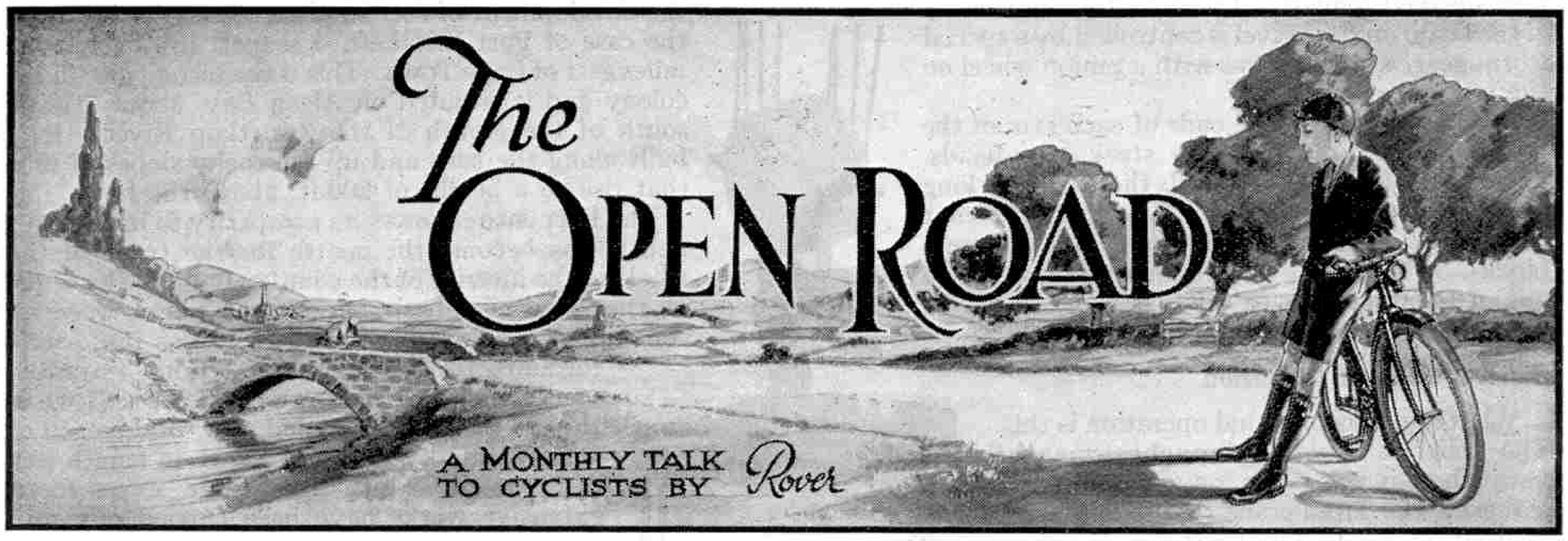


Fig. 8



FROM the letters that I have received since the publication of my notes last month, it is clear that a large number of my readers have learned for the first time of the joys of touring on their bicycles. It is evident also that hundreds of these same readers are now planning tours—some of only a day's duration and others, more ambitious, extending over several days.

A Few Suggestions

Quite a large number of readers write asking for definite suggestions for tours. As the subject is of general interest I propose to reply briefly to these enquiries in this article, and to deal with one or two other points that have also been raised. In the near future I shall describe more definitely a particular tour, starting from Bristol, that I made a little time ago and in order that I may refresh my memory on some points, I intend to cycle over the ground again next month.

Well, now, in regard to definite suggestions for touring. In this country we have endless objects of interest, quaint links with the past, and any amount of magnificent scenery that can only be seen by the tourist. No matter whether my readers live in the north, south, east, or west, they can plan any number of delightful tours, and I will warrant that the memory of these tours will remain with them for many a long year.

In the south, for instance, there are the glorious Kent lanes, the Surrey hills, and—to the west—the moors of Devon and Exeter. A little further north from this last-named ground lie Wells, Glastonbury, and Cheddar Gorge, in the centre of a district full of interest and romance. Still further north is the beautiful Wye Valley, with Stratford-on-Avon and the Shakespeare Country, a great attraction for all American tourists, close at hand. In the north of England there are the dales and moors of Yorkshire, with fine roads running alongside the bracing east coast. To the north-west is that wonderful touring ground, the Lake District, with its unequalled scenery—and its notorious hills! Scotland and Wales in themselves provide enough places of interest for a dozen tours, with historic castles and abbeys and magnificent scenery.

Camping on the Dee

Apart from "district" tours, there are many interesting towns that can well be made the objective of a tour. For instance, Chester, surrounded by its ancient walls—some two miles in length—inside which are to be found a beautiful Cathedral and an ancient Castle. Here also are the "Rows," or covered galleries paved with flagstones and level with the first floor of the houses, where pedestrians may walk above the level of the street. Across the Dee is the second largest stone bridge in the world and there are also numbers of old buildings, such as the "Bear and Billet" Inn, at one time a mansion belonging to the Earls of Shrewsbury.

There is splendid boating and fishing on the River Dee, and one can canoe for over 70 miles up the river. A few days spent on the river, camping out on the bank at night, would form a very enjoyable extension of a cycling tour, the bicycles being left at the boat-house—however, "that is another story," as Kipling says, in one of his books.

Consult Guide Books

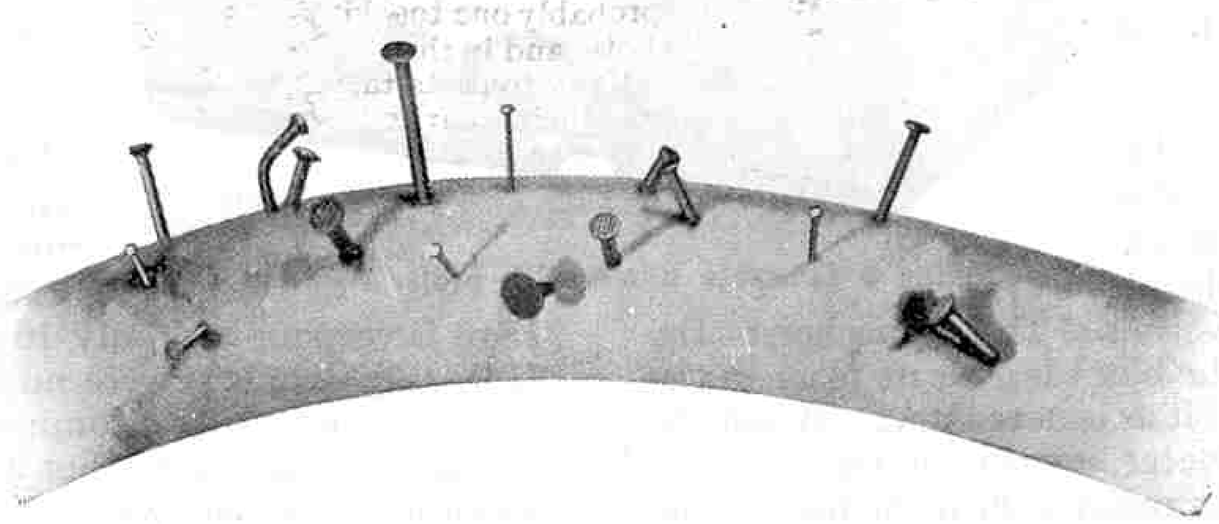
Another fine old city is Lincoln, where William the Conqueror built his Castle in 1068. The ancient Cathedral, commenced in 1092, has recently been before the public eye, because of the cracking of its walls and the engineering efforts that have been made to save it from collapse. There are many other interesting relics here, and although Lincoln itself stands on a hill, the surrounding country is very flat and does not therefore call for so much exertion as hilly Yorkshire, Wales, or Scotland!

I could "go on all day," as the saying is, describing countless interesting and beautiful spots in all parts of the country, but space forbids. These are but two examples of interesting towns that might well be made objectives of two tours. It behoves every reader to look around for himself and select a suitable touring ground. In case of any difficulty visit your local reference library, where you will find a mine of information in the numerous guide books available.

Whatever town or district may be your destination, or however short or long may be your tour, remember the advice I gave last month and do not plan to ride too far each day. Take things comfortably and instead of trying to "pile up the miles" and see how much ground you can cover, "go easy" and make your tour a really enjoyable and health-giving holiday.

There are two ways of making a cycling tour. The first is to decide beforehand the places you intend visiting and the exact distance to be covered each day, and "riding to schedule," as it is called. The second is to choose a district to tour, and to visit each day the places you think will prove most interesting. You are not then tied down by a definite programme and can spend as much or as little time as you wish at any particular spot, according to the inclination of the moment. This

No More Punctures!



We reproduce this interesting photograph to show the remarkable immunity from tyre trouble that results from the use of a good puncture-sealing solution. The inner tube shown was treated with "Fibermetic" solution and inflated to ordinary riding pressure. Several nails, tacks and pins were then pushed into the tube as shown, but in spite of this drastic treatment—more severe than is likely to be met with on the road at any time—the tube held up perfectly. There was no escape of air, which fact shows clearly that this puncture-sealing solution does its work effectively.

method is, I think, much to be preferred, for more reasons than one.

Clothing and Equipment

The first question, after deciding where to go, is what clothing and tools, etc., are necessary. Equipment should be cut down to the absolute minimum in order to reduce weight, and with this in mind it soon becomes not so much a question of "What shall we take" as of "what can we do without."

To a large extent, of course, the outfit depends on the length of the tour. For instance, on a tour of a few days only, practically no spare clothing need be carried. On a longer tour, a change of under-clothing and clean stockings and collar are desirable, although if one wishes to travel light, it is a good plan to post these on to some address in advance, and pick them up on the tour. Perhaps the most suitable clothing for a cycling tour of any kind is a sports coat, shorts, and cycling stockings, with a cycling cape strapped on the carrier.

If the plan is for a camping-out tour, then there will be the waterproof sleeping tent, to which reference was made last month, and a light saucepan or kettle for boiling water. It may be decided to carry a "pocket" oil stove—this does not weigh much, and is certainly an advantage in case no fuel can be found when it is time to make tea. However—the whole question of equipment is largely one of "ways and means," which each reader will be able to settle to his own satisfaction.

In regard to the machine. A complete tool kit, a pump, and puncture repair outfit should be carried. If more than one is touring, probably one tool kit, pump, etc., will serve both, and in this way weight will be saved. Many tourists take a spare inner tube with them, carried wrapped around the handle-bar, but unless the tour lies off the beaten track this is not very necessary, as inner tubes may be bought almost anywhere these days, should an emergency arise.

As previously mentioned, the bicycle itself should be given a complete overhaul before commencing the tour. All bearings should be well greased, the chain cleaned and oiled, both brakes put into working order, and the lamps trimmed and filled.

Care of Tyres

Perhaps the most important part of the machine, so far as an enjoyable tour is concerned, is the tyres, and no cyclist who intends setting out on tour should neglect them. A rider who treats his tyres with proper care will invariably be repaid by getting from them an increased mileage. No oil or grease should be allowed to touch the rubber, and the fabric should never be damp or wet. Small pieces of grit or stones should be removed immediately from the covers, and all cuts should be repaired as soon as possible, with the special "tyre-stopping" supplied for the purpose. This is sold in small tins and consists of rubber composition, which, though plastic when the tin is opened, soon solidifies when exposed to the air. First, the cut in the cover is thoroughly cleaned and any grit or flints carefully extracted with a blunt instrument. A small portion of the tyre-stopping is then pressed into the cut until it is filled. The stopping is then allowed to set and in this manner the cut is filled, very much after the style in which a dentist "stops" a tooth.

Equally as important as filling the cut is to clean and repair the canvas of the outer cover. The filling of the cut serves only to make it waterproof and cannot be expected to prevent the inner tube from blowing through the hole—this is the function of the canvas.

If an outer cover is showing marked signs of wear it is wise to replace it by a new one if possible, before going on tour, keeping the old cover for local runs. Naturally there is always more wear on the back tyre, and very often a cover that shows signs of wear will do long and useful service on the front wheel, whereas it might be a continual source of trouble on the back wheel.

All-Weather Machines

In order to be prepared for rain during a tour many cyclists protect the plating of a new machine by covering it over with a thin layer of petroleum jelly. Although this treatment means that all mud or dust is retained by the grease, the advantages are great, for in fine weather the whole mass can be quickly removed, revealing the clean and brilliant plating beneath. Other riders prefer to convert their cycles into all-weather (all-black) machines by enamelling the plated parts, such as the handle-bars, wheel-rims, chain-wheel, pedals and cranks. This treatment saves considerable time in drying and polishing after a wet run and also prevents pitting and rusting. Before these plated parts will take enamel, however, they must be treated with a suitable metal size, which should be applied first and allowed to dry. Then the whole machine may be enamelled at one operation.

NEXT MONTH:—

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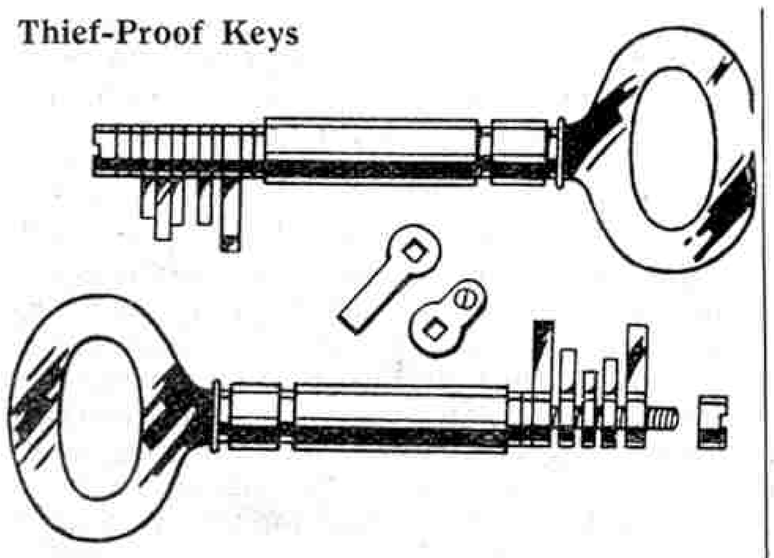
OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

Every day new inventions and ingenious labour-saving devices are being brought into existence. From time to time the most interesting of these will be described and illustrated in these columns. Readers are invited to send particulars (accompanied, if possible, with photos, sketches, or cuttings) of any interesting inventions or devices that may come to their notice. Payment at our usual rates will be made for any contributions used.

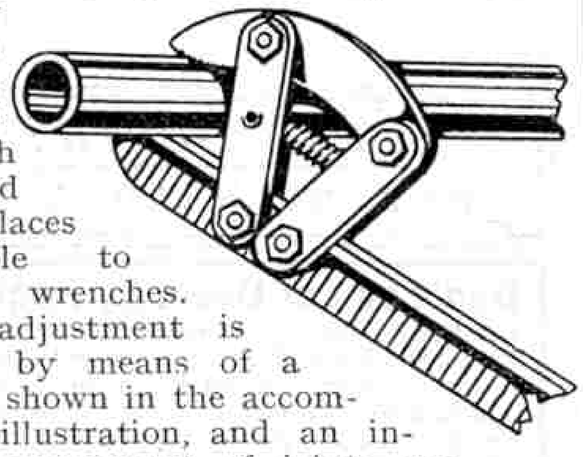
Thief-Proof Keys



A new form of thief-proof lock and key, said to equal the famous Yale locks in ingenuity, has recently been patented in Germany. To enable a change to be made from one adjustment to another, lock and key are fitted with an arrangement of loose teeth. Thus the levers and springs of the lock may be set in several different combinations known only to the owner. The key has a corresponding number of sliding teeth that may be arranged in an almost endless number of positions.

Self-Adjusting Wrench

The inventor of this powerful but simple pipe wrench has arranged the jaws so that the more pressure placed upon them, the firmer is their grip. The wrench instantly adjusts itself to any width within the limits of its jaws, and as it cannot slip it will not throw its user backwards during a hard pull. The manner in which it grips permits the wrench to be used in many places inaccessible to ordinary wrenches. Instant adjustment is obtained by means of a spring as shown in the accompanying illustration, and an ingenious arrangement of joints connects the two jaws.



A "Weather Glass" in a Hat

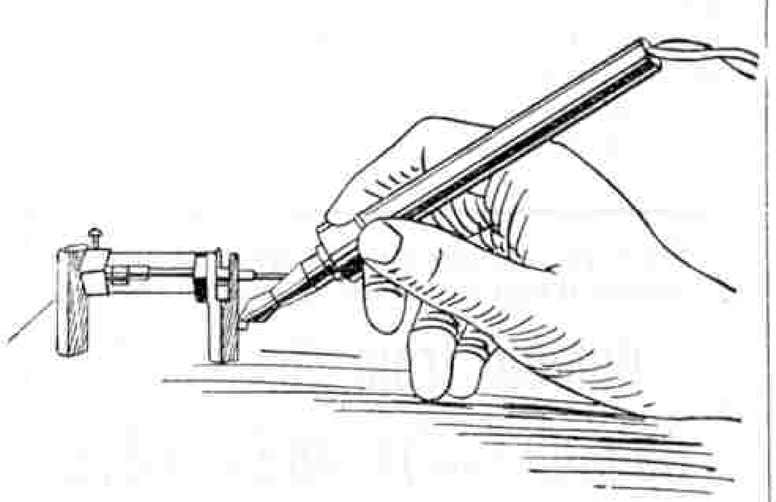
Boys are well known for their dislike of carrying umbrellas unnecessarily, and Meccano boys are no exception to this rule. A new form of hat that will give an accurate forecast of the weather should, therefore, be particularly popular. Beneath the crown of this strange hat is pasted a piece of blotting-paper that turns blue when clear weather is promised and pink when rain is due. The secret of this handy weather prophet lies in the fact that the blotting-paper is treated with a solution of one part of cobalt chloride, ten parts of gelatin, and one hundred parts of water, cobalt being extremely sensitive to variations of moisture in the atmosphere.

An Expanding Hammer

A hammer with moveable vice-like claws is an invention that should prove popular among carpenters and handymen, as it is capable of pulling even the most stubborn and headless nail. The claws are pivoted 1½" from their ends and in gripping a nail they spread apart when pushed toward the handle. Then, when they are straightened by a pull on the handle, they are forced into the wedge-shaped opening of the bearing shoulders, thus tightening the hold on the nail in proportion to the force required to draw it. A spring in the head of the hammer automatically re-adjusts the claws when the nail is removed. Should the jaws be damaged they may be replaced by new ones in a few minutes.

A "Solder Pen"

An electric soldering iron, which is no larger than a fountain pen and enables soldering in difficult corners to be easily accomplished, should prove particularly interesting to all amateur engineers and wireless enthusiasts who construct their own sets. The tool is said to be the smallest and most efficient soldering iron yet made and is already in great demand, particularly in America. The "Solder-pen" has a platinum heating unit and soft wire solder is used on small work.



BRIGHT IDEAS

This column is reserved for dealing with suggestions for new parts, new models, and new ways of making Meccano model-building attractive.

V. Hughes (Middlesboro').—We list a Threaded Coupling (No. 63c) for joining a plain Rod to a Threaded Rod.

R. D. L. Darly (Ealing, W.)—It is a fairly straightforward matter to arrange the construction so as to obviate the coupling when joining two rods interferring with any other part of the mechanism. We think that your screw method of joining rods would be costly and somewhat difficult in view of the narrow diameter.

Jack Andrews (Box Hill, Victoria, Australia).—Practically all the railway accessories you mention have recently been introduced.

Frank Johnson (Mansfield).—(1) Elongated holes on both flanges of Angle Girders would be a disadvantage rather than otherwise. The present type takes care of two functions (a) to provide adjustment by means of the elongated holes on the one side and (b) the single holes for rod bearings. (2) A 1" reversed angle bracket may be formed by bolting two existing 1" angle brackets together.

S. Sylvain Knecht (Algiers).—(1) Do you consider a 3½" slotted strip has any advantages over the 5½" slotted strip? Up to the present we have not experienced any call for this particular size. (2) A flat sector plate may contain possibilities which we shall examine.

F. Francois (Viviers, France).—We agree that perhaps the bearings of the armature shaft of the 4-volt motor are not quite as broad as they might be, but a simple reinforcement may easily be effected by the bolting of one or two extra strips to the side plates.

L. O'Brien (Johannesburg, S.A.)—We do not think that a six-holed bush wheel would fill any definite requirements. Up to the present the necessity for this particular part has not been apparent.

Tom Fish (Gunthwaite, Yorks.)—We have devised a clutch mechanism for the model chassis and this is now in course of publication.

J. Crebassol (St. Martin de Villerglan).—Much regret, but we do not follow your suggestion in connection with the bush wheel. A sketch would be helpful.

M. Paquier (La Chapelle St. Mesmin, Loiret).—(1) A flat sector plate has already been suggested (see above). (2) We shall have to examine carefully the adaptability of the various sizes of reversed angle brackets and curved strips you mention. (3) We already list a 25 mm. bolt. As far as the 38 mm. and 5 cm. bolts are concerned, we think the threaded rods would serve the same purpose. (4) A 5 cm. flanged wheel may be obtained by bolting the small flanged disc to the face plate.

J. Candles (Tulse Hill, S.W.)—The functions of the right angle flat bracket are taken care of by the existing corner bracket.

R. Lacombe (Chateaurous, Indre).—We have not yet found any uses for an interior-toothed gear wheel. Its introduction for one specific use would not be justified.

H. Stewart (Glenferrie).—We have found that the cam made up from Meccano parts and used on the loom works quite satisfactorily. A specially constructed cam for this model would have no use in other directions and we endeavour to avoid the duplication of elements. Regarding your observations on the shuttle, this element obviously does not lend itself to construction from existing parts.

A. Langois (St. Sauveur-Levasville).—We are considering an increase in the variety of bevel gears.

Ch. Waldschmidt (Dunkerque, Nord).—Grub screws are obtainable separately and are listed in the accessory list under numbers 69a and b.

J. Vincent (Basse-Tutz, Moselle).—(1) Regret we do not follow your suggestion in connection with the threaded wheels. Perhaps you would give us a little further explanation. (2) At the moment we are engaged on a suitable sliding gear.

J. Palmer (Norwich).—We are exploring the possibilities of a worm wheel with a wider pitch.

W. Cheary (Forestille, S. Australia).—(1) We are afraid that the present Meccano nut is not suitable to permit of its being adapted to the wing or butterfly type. In any case we think that, in many cases, the wings would prove an obstruction. (2) Your suggestion for deepening the grooves on the pulleys is sound and we shall look into the matter. (3) The alterations or additions you suggest to the No. 2 Hornby Loco. are more in the nature of extra finish, to which we shall probably work up in due course.

N. Batham (Farnworth).—The Hornby series of accessories is by no means complete. We have several new and interesting items in course of preparation.

A Pair of Tame Fox-cubs

Orphan Foxes will make Novel Pets

by Gerald O. Rennison

WHEN out gathering mushrooms soon after daybreak in the fields near his home at Stamfordham, Northumberland, Mr. C. Arkle came across the two fox cubs shown in the accompanying photograph. They were lying in a very exhausted state, evidently having been without food for some time. Mr. Arkle came to the conclusion that their mother had been killed, and that they had left the "den" to search for food for themselves. He picked them up carefully and took them to his home, where a little warm milk soon restored the small orphans to activity.

After keeping them warm in the kitchen for a few days he put them in a small hen-coop on the grass in his allotment, with a nice warm little hutch for them to go into at night. The cubs are thriving well, and although chickens run past their hutch they seem to have lost all the mischievous instinct of foxes, and they never attempt to catch and kill the little chicks.

Silver Fox Farm in Scotland

It is a very interesting fact that the Canadian silver fox can be successfully bred in captivity in Scotland. Unlike the ordinary British fox, the silver fox has a skin that is of great value, unusually good specimens having fetched in the London market as much as £100.

The breeding of silver foxes for the sake of their skins is carried out on a commercial scale at the Ben Bhragie Silver Fox Farm, Golspie, Sutherlandshire. It has been found that for this purpose the climatic conditions in Sutherlandshire are as good as, if not better than those existing in Canada. Recently twenty-eight silver foxes destined for the Ben Bhragie farm were brought over by the liner "*Canada*" from Prince Edward Island to Liverpool. They stood the journey well and arrived in excellent condition.

Photographing a Nest

When you are out with your camera does it ever occur to you to try to take a photograph of a bird's nest? You may have to do all sorts of things to get a good photograph, as nests are often in very awkward places.

The one illustrated belongs to a Chaffinch and was taken one afternoon while on holiday. There were no birds in when I found it, and I learned afterwards that the nest was deserted. The camera had to be tilted downwards to get at the nest, which was very low, but by good luck the camera did not fall and I was able to accomplish my object. The exposure was 5 seconds, at F/26, 3 p.m. Group E of the Burroughs and Wellcome photographic diary.

In conclusion I would like to say that it is always desirable to have an exposure meter with you, as without one you are liable to make mistakes and get underexposed negatives.

W. M. SMITH (Thackley, Bradford).

Eggs and Nest of Chaffinch

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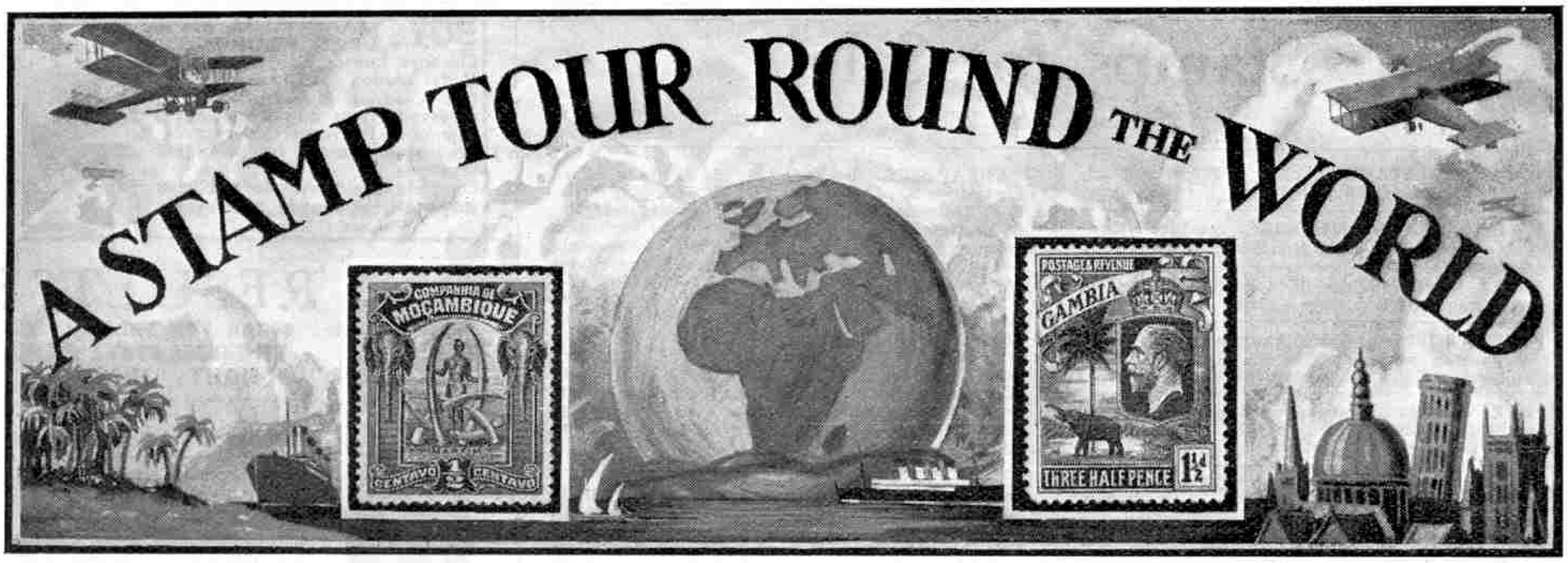

IX. AUSTRALIA AND SOUTH AFRICA

SYDNEY, to which we make our way after leaving New Zealand, is, of course, the capital of New South Wales. Few towns can rival its natural beauty and advantages. The famous harbour is divided into a number of inlets, the largest being over six miles in length. Sydney Harbour is the deepest, safest and most beautiful harbour in the world, and has extensive floating, dry, and other docks, capable of handling an immense amount of traffic.

In the eyes of advanced stamp collectors those stamps known as "Sydney Views" rank on a level with the famous "Cape Triangulars." The first Sydney View appeared in January, 1850. It was engraved by Robert Clayton, of Sydney, and was printed in red, at first on soft yellowish paper and later on hard bluish paper. A perfect unused copy could then be purchased for the price of one penny, but now only a medium unused specimen purchased from a stamp dealer costs not less than £75! The first issue appeared in four shades on the soft and two on the hard paper.

The original plate was soon discarded and in August of the same year a new issue appeared from a plate engraved by H. C. Jervis. The most noticeable difference was the addition of clouds in what had been, until then, a perfectly cloudless sky.

At the same time as the first 1d. value was issued there appeared a 2d. value of similar design engraved by John Carmichael. In the two years 1850 and 1851 five different plates were used, re-engraved by H. C. Jervis, and each distinguishable from the others.

A 3d. value also appeared in 1850, but there was only one die of this value.

Most, if not all, "Sydney Views" are beyond the means of the average collector and their possession is a dream but rarely realised. There is however one Sydney view stamp within the reach of all, namely, that issued as the 1d. value in the 1888 series. It appeared in three sizes of perforation, two watermarks, and two shades so that this value also lends scope to specialisation by skilful collectors.

The Glories of Tasmania

Sydney is the only Australian view so far depicted on postage stamps and we now turn southwards until we come to Hobart, Tasmania. Hobart (shown on the 2d. 1900 and following issues), is the capital of Tasmania and stands on the low hills at the foot of Mount Wellington (1d. of the same series), the famous peak, 4166 ft. in height, whose summit is often snowclad. At Port Davey at the south-west corner of the island is Spring River shown on the 3d. value of this series. In the interior of the island is Lake St. Clair (5d. value) standing at the foot of Mount Gould.

Tasmania is an island of mountains and plateaux and Lake St. Clair is one of the many freshwater lakes on the central plateau. As is natural in so mountainous a country, there are many waterfalls, two being shown in the same series of stamps. That on the 4d. value shows Russell Falls and that on the 6d. shows the Dilston Falls. The 2½d. value shows Tasman's Arch, a huge natural arch of rock worn into its present shape by the passage of the river below through untold ages.

Via The Indian Ocean to Africa

Rejoining our ship at Hobart, we again set sail and now turn westwards for a distance of about 4,000 miles until we arrive at Reunion, a small island and French colony in the Indian Ocean. Situated 400 miles S.E. of Tamatare, the chief port on the eastern coast of Madagascar, Reunion is also near Mauritius, being 130 miles south-west of Port Louis, the capital of the British colony. Reunion itself is oval in shape and has a greatest length of 45 miles and a greatest breadth of 32 miles. It consists of two sets of volcanoes that have raised themselves above the floor of the surrounding ocean at different times, and the whole island is a mass of volcanic cones, several of which are active.

St. Denis, the capital of the island, is shown on the 20c. to 75c. values issued since 1907. It lies on the north coast of the island, has a fairly large population and several fine public buildings. St. Pierre, at the south-western corner of the island, has a small artificial harbour and is shown, with the Crater Dolomieu, on the franc values issued since 1907. Although eruptions of the various volcanoes are comparatively frequent they are not often of a serious nature.

From Reunion we sail north around Madagascar and arrive at our first port of call in Africa—Zanzibar, the great distributing centre for the eastern seaboard of Africa. A view of the port was shown on the values from 10 to 200 rupees in the 1908 series, issued by the British protectorate of the same name and of which Zanzibar is the capital. The town has a population drawn from all parts of Africa, a considerable trade being done in ivory, gum copal, hides, skins, cloves and copra. Most of these goods come to England, with the exception of the copra which goes to Marseilles. India supplies Zanzibar with nearly all her imports, these being chiefly foodstuffs, amongst which rice predominates.

Turning southwards we come to Mozambique, really part of Portuguese East Africa. Although few definite view stamps of this district have appeared as yet, the Mozambique Company, who administer the districts of Manica and Sofala, have issued a very fine series showing the various occupations and products of the district. This series was issued between 1918 and 1921 and consists of eighteen values, all of different types. These types in order of value, commencing with the lowest, the ¼ cent., represent: native village (illustrated here), ivory, maize, rubber, sugar, river transport, tobacco, Port of Beira, one of the chief towns (illustrated here), coffee, oranges, cotton, sisal, Beira railway, the Court of Justice, cocoanut, tannery, cattle, and,

(Continued on page 231)

Stamps for Sale

(*See also page* 228)

1,000 MIXED STAMPS 7d., 1/- or 2/6.—Cranwell, 55, Cowslip Road, London, E.18.

100 DIFFERENT STAMPS FREE. Send for ½d. approvals.—Cox, 135, Cambridge Road, Seven Kings.

FREE.—Sheet 50 Unused to genuine applicants for approvals. Send postage.—Croft, Adel, Leeds.

FREE. 30 Different South American, many mint. To applicants for approvals.—S. J. Huckle, 53, Birkenhead Avenue, Kingston-on-Thames.

FREE Packet to genuine approval applicants, sending postage.—Hewitt Bros., 52, St. Agnes Road, Moseley, Birmingham.

BRITISH COLONIAL AND FOREIGN STAMPS at 8d. in the 1/- discount.—J. McCallum, 56, Trefoil Avenue, Shawlands, Glasgow.

55 Different, including Falkland, Fiji, Brunei, Sarawak, Seychelles, Somali, Siam, etc., 4d.—"Philatelic," 54, Claremont Road, Westcliff, Essex.

65 DIFFERENT FREE, including set 4 Persia (unused).—Adams, 39, Scotts Road, E.10.

FREE. 500 Stamps to purchasers of 1/6 Bargain Parcel. Contains 50 diff. Portuguese Cols.; 8 diff. Samoa; 100 diff. Hungary; 500 mounts.—D. Hulse, 13, Silverdale Road, Wolstanton, Staffs.

Six Revolutionary Crete Free to "Big Discount" approval applicants.—H. Scott Johnson, C.P.A., Room C, 49, Feldon St., S.W.6.

"THE PHILATELIC MAGAZINE," 46, Victoria St., London, S.W.1. Best stamp newspaper. Order from your newsagent. 3d. fortnightly, or send 4d. for specimen and bonus form worth 2/6. Album catalogue free.

OPPORTUNITY NOT TO BE MISSED. Bargains for all. Giving up approval business. Whole stock to be cleared in packets of 250 unpicked. Price 1/- postal order. Worth up to 10/-.

SCOTT, 154, Wellesley Road, ILFORD.

BIG BARGAIN. 250 Stamps including Nigeria, Rhodesia, Mauritius, Malay Straits, Cape, Natal, Bulgaria, Finland, Persia Straits, Angola, Cape Verde, Guiné, Poland, post free, 6½d. 5 Cochin included if approvals required.—Morris & Co., Stamp Dealers, Bletchley.

12 DIFFERENT BARBADOS, 4d.; 20 Belgium, 4d.; 20 Canada, 4d.; 25 Ceylon, 6d.; 25 French Colonials, 6d.; 20 German, 3d.; 25 Holland, 5d.; 25 Russian, 4d. Postage extra on orders under 1/-.

MORRIS.
53, Wane Road, Hertford, Herts.

FREE. Packet of 100 different Stamps and 100 Stamp Mounts to all Collectors requesting approvals. Above free packet contains some really good stamps. Send postcard now to—W. Gosling, 93, Wherstead Road, Ipswich.

FREE Any one of the following sets to genuine applicants for approvals. 6 Mint Hayti 1904, 15 Ruthenia and Ukraine, 22 German Provs. and Prussia, 14 Soviet Russia and Danzig, 8 Mexican Civil War Issues (cat. 3/3). Ask how to increase your collection for nothing.—Alban Simmons, Hillside, New Barnet.

IS YOUR COLLECTION UP-TO-DATE?

Not unless you have my **"New Issue Packet"** which contains **30** diff. stamps **all issued during 1925** and **all mint,** including Monaco, **Siam Air Mail,** Syria, **Grand Liban,** Algeria, set **Portugal (Branco),** Azores, Morocco Agencies, Martinique, &c. Many high values, no rubbish. Bargain price **1/3,** post 1½d. extra. **FREE** to new customers purchasing above, set 9 mint Air Stamps, and set 14 mint Ukraine.

D. P. SOAR, 65, Baxter Avenue, SOUTHEND-ON-SEA.

This Space is set to ½ inch s.c. and costs 5/- per month. This sum is the 64th of £16, the price of a whole page advertisement. Over 70,000 copies of the December number were distributed all over the world. You therefore reach this exclusive public for less than one penny a thousand.

CHEAP SETS. 10 Angola, 6d.; 14 Australia, 6d.; 5 East Africa and Uganda, 6d.; 20 Finland, 6d.; 30 do., 1/-; 24 Sweden, 6d.; 60 do., 1/-; 9 Madagascar, 6d.; 10 Martinique, 6d.; 80 Portugal, 3/-; 20 Portuguese Colonies, 6d.; 30 do., 10d.; 60 do., 2/-; 15 Venezuela, 1/-; 20 Travancore, 1/-; 26 Indian Native States, 1/-; 50 do., 2/-; 100 do., 7/3; 13 Indo China, 1/-; 7 Belgian Congo (beautiful stamps), 1/-; 75 Czecho Slovakia, 3/-; 18 Ceylon, 1/-; 15 Turkey, 6d.; 50 do., 2/6; 50 Roumania, 1/-; 100 French Colonies, 2/9; 20 Cuba, 6d.; 25 Asiatics, 1/-; 25 Africans, 1/-; 30 S. Americans, 1/-. Postage extra. Price lists (60 pages) with hundreds of other cheap sets, albums, etc., and many interesting stamp chat pars, free on request.—**Edward Sandell, 10-11, Fetter Lane, London, E.C.4.**

STAMP COLLECTORS! SPECIAL OFFERS.

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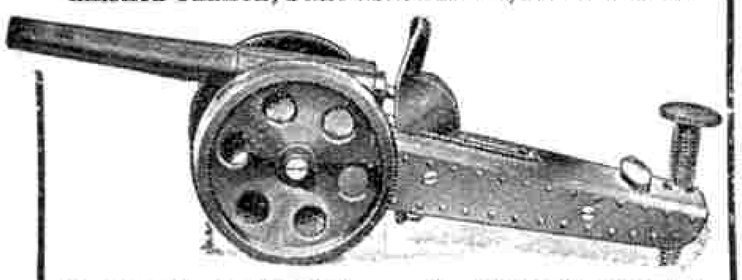
It Bangs! Flashes! and Shoots!

7½ in. long

No Caps, Powder, or Special Ammunition. Practise and Beat Father with this beautifully finished Cannon, built with Bronze, Steel & Brass.



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NORTHAMPTON.

BOYS MAKE YOUR OWN LEAD SOLDIERS.

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Has increased my own height to 6 ft. 3¾ ins.
FIRST IN 1907. FIRST TO-DAY.
No appliances, no drugs, no dieting.
ROSS SYSTEM NEVER FAILS.
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A Client, aged 37, reports: "I have increased my height nearly an inch, and I have not been a full month yet!"
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THE GENUINE SYSTEM.

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Is the very latest Pocket Instrument; plays in all keys and produces every shade of notes as perfectly as the human voice. Blends beautifully with Piano or Gramophone. So simple a child can play it.
Post free by return post with full instructions. **2/6** From the maker.
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Dept. **J889) Birmingham.**

FROM 1/4 WEEKLY

FREE! THE ELM PACKET AND COLLECTOR'S OUTFIT.

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MODELS OF 17/6 SWAN, WATERMAN AND ONOTO SELF-FILLING FOUNTAIN PENS with Pocket Clips, 5/- each, postage 2d. State Fine, Medium or Broad Nib.—Bateson's Sports Depôt, Blackpool.

A Stamp Tour Round the World—

(*Continued from page* 229)

lastly, the arms of the Company. From this list it will be seen that the country has a large variety of products.

The Victoria Falls

The British South Africa Company, now Rhodesia, have produced one of the most beautiful of all stamps, that showing the Victoria Falls, illustrated here. It was issued in 1905 to commemorate to a certain extent the completion in April of that year of the railway bridge that now spans the river Zambesi within the sound of the Falls.

The Victoria Falls were discovered on 17th November, 1855, by David Livingstone and named by him after Queen

Victoria. They are the greatest waterfalls in the world and where they fall into a huge chasm 300 ft. in depth the river is over 1,800 yards in width. The chasm into which the river leaps lies at right angles to the river's path and varies from 80 to 240 ft. in breadth. Although it would thus seem that excellent views would be obtainable from the far side of this chasm, this is only the case during the dry season when the river is low, since at all other times the whole chasm is surrounded by vast columns of vapour.

The waters leave the chasm by means of a narrow gorge, not more than 100 ft. in width, about three-fifths of the way from the western end of the barrier wall. Thence the river flows into and along the Grand Cañon, under the railway bridge, through a huge zig-zag course over 40 miles in length. Its almost perpendicular walls are 400 ft. in height, their top being the same height as the river before it reaches the Falls.

The railway comes from Bulawayo and is part of the Cape to Cairo railway scheme. The bridge is 650 ft. in length, having a main arch with a span of 500 ft. The rails are 420 ft. above the level of the river when it is at low-water level.

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NEXT MONTH:—

THE CAPE, St. HELENA and MOROCCO

A Clever Forgery

In 1872–73 a notable attempt was made to defraud the Post Office by the issue of a forged stamp belonging to Great Britain. The stamp in question was the 1/- value of the 1867–80 issue, a green stamp with a large uncoloured letter in each corner. In this stamp the plate number is placed half-way up each side of the stamp in white figures on a coloured ground. The forgeries bear the plate number "5," the genuine copies of which plate number were first issued during 1871.

During the two years 1872 and 1873 many thousands of these forged 1/- stamps were used on telegrams handed in at the London Stock Exchange Post Office. The forgeries were excellent representations of the original—indeed they were sufficiently good imitations to deceive the officials at the Post Office for many years. The forgery was not discovered until 1898, twenty-six years after the stamps were used! Even then the discovery would not have been made had not Mr. Charles Nissen, a collector who specialised in the stamps of Great Britain, noticed a peculiarity in some of the stamps he was examining and comparing. Closer inspection revealed the forgery, but it was, of course, hopeless to attempt to discover the perpetrators of the fraud after so many years had elapsed. The printers had evidently expected that the telegrams and stamps would be destroyed in the usual way, never thinking that the stamps would be torn off and saved for collectors.

The Reason for "Corner Letters"

No doubt many of our readers have wondered why the early stamps of Great Britain have letters in their corners, and why there are so many different combinations of these letters.

Until the Queen Victoria Jubilee issue of 1887 all the stamps of Great Britain had these letters in their corners. In the issues previous to 1858 these letters appeared only in the two lower corners of each stamp, but after this date they appeared in all four corners, the letters in the upper corners being the reverse of those in the lower corners. The extra letters were added in this manner so as to make it more difficult for dishonest persons to piece together unobliterated portions of stamps with the idea of making up stamps that could be used again—a profitable trick that had soon been learned after the introduction of adhesive stamps.

The use of letters in the corners was brought about by Sir Rowland Hill, who thought that if anyone made forgeries of the stamps they would be most likely to print the stamps singly and not in sheets as the authorities did. Accordingly, Hill introduced these check letters, arranging them as shown below.

The first stamp in the uppermost row was lettered AA, the second stamp in this same row was AB, and the third AC, and so on along the row until AL was reached on the last stamp of the top row. The second row began with BA, and so on through the sheet, the full sheet reading:

1st row—AA. AB. AC. AD. AE ... AL
2nd row—BA. BB. BC. BD. BE ... BL
3rd row—CA. CB. CC. CD. CE ... CL

.....

19th row—SA. SB. SC. SD. SE ... SL
20th row—TA. TB. TC. TD. TE ... TL

Thus each stamp in the sheet had a different set of letters by which, incidentally, its position on the full sheet could be identified. Thus if a forger printed his stamps singly from one die, they would all have the same corner letters. To make it worth while to forge stamps of so low a value as 1d., a considerable number would have to be printed, and Sir Rowland Hill relied upon the fact that the large number of stamps passing through the post, all with the same particular corner letters, would attract the attention of the officials and lead to the discovery of the fraud.

A Picturesque Stamp

This splendid production might be said to complete the pictorial series of Jamaica issued in 1921, although it appeared for the first time in 1922. The centre, in black, shows a view of the Town and Harbour of Port Royal (about 1850) and consists mainly of a number of sailing ships. The frame, in blue, consists of an anchor in each upper corner, and the usual medallions. The stamp is line-engraved and printed in sheets of 40, in five rows of eight, on paper watermarked multiple script "CA" and Crown, perforated 14 by a single-line machine.

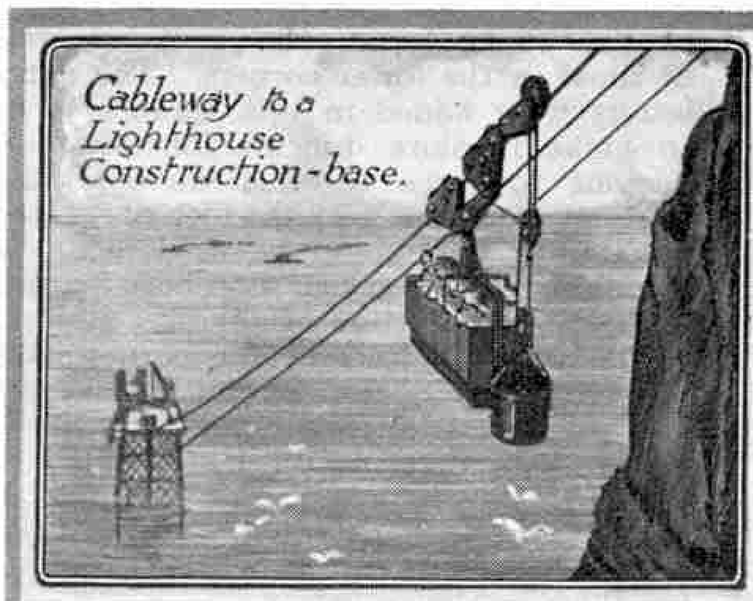
IN REPLY

R. Bentley (Frodsham).—There are three types of garter watermarks in the 4d. Carmine Great Britain of 1855 to 1857. These are of three sizes, the two larger ones are not easily distinguished, however.

L. Norton (Bournemouth).—The stamp you send belongs to Negri Sembilan, one of the Federated Malay States. Its catalogue value is 1/6.

A. Grant (Hammersmith).—The stamps of the Cape of Good Hope were overprinted British Bechuanaland, both in black and in red. There are a number of varieties, and an error in the overprint is catalogued showing the omission of the "B" in "British."

L. Bailey (Newton-le-Willows).—A chalk surface paper has a peculiar shine on its surface. Paper of this type was used for printing most of the values of 1902 to 1910 Great Britain and Colonies. It was used to safeguard the stamps, as although printed in fugitive inks they were found unsatisfactory and chalk surface paper was therefore introduced in addition.



Engineering News of the Month

New Thames Bridges

Lambeth bridge is to be reconstructed and in its new form it is expected that it will relieve Westminster bridge of a great amount of traffic and so prevent the congestion at Vauxhall.

Further up the River, new bridges have also been suggested at Twickenham and Teddington. It is claimed that these bridges would relieve the congestion of summer and holiday traffic at both Richmond and Kingston.

* * * *

Australian Order for the Clyde

The Australian Government has placed an order for two cruisers with Messrs. John Brown & Co. Ltd., Clydebank, at an approximate cost of £4,250,000.

* * * *

Cork Houses

We have recently read a good deal about concrete houses and in the March "*M.M.*" we described a new departure in steel houses. Now comes news of houses constructed of compressed cork. These houses, which are being built near Deal, have a steel framework to which are attached slabs of compressed cork from two to four inches thick. The outside of the cork is coated to a thickness of 1½" with concrete applied by means of a cement gun. It is claimed for cork houses that they are not only fire-proof and sound proof, but they act also as heat insulators.

* * * *

The New Piccadilly Circus

The reconstruction of the Underground station in Piccadilly is now being carried out. Since the present station was opened in 1906, the number of passengers has grown from 1½ to 18 millions per annum. The new station will be 15 ft. below the ground level, and oval in shape. Nine lifts will serve the platforms and there will be a wide subway with smaller subways giving connection with seven parts of Piccadilly Circus. The new station will be capable of dealing with 50 million passengers yearly.

* * * *

Preventing Waste of Water

Recently an investigation was organised in America with the object of reducing water waste. It is amazing to learn that several leaks in excess of 50,000 gallons a day were discovered, whilst one was found to be an unchartered 3 in. blow-off valve in a reservoir which was wide open and was discharging 700,000 gallons of water daily.

Huge Dock Scheme

A £13,000,000 scheme is in hand by which it is hoped to make Southampton docks the biggest in the world. The scheme in its present form includes some daring engineering plans. First it will be necessary to reclaim the mud on the foreshore over an area of two miles. Next the River Test will be dredged to give a passage even at low water for the greatest ships afloat. Two huge dry docks, with five jetties, are then to be built. The docks will be capable of holding at the same time ten such giants as the "*Aquitania*" and "*Majestic*." The scheme will take the Southern Railway about ten years to carry out and at the moment is held up by the refusal of the owner of the mud to sell it!

The main dock is to be built on a similar plan to the New York docks, the five jetties will be of reinforced concrete, each 1,000 ft. in length by 260 ft. in width. On these will be erected double storage sheds equipped with the latest machinery for loading and unloading liners.

Great developments are planned for the reclaimed land. Here a new railway line is to be built, linking up with the present line running completely round the new ground, and within this loop factories, workshops and warehouses will be erected.

* * * *

Mishap while Testing Bridge

A serious accident recently attended the testing of a bridge on the Goole and Selby line. The bridge is comparatively new and was being tested by the Bridge Stress Committee. An engine had run across the bridge at high speed and had come to rest about a mile on the other side. Another engine followed at even higher speed, but after crossing the bridge it was not pulled up in time to avoid collision with the first engine, with the result that the driver of the latter was seriously injured.

* * * *

A Loss to Engineering

Engineering lost a prominent authority in the death (on 2nd of April) of Sir William Mitchell Ackworth. Sir William, who was the leading authority in this country on railway economics, was born at Bath in 1850 and was in his 75th year at the date of his death. Educated at Uppingham and Oxford he served for 18 months as the tutor of the ex-Kaiser, and returning to this country was called to the bar in 1890. His great interest in railways was aroused in the first instance by reading Frances' "*History of Railways*." Sir William was appointed a member of the Royal Commission on Railway Accidents in 1899 and he was a strong opponent of the nationalisation of the railways.

New "Beam" Stations

The Postmaster General states that the high-power wireless station at Rugby is expected to be completed in about eight months' time. A smaller station for communication on the "beam" system with a similar station in Canada is expected to be completed in October next. Orders will be given for the erection of additional "beam" stations for communication with India, South Africa, and Australia, as soon as definite arrangements for corresponding stations had been made by the Indian and Dominion Governments.

* * * *

Engineering Scholarships

The council of the University College of Southampton have decided to award two open exhibitions in engineering to candidates who may or may not be resident in the district. The awards will be made on the recommendations of the Board of the Engineering Faculty without formal examination, provided the candidates have matriculated and are prepared to study for a degree in engineering.

* * * *

More Gas for Coventry

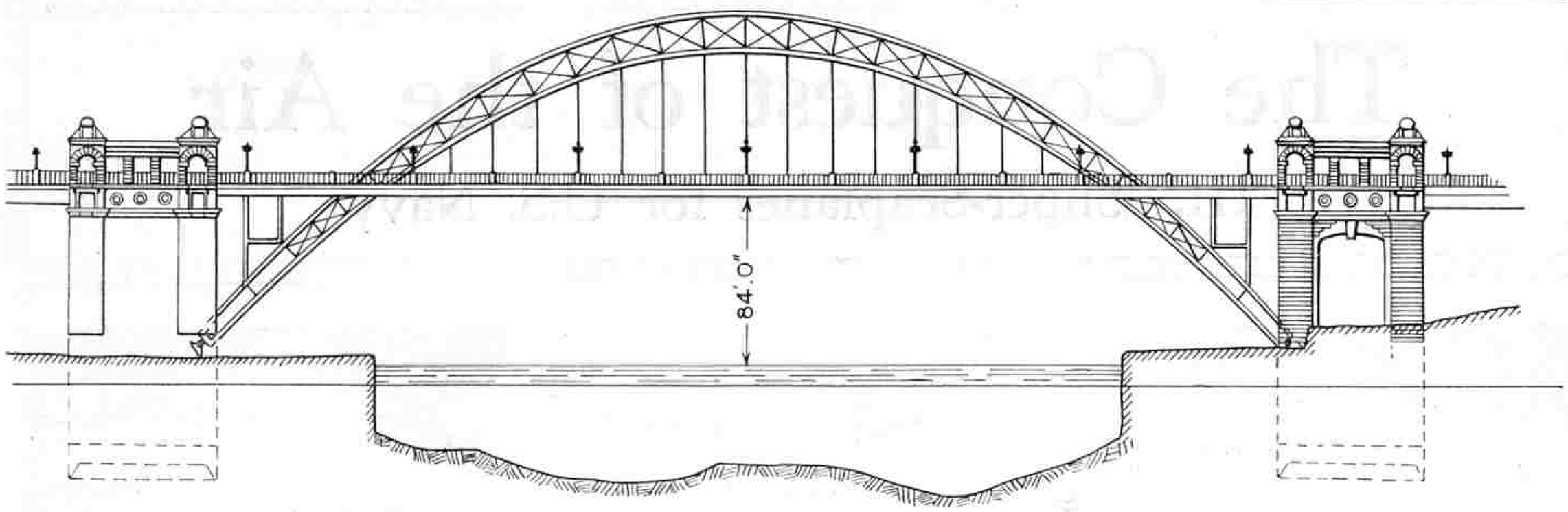
Extensions at the Coventry Gas Works costing over a quarter of a million sterling, are to be put in hand immediately. The work includes the extension of the gas-making plant by installing new vertical retorts with a total capacity of two and a quarter million cubic feet of gas daily and five million cubic feet gas-holder and tank. The scheme includes the extension of the railway siding and other improvements.

* * * *

Repairing Durham Castle

Engineers have often been called in to strengthen buildings and perhaps the most notable instance of recent times is that of St. Paul's Cathedral, where the operations will require several years to complete.

Work has been in progress for some months underpinning Durham Castle by concrete buttresses and walls. In this instance, as in the case of the repairs to the tower of Lincoln Cathedral, cement grouting is being used. This consists of forcing liquid cement through cracks in the walls, where it hardens and solidifies with the original masonry, the whole becoming a solid mass. In the case of Durham Castle over 10,000 gallons of liquid cement have already been used, and the work is still in progress.



A New High Level Bridge Across the Tyne

A new high-level bridge is to be built over the Tyne between Pilgrim Street, Newcastle, and High Street, Gateshead. The bridge will have a span of 540 ft. and will thus have the largest arch of all bridges in this country. The clearance of the bridge will be 84 ft. above the river, which incidentally is the same as that of the existing high-level bridge and of the King Edward VII. Railway Bridge. The bridge will carry a roadway 38 ft. in width and a 9 ft. footpath at each side. A double tram track will be laid in the middle of the roadway and the whole cost, including the approaches, will be about £1,000,000.

The existing high-level bridge was built by Robert Stephenson and opened for traffic on 15th August, 1849. One of the many fine bridges erected as the result of the development of railways, the bridge crosses the deep ravine that lies between Newcastle and Gateshead, with the river Tyne flowing below. For some 30 years the Newcastle Corporation had discussed various methods of improving the very inadequate communication between the towns. They consulted Telford and other eminent engineers, but negotiations drifted on year after year without anything definite being decided, and it was not until the northward march of the railway made a new bridge absolutely necessary that any progress was made.

The existing bridge may be said to combine the two principles of the arch and of suspension. It is composed of six spans of 125 ft. each. The four ribs of each span are of cast iron, while the suspension rods are of wrought iron encased in hollow iron castings. The local authorities insisted that the bridge should carry foot passengers and ordinary vehicles, as well as the railway, and therefore the bridge is provided with two decks. The upper deck, above the arched ribs, carries the railway, and the lower one, which is suspended from the arched ribs, carries the roadway, consisting of a carriage-way 20 ft. 4 in. wide and two footways. The length of the bridge and viaduct from Gateshead station to the Newcastle terminus is about 4,000 ft. and the bridge passes over the roofs of houses on both sides of the ravine.

The piles used to obtain the necessary foundation for this bridge were driven by means of a Nasmyth steam hammer, and this was probably the first occasion on which the steam hammer was employed for bridge pile-driving.

The King Edward VII. Bridge, crossing the Tyne to the west of the present High Level Bridge, is for railway traffic only, and it is expected that the new bridge will do much to relieve the congestion in road traffic.

More New Bridges

Another new bridge that it is proposed to construct is a swing bridge over the River Ouse at Booth Ferry, north of Goole. At Yarmouth a new bridge over the Yare is to replace the Southtown bridge. A new bridge is to be built over the Trent at Gunthorpe near the present Gunthorpe Toll Bridge, and the widening of six bridges over the Avon at Bath is also contemplated.

* * * *

Smaller Ships

The restriction of emigrant traffic to the United States has so reduced the volume of traffic that, coupled with high building and operating costs, the building of further steamships of the monster type in the near future is rendered problematical.

Steamship companies announce that they will watch closely developments in the methods of propulsion, so that the best and most economical means may be employed to restrict their building programme to vessels of moderate size and with a less elaborate decoration and furnishing of the public rooms. While maintaining the present standard of comfort for first-class passengers, the companies will institute improvements for the comfort of second and third class passengers.

Lifting 72,000 Tons

The world's heaviest ship, the White Star liner "*Majestic*," was last month lifted 40 ft. by the great floating dock at Southampton. This is the first occasion on which a weight of more than 50,000 tons has been lifted by any dock in the world. It is also the first time that it has been possible to dry-dock the "*Majestic*" in British waters, her half-yearly docking having hitherto been done in America as there is no graving dock large enough to take her in this country.

The weight of the "*Majestic*" is 64,000 tons fully laden, but when in dock she was without fuel or stores, which enabled her weight to be cut down to 55,000 tons, a weight well within the calculated lifting capacity of the dock. Five hours were required to lift the ship. The fourteen pumps pumped 88,000 tons of water out of the tanks in the sides and hold of the dock, and she floated with the ship poised in the cradle on the bottom platform.

The dock itself, which was opened by the Prince of Wales last summer, weighs about 17,000 tons, so that the total weight raised on this occasion was something like 72,000 tons.

Bridge across the Zambesi

The construction of the proposed bridge across the Zambesi is going forward. The bridge is estimated to cost £800,000 and it will connect the Trans-Zambesi and Central African Railways, and complete a through-line from Beira to Nyassaland. The bridge will help largely in the development of the coal mines of the district.

* * * *

Forth Road Bridge

A proposal has recently been made to build a road bridge across the Forth at Queensferry. The cost of the proposed bridge, including the acquisition of land, is estimated at £4,000,000. It is suggested that the bridge be of the suspension type, with two spans of 2,400 ft. each. Should the bridge be constructed it would allow the continuation of the Great North Road through Scotland to Inverness and Aberdeen.

* * * *

New Montrose Bridge

Montrose Town Council has decided to replace the suspension bridge over the River South Esk by a modern structure costing £90,000.

The Conquest of the Air

III. Super-Seaplanes for U.S. Navy

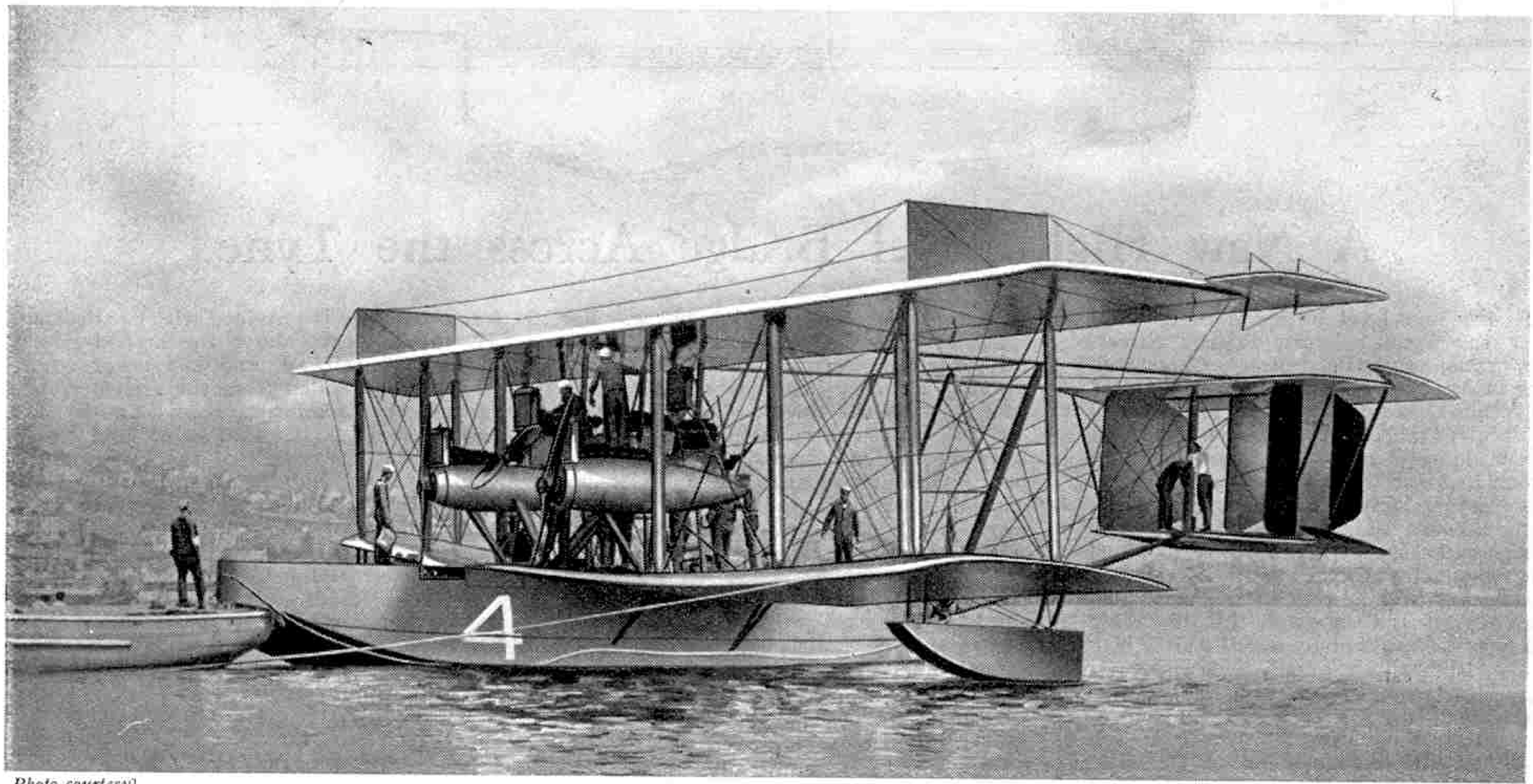


Photo courtesy] [*U.S. Navy Department*

The first U.S. Navy Seaplane (N.C.-4) which flew across the Atlantic between 8th and 31st May, 1920.

THE importance of large seaplanes, having a great range of flight and capable of working well in advance of the fleet to which they are attached, is becoming increasingly apparent. As a result, super-aeroplanes and super-seaplanes are being planned and constructed in almost every country that has either a commercial or strategical interest in aviation.

In America in particular, the advantages of these super-aeroplanes are fully realised. Experts have recently pointed out to the Secretary of the Navy that seaplanes of a type capable of working independently of support from any surface vessels would be particularly useful in the Pacific.

The United States has a considerable coastline to guard, both in the Atlantic and the Pacific, and although the cutting of the Panama Canal has simplified its defence very considerably, there yet remains the very grave problem of giving adequate naval protection to both east and west coasts. In the event of the United States being at war with any nation possessing fighting ships, this problem would become acute.

More certainly would this be the case in the Pacific, where the United States has island possessions (Hawaii) that are of great strategic importance. It is more particularly in regard to this and other similar outlying territories that seaplanes and aeroplanes would be of the greatest value to the United States. Not only would they by bomb attacks be able to considerably hinder and disorganise an invading force, but they would be able to fly to, and defend any point on the coast long before the Pacific Fleet itself could reach the scene of action.

A Giant Seaplane

For these reasons alone, this type of aircraft is the centre of attention in America at the present time, and orders have recently been placed by the American Navy for a super-seaplane which, if successful, will probably lead to orders for a large number of a similar type. The new seaplane, when fully loaded, will weigh 24,000 lbs. Its wings will have a span of 87 ft. 6 in., a width of 14 ft. and a total area of 2,400 sq. ft.

The fuselage, 60 ft. in length, will be built entirely of duralumin. The advantage of constructing the body of duralumin is that it will not become waterlogged—as might be the case with a wooden hull—and on this account it is claimed that the new seaplane will be sufficiently seaworthy to keep afloat, even in the roughest sea. Further the use of duralumin reduces the weight to a minimum, more particularly so as the same metal is used in the construction of the wings. The decreased weight allows greater fuel-carrying capacity and gives greater speed, the latter advantage also being assisted by the decreased air resistance of the wing truss, to details of which further reference will be made later.

Geared-down Engines Used

The new giant will be driven by two 800 h.p. Packard motors—the largest aero engines ever built in America. They are designed for the high working speed of 2,200 revs. per minute, at which speed they give their maximum power for a given weight.

It must be noted, however, that this high speed is not the propeller speed, for the engines will not drive the propellers directly. Instead, they are geared down to give co-ordination between engine and propeller, to ensure that the speed at the tip of the propeller blades is in ratio with the forward speed of the aeroplane—an important matter.

The plan to gear down the engines is in accordance with the best modern practice. Experts are agreed that in the future, in all "slow" aeroplanes, geared-down engines will be adopted universally. The term "slow" is here used in a comparative sense, judged by some of the high flying speeds attained by other—and often specially-designed craft. For instance, although the new American giant falls within the "slow" classification, it will nevertheless be capable of a speed of at least 100 miles per hour!

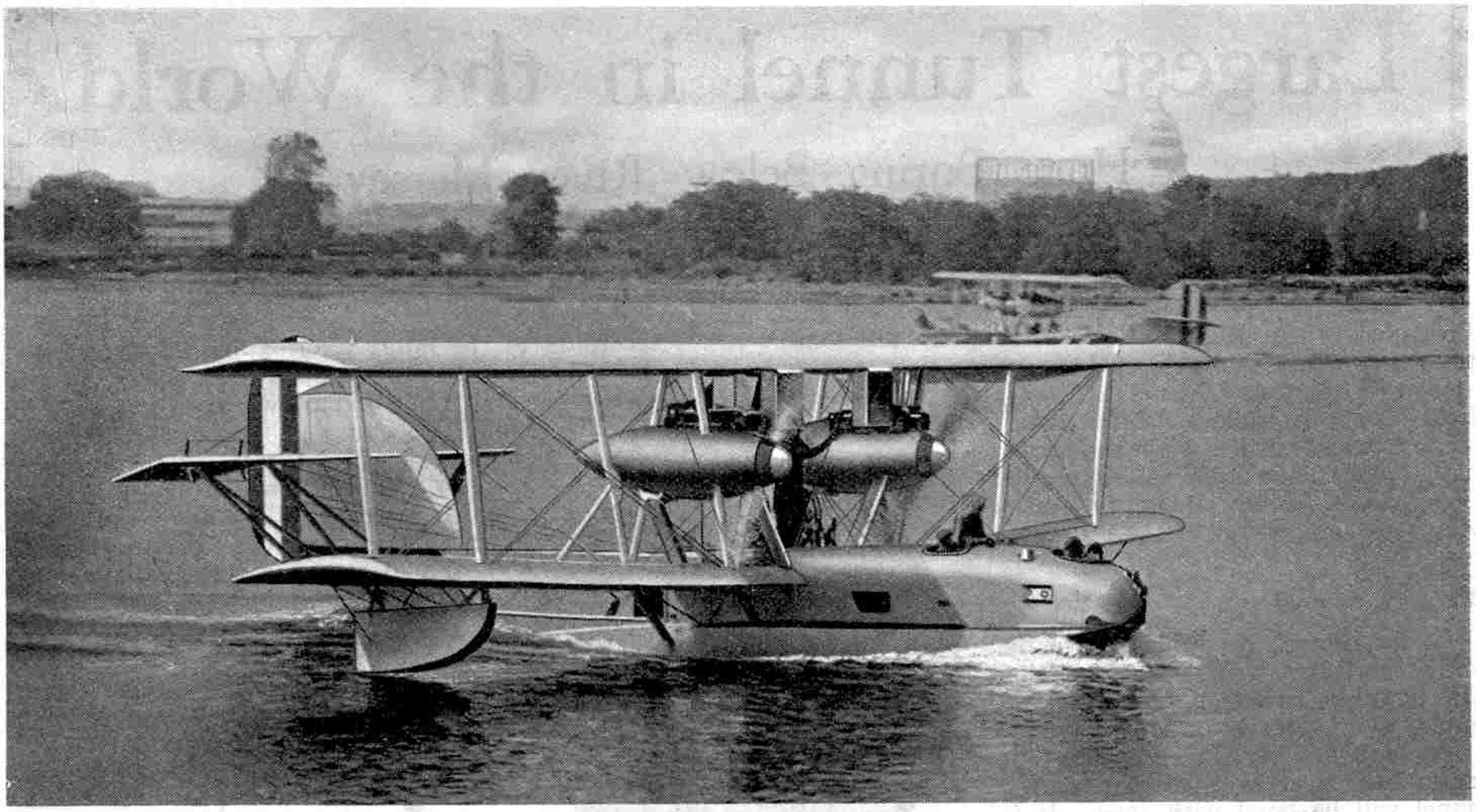


Photo courtesy [*U.S. Navy Department*

Long Distance Scouting Seaplane (PN–7) of the U.S. Navy

Tandem v. Parallel-Mounting

It is interesting to learn that the two engines of the new giant will be mounted in tandem, one propeller being at the front of the engine and the other at the rear.

Although mounting the engines on either wing is generally regarded as being more efficient than mounting in tandem, tandem mounting has the advantage that, should one of the engines fail, the plane will be able to continue in flight on one motor only. Although this is theoretically possible with two engines not arranged in tandem but on either wing, it has been found in practice that should one of the engines fail, when the pair are mounted on either wing, the unbalanced thrust of the remaining propeller becomes a definite source of danger. This is because of the fact that it is thrusting "off centre" and this renders control of the aeroplane very difficult. The advantage of being able to sustain flight indefinitely on one motor far outweighs the slight loss in efficiency.

Illustrations and further details of the new giant seaplane are not yet available. It is believed, however, that the design will follow very closely the lines of the successful P.N.–7 type of long-distance scouting seaplane now in use by the American Navy Department, which we are able to illustrate on this page.

Five Years' Progress

It is very interesting to contrast the P.N.–7 with the N.C.–4, the first giant seaplane to be built for the American Navy. Although only five years have elapsed since the N.C.–4 was constructed, a comparison of the two photographs accompanying this article shows how great has been the progress in design in the meantime. It will be noticed that the P.N.–7 has a clean wing truss, whereas the N.C.–4 is more cumbersome in this respect. The design of the P.N.–7 does not, however, show any radical alterations or extraordinary changes from previous designs. Greatly improved in general details, it shows a steady advance in many minor points.

The main advantages are found in the wing trussing. The N.C.–4 necessarily had innumerable struts and wires in its wing structure, because it had a comparatively "low-lift" wing and a correspondingly large wing area. It had a shallow wing camber giving a correspondingly low resistance to bending stresses. The P.N.–7 on the other hand, has a "high-lift" wing, which enables a reduction to be made in both the area and the span. In it, too, the considerable depth of camber allows the use of long unsupported spans and reduces the external wing-bracing to a minimum.

London to "Mespot." Non-Stop

The N.C.–4 had four Liberty motors each of 400 h.p. Although the horse-power was practically the same as that of the giant seaplane now building, the maximum speed of which the older machine was capable of was only 75 m.p.h. whereas, as has already been mentioned, the new giant will have a speed of at least 100 m.p.h.

The N.C.–4 weighed 28,000 lbs. and its range was 1,600 miles at the outside. The new giant seaplane is 4,000 lbs. lighter and has a range of at least 2,600 miles. If flown from a base in this country it would be able to make a non-stop flight from, say, Croydon to the Ural Mountains; to the Caspain Sea; to Egypt; or almost to Basra and the Persian Gulf. It would also be able to fly across the Atlantic with ease. Indeed, it would have the greatest range yet attained by any aeroplane or seaplane of its size and weight.

It should be mentioned that the maximum range is not calculated on a stripped machine but is based on the weight of the plane carrying enough petrol for its maximum range, a crew of five—two pilots, two mechanics and a wireless operator—together with full fighting and bombing equipment.

Giant Block-Setting Cranes—

(*Continued from page* 223)

sea-walls, and in the combating of the elements during their construction, that this branch of engineering is seen at its best. In his difficult task the harbour engineer has no more powerful assistant than the giant block-setting cranes that we have described in these articles during the past few months.

These giant cranes thus play an important, although indirect part, in developing British trade and in advancing the interests of the Empire. The cranes build a harbour, the harbour enables ships to load and unload, and the town that owns it becomes a leading port and the centre of trade for a wide and prosperous area. Ships come and go, carrying the produce of the country to distant ports, where in turn other harbours shelter them from the fury of the seas whilst they unload their cargoes. All this has been made possible by giant block-setting cranes, without which the engineer could never have carried out the great works that stand to his credit to-day. It will be no matter for wonder, therefore, if cranes of this type will be the most popular type of crane models of the future among Meccano boys.

(THE END).

Largest Tunnel in the World

Huge Boring Below River Mersey

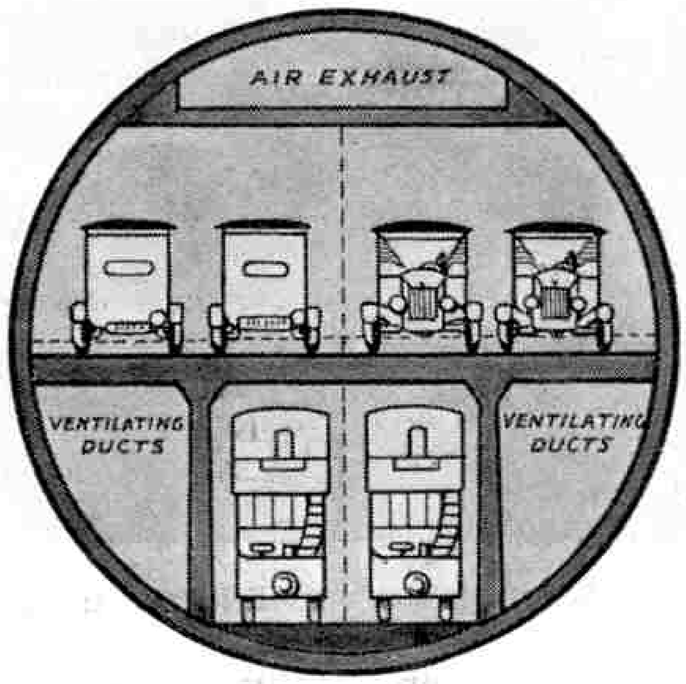
A GREAT engineering scheme for a new tunnel under the River Mersey between Liverpool and Birkenhead has been under consideration for some time and negotiations have been proceeding with a view to obtaining financial assistance for the project from the Government. After long conferences and seemingly endless discussion the matter has at last taken practical shape, the Government having offered to bear a very large proportion of the estimated cost.

Bridge v. Tunnel

The tunnel will be the largest in the world, and the works in connection with it will be on such a scale as to find employment, directly or indirectly, for a very large number of men. Important orders for steel will result, as the tunnel will be lined with steel. It is estimated that the work will require at least 125,000 tons of cast iron, the cost of which would be about £1,000,000, and the engineering trade as a whole would benefit in this and in other ways.

The decision to construct the tunnel was arrived at after consultation with leading engineers, a tunnel being generally preferred to the alternative suggestion for a huge bridge to span the river. There is already a tunnel under the Mersey, of course, but it is solely for the use of the electric trains of the Mersey Railway between Liverpool and Birkenhead. The new tunnel, on the other hand, is essentially intended for road traffic, its value lying in the fact that at present the only direct communication between Liverpool and Birkenhead is by ferry-boat across the river, the alternative being a long journey via Runcorn and over the famous transporter bridge.

As first planned the new Mersey tunnel was to take roughly the course indicated in the illustration at the foot of this page, but the branch leading to Seacombe has now been abandoned. It was also planned originally to construct the tunnel for four lines of traffic for ordinary vehicles with a section below for trams, as shown by the circular diagram. It has now been decided, however, to dispense with the tramway part of the scheme.



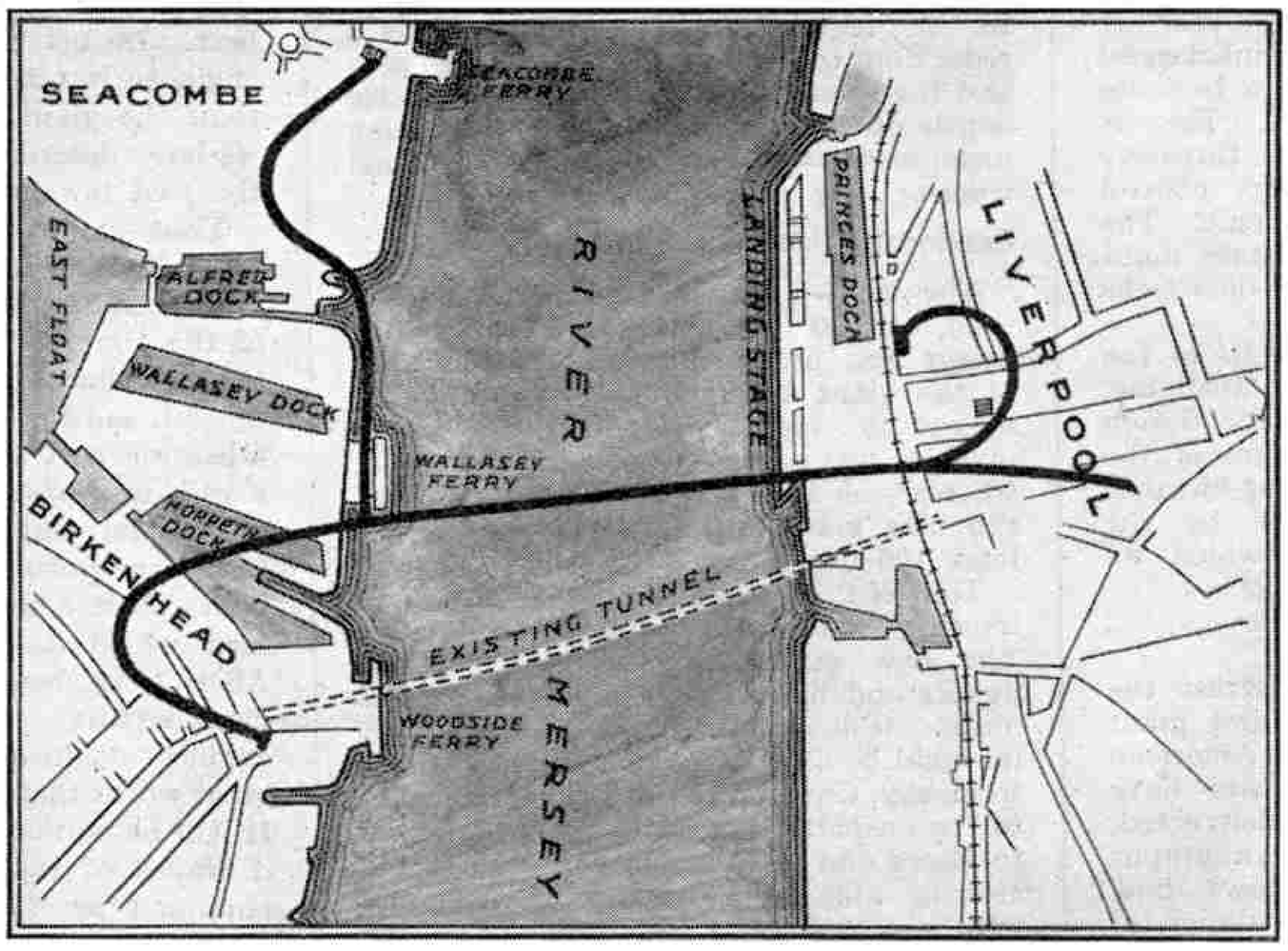
A :—Section of Tunnel as originally planned, with double track for road vehicles above and tramway track below

According to the latest information the tunnel will be 44 ft. in diameter and will have an upper road to carry four lines of traffic and a lower road to carry two lines. The tunnel is estimated to cost £5,000,000, towards which the Government are to pay £2,500,000. In addition the Government have agreed to allow tolls to be levied for a period of 20 years and to bear half the charge of upkeep of the tunnel for all time.

Liverpool's Huge Exports

The supporters of the new tunnel scheme believe that its construction will result in considerable further development of Liverpool and Birkenhead. Whether this proves to be the case or not, it is certain that the tunnel will relieve the existing traffic congestion between the two places. It will also give easier access to the whole of the Wirral, to Chester and to North Wales, for traffic from West Lancashire.

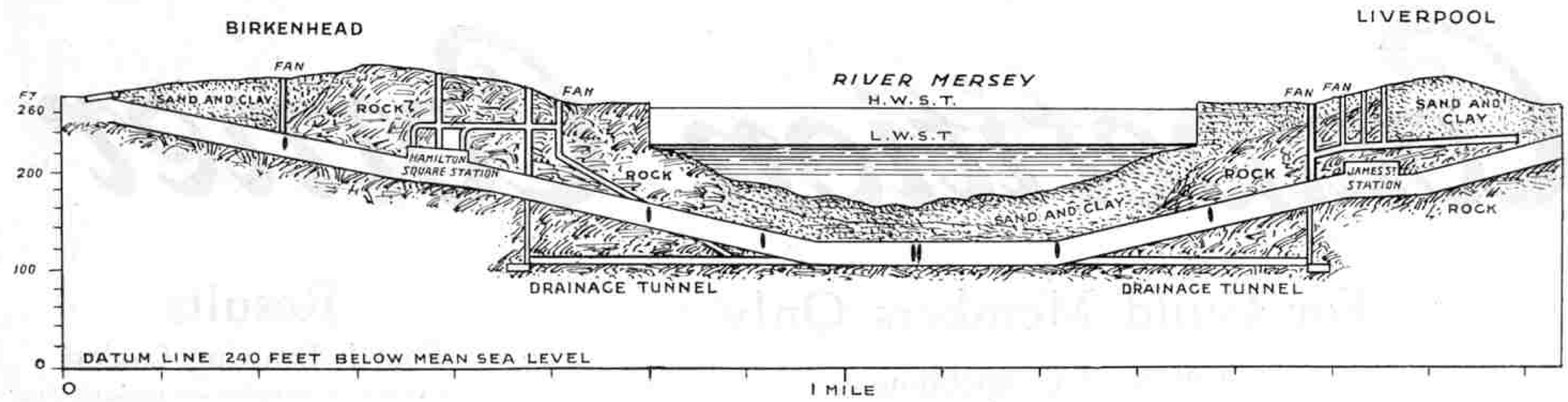
The growth of Liverpool as a port has been very remarkable. In 1858 the water area of the Liverpool and Birkenhead Docks was just under 200 acres, as compared with 600 acres to-day. In the same period the quayage has increased from 15½ miles to nearly 37 miles, and the tonnage of vessels using the port has grown from about four millions to nearly fourteen-and-a-half millions. To-day Liverpool is the first export port of the United Kingdom, exporting twice as much as London, and more than London, Manchester, Hull, Middlesbrough, Bristol and Southampton combined. As regards imports Liverpool is the second port of the Kingdom, London being the first.



B:—Approximate course of tunnel as first proposed

The Existing Tunnel

The course of the existing Mersey Tunnel is well shown in our sketch on the next page. The construction of this tunnel was authorised by Parliament in 1856 but work was not commenced until December 1879, when a small experimental tunnel was driven to test the



C:—Plan of existing Mersey Railway Tunnel

continuity of the sandstone across the river. This preliminary work was completed in 1881 and the main tunnel itself was begun. Shafts were sunk on each shore to a depth of 170 ft., sufficient to draw off water from the drainage tunnel, which had to be formed below the main tunnel, with a fall from the centre towards each shaft as shown in the illustration. The distance between the shafts was one mile and ten yards. Pumps were placed in both shafts to keep the works dry during their construction and also to drain the tunnel after its completion.

The Liverpool drainage tunnel was driven by hand at an average rate of about 11½ yards per week, while the Birkenhead drainage tunnel was driven by a Beaumont boring machine at an average rate of 14½ yards per week. The two portions of the drainage tunnel were joined at a distance of 1,115 yards from the Birkenhead shaft, the divergence between the two lines being only 2½ inches. The main tunnel was 26 ft. in width and 23 ft. in height.

For the traffic between Liverpool and Birkenhead it was necessary to have stations nearer the river than the points where the inclines from the tunnel come out into the open. Accordingly a station was constructed on each side, in the rock, slightly inland from the pumping shafts, the railway level on the Liverpool side being 92 ft. below the surface and that on the Birkenhead side 103 ft. below. Hydraulic lifts are provided to convey passengers to and from the street above. The ventilation of the tunnel is provided by two fans on each shore, which maintain a continuous current of air through the tunnel.

This Mersey Tunnel is of interest as being the first important submarine tunnel specially designed for railway traffic, although a railway was actually run earlier through the Thames Tunnel.

OUR MAIL BAG

In these columns the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

W. L. Holcroft (East London, S.A.)—"I told my older brother that there is much more sense in writing to you and playing with Meccano than eloping with girls till twelve o'clock at night." We should think so indeed, W.L.! We have sent you some interesting literature by separate post. We are always pleased to hear from you.

L. Millery (Ramsey).—Your suggestion for a competition in connection with the "*M.M.*" covers is good, and we shall probably adopt it. We are surprised to hear that you have an epidemic of measles, for we have always found Ramsey a remarkably healthy place.

B. Spooner (Orehunga, N.Z.)—We have posted the back numbers of the "*M.M.*" to you. We are sorry that you have had such a tough time for the last year or two, Bruce, and we wish you better luck in the future. It isn't everyone, though, who has such a good mother.

C. Westrope (Surbiton).—We receive many hundreds of letters from boys each day and all the specially interesting ones like your own we read and deal with personally. We are sorry you do not like the Meccano boy's short trousers—we must take this matter up with his tailor!

V. Halpe (Colombo, Ceylon).—"We never enjoy a fine winter here in Ceylon, for there is no snow. I envy you your better luck." Don't envy us Vernon. We would risk exchanging one of our winters for one of yours. Copies of the "*M.M.*," to replace those lost in transit, have been posted to you.

S. Marsh (Thornton-le-Fylde).—We are constantly warning our readers not to send presents to native boys in the West Coast of Africa, or even to reply to their letters, and we are glad you ignored the one that you received recently. Thanks for your suggestion for a new competition, which we will consider.

E. Watson (Poulton-le-Fylde).—Your suggestion for a "Poet's Corner" for the "*M.M.*" rather startled us. No doubt it would be very interesting to describe the life and work of one poet each month, but of course Meccano boys are really more interested in engineers, inventors and scientists than in poets. I am sure that if we were to substitute "*Famous Poets*" for "*Famous Engineers*," our readers would descend upon us like a whirlwind. Your four lines of poetry describing the disastrous journey of Owen Moore are pathetic but we seem to have heard them before:—

Owen Moore went out one day,
Owin' more than he could pay.
Owen Moore came back that day,
Owin' more.

J. Hudson (Haworth).—No engineering structure in the world is more wonderful than a huge liner and you will be glad to know that we are preparing an interesting article on this subject. We are delighted to hear that you think the "*M.M.*" is "simply spiffing." If your Dad has to drag you away from the Magazine late at night we expect it is so that he can settle down to read it himself!

L. A. J. Edwards (Streatham).—"When I tried the King of Papers, the '*M.M.*' I gnashed my teeth with rage at being such a fool as not to have tried it before." Perhaps your action was rather strong, Leslie, but it shows the right spirit! We are glad that you have registered a vow never to miss another number. It was very encouraging to hear the opinion of your engineering friend who thinks the "*M.M.*" "ripping" and wishes it had been published when he was a boy. Your idea for a "Hobbies Page" is being considered.

B. Stewart (Newtownards).—"Going down two steps my puppy got his fore-paws on the bottom step while the cart was on the top step. The strap under his body held his hind legs hanging in the air and in trying to get down, his hind legs went so fast I could not see them!" This is a really trying experience for any puppy, B.S., and when the hind legs did ultimately get down, we hope you were duly sympathetic with their small owner. We were startled to hear that on a previous occasion your puppy "sat down and sang a foxtrot," but we conclude that we have under-estimated the musical abilities of terriers although we have three of our own!

Jas. Mason (Lickley).—

"The Meccanograph and Weaving Loom,
And Meccano sets are quite a boon.
The children now, they want a model
As soon as they begin to toddle."

Your other verses are not quite so good, James, although they contain golden truths.

D. C. Todd (Staverton).—Many thanks for your article. You say that it is your first effort in this line and that you submit it in fear and trembling "for we all know how complimentary Editors are to would-be journalists!" Editors are not half so terrible as they are reported to be—in fact most of them are just ordinary human beings with full sympathy for beginners. Never hesitate to send articles to us, for they will always be read with interest and considered carefully with a view to publication.

W. S. Mitchell (Edinburgh).—Your suggestion that we should publish at the close of each year an index for the previous twelve issues is excellent and we think it should be quite possible for us to carry out the idea next December. We already issue a spring-back binder, as no doubt you know. You say you look forward to the time when there will be 100 pages in each issue. We, too, should like that time to arrive, as then we should have plenty of room for the things that even yet are so often "crowded out." We are glad to hear of your success in shorthand and we hope that you will attain the speed at which you are aiming.

C. J. Miller (Southampton).—"When I entered the Competition I felt I had about as much chance of winning a prize as a mouse caught in a trap. You may imagine my surprise when I saw my name as a prize-winner." We are afraid that many readers are too apt to regard their chance of winning a prize as hopeless. The way to win a prize is to tackle competitions in a spirit of confidence. We shall be glad to see a photograph of your wayside station when it is finished. Your cardboard station certainly met with ill-fortune, but after all no one expects people to fall over railway stations!

Miss W. Fornachon (Cambridge).—We are certainly not among those who are shocked when you say that you wish you were a boy. Your enthusiasm for Meccano is very refreshing, and we were particularly interested to hear that "even Mother approves of Meccano now!" although no doubt she was a little startled when you declined the needlework basket and demanded a Meccano set! You appear to have succeeded in getting your own way, no doubt because—as you put it—"I stuck to it like a pot of glue." We have written you separately in regard to the gramophone you propose to make, but although possible in Meccano we fear it is a complicated model to make successfully.

Competition Corner

For Guild Members Only

"Motto" Competition

Nearly five years ago we invited members of the Meccano Guild to submit suggestions for a motto for the Guild. Many mottoes were sent in, but we did not consider any of these quite good enough to be adopted and we determined to ask for further suggestions at a later date. Enthusiasm for the Meccano Guild is now greater than ever before, and therefore we have decided that this is a suitable time to introduce this matter again.

This competition is confined entirely to members of the Guild. Entries must consist of one or more mottoes applicable to the Guild as a whole and expressing its spirit and objects. It is clear that a motto of this kind must be short, and provided that they fulfil the above conditions the mottoes consisting of the fewest words will have the best chance of success.

A prize of 10/6 will be awarded for the winning motto. There are no age limits in this contest and competitors may send in as many mottoes as they like. Envelopes containing entries should be marked "Motto" in the top left-hand corner and should be addressed to the *Guild Secretary*.

Closing date 30th May (Overseas: 30th September).

Essay Competition

"How I spent my Easter Holiday"

By the time this issue of the Magazine is in the hands of our readers the Easter holiday will be over. It is always interesting to look back upon a holiday and recall the many pleasant hours spent and the jolly times we had with our friends, whether indoors or out in the open. Meccano boys are particularly fortunate in regard to independence of the weather during holidays, for if outdoor amusement is impossible there is always the old Meccano or Hornby Railway to fall back upon, with the certainty of hours of keen enjoyment.

We at Headquarters are always interested to hear of our readers' doings at holiday times, and therefore this month we announce an Essay Competition on the subject, "How I Spent My Easter Holiday." Possibly some readers may think that they have no chance in such a competition because their holiday was spent quietly at home without any particularly noteworthy incidents occurring, but this is not the case. The winning essays will be those that give the best account of a holiday, without reference to how or where the time was spent.

The competition will be divided into two sections, (A) for those of 16 years and over and (B) for those under 16. Four prizes will be awarded—Meccano goods to the value of £1/1/– and 10/6 for the first and second in each section respectively.

Essays must not exceed 1,000 words in length and must be written legibly on one side of the paper only, with the competitor's name, address and age on the back of each sheet.

Closing date 30th May (Overseas: 30th September).

Painting Competition

In response to many requests from our readers we are announcing this month a Painting Competition, the subject being "My Hornby Train." This subject was put forward by one of the successful entrants in our recent "Suggestions" competition and we hope to have a large number of entries. A Hornby Train lends itself well to a contest of this kind and we confidently expect some very realistic results. Although we announce this as a "painting" contest, entries coloured in crayon or otherwise will be accepted. The main thing is to produce a realistic reproduction in colour.

The competition will be divided into class (A) for those of 16 and over and (B) for those under 16. We are offering four prizes—Drawing or Painting Materials, or Meccano products if preferred, to be selected by the winners, to the value of 10/6 and 5/– respectively for the first and second in each section.

Closing date 30th May (Overseas: 30th September).

Competition Closing Dates:

HOME.	
Essay (April)	30th May.
Fourteenth Photo	30th May.
Fifth Drawing	30th May.
Guild Motto	30th June.
Easter Holiday Essay ...	30th June.
Painting (Hornby Train) ...	30th June.
Fifteenth Photo	30th June.
OVERSEAS.	
Twelfth Photo	30th June.
Fourth Drawing	30th June.
Essay (March)	31st July.
Thirteenth Photo	31st July.
Essay (Inventors)	31st July.
Essay (April)	31st August.
Fourteenth Photo	31st August.
Fifth Drawing	31st August.
Guild Motto	30th September.
Easter Holiday Essay ...	30th September.
Painting (Hornby Train) ...	30th September.
Fifteenth Photo	30th September.

Results

Fourth Drawing Contest

A great many of our readers took advantage of this drawing contest, the subject of which was a "A Petrol Motor Bus or Motor Lorry." Competitors still further showed their artistic abilities with pen and pencil and quite a number of the drawings received were remarkably good, the details being well brought out. Under the circumstances it was a most difficult problem to adjudge the winners, but after very careful examination it was decided to award the prizes as follows:—

Class (A), 16 and over, First Prize (Drawing or Painting materials or Meccano Products value 10/6), S. Sharvell (Wembley); Second Prize (Drawing or Painting materials or Meccano Products value 5/–), S. Howson (Cumberland). In Class B, under 16, similar prizes were awarded to L. Lee (Surrey) and F. Weeks (Middlesex) respectively.

Twelfth Photographic Contest

Many excellent photographs were received in this competition, the subject of which was a "Bridge, Viaduct or Aqueduct." Bridges of all kinds were "snapped," ranging from the Forth Bridge to a small rustic bridge crossing a stream, and the detail in the photographs in most cases was excellent. In passing we may mention that we should like to see more competitors doing their own developing and printing.

In section A, under 14, B. Sandham (Preston) has been awarded the first prize, Meccano Goods value 10/6. for his fine snapshot and enlargement of the Forth Bridge. The second prize, Meccano Goods value 5/–, was won by L. E. Ashforth (Birmingham) for a snap of the Cuthadam Bridge. In section B, 14 and over, similar prizes were won by D. J. Kendrew (Southport) and F. G. Clements (Luton).

Third Cross Word Puzzle Contest

We endeavoured to make this puzzle a little more difficult than the previous "Cross Word," and it certainly proved a "teaser," for the number of entries was much smaller than in the previous contest. Many readers made a valiant effort to solve the puzzle and a considerable number submitted very creditable efforts. We were glad to notice a considerable improvement in the original puzzles submitted. These on the average were not only much more carefully prepared but also they showed a very considerable amount of ingenuity.

All entries were treated on their own merits and it was finally decided to award the three prizes offered as follows: First Prize (Meccano Goods value £1/1/–), Alan G. Pirie (Glasgow); Second Prize (Meccano Goods value 10/6), Ian Lamb (Broughty Ferry, Forfarshire); Third Prize (Meccano Goods value 5/–), Helen Holtby (Worthing).

We heartily congratulate the prize winners, especially Helen Holtby, on their really excellent entries.

Overseas Result

Christmas Puzzle Contest

Boys of every age from all over the World entered this popular puzzle contest, and although the entries were not quite so numerous as those in the Home Section there were quite enough to keep us extremely busy.

Every individual entry was examined very carefully and we found that several competitors had sent in the correct solutions to all the puzzles they selected. After the fullest consideration, and in accordance with the rules governing this contest, in which neatness played an important part, the prizes were awarded as follows:—First Prize (Hornby No. 2 Goods Set), T. G. Young (Auckland, New Zealand); Second Prize (Hornby No. 2 Tank Loco), J. S. Anderson (Tasmania, Australia). Three other prizes consisting of Meccano Radio Receivers or Headphones were awarded to E. H. Craft (New South Wales, Australia), N. Montgomery (Melbourne, Australia), and D. Moore (Tasmania).

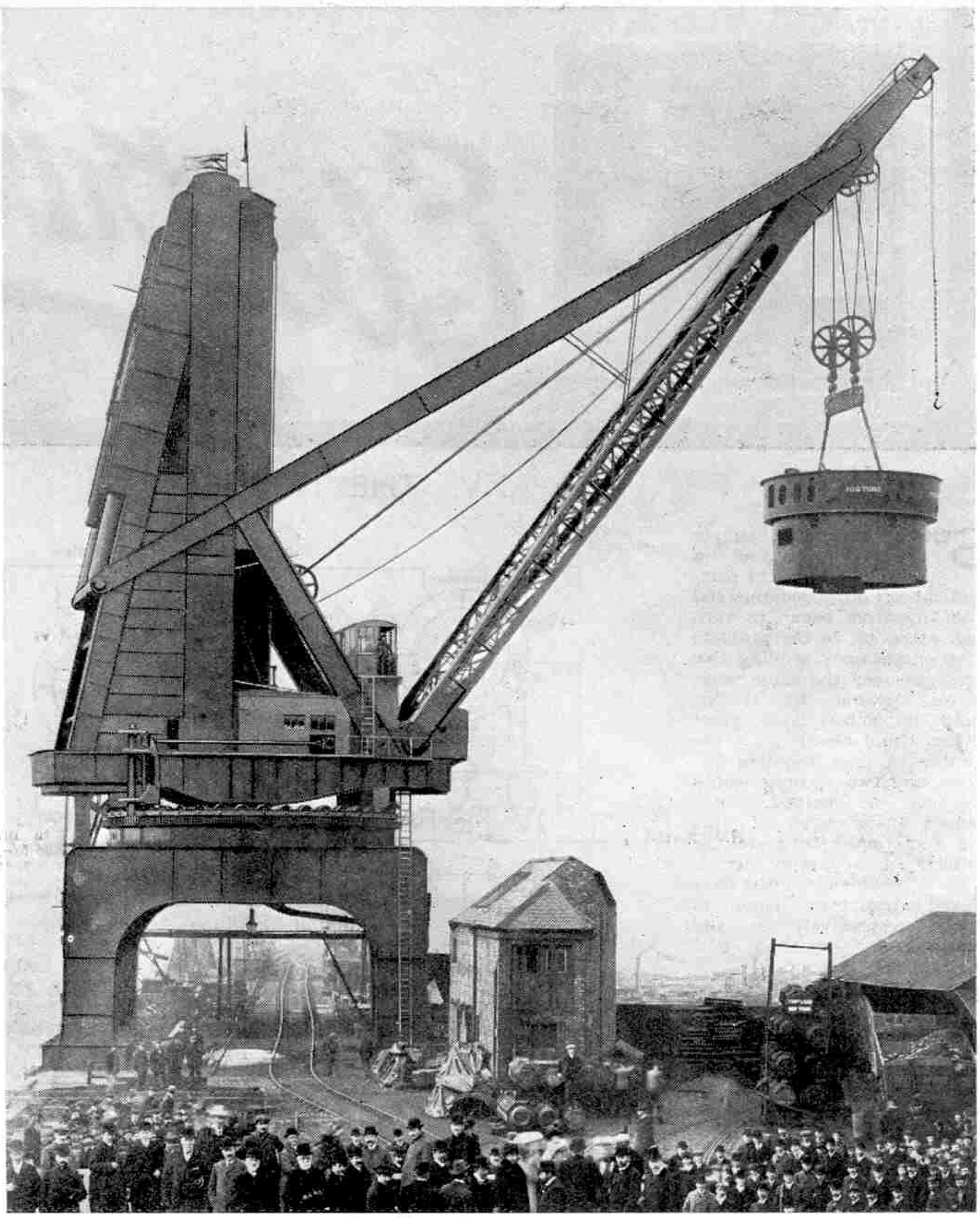
(*Continued foot of next column*).

A Fine Crane

By the courtesy of Messrs. Sir W. G. Armstrong Whitworth Ltd. we are able to illustrate on this page a special hydraulic crane, which is also shown on our cover this month. This fine crane is of 200 tons capacity and was used in the shipment of the 2-8-0 locos. built for the Belgian State Railways by the same firm, and described elsewhere in this ussue. The crane should form an excellent model for reproduction in Meccano.

As will be seen from the illustration the jib and operating mechanism is mounted on a massive base. This pivots on a central pillar and rotates on a roller race, which is fitted with rack gearing on its outside edge. Meshing with this racking gear is a pinion wheel, which is driven through a vertical rod by bevel gearing to a horizontal rod that, through bevel gearing again, transmits power from the engine.

The movement of the jib is controlled by pistons that are directly connected to the guide arms, and as full play is given to the movement of these pistons it follows that the jib can be raised or lowered through a very wide arc.



"Lynx-Eyed" Contest Solution of Third Series

Owing to the Overseas Section of this contest not closing until the 30th April we have not been able to publish the solutions before this date. Hundreds of entries were received in this contest and we made it a point of giving a prize to each competitor who sent in a correct solution. In accordance with the rules laid down in the event of a tie, the first three prizes were awarded to those whose entries were the neatest.

We now give the correct solutions to the three sets of Puzzle Pictures appearing in the October, November and December issues of the "*M.M.*" respectively:—First Set:—Picture No. 1, Model No. 335. (2) 20, (3) 314, (4) 105, (5) 215, (6) 42, (7) 339, (8) 203, (9) 330, (10) 223, (11) 305, (12) 130. Second Set:—(13) 343, (14) 33 (15) 241, (16) 115, (17) 224, (18) 228, (19) 244, (20) 64, (21) 253, (22) 47, (23) 217, (24) 131. Third Set:—(25) 317, (26) 3, (27) 220, (28) 41, (29) 309, (30) 220, (31) 116, (32) 50, (33) 107, (34) 204, (35) 17, (36) 128.

Shipping Locos. Overseas—

(*Continued from page* 215)

as Liverpool varied and interesting shipments of a similar nature are constantly being made. Only a few weeks ago, for instance, the King of Egypt's State Railway Coach was lifted by the "*Hercules*" and deposited on board the deck of the S.S. "*Amarapoora*" to be shipped to Port Said.

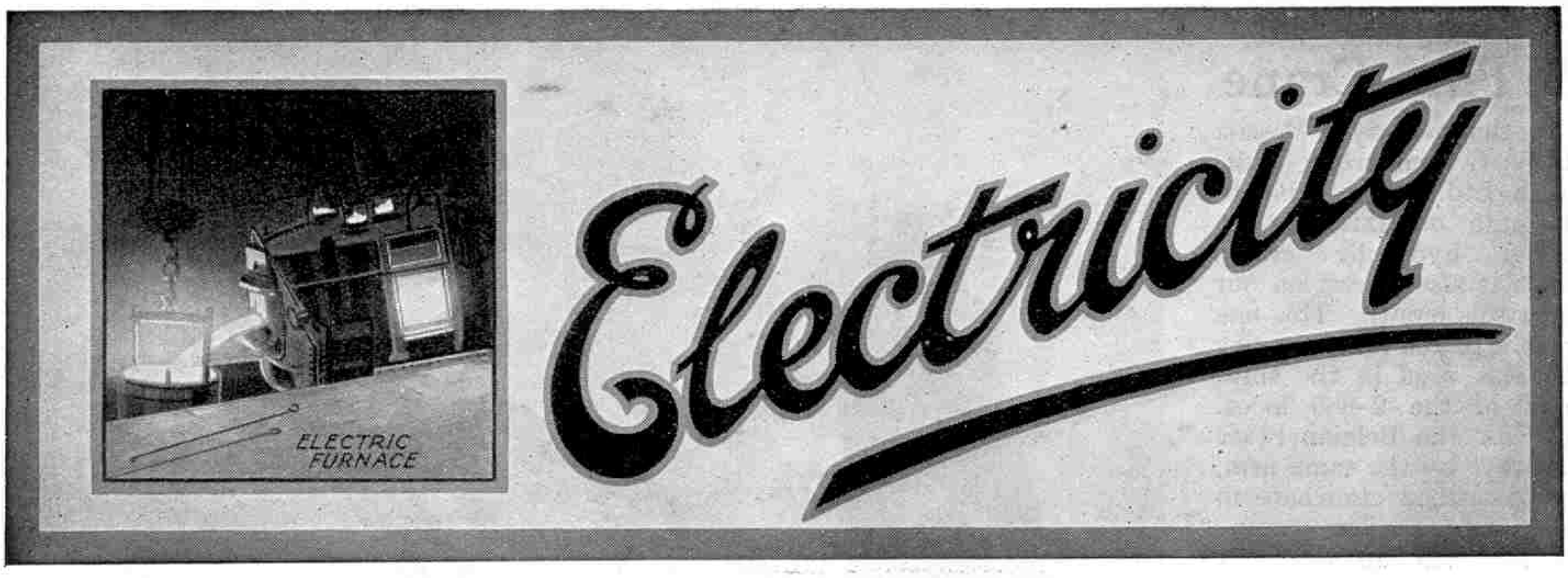
No doubt many of our readers saw this luxurious coach when it was on view at the Wembley Exhibition last year. In this connection it is estimated that nearly two million people inspected it, inside and out, at Wembley.

The Coach is 70 ft. in length and weighs 60 tons. There are six compartments, comprising vestibule, lounge, bureau, bedroom, bathroom, and a room for the King's valet. The lounge is decorated after the Louis Quatorze period, the bureau in the Adams style and the bedroom in the Louis Sieze style, with white and old gold predominating.

A Vision of Cream and Gold

It is fitted with electric heating to supply hot water for the bath and wash basins. The exterior is painted in cream colour, picked out with gold lining, and each centre panel has a hand-painted reproduction of the Royal Coat-of-Arms. The coach is, indeed, regarded as one of the most luxuriously appointed state vehicles on any railway.

Owing to the great width of the coach special arrangements had to be made for its conveyance to Birkenhead. It was placed on special bogies on the L.M.S. Rly., at Birmingham (where it has been stored since the exhibition) and all traffic was stopped during its journey to Birkenhead. Special care had to be taken in lifting it so as not to strain the under-carriage unduly, and the precautions in this connection, and also in the shipping of the coach, were of an elaborate nature.



XV. THE TELEGRAPH

SOON after the simple telegraph became a practical means of communication on a commercial scale inventors began to turn their attention to the problem of simultaneously sending two messages over the same wire. It was obvious that if this could be achieved a great saving would result, since the number of lines required between any two stations would at once be halved. After various unsuccessful attempts had been made to solve the problem, two methods were evolved which ultimately proved satisfactory. These are known respectively as the "differential" method and the "bridge method."

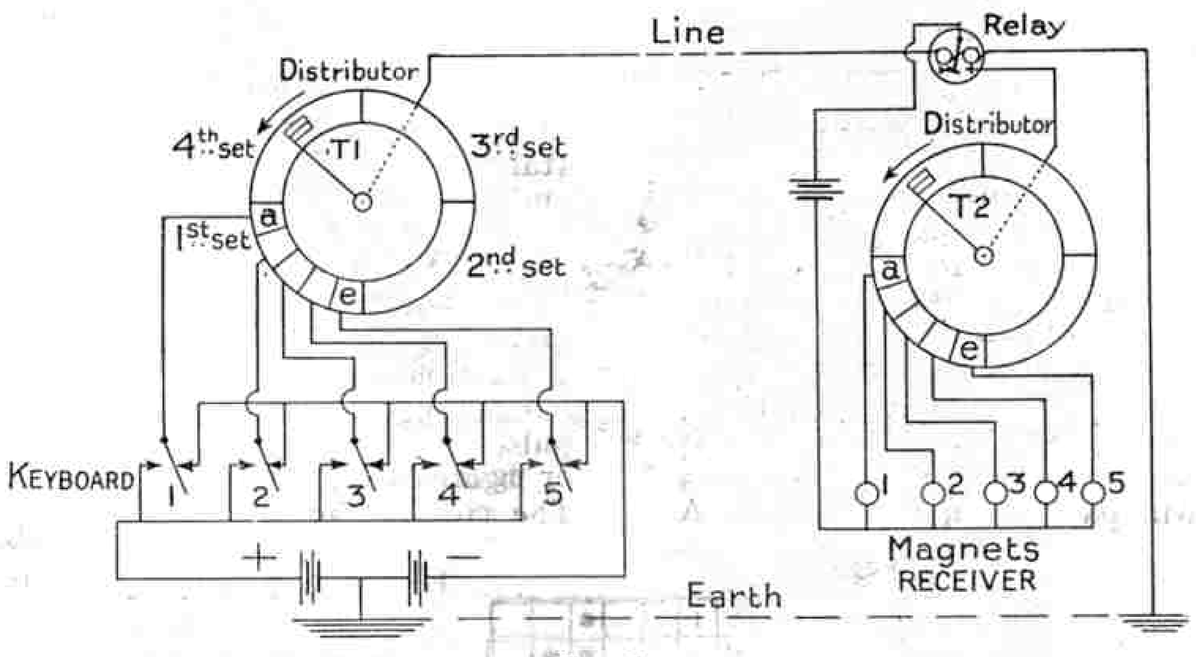


Fig. 1

The Differential Method

The differential method is so called because it makes use of double or differential windings on the relay. The circuit is shown in Fig. 4. When the key K is depressed so that pivot "p" is electrically connected to the stud "b," a current will flow from the battery BB through the key to the link BC on the relay. Here the current divides into two equal parts, one of which passes through each winding of the relay. One part of the current then flows by way of terminal A to line, and the other part through D, resistance R and condenser X to earth.

The values of the resistance and the condenser are so adjusted that they exactly balance the resistance and capacity-to-earth of the line, and the technical name for these two units is "artificial line."

Since the real and artificial lines are identical so far as the current arriving at BC is concerned, this current splits up into two exactly equal portions, and these, passing in opposite directions round the magnets of the relay, neutralise each other's magnetising effect and so do not act on the armature of the relay.

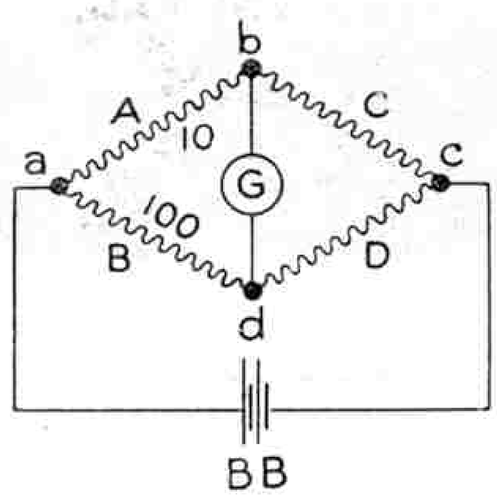


Fig. 2

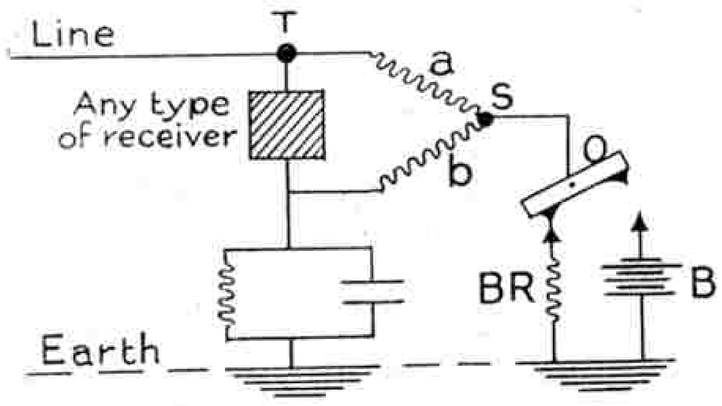


Fig. 3

Path of Received Current

A received current passing along the line enters the relay at A, flows through one of the coils of the magnet to C, and thence passes to the key K. If the key is in the position shown in the diagram the current flows through the back stop "a" and the resistance BR—adjusted to equal the resistance of the battery BB—to earth. If the key is depressed when the current arrives at "p" the current flows through the battery BB to earth. Since the current flows only through one coil of the magnets, these act on the armature and complete the circuit consisting of this armature, the sounder S and the sounder battery SB.

If the key happens to be in the midway position, however, so that it is not making contact with either "a" or "b," the received current, having passed through the first coil of the relay, will pass through the second coil from B to D, going round the magnets in the same direction and thence through the artificial line to earth. The added resistance of the line, of course, halves the current, but this now passes round the magnets of the relay twice as many times as formerly, and therefore acts upon the armature of the relay with as much force and certainty as before. Thus both stations are able to transmit and receive messages to and from each other at the same time without the slightest interference taking place.

The early difficulties encountered in duplex telegraphy were due mainly not to faulty method but to the fact that no allowance was made for the capacity of the line to earth. Until this factor was taken into consideration the artificial line could not be electrically identical with the actual line.

The Wheatstone Bridge

Another system of duplex telegraphy much used is shown in Fig. 3. This is known as the bridge method, owing to its similarity to the well-known method of measuring

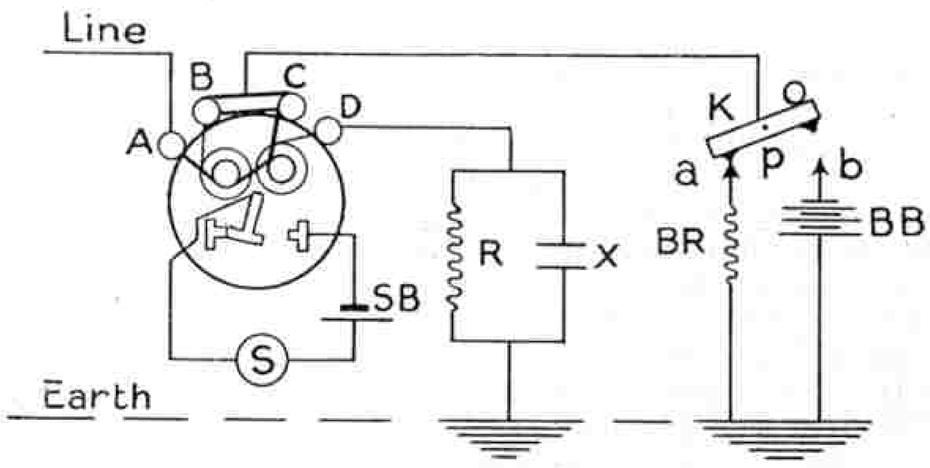
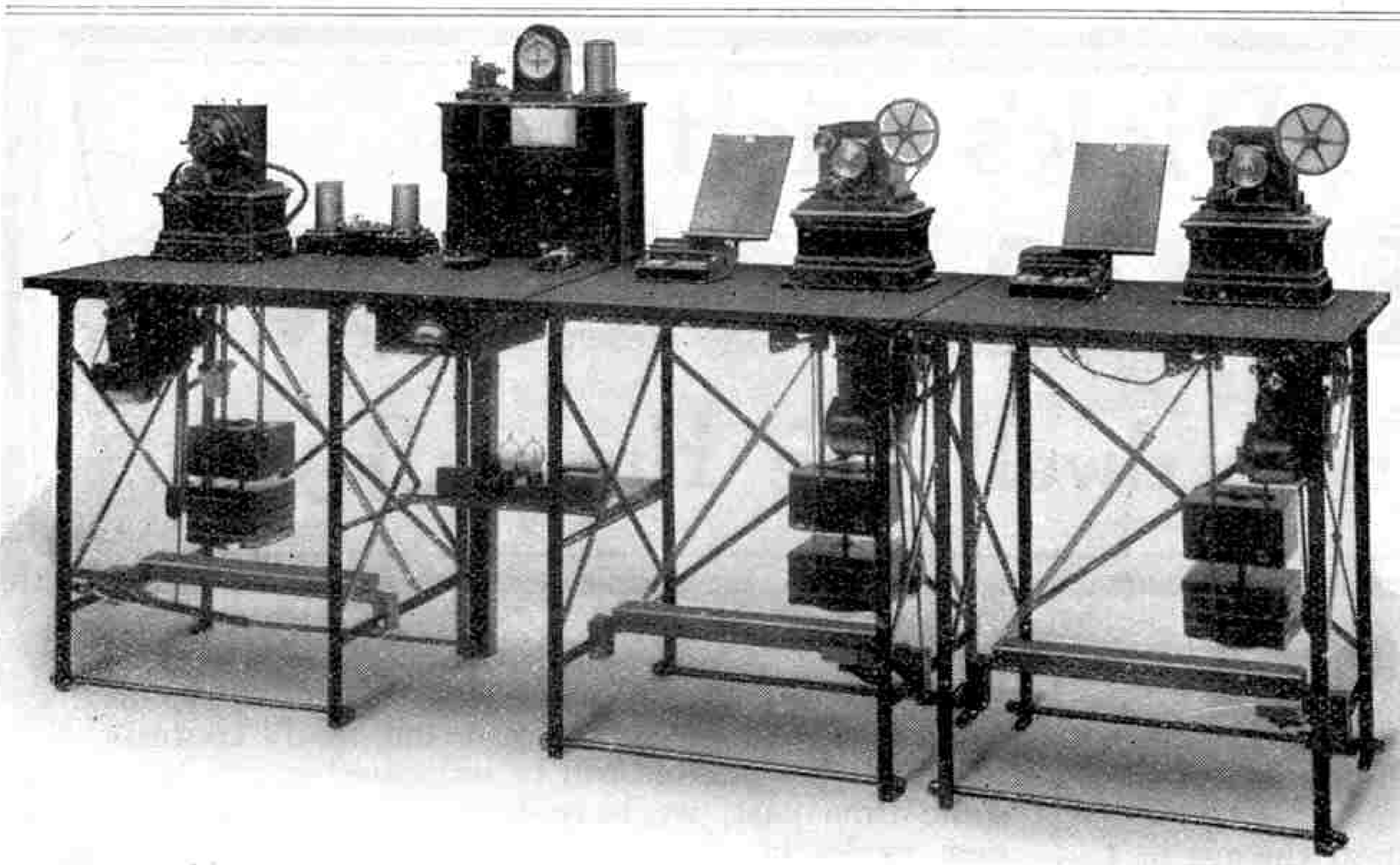


Fig. 4



Courtesy] [*Messrs. Siemens Bros. & Co. Ltd.*

Fig. 5. Baudot simplex double station set

the value of an unknown resistance by means of a Wheatstone bridge.

The diagram of the circuit of the Wheatstone bridge is shown in Fig. 2, in which A and B are two known resistances of, say, 10 and 100 ohms respectively, C is a variable resistance and D is the unknown resistance to be measured. At G is an ordinary galvanometer and the more sensitive this is the more accurate will be the final results. There is a small battery at BB.

It is clear from the diagram that the current from the battery, upon arriving at "a," will divide in the proportion of 10 to 1, since this is the ratio of the two resistances A and B. This means that ten times as much current will pass through resistance A as through resistance B.

Now, if the resistances C and D are also in the same proportion, no current will flow through the galvanometer and the needle will not be deflected. Hence, if we adjust the variable resistance C until the needle is not deflected at all, we know that D is then ten times the resistance of C. We know the value of C, and therefore it is quite easy to calculate from this the resistance of D. This is the usual method of measuring electrical resistance and the Wheatstone bridge is one of the most useful pieces of apparatus in the possession of the electrician.

The bridge method of telegraphy (Fig. 3) operates as follows. When the key is depressed, current flows

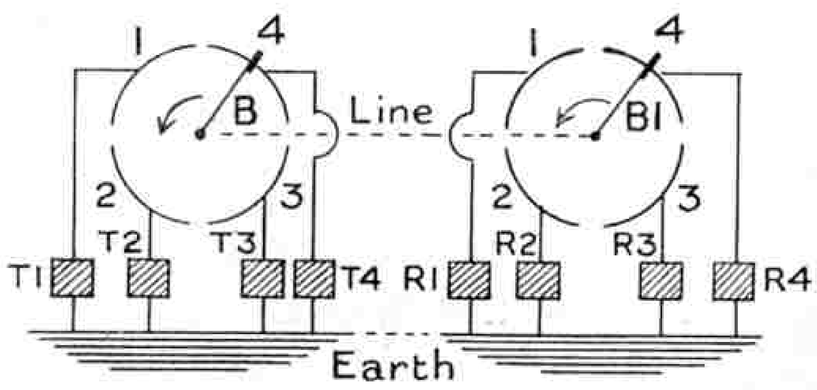


Fig. 6

from battery B and splits at S, part going through the resistance "a" to line and part through "b" to the artificial line and to earth. If the resistance "a" bears the same proportion to the resistance "b" as the resistance and capacity of the line bear to the resistance and capacity of the artificial line, no current will flow through the receiving instrument. This method possesses the advantage that any type of receiver may be employed, thus making the system suitable for cable telegraphy.

Multiplex Telegraphy

Multiplex telegraphy is a system whereby a large number of messages may be sent over one wire at the same time. The method consists of having, say, four transmitters at one end and the same number of receivers at the other end. Each of the transmitters is connected in turn to the line by means of the rotating brush B, Fig. 6, where T1, T2, T3 and T4 are four transmitters. At the receiving end is a corresponding rotating brush B1 that connects the four receivers R1, R2, R3 and R4 to line. The two brushes rotate at the same speed, and thus R1 receives only from T1, R2 receives only from T2, and so on.

This method may be employed for more than four transmitters and receivers if desired. Our diagram merely shows the principle of the apparatus, and in actual practice various modifications have to be made. The greatest difficulty lies in the motors driving the brushes, for the two independent motors at the two stations must both revolve at exactly the same speed in order that the two brushes may keep pace with one another. The transmitters and receivers may be of almost any type.

The Baudot System

The foregoing method of transmission is no longer used in Great Britain, but the Baudot system of multiplex type-printing telegraphy utilises a very similar method. This system is used extensively in the British Post Office, in the French telegraph services, in Italy, Russia and other countries in Europe, as well as in India and Ceylon.

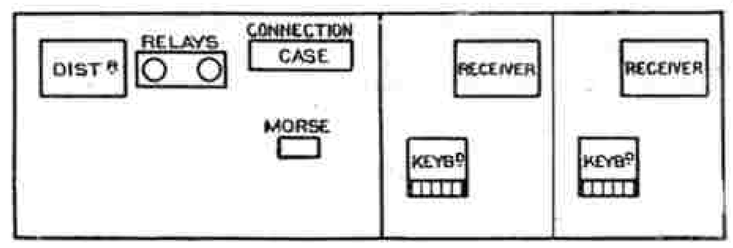
The Baudot system was first used commercially in France about 1877, and in recent years its use has increased very greatly owing largely to its adaptability to many different types of telegraph service.

In this system the Morse alphabet is not used, but instead five pulses of current are used to denote each letter. These pulses may be either positive or negative currents, and letters or figures are indicated by altering the arrangement of the pulses. The code is shown in the accompanying table (Fig. 7).

The pulses are controlled by a keyboard with five letters. A simplified wiring diagram of the circuit of one sending and one receiving station is shown in Fig. 1, from which its similarity to the multiplex system already described will be seen.

360 Words a Minute

The two trailers T1 and T2 rotate in unison. Thus segment "a" at the sender is connected to line at the same time as the "a" segment at the receiver, and so



Courtesy] [*Messrs. Siemens Bros. & Co. Ltd.*

Fig. 8. Plan of set illustrated in Fig. 5

on. Each of the five keys at the sender is an independent reversing switch and if the correct keys to indicate a particular letter are pressed while the trailers are passing over segment "a" to "b," the reversed currents will act on the polarized relay and these particular magnets in the receiver will receive an impulse of current. Thus if keys 1 and 4 are pressed, magnets 1 and 4 will be energised.

These magnets produce certain mechanical movements in the receiver, causing the letter corresponding to the pressing of keys 1 and 4 to be printed on a strip of paper tape.

Each of the four sets of segments on the distributors is connected to separate transmitters and receivers and thus four messages can be sent along the line at once, each sender transmitting one letter per revolution of the trailers. This occurs 180 times a minute, and in consequence a quadruple set sends out 720 letters or about 120 words per minute.

A sextuple duplex—the first of which was installed in England in December 1913—sends 360 words a minute.

In order that the operator shall know when to press the keys, a cadence note sounds

(*Continued on page* 247)

A	1			●		
E'	&			●	●	
E	2				●	
I	⅊				●	●
O	5			●	●	●
U	4			●		●
Y	3					●
B	8		●			●
C	9		●	●		●
D	0		●	●	●	●
F	£		●		●	●
G	7		●		●	
H	⅊		●	●	●	
J	6		●	●		
K	(	●	●	●		
L	=	●	●	●	●	
M	)	●	●		●	
N	№	●	●		●	●
P	%	●	●	●	●	●
Q	/	●	●	●		●
R	–	●	●			●
S	;	●				●
T	!	●		●		●
V	'	●		●	●	●
W	?	●			●	●
X	,	●			●	
Z	:	●		●	●	
⅊	.	●		●		
⅊	⅊	●	●			
FIGURE SPACE			●			
LETTER SPACE		●				
KEYBOARD		V	IV	I	II	III

Courtesy] [*Messrs. Siemens Bros. & Co. Ltd.*

Fig. 7. The Baudot Alphabet

(Continued)

"ABOUT what age do boys usually take up Meccano, and when do they leave off building with it?" I asked.

"Tens of thousands of boys take it up at the age of 4 or 5, practically as soon as they can use a screw-driver," replied Mr. Hornby. "As far as I can see, they give up building with Meccano only when they die!"

"The most suitable age is anywhere between 5 and 70. Young boys play with it for the fun of building machines and seeing them operate. Boys from 14 to 20, who have reached the thinking age, find in Meccano something more than a hobby for their leisure hours. Through Meccano many of them have discovered that they have a natural gift and inclination for engineering work. They are making engineering their profession in life and solving the great question of their future career in the best way of all, that is by their own free choice and inclination. They take up real work, still encouraged and instructed by the hobby that they began as children.

"Then grown men — professors, draughtsmen and engineers—use Meccano for building scientific instruments, models of inventions, new devices and for trying out ideas. Here is a file of letters from men all over the world who have written to tell us that they are using Meccano every day of their lives for one thing or another, and by doing so are saving thousands of pounds that they would otherwise have to pay for models and patterns with which to try out their ideas."

A Hundred Thousand Models

"All this is very interesting indeed," I said, "and I am beginning to wonder why boys ever buy any toy other than Meccano. How many models do you think your biggest Outfit will make altogether?"

"That is a question," replied Mr. Hornby, "which I hope never to be able to answer. We show over 400 in our Manuals, and we have hundreds and hundreds of new ones, as yet unpublished, and each of them is as good as any we have ever had.

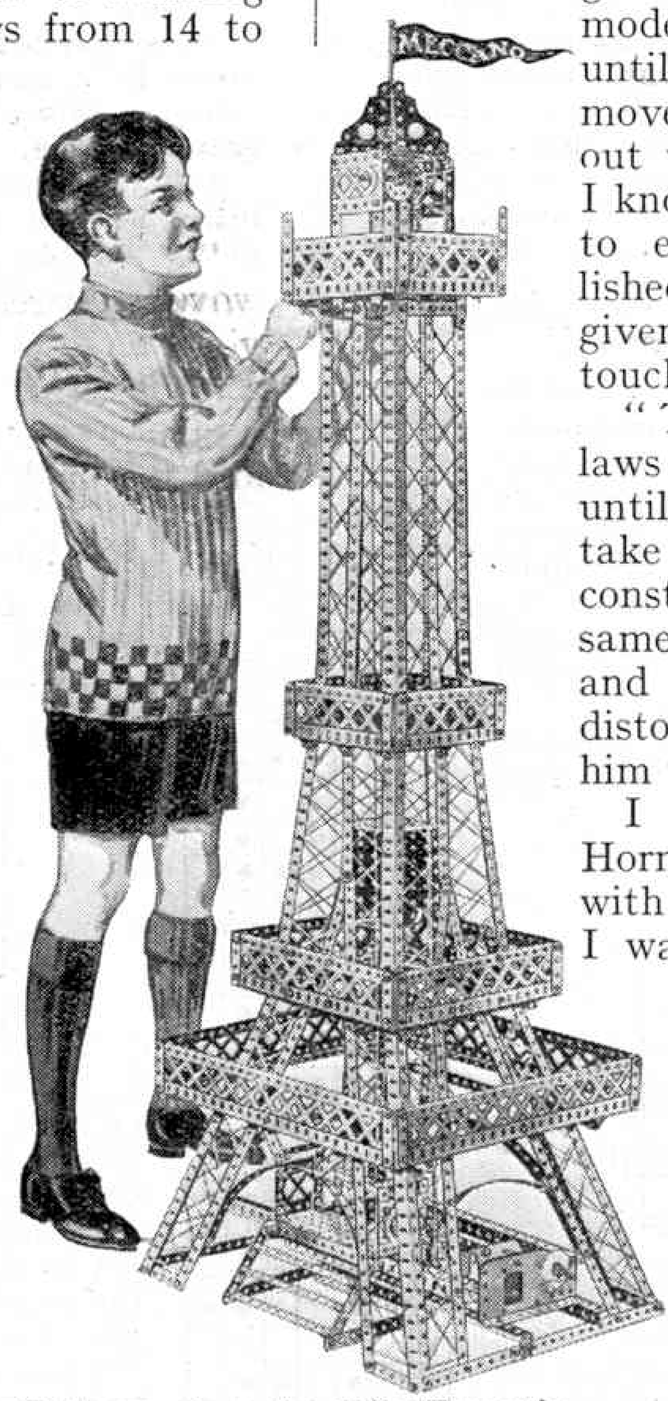
"New ideas for models reach us every day. Over a hundred thousand have been sent in for the Meccano Prize Contests by competitors—and I can tell you that as long as our staff of expert model-makers produce at their present rate, and as long as Meccano boys continue to show the same ingenuity in our many contests, the new models available will be unlimited in number. For some time past, we have been describing at least one new model in every issue of the *Meccano Magazine*."

Don't Buy an Imitation

"When Meccano was first invented it was possible to build only simple models with it, but as new engineering parts were added to the system, models of a much better type became possible, until now we claim that there is no mechanical movement known that cannot be worked out with Meccano. This is a strong claim, I know, but it is the fidelity of Meccano parts to engineering principles that has established the supremacy of the hobby, and given it a standing that competition cannot touch.

"The Meccano system is based on the laws of engineering and mechanics, and until these laws are superseded nothing can take its place. Take it from me, any other constructional toy that attempts to do the same thing in any other way is unscientific, and will do a boy more harm than good, distorting his mind instead of furnishing him with useful knowledge."

I felt that I wanted to interrupt Mr. Hornby to tell him how cordially I agreed with all he said, and how full of admiration I was for the great work that he and his Company were doing among boys like my own. His enthusiasm and earnestness were wonderful things to me, and I found myself beginning to share them.



Dick examines the Eiffel Tower in Meccano

A Loom that Weaves

As he finished speaking he crossed over to a small table and brought back with him a model, the mechanism of which was about as complicated as anything I had ever seen.

"Look carefully at this model," he said. "It is the Meccano Loom. It was designed by a man who has made textile engineering his life-study and business. Every part used in it is a Meccano part, which may be purchased from any Meccano dealer.

"It is at present set to weave a length of coloured material suitable for a tie or hat-band, and I want you to notice how regular and perfect the material is—in fact it is just as good as the best you could buy in a first-class store. Now watch! I am going to

weave a little of the material for you."

He commenced to turn the handle, and instantly the whole machine came to life. The healds worked up and down in regular rhythm; the reed swung backward and forward, closing up the material, and the shuttle darted from side to side, leaving a trail of bright blue thread behind it, called the "weft," I believe.

The above illustration shows some of the beautiful material that may be made with the Meccano Loom. Unfortunately, it is not possible to reproduce the finished product in colours, so that the illustration gives but a poor idea of the attractive appearance of the finished fabric, the patterns of which are worked in blue, orange, gold, red, etc.

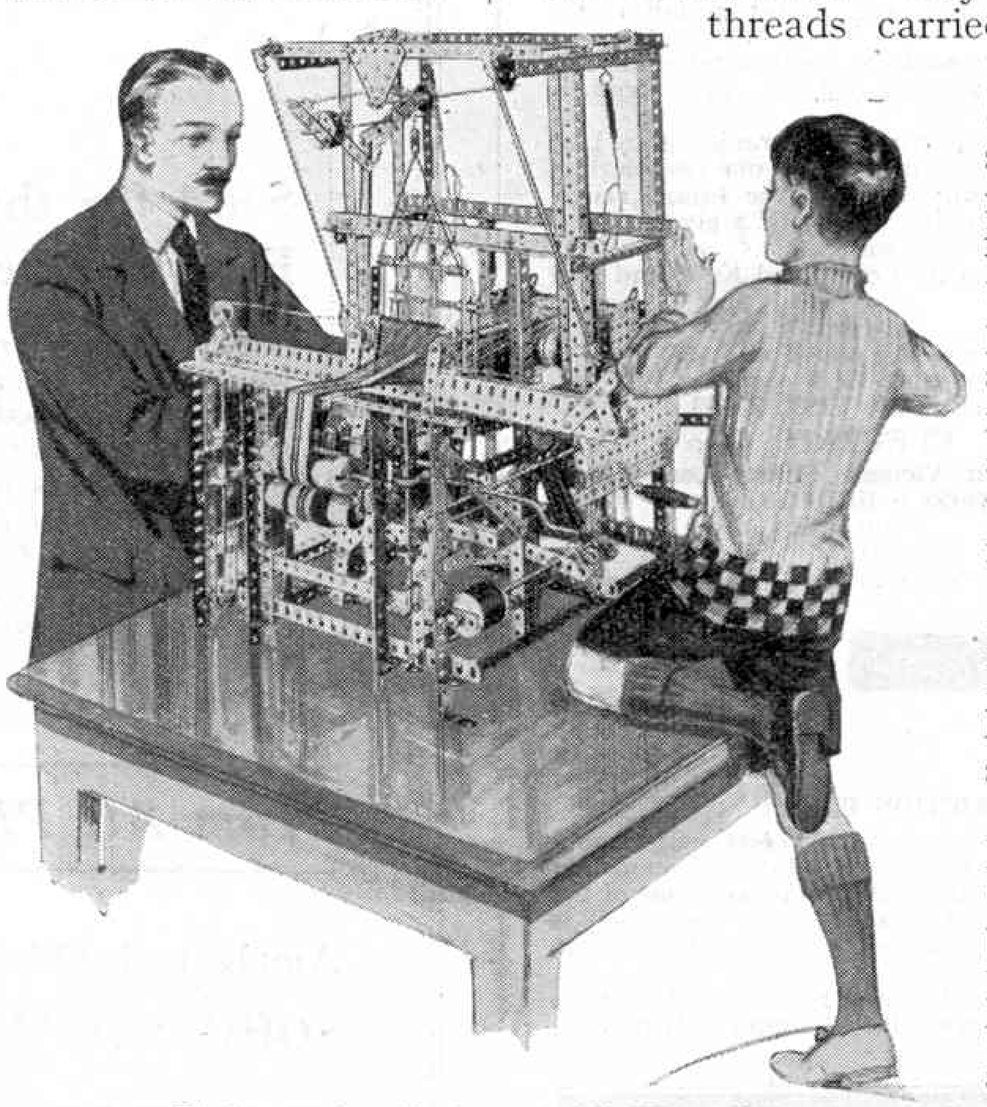
Before our astonished eyes a piece of most beautiful fabric was being woven, and anything more fascinating it would be impossible to conceive. This was a triumph of mechanism that I had never expected to see, and I was quite willing to believe Mr. Hornby's statement that no mechanical or engineering movement was impossible to Meccano. I was so fascinated with the model that I believe I should have stolen it if Mr. Hornby had not been in the room—I wanted it for myself and Dick!

I Become a Weaver

As I fingered the beautiful fabric over and over again, I could scarcely realise that I had actually seen it being woven. I took hold of the handle myself, and as I did so I wondered if the machine would be as obedient to me as it had been to Mr. Hornby. I commenced to turn, and felt a thrill of eager expectancy such as I had not experienced for many a long year.

Again the machine sprang into life, every little part of it seeming to know exactly what to do and just when to do it. I was fascinated by the "zip-zip" of the shuttle as it shot backward and forward between the threads of the warp, leaving in its track a little blue line of weft, which the reed instantly pressed firmly into the finished fabric.

"Now you see for yourself," said Mr. Hornby, "that weaving with the Meccano Loom is delightfully simple. All that is necessary is to turn a crank handle—the model does the rest. I should mention, perhaps, that there is a certain knack in turning the handle, but this is soon acquired. Perhaps the only difficulty is to get the edges of the material even, but this comes easily after a little practice.



. . . Dick was frantic to get at it himself . . . .

"Fabric woven with the Meccano Loom makes beautiful hat-bands or neck-ties. Tastefully woven, these will make excellent gifts for your friends, Dick. Imagine their surprise when you tell them the fabric is made to your own design on a model loom of your own construction."

Here Mr. Hornby took out a dozen beautiful fabrics from a drawer.

"Look at these," he said. "All these fabrics were woven entirely on a Meccano Loom from silks such as you buy in the hank or in bobbins. They represent only a few of the infinite number of patterns obtainable, the designs of which depend entirely upon the mechanical skill and the artistic ability of the person working the Loom.

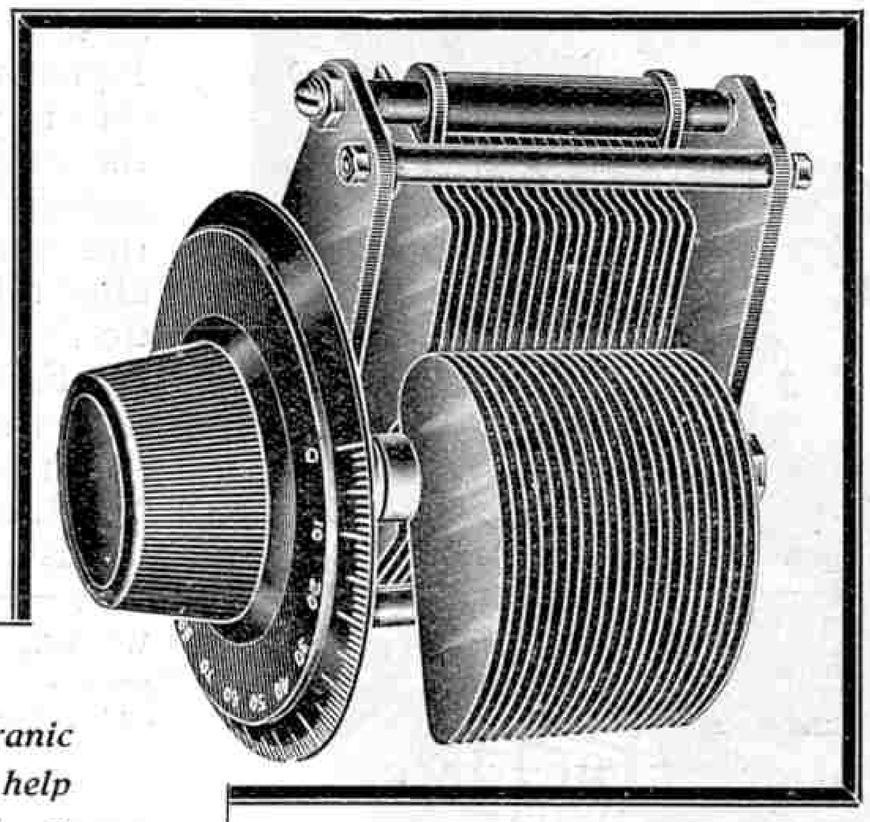
"If it is desired, fabrics that are entirely plain may be woven, or a simple or intricate pattern introduced at will, in any chosen colour. The width of the material depends upon how you construct your Loom. On all Meccano Looms the fabric may be woven to any desired length, however, for when the threads of the warp are exhausted they may be joined to more threads carried on a second beam, and the process continued indefinitely. Similarly, when the weft in the shuttle has all been used, a new shuttle may be slipped into position in an instant and the weaving continued. The process need not be completed at one operation, as weaving may be stopped at any time and re-started when required, without the continuity of the material being broken."

"Could we buy one of these Looms to-day?" I asked Mr. Hornby. "I am sure we should like to take one back with us, shouldn't we, Dick?"

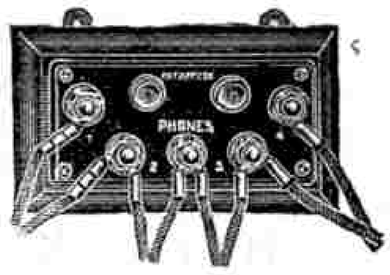
"You cannot buy the Meccano Loom," Mr. Hornby replied. "You see we do not sell models but Meccano Outfits, and the Loom is built with the same parts that make the Clock, the Chassis, and hundreds of other models."

(To be concluded)

IGRANIC SQUARE LAW CONDENSER

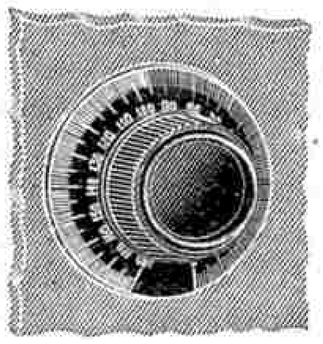


Some Igranic Devices to help you build a better Radio Set



IGRANIC TELEPHONE CONNECTOR

A handsome and useful addition to any set. Provides connections for addition of four pairs of telephones. Easy to fit. Price **8/6**



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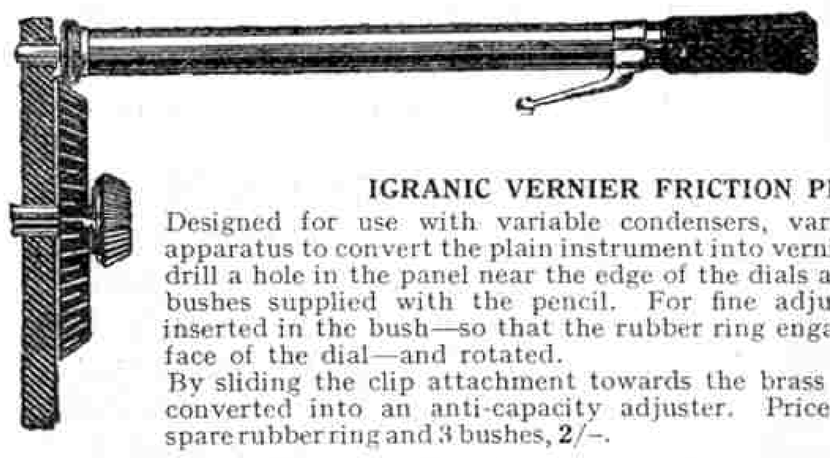

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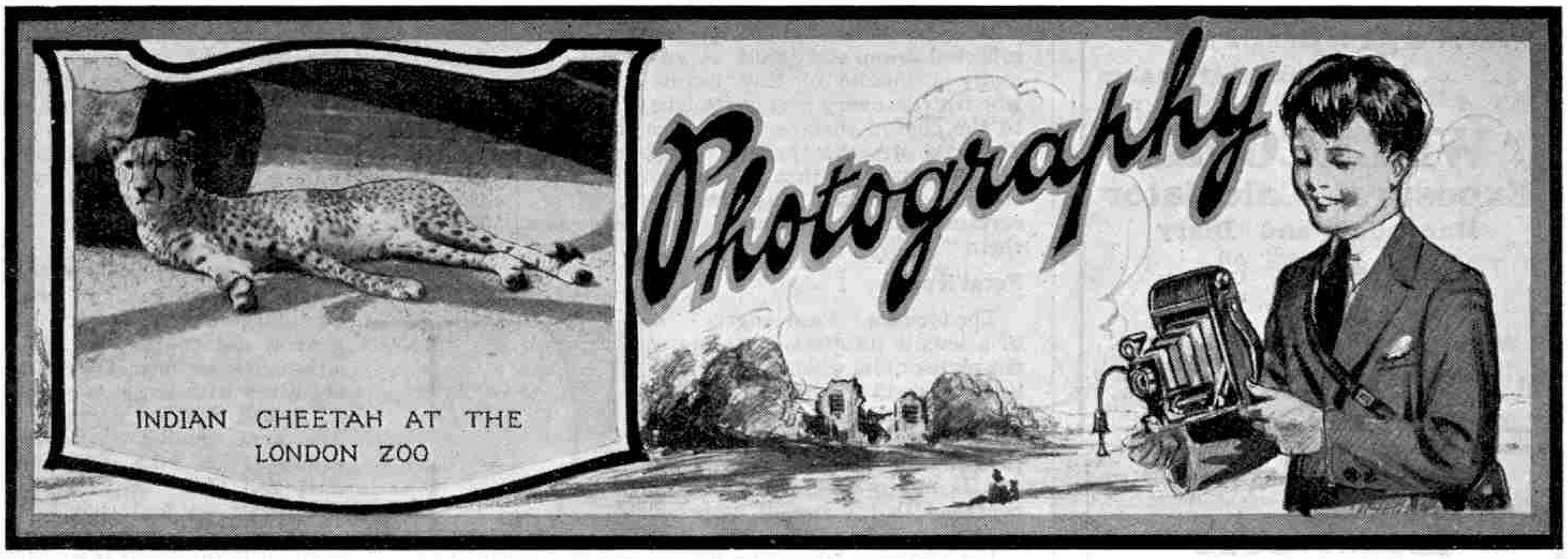

II. CAMERA LENSES

LAST month we dealt with the various types of cameras and the question of the choice of plates or films. Now we come to an equally important consideration, that of the lens and shutter. Usually standard lenses and shutters are fitted in the cheaper cameras, but as a rule the purchaser of a better camera has the choice of one or more makes or types of lenses, and, perhaps, of shutters also. Different lenses serve different purposes and this article will give you some idea of the principles involved, so that you will more easily be able to choose a lens to serve the particular purpose for which it is required.

It is a common experience for an "old hand" at photography to be told, on showing a particularly fine specimen of his work, "You must have a wonderfully good lens." This remark is made time after time by people who have no knowledge of photography, and it shows that they attribute the excellence of a photograph almost entirely to the quality of the lens.

No greater mistake can be made, for although a good lens must obviously be better than an inferior one, yet without knowing the condition under which a particular photograph was taken it is impossible to say whether the photographer used a lens of the highest quality or one that would be classed as inferior.

Pinhole Cameras

No doubt at some time or another most Meccano boys have possessed what is known as a "pinhole" camera. This is a camera without a lens and in which the photograph is taken by means of a tiny hole pierced through the front of the camera. Such a camera is of little practical use for a reason that we shall see in a moment, but it serves to illustrate the principle of the lens.

Every object that we are able to see reflects rays of light from every point, and as light always travels in straight lines, each of these rays travels in a straight line from the point on the object from which it is reflected.

If we place a sensitive plate in some kind of frame and hold it up in front of a building, such as a church, with the idea of taking a photograph, we shall fail utterly because when we come to develop the plate it instantly turns black all over and is useless.

The reason of this is that every part of the plate receives rays of light from every part of the church and the result is hopeless confusion. In order to photograph the church we must arrange matters so that the rays from the nave fall only on one part of the plate, the rays from the tower only on another part, and so on. In the case of a pinhole camera this is done by enclosing the plate in a box that is light-tight except for a tiny hole in the end of the box opposite to the plate. The effect of this is to allow only one set of rays from each part of the building to reach the plate, other rays that are not wanted being excluded.

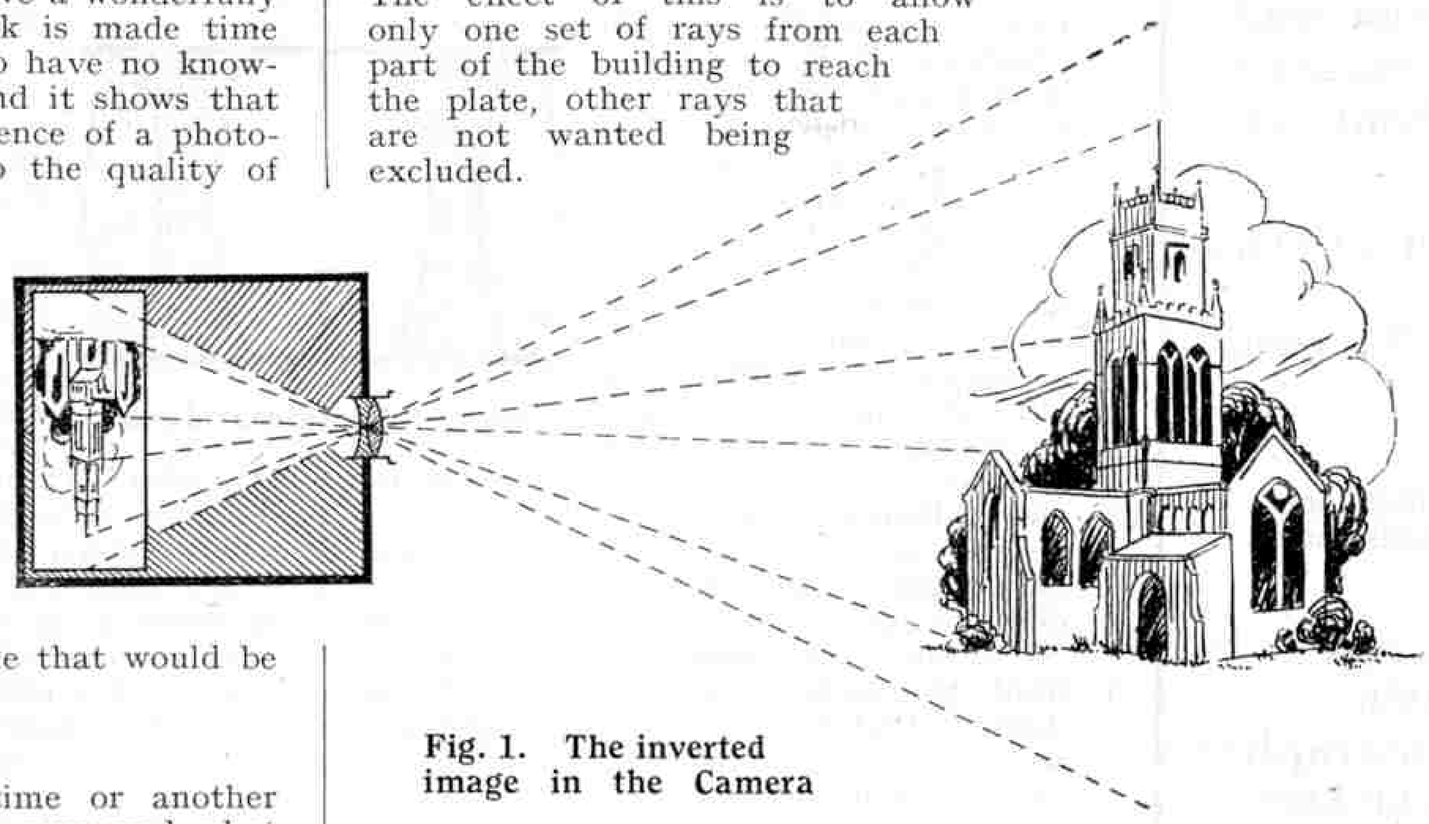

Fig. 1. The inverted image in the Camera

Because all rays of light travel in straight lines, the course of rays reflected from any object is that shown in Fig. 1. Each bundle of rays that passes through the pinhole into the camera continues its straight course to one particular part of the plate.

Why the Image is Upside Down

If we fit a piece of ground glass in the position occupied by the plate we shall be able to see exactly the same picture as will appear on the plate after development, and we shall notice at once that the picture is upside down. A little study of Fig. 1 will show why this is the case. Notice that the rays from the base of the church are travelling upward in a straight line when they pass through the pinhole, and that they continue their upward course until they reach the top of the plate. Similarly the rays from the top of the tower travel downward and so reach the bottom of the plate. The same thing holds good with all the rays in proportion and the result is that the image of the church on the plate is upside down.

Quite successful photographs can be taken with a pinhole camera but, owing to the very tiny dimensions of the pinhole, the amount of light illuminating the plate is so small that an extremely long exposure is needed to effect the chemical change in the emulsion of the sensitive plate necessary to produce a photograph. This means that a pinhole camera must always be used on a stand or placed on a table or wall. Of course, it is quite impossible with such a camera to photograph any object that is moving, no matter how slowly. It might be thought that this difficulty could be overcome easily by enlarging the size of the pinhole, but directly we do this we get back to our original trouble, that of rays from all parts of the object reaching all parts of the plate.

Superiority of the Lens

Fortunately, however, the difficulty disappears if we substitute a lens for a pinhole. The lens allows us to use a very much larger aperture than a pinhole because it bends or "deflects" all the rays of light that reach it, with the result that bundles of rays from each part of the object are concentrated on one particular part of the plate instead of being allowed to reach all portions of it.

(Continued on next page)

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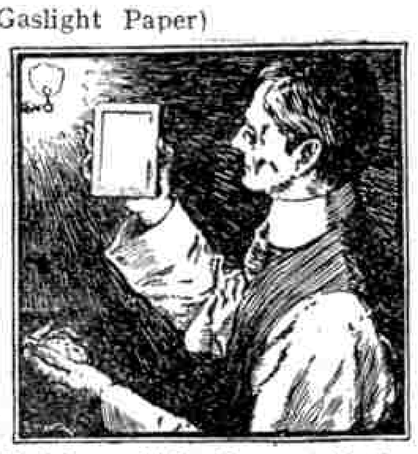

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What appears to be a single ray of light reflected from one point of an object is really a bundle of tiny beams of light which strike every part of the lens. Owing to the curved surface of the lens they do not pass straight through, however, but are deflected so that on emerging from the inside of the lens they meet at a certain point. This point is known as their "focus."

Focal length

The focus or "focal length" of a lens is its distance from the plate or film when focussed upon a distant object. The size of the image produced by any lens is exactly proportionate to its focal length, and is not in any way connected with the size of plate used.

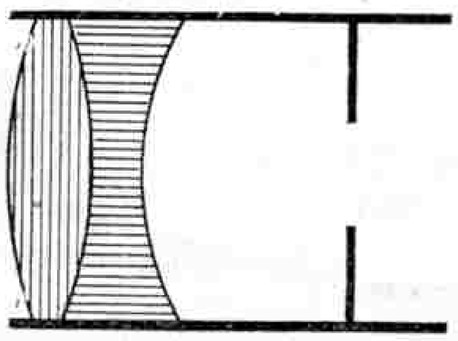

Fig. 2. Single Lens

For instance, supposing we have two lenses each of 6 in. focal length, one made for use with a quarter-plate and the other with a half-plate, the images produced by these two lenses will be exactly the same in size, but because the half-plate is larger it will include more of the view.

Stops or Diaphragms

With every photographic lens some form of "stops" or "diaphragms" are used. In their simplest form these stops may consist merely of a series of holes in a strip of metal that can be moved so as to bring any particular hole into position in the lens. Practically all modern cameras are fitted with what is known as an "iris diaphragm" however, consisting of a number of extremely thin metal or vulcanite leaves that may be moved so as to produce a series of circular apertures of various sizes. A similar arrangement is used in the human eye, where it works automatically, according to the light that strikes the eye. To test this beautiful piece of apparatus, go into a darkened room where there is a looking glass. After remaining a few seconds in the dark, light a candle and approach the mirror. Watch the pupil of your eye in the mirror, bringing the candle near to your eye. You will see the pupil large at first, but as the rays from the candle fall upon it it commences to contract, closing automatically according to the proximity and brilliance of the light.

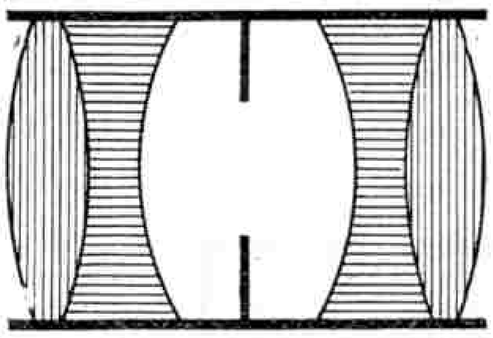

Fig. 3. Rectilinear Lens

The exact position in which the iris diaphragm is placed in a lens varies with different types. Whatever its position its action is the same in every case—it limits the diameter of the aperture to be used, so that by adjusting the diaphragm we may use either the full lens or only a small central portion of it.

The size of the aperture as thus regulated by the iris diaphragm has a very marked effect on the photography of objects near and far from the camera and this point will be dealt with when we come to the actual exposure.

F. Numbers

The stops or diaphragms are described by the relationship between the focus of the lens and the diameter of the stop. There are two systems in use, the "F" system, which is mostly used, and the "U.S." system.

The "F" number is obtained by dividing the focal length of the lens by the diameter of the stop. For example, the value of a $\frac{1}{2}$ in. stop in a 4 in. lens would be F8, while a $\frac{1}{4}$ in. stop used with the same lens would give F16.

The "U.S." or "Universal System," which is used on all Kodaks, starts from the basis of the value F4 and calls this 1. The next smaller stop is 2, the next 4, and so on.

All good lenses are marked with either F or U.S. numbers. Probably the largest F number in general use to-day is F4.5, although some special cameras are fitted with lenses working at much larger apertures. The next smaller stops are usually F5.6, F6.5, F8, F11, F16, and F32.

In order to find the U.S. number for any stop marked with an F number it is simply necessary to divide the F number by 4 and square the result. For instance, F8 equals U.S.4, while F16 equals U.S.16, the latter being the only case in which the figure is the same in both systems.

Types of Lenses

The speed of all lenses working at the same stop is the same, and therefore the photographer knows that if he has half a dozen different lenses, and uses each one with the same stop, an exposure that is correct for the first lens will be correct also for all the others.

Having seen something of the principle of the photographic lens we must now turn to the types of lenses in everyday use. These are three in number, the single lens, the double lens or rapid rectilinear and the anastigmat.

Single Lenses

The single lens, which is variously described as "achromatic," "meniscus," or "landscape," is not really a single lens at all, but is made up of two lenses cemented together so as to appear one, as shown in Fig. 2.

A true single lens such as an ordinary magnifying glass cannot be used conveniently for photographic purposes because it is not achromatic. Those of our readers who have studied physics know that white light is made up of rays of seven different colours, namely, red, orange, yellow, green, blue, indigo, and violet. When light passes through an ordinary magnifying glass the different coloured rays are not all deflected to the same extent. For instance, the violet and blue rays, which have the strongest effect upon the sensitive emulsion of the plate, come to a focus appreciably nearer the lens than the other rays. The result is that it is impossible to obtain a sharply focussed photograph with such a lens without special adjustment.

In the photographic single lens the effect of combining two lenses is to produce an achromatic lens that deflects the rays of every colour to the same extent. The single lens is excellent for landscape work and it will take portraits, but it has the disadvantage that it cannot be used with a larger stop than F11, and consequently it is comparatively slow. It also has certain disadvantages in regard to distortion, this being particularly noticeable

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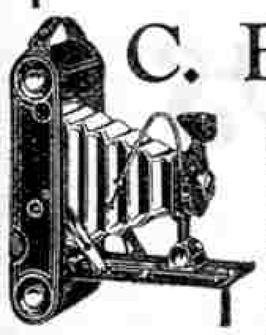

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The Rapid Rectilinear

The rapid rectilinear or double lens is a great improvement on the single lens. As shown in Fig. 3 it consists of two single lenses fitted in a tube at some distance apart with a stop between them.

This lens, which is commonly spoken of as an "R.R." lens, is suitable for all kinds of work and is quite free from the distortion of the single lens. There is also the advantage that these lenses work well at F8 and are therefore appreciably more rapid than single lenses.

Yet another point about the "R.R." lens is that its two components can be used separately, each forming a single lens of about twice the focal length of the complete lens.

Anastigmat Lenses

The third and best type of lens is the anastigmat, of which there are many patterns. These lenses generally consist of a number of separate glasses, which may

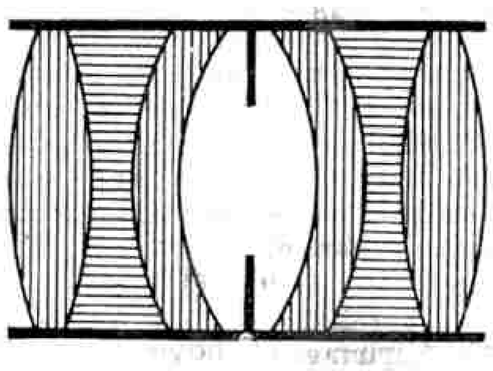

Fig. 4. Anastigmat Lens

be all cemented together or some of which may be separated by an air space.

An anastigmat lens is free from all distortion and is considerably superior to the "R.R." lens in fineness of definition. These lenses are expensive but are well worth the money, as although an "R.R." lens will do many kinds of work practically as well as an anastigmat, yet for certain work the latter is undeniably far superior.

Some anastigmats are "convertible," that is to say the component lenses can be used separately, but many of them can be used only in their complete form.

In addition to the perfection of image that it gives, the anastigmat has the great value of permitting the use of extremely large apertures. Whereas the maximum aperture of the "R.R." lens is F8, anastigmats may be obtained to-day to work perfectly with a stop as large as F2.7.

The question of lens speeds will be dealt with in a subsequent article.

Wide Angle and Telephoto

There are other types of lenses used for special purposes. These include wide-angle lenses, which take in a wider view than the normal lens and are mostly used for architectural work in confined situations; portrait lenses, which are used by professional workers but are not likely to be of much interest to amateurs, and telephoto lenses used for obtaining large images of distant objects.

We have now dealt briefly with the various types of cameras and lenses, and next month we shall deal with the different forms of shutters and show how the exposure problem may be simplified.

Fifteenth Photo Contest

Among the large number of letters we receive every day from our readers there are always several that give an account of some favourite pet, and in many cases this description is accompanied by one or more photographs. It is evident that those of our readers who possess cameras are keen on taking photographs of their pets, and as we wish to encourage this enthusiasm we are announcing this month, as the subject of our Fifteenth Photo Competition, "MY FAVOURITE PET."

We use the word "pet" in its widest possible sense and entries may consist of photographs of any animal in which the competitor is specially interested. More than one photograph may be submitted by a competitor if desired.

Prints may be of any size and made by any process and the work may be done by the competitor himself or by a photographic dealer. In the event of a tie for a prize preference will be given to prints that have been made by the competitor himself, and therefore every entrant must state on the back of his print by whom it has been made. In addition each print must bear the name, address and age of the competitor, clearly written.

The competition will be divided into two sections A. and B., for competitors of 16 and over and under 16 respectively. Four prizes are offered—Photographic Goods to the value of £1/1/- and 10/6, to be chosen by the winners, as first and second prizes respectively in each section.

Closing date 30th May (Overseas: 30th September).

Rajar Roll Films

The popularity of the roll film increases steadily year by year and appears likely to continue to do so. The film is the vital unit of the amateur's equipment and if it is defective good photography is impossible.

"Rajar" films possess all the qualities that are necessary for successful work. In the first place they are extremely rapid, thus enabling the most inexperienced amateur to obtain good negatives even in a comparatively poor light. In addition these films give excellent colour correction, and are probably as free from the tendency to curl as any roll films can be. All the standard sizes are manufactured and there is a "Rajar" film for every camera. An interesting and well-illustrated booklet dealing with these films will be sent (post free) on mentioning the "*M.M.*" by Messrs. The Amalgamated Photographic Manufacturers Ltd., of Soho Square, London, W.1.

Electricity—(*cont. from page* 241)

in each keyboard at the correct time.

The fact that the messages are received ready printed on strips of paper tape results in saving the time that would otherwise be occupied in writing out the messages, for all that has to be done is to cut up the tape into short lengths and gum these on to telegraph forms ready for delivery.

There is no necessity for all the senders and receivers to be working during the whole time. For example, in a station equipped with a sextuple set the day may commence with only one or two sets working, and then, as the volume of traffic becomes greater, the other sets are put into operation one by one until all sets are working. While the Baudot apparatus is fairly robust, and most of the moving parts are made of very hard metal, it is usually necessary to employ a skilled mechanic to attend to the various adjustments that become necessary from time to time.

NEXT MONTH:—

The Wheatstone Automatic System

L.M.S. Locomotive Contracts

In addition to the order for five 4–4–2 passenger tank engines for the London, Tilbury and Southend services, which the L.M.S. have awarded Nasmyth, Wilson and Co. Limited, of Manchester, the same firm has now received an order for ten 0–4–4 passenger tank engines, of the existing Caledonian type. These latter are intended for the Cathcart service (Glasgow).

* * * *

Is Electrification Justified?

Speaking at Torquay recently Sir Felix Pole, general manager of the G.W.R. said that electrification was put forward as a cure for everything on the railways. "For the last two years," he added, "I have had a committee at work trying to discover places where the traffic would justify electrification. So far we have not been able to produce a scheme, and the best information I get rather tends to make me believe that to a very large extent the idea of the electrification of railways is not well founded."

* * * *

New Style Train Signals

An electric-lighting scheme, with four-colour lamps, is being installed on the Southern Railway to speed up the train service. A new method of signalling by coloured lights will be used on the sections that are being electrified.

The old semaphore signal with its upright and dipping arm, will be superseded by a much shorter post carrying four electric lamps placed on a level with the eye of the engine-driver. A red light will be the warning to "stop"; a yellow light, "proceed," prepared to "stop;" two yellow lights, "proceed, signal ahead is showing yellow light;" and green, "proceed at speed." Hitherto it has only been possible to signal "all clear" and "stop" but it is hoped that the new arrangement will result in obtaining the greatest possible acceleration from the electrification.

* * * *

Telephoning to Trains

Recently there have been considerable developments in Germany in perfecting telephones on trains, and within the next two or three months the first through service of trains fitted with telephones will run between Berlin and Hamburg. It is intended also to instal the new telephone system on trains travelling on other main lines, such as Berlin–Munich, Berlin–Stuttgart, Berlin–Frankfort, and Berlin–Hanover.

Travelling on these main-line trains, passengers will then be able to hold direct telephonic communication with any telephone subscriber in any part of Germany. It will also be possible for a passenger on the train to be "called up" by any telephone subscriber and for telephone communication to be established between passengers travelling on different trains. The train telephone will be of particular service to business men, of course, who will be able to keep in touch with their office or headquarters and thus advised of latest market prices, and other information that it is essential for them to have without delay.

* * * *

Locomotives without Fireboxes

Fireless locomotives are being tried-out on Continental Railways. These locos. are of novel design and at present are being used on small-gauge railways for short runs. Some weigh about 28 tons, and are capable of hauling ten wagons, each of 21 tons, over a total distance of about seven miles. They are driven by an ordinary steam engine and coupling rods, the steam being supplied from a boiler acting as an accumulator. The water in the boiler is heated by passing steam into it through an external source, raising steam temperature to, say, 200° Centigrade at a pressure of perhaps 150 lb. per square inch. When the pressure is relieved by the operation of a valve, a large amount of steam is generated at somewhat lower pressure, and the process goes on till the pressure drops to, say, 30 lb. per square inch, when it is no longer sufficient to drive the engine. The locomotives are useful for shunting and similar purposes, their great advantages being that they are less costly to run, and that their upkeep is less than that of locos. of the ordinary type. The largest fireless locomotive yet built weighs 57 tons and carries 21 tons of water under pressure.

* * * *

An Early Telegraphist

The L.N.E.R. in their search for old railwaymen who worked on the Stockton and Darlington Railway before 1863, have traced one survivor in America. This is Mr. J. H. Pickering, of Kansas City, who was instructed in telegraphy under George Stevenson, and who remembers "Locomotion No. 1."

* * * *

War-time Locos.

During the last two years of the war, over 500 heavy goods locos. of Great Central 2–8–0 type were built for service with the army in France. After the war most of these were lent to British Railway Companies for a year or so, after which they seemed to disappear! Less than 100 were bought by the Great Western, London and North Western and Great Central lines. Now 125 have been bought by the London and North Eastern Railway. Where are the others?

Ten 2–6–0 fast goods locos., built about three years ago at Woolwich Arsenal by the Government, have been bought by the Southern Railway. The locos. are identical with those running on the South Eastern and Clapham Section. Some 30 more are to be purchased and some are to be converted to correspond with the 2–6–4 tank locos., which were developed from the same design.

Ten Government locos. have been sold to the Great Southern Railway of Ireland, and are being altered to the Irish gauge. Six others, bought by the Metropolitan Railway, are being rebuilt in Manchester as 2–6–4 tank locos.

* * * *

New G.W. Locos.

Within the last few months Swindon works has turned out 20 heavy goods tank locos., 2–8–0 type, five 0–6–2 passenger tank locos. of a new design, and is now building another series of 2–6–2 passenger tank locos. for service in hilly districts.

Many locos. from the small amalgamated railways are being equipped with G.W.R. standard boilers, cabs, etc.

* * * *

Averaging 75 m.p.h.

We hear so much about the fine work performed by the four-cylinder "Castles" and "Stars," that the older engines are "pushed out of the picture." Yet many of them can put up a fine show when called upon, as is evidenced by the fact that one day, late last year, a two-cylinder "Saint" class engine, 4–6–0 type, left Swindon for London at the head of a train composed of eight coaches, weighing about 300 tons. On the 77 miles journey, eleven minutes were regained and the journey, start to stop, was done in two minutes over the hour, representing an average speed of nearly 75 m.p.h. The train was the 12–15 p.m. up-Bristol express, and the loco. 2998 "*Ernest Cunard*," built in 1902. These engines are the fastest on the line, although they cannot haul the same loads, and keep up to time whilst doing so, as the four-cylinder engines.

New Grain Elevator

The Great Western Railway Company will shortly bring into use at Cardiff Docks a floating pneumatic grain elevator which has been built by Messrs. Simon Ltd., of Manchester. The plant, which embodies the most up-to-date improvements in equipment of this description, will be capable of discharging grain at the rate of 120 tons per hour. It has been so designed that it will be able to work on the offside of ships and discharge to quay across the deck of a ship or into lighters alongside. If necessary, these operations can be carried on simultaneously.

The hull of the elevator consists of a steel pontoon, and the machinery erected thereon includes, in addition to the engines and suction pumps, an independent electric generating set for power and lighting. Apparatus is also provided for automatically weighing the grain while it is being discharged. From the point where the grain is discharged to the quay a new portable conveyor, which has been constructed in conjunction with the elevator, will take the grain into the warehouse and deliver it to the warehouse conveyors.

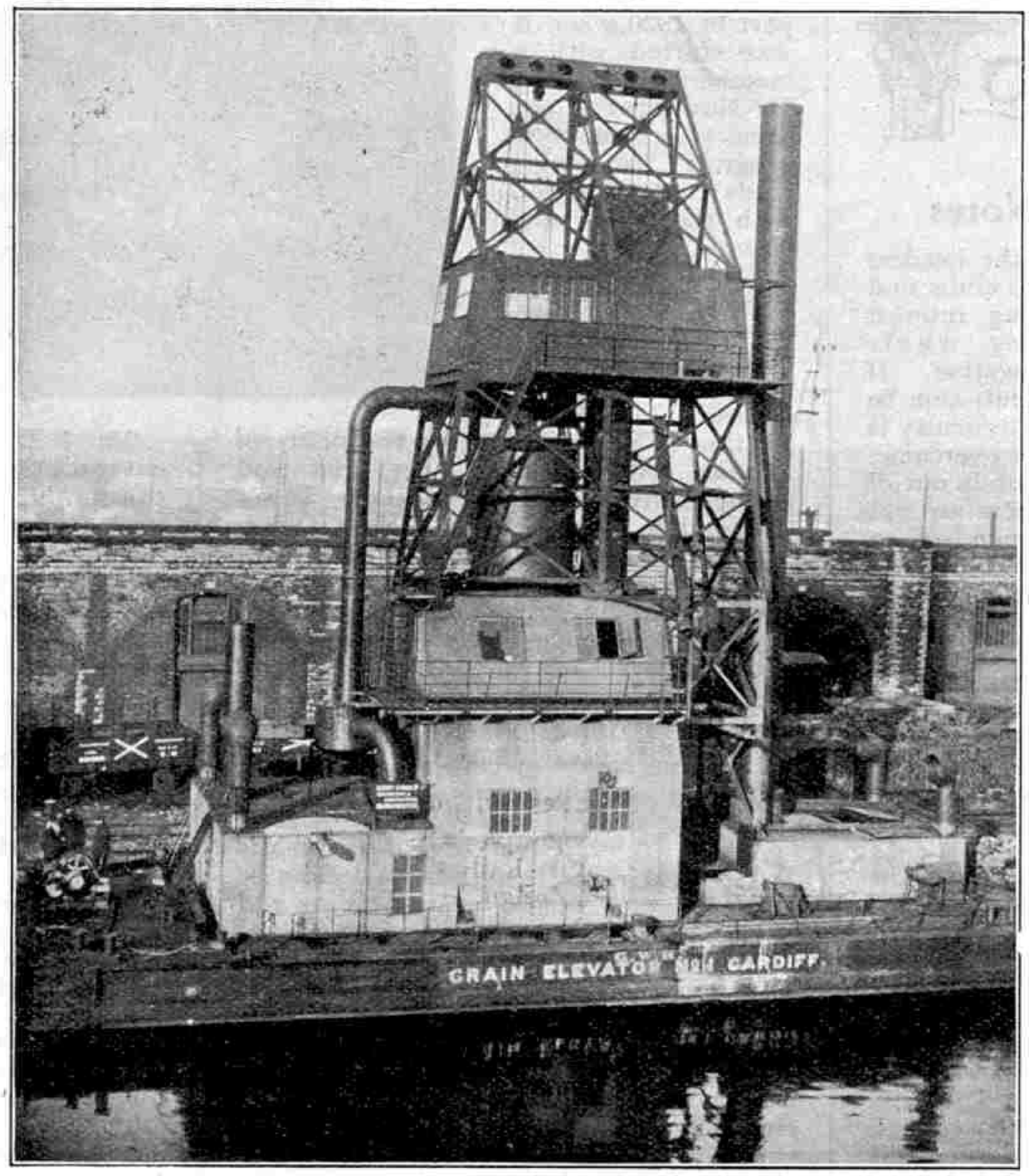

Photo courtesy] [*G.W.R.*

General View of the New Grain Elevator at Cardiff Docks

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Engines Wash Themselves

At the L.N.E.R. King's Cross Locomotive Depot, where the "*Flying Scotsman*" and other "Pacific" Locomotives are housed after their run from Scotland, an ingenious washing out appliance has been installed. By a system of pipes, filters and pumps the steam remaining in a large locomotive, instead of being let out to waste, is condensed into water and used, under pressure, to wash out the 3,800 ft. of internal pipes. Soot, scale and fur quickly collect in the interior of a locomotive, and the cleaner she is kept on the inside, the more power is obtained.

Recent tests extending over three days have proved the efficiency of this hot washing plant, which has enabled the largest locomotives in the world, the "Pacifics" used on the L.N.E.R. main line to Scotland, to consume only 46 lbs. of coal per mile against a higher figure previously.

When locomotives wash themselves out by their own steam in this way, it also means a great saving of time as the old method was to wait until they were cold before they could be touched. Every day, scores of locomotives are cleaned out at King's Cross, the average time taken being about twenty minutes.

* * * *

Order for Germany

A contract for 15 heavy main line locomotives for the Union of South Africa Railways has been awarded the German firm of Maffei, Munich.

Building "Baltics" at Horwich

In connection with our special article last month on Baltic Tank Locos. we now learn that the L.M.S. works at Horwich are nearing the completion of the series of twenty 4-cylinder superheated passenger locomotives, numbered 10455–10474. These engines are generally similar to those of the same class previously built, with the following exceptions :—

The boiler is identical with that fitted to the "Baltic" tank engines, but has 29.6 sq. ft. of grate area as against the 27 sq. ft. of the earlier series.

The bogie wheelbase and front portion of engine frame has been extended to coincide with practice on the "Baltic" tank.

The cab roof has been modified to conform to the Midland loading gauge.

For the time being these engines are being turned out painted plain black with the number in small figures on the cab sides, but it is intended that they assume the standard red passenger engine livery of the Company in due course.

On the completion of the above, Horwich will proceed with the construction of twenty 4–4–0 compound passenger engines of Midland design, identical with those which have just been turned out from Derby works, *i.e.*, having the shortened chimney, dome and cab, to enable the engines to run on any part of the system, and 6 ft. 9 in. coupled wheels instead of the 7 ft. of the earlier engines.

A 50-ton Load

An interesting load was dealt with recently by the G.W. Rly. at the arsenic works, Danygraig, Swansea. The load consisted of a rotary calciner of a total weight of 50 tons, consigned to the South Wales Portland Cement Company, Penarth. It measured 62 ft. long and 7 ft. in diameter. After being dismantled it was loaded on a "crocodile" wagon, two check wagons being necessary.

* * * *

New Steamers for Channel Islands Service

The "*St. Helier*" the second of the G.W. Co's new steamers for the Channel Islands service, has been successfully launched at Clydebank. With the sister ship "*St. Julien*," she will be available for the summer holiday traffic to Guernsey and Jersey.

* * * *

More Locomotives for South Africa

The order recently placed by the Rhodesian Railways with Beyer, Peacock and Co. Ltd., of Manchester, for four "Garratt" locomotives has now been increased to twelve. The locomotives will have a tractive effort of approximately 35,000 lb., with a maximum axle load not exceeding 13 tons.

* * * *

20-ton Coal Wagons

The 20-tonner coal wagons mentioned a short time ago in the "*M.M.*" appear to be rapidly increasing in numbers. They are seen regularly at Newport, Barry, Port Talbot, Swansea and Milford Haven, and they are giving excellent results. The reconstruction of the tipping appliances at the Bristol Channel ports is making good progress, and it is stated that the use of the new wagons will be considerably extended during the present year.

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Building Locos. in Australia

The Western Australian Minister for Railways recently stated that during the next two years it is intended to construct at least ten new locomotives at the Midland Junction workshops. Orders have been given for the extra plant required, which will cost £91,000. It is expected that the cost of construction will be about £190,000. The locomotives will be similar to those ordered in England on which the Federal Government had asked £21,900 duty.

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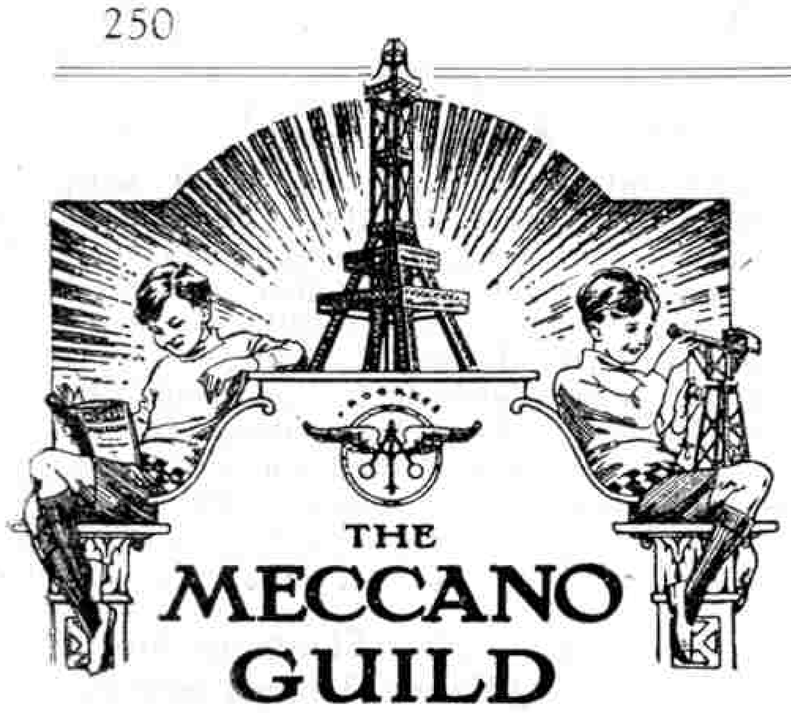
New Wagons for Egypt

A contract for 1,000 covered wagons for the Egyptian State Railways has been divided between the Metropolitan Carriage Wagon Co. Ltd., of Saltley, Birmingham, and the Ringhofer Works of Czecho-Slovakia.



The Secretary's Notes

Summer Difficulties

During the summer months the Leaders of some of the smaller Meccano clubs find great difficulty in maintaining interest and keeping their members together. If a cricket club can be formed the difficulty is fairly easily overcome, but in many cases a cricket club is out of the question, either because there are not sufficient players among the members or because the club funds are not able to meet the necessary outlay for materials, not to mention the probable additional cost of hiring a field. A cycling club is a fairly good substitute for a cricket club, but for various reasons some Meccano clubs find it impossible to run even this section. In such cases the task of the Leader is not easy, but at the same time it is by no means hopeless.

Rambles with an Object

The Leader of a certain club in the south of England found himself faced with a problem of this kind and he solved it by collecting his members every Saturday afternoon and taking them for rambles to various places of interest in the neighbourhood. This particular Leader, however, was wise enough to realise that boys do not care for walks just for the sake of walking, and that some object must be provided in order to arouse interest. He therefore planned his walks carefully with this object in view. He provided himself with one or two books dealing with the locality and by studying these, together with a large-scale map, he acquired a really surprising amount of interesting knowledge which he was able to impart to his members, during the rambles, in a chatty manner that never failed to hold their attention. Quite apart from the fact that by these methods this club was successfully steered through a very trying period, there was also the good result of opening the eyes of the boys to things of great interest which they had never considered seriously because they were too familiar and close at hand. The Leader of this club told me that often a boy would exclaim : "Why I have passed this old place scores of times on my way to school, but I never knew before that there was anything interesting about it!" I strongly urge Leaders of small clubs to give this plan their serious consideration. Of course, if a Leader has any knowledge of Botany, Geology, Birds, etc., his task is easier, but even if he has no particular leaning in these directions he can, by a little study, provide himself with material amply sufficient to enliven a number of summer rambles.

Stationers' School M.C.

Our illustration shows a group of members of the Stationers' School Meccano Club, London. This club dates back to the early part of 1920 when it was started with a membership of eight. By November of the same year such good progress had been made that affiliation with the Guild was granted.

The members have always been keenly interested in model-building, and also have made the utmost of their favourable position in regard to seeing the sights of London. Already visits have been paid to the South Kensington Museum, Tower of London, Mint, General Post Office, "Daily Mail" printing works, and more recently Marconi House, where members were shown an interesting film demonstrating the wonders of high-speed wireless photography.

Mr. J. D. Carey, the Leader, is a most enthusiastic and untiring worker and is constantly arranging new educational visits or other pleasant surprises for his members. The secretary, R. S. C. Greenway, has rendered very valuable assistance to the Leader and has done a great deal to raise the club to its present state of efficiency.

A Suggestion for Wet Weather

However carefully club plans may be laid, they are always liable to be upset, perhaps at the very last moment, by rain. This invariably results in a general feeling of disappointment, and unless alternative plans have been prepared for such an emergency the position is a little trying. Something must be done and done quickly, otherwise the members will drift away feeling thoroughly disgusted. For such an emergency I should like to suggest a plan tried by the secretary of the Handsworth (Birmingham) M.C. In this case the trouble was not rain but the last-minute failure of a lecturer to turn up. The secretary promptly rose to the occasion. He prepared a number of slips of paper and wrote on each one a certain subject, such as "Gas," "Music," "Broadcasting," etc., and then placed all the slips in a hat and shook them up thoroughly. Each member then drew a slip, and whatever subject was written upon it he had to speak on for from three to five minutes. As may be imagined, many of the members drew subjects of which they had no knowledge whatever, but they all entered into the spirit of the thing. Of course, nobody tried to be very serious in his miniature lecture, and the result was to provide an hour or so of thoroughly lively amusement. This experiment was so successful that the Handsworth Club intend to repeat it before long.

Guild Growing in Strength

Looking back over the past Session I feel greatly encouraged by the steady growth of the Guild membership and the progress made by the newly-formed clubs. Not only has excellent work been done in the club room, but also outdoor sports have been more successful than in any previous year. Football in particular has made great strides, and club teams have won a good percentage of their matches and have proved themselves thorough sportsmen. Many clubs brought the Session to a close with a Social, a Concert or an Exhibition, and at the same time elected a committee to arrange the club activities throughout the summer. Judging by the programmes already to hand, the next two sessions promise to be thoroughly enjoyable, especially if we are favoured, for a change, with a really good summer.

Clubs and Publicity

I have never ceased to urge upon Leaders and secretaries the necessity for obtaining the greatest possible publicity for their clubs and I am glad to be able to report a considerable improvement in this direction. Last year almost all Meccano clubs, even the very small ones, held one or more exhibitions, many of which were exceedingly successful from every point of view. There was a great demand for models to be loaned from Headquarters for these exhibitions and I received many letters describing the interest these big models aroused among visitors. In the case of two or three clubs I was unfortunately unable to arrange for the desired models to be built in time for their exhibitions, and I wish to emphasise the fact that in order to make certain of a model from Headquarters at least three weeks' notice must be given. It is interesting also to observe that clubs are taking more trouble to obtain short notices in the local newspapers, and I now receive newspaper cuttings regularly from all parts of the world dealing with the doings of Meccano clubs. Another feature of the past year was the great increase in the number of clubs taking part in local shows, bazaars, etc. At many of these functions the Meccano stalls proved remarkably successful.

CLUB NOTES

Marsh Street (Walthamstow) M.C.—Have held their Exhibition in conjunction with the Congregational Church Bazaar, but a full report is not yet to hand. Great interest was taken in a competition in which the Leader selected a model from those within the scope of a No. 0 Outfit and members were allowed one minute to study the model and then had to construct it. Other activities include Lectures and Discussions on "Steam Engines," "Trams v. Buses," and impromptu speeches by members. Club roll: 18. *Secretary*: C. W. Redfern, 33, Church Hill Road, Walthamstow, London, E.17.

St. Marks (London, S.E.) M.C.—Meetings have been interrupted by the influenza epidemic but members are now all well again and club activities have recommenced. It is hoped shortly to visit the Central Telegraph Office, Bryant and May's Factory and other places of interest. Club roll: 22. Average attendance, 15. *Secretary*: G. C. Green, 21, Hafton Road, Catford, London, S.E.6.

Accrington M.C.—Two excellent lectures have been given by Mr. Rawson, the President, and Mr. Whipp, on "Gas" and "Motor Cycle Engines" respectively. On certain specified evenings members take their Hornby Trains to the club room and combine to make an elaborate layout. Club roll: 27. Average attendance 17. *Secretary*: V. Waterhouse, 45, Ramsbottom Street, Accrington.

1st Herne Bay M.C.—Negotiations have taken place for the club to have a stand at the Herne Bay and District Horticultural and Industrial Society's Spring Show. Prior to the show it is proposed to hold a Model-building Competition, and the models built are to be exhibited on the club's stand together with the Motor Chassis lent by Headquarters. After the show a grand "Jollity Night" will be held. Club roll: 19. Average attendance: 12. *Secretary*: C. W. Russell, 4, Clifton Villas, South Road, Herne Bay.

Holy Trinity (Blackburn) M.C.—The Exhibition held in aid of the local Sale of Work was a great success and the proceeds amounted to £6. Valuable assistance was given by Mr. Moulding, who helped the members in every possible direction. Model-building Competitions are the chief feature for the immediate future. Club roll: 29. Average attendance: 21. *Secretary*: H. Jepson, 11, Pine Street, Blackburn.

Garstang M.C.—A new Leader is urgently required, and in the meantime H. O. Irvin, the secretary, is doing his best to keep the club going. Several interesting and exciting Table Football and Tennis contests have taken place and weekly Painting Competitions are also helping to keep the members together. Club roll: 10. *Secretary*: H. O. Irvin, Sunny Bank, Garstang.

Buckfastleigh M.C.—Have not been able to hold meetings recently owing to being without a room, but members hope to obtain suitable accommodation very soon. Club roll: 34. *Secretary*: H. J. Parsons, Bell Cottage, Fore Street, Buckfastleigh.

St. Mary (Newington Butts) M.C.—To test the members in building Meccano models with accuracy and speed several novel competitions have been held, in which models were printed on paper and each member given one to construct. A Model Railway section has been opened in charge of the Rev. Rham, the Vice-President, and another interesting feature is a special Social Department for ex-members who are unable to attend regularly owing to evening classes and business. Arrangements are being made for Lantern Lectures and Visits to Works and other places of interest in and around London. Club roll: 139. Average attendance: 68. *Secretary*: Mr. C. Curle, 37, Pullens Flats, Peacock Street, Kensington, London, S.E.11.

Redruth M.C.—It is intended to continue club meetings throughout the summer and to have outings when the weather is suitable. Physical drill is now a regular feature in the programme. Two Lectures were recently given on "Motors" and "First Aid," and the members were keenly interested. Club roll: 36. Average attendance: 22. *Secretary*: L. Trenberth, Tunnel Stores, Redruth.

St. Mary (Bourne) M.C.—Owing to members finding it too expensive to run a Cricket Club, a Cycling Club is being formed, and arrangements are being made for Picnics and if possible a Camp. The club Football Team so far have won six matches out of eight. Club roll: 19. Average attendance: 14. *Secretary*: D. L. White, Rosedale, Stoke, Andover.

Meads (Eastbourne) M.C.—A Concert was recently held and proved a great success, the hall being absolutely filled. Another event of interest was a "Social" at which prizes were awarded by Mr. Adams, the President, for the best models made during the session. Mrs. Bradford presented the prizes to the following: L. Crose, first prize; H. Bradford, second; and V. Bradford, third. Several dialogues were given by Mr. Taylor, and the Rev. M. R. Kingsford gave a lecture on "Our Colonies." Club roll: 19. *Secretary*: A. A. Moore, 7, Rodmill Road, Eastbourne.

Handsworth (Birmingham) M.C.—A novel feature was adopted by the secretary when a certain lecturer was unable to come at the last minute. He prepared several slips of paper by writing on each a certain subject, such as "Gas," "Music," "Evils of Broadcasting," etc. The slips were then put in a hat and each member drew one and had to speak for from three to five minutes on the subject drawn. This caused great amusement and it is proposed to try the idea again soon. Club finance is very sound and a small banking account has been opened with the Birmingham Municipal Bank. Club roll: 24. Average attendance: 20. *Secretary*: N. J. Robertson, 30, Hinstock Road, Handsworth Wood, Birmingham.

Ellesmere Port M.C.—Recently held a Social in Watkins Café at which 63 persons were present. Many good games were played and prizes were awarded for competitions. S. Caveny and R. Lawley did excellent work and the evening was voted a great success. Other activities include Lectures and a Fancy Dress Dance. Club roll: 22. Average attendance: 16. *Secretary*: W. H. Hope, 41, Princess Road, Ellesmere Port, Cheshire.

Meccano Club Secretaries

No. 2. B. Warnock.

Bertie Warnock is the Secretary of the Loanhead Boy Scouts' M.C. and it was through his efforts that the club was started in March 1924. Such good progress was made that affiliation with the Guild was granted in the same month. Meetings are held in the Boy Scouts' club room and all the members are keen and enthusiastic.

The Rev. W. Warnock, B.A., father of Bertie Warnock, has been Leader of the Loanhead Club for some time and has always shown genuine interest and enthusiasm in promoting the welfare of the Meccano Guild.

Bearwood M.C.—Are unfortunately still without a Leader. A special Railway Night was held when all the members brought their Meccano Sets and Hornby Trains and built a large railway track all round the room, with five separate sidings. Further activities included a Lantern Lecture on India by a local gentleman and a debate on the "Meccano Magazine," in which all articles were thoroughly discussed. A wireless set is to be fitted up in the club room. Club roll: 30. Average attendance: 28. *Secretary*: C. White, 72, Katherine Road, Bearwood, Birmingham.

Boroughmuir School (Edinburgh) M.C.—Arrangements are being made to visit the following places of interest:—Observatory, "Scotsman" Office, Haymarket Junction, Gasworks, Rubber Mills, and if possible Rosyth Dockyard. It is also proposed to re-visit the Fire Station and Telephone Exchange. Mr. Erskine, the Geography Master, gave a most interesting lecture on "Birds and Seals of the Antarctic," and other lectures dealt with "Wireless and the Crystal Set" and "Bridges." The Jazz Band has been augmented and promises to make a "big noise" when called upon! Club roll: 41. Average attendance: 34. *Secretary*: J. D. Watson, 1, Alvanley Terrace, Edinburgh.

Rosyth M.C.—Marked progress has been made since Mr. G. A. Cook took over the Leadership. The club has been divided into two groups named "Hornby" and "Zulu" respectively, with the object of arranging group competitions and testing the members' knowledge of Meccano and engineering. It has been decided to print a weekly bulletin called "Progress" and to publish at the end of each session "The Rosyth Meccano Magazine." Club roll: 10. Average attendance: 7. *Secretary*: E. T. Hunter, 79, Admiralty Road, Rosyth.

Ruislip Common M.C.—Owing to the illness of the Leader and most of the members meetings were temporarily abandoned, but now all are well again and prospects are bright. Present activities include a Miniature Railway Layout, Lectures and Model-building. Club roll: 6. *Secretary*: L. Ive, Chestnut House, Ruislip Common, Middlesex.

Luton M.C.—It has been arranged for members to bring their own programmes on club nights, so that it may be seen which are the most popular evenings. Several very interesting models were constructed at a recent Model-building Competition, marks being given for accuracy. Club roll: 28. Average attendance: 20. *Secretary*: L. Goldsmith, 69, Tennyson Road, Luton.

St. Barnabas (Barnetby) M.C.—Members are busy preparing papers to compete for the Special Merit Medallion. It is proposed to hold a Whist Drive and Dance in aid of the club funds. The fifth anniversary of the club was held on the 17th March last. Club roll: 23. *Secretary*: R. H. Ward, Laurel Villas, Victoria Road, Barnetby.

South Park (Ilford) M.C.—The second winter session has proved highly successful and the club have a good cash balance in hand. In a recent discussion to decide the relative popularity of Meccano and Fretwork, Meccano won by 11 votes to 7. Club roll: 30. Average attendance: 20. *Secretary*: N. Tweddell, 103, Braemore Road, Seven Kings, Ilford, Essex.

Newcastle-on-Tyne M.C.—Mr. H. Scott, the President, has kindly offered to the members a new club room furnished with a bookcase, cupboard, tables and forms. The Special Merit Medallion has been awarded to H. Cummins for the best all-round club work. Club roll: 23. Average attendance: 20. *Secretary*: J. Stoddart, 71, Walker Road, Newcastle-on-Tyne.

St. James Choristers (Exeter) M.C.—Affiliation was granted last month. Members have just completed a Meccano Tower which is to be displayed in a local shop window. It is proposed to construct a model of the Exeter Cathedral Tower. Cricket and Cycling figure in the summer programme. *Leader*: Mr. M. C. Hodder, 60, Elmside, Exeter.

West View (Nottingham) M.C.—At a general meeting held at the close of last session it was decided to carry on during the summer with Cricket, Rambles, Trips with a Camera and Picnics. Arrangements are being made to visit engineering works and to carry on indoor pastimes in wet weather. A feature of interest recently introduced is a "Police Court," in which members take the parts of the respective officials. Various charges are tried and there is full scope for spontaneous humour. Other activities include Lectures on Wireless, Book Binding, Hosiery and Stamps. Club roll: 28. Average attendance: 28. *Leader*: Mr. H. W. R. Cousens, 494, Mansfield Road, Sherwood, Nottingham.

India

Delhi Childrens' M.C.—An exhibition was held in connection with the National Baby Week in which the club were allotted a stall for exhibiting Meccano goods and models. Nearly 50,000 people visited the show and the Meccano models were greatly admired. The Viceroy of India and Lady Reading both took special interest in the models of a Tram Car and an Automatic Weighing Crane, and remarked on the excellent constructional work done by the club members. Meetings have been held in the premises of the Commercial High School, with a very satisfactory attendance, and Model-building has been the chief feature. Mr. A. P. Mitra built an Inclined Delivery Chute from a No. 4 outfit and explained all the parts, and Mr. K. R. Bansal gave a lecture on "The Indian Railways." Club roll: 25. *Leader*: Mr. R. Raman, Childrens' M.C. Charkhe Walan, Delhi, India.

Calcutta M.C.—Splendid progress has been made and it is hoped shortly to increase the membership. Radio Evenings, Musical Soirees, Model-building and various other attractions have made the club very prominent in the city. Two No. 4 Meccano Outfits have been purchased for general use in the club. Club roll: 32. *Secretary*: A. N. Roy Chowdhry, 35/2 Beadon St., Calcutta, India.

Ceylon

1st Ceylon M.C.—While the secretary was away at the Imperial Jamboree, last year, the club unfortunately did not prosper and many of the old members have left. It will shortly be completely re-organised, however, and fresh activities commenced. *Secretary*: B. K. Billimoria, Dharmaraja College, Kandy, Ceylon.

New Zealand

Wisemans (Auckland) M.C.—Is now the largest Meccano Club in the world, having a membership of 660. Affiliation with the Guild was granted in March. At the first meeting held last December, Mr. F. Wiseman, the President, was in the chair and the attendance was 150. It was impossible for all the members to be present as some of them live a considerable distance away from the club. The Rev. Calder, Auckland City Missioner, addressed the meeting on "Cleanliness of Thought and Habit, Truthfulness, Patience and Perseverance." Mr. McPherson, late of Glasgow, spoke on his experience in the "Clubland" of Glasgow, and this item was greatly appreciated by the members, who are looking forward to another visit from him. Mr. Wiseman offered ten splendid prizes for a Model-building Competition.—*Secretary*: Mr. W. S. Weaver, 170, 172 Queen Street, Auckland, New Zealand.

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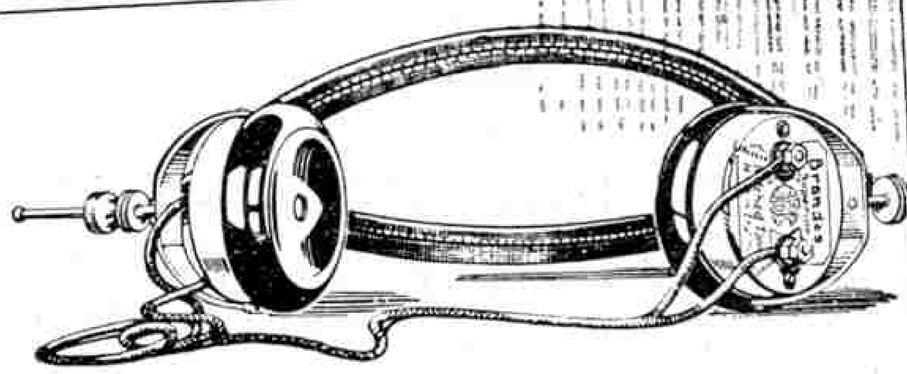

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May Puzzle Competition

Palindromes

POSSIBLY the first thing my readers will notice on this page is that there is no Cross Word Puzzle this month. I have come to the conclusion that we have had about enough of these puzzles, at any rate for the present. At the same time I feel sure that my readers would be disappointed if I did not provide them with some knotty problem to worry out during the month and therefore as a substitute for Cross Words I am introducing a type of puzzle known as the "Palindrome."

A Palindrome is a sentence that reads the same either forward or backward. An excellent example is the alleged first sentence spoken by Adam to Eve, "Madam I'm Adam." It will be seen that this sentence is exactly the same whether read forward or backward. Another well-known Palindrome is the sentence said to have been spoken by Napoleon, "Able was I ere I saw Elba."

The invention of a Palindrome is by no means easy but it is an interesting and even exciting pastime. I am offering three prizes for the best three specimens sent in—Meccano Goods to the value of £1/1/–, 10/6 and 5/– respectively. Competitors may submit more than one sentence if they wish, and the only condition is that each sentence must read *exactly* the same from either end. Entries must reach this office on or before 30th May.

During the year I intend to introduce quite a variety of puzzle competitions in order that every reader may find something to interest him. I hope that readers who wish any particular type of puzzle to be introduced or to be kept going will write and let me know, and I shall also be glad to have criticisms from readers who may not be interested in any particular form of puzzle published. This "Puzzles" page is already very popular but I want to make it even more so, and I can only do this if readers will let me know their likes and dislikes.

Puzzle No. 87.

A Square Word Puzzle :—

1. A wild animal.
2. A volcano.
3. A Latin word meaning "against."
4. Something that refreshes the ground.

* * * *

Puzzle No. 88.

My first is almost worthless,
My second is indefinite,
My third is light, round and spongy,
My whole is a poor creature.

Puzzle No. 83.

Harry pointed to his bookcase which contained the nine handsome volumes of an encyclopædia that his father had given him for a birthday present. "That is very funny" he said.

"What do you mean ?" asked his sister.

"Well," replied Harry, "I put the nine volumes on the shelves anyhow this morning before I went to school, intending to put them in their proper order when I came home, and I was just going to do so when I made a curious discovery."

"I don't see anything unusual about the books," said his sister.

"Look again," said Harry. Volumes 6, 7, 2 and 9 are on the top shelf and volumes 1, 3, 4, 5 and 8 on the shelf below, and these figures, written as a fraction, $\frac{6729}{13458}$ equals $\frac{1}{2}$.

"That is so," said his sister, "but it is just chance. Can you re-arrange them to equal $\frac{1}{3}$?"

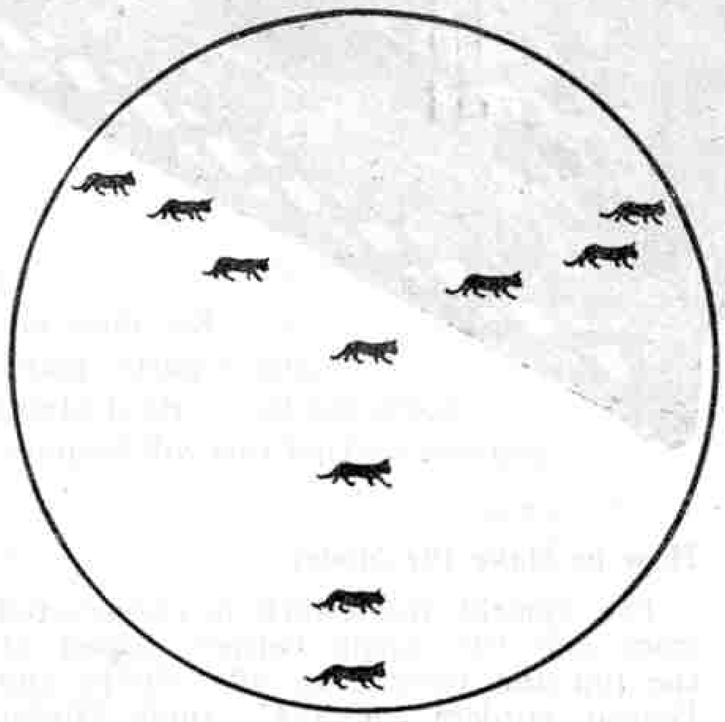
"I can easily do that," said Harry. "I can make them equal $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$ and $\frac{1}{9}$."

Harry thereupon did so and his sister admitted that he was right. How did he do it ?

* * * *

Puzzle No. 84.

A certain old man kept ten black cats as pets. He found that these cats were always quarrelling and fighting among themselves and he determined to separate them. He therefore drew a circle and placed the ten cats inside it as shown in the diagram below. He then drew three other circles inside the large one in such a manner that no cat could reach another cat without crossing one of the circles. How did he do it ?



* * * *

Puzzle No. 85.

A Boy Scout was standing on the platform of a railway station one day and he noticed that the number on a certain engine contained four figures. The first and the last figures were the same, and when multiplied together they gave the two middle figures. Also the sum of the two middle figures gave the first and last figures. What was the number on the engine ?

* * * *

Puzzle No. 86.

By placing the vowel "I" at the proper points in the following diagram a sentence can be made. The end of a line does not necessarily mean the end of a word.

B L L S S T
L L L V N G
W T H J M S
M T H N T H
S B G C T Y

Answers to Last Month's Puzzles

No. 77.

No. 78. The hidden flowers are : Pink ; Larkspur ; Buttercup ; Snapdragon ; Cowslip ; Primrose ; Speedwell ; Snowdrop.

* * * *

No. 79. 54 and 45 miles.

* * * *

No. 80. 19 men, 1 woman, 80 children.

* * * *

No. 81. The word can be found 1,200 times.

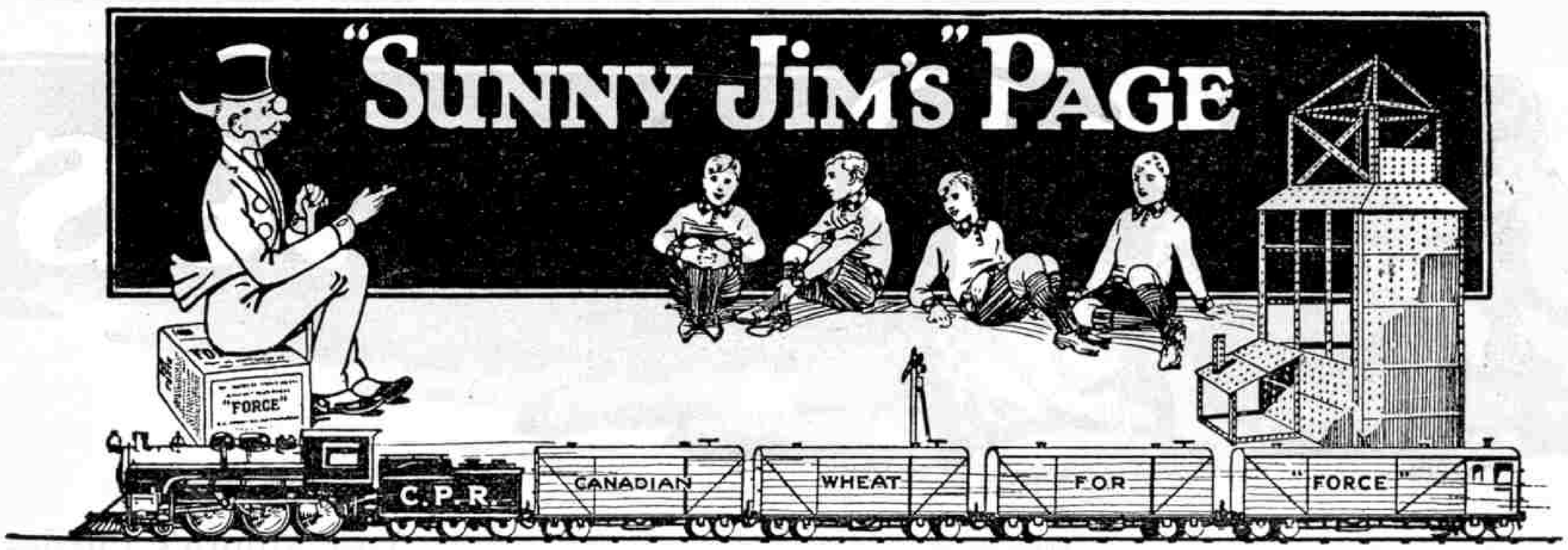
* * * *

No. 82.

3	20	7	24	11
16	8	25	12	4
9	21	13	5	17
22	14	1	18	10
15	2	19	6	23

Puzzle No. 89.

If 16 is added to 13 times a certain number, the result is the same as if 16 is taken from 29 times the number. What is the number ?



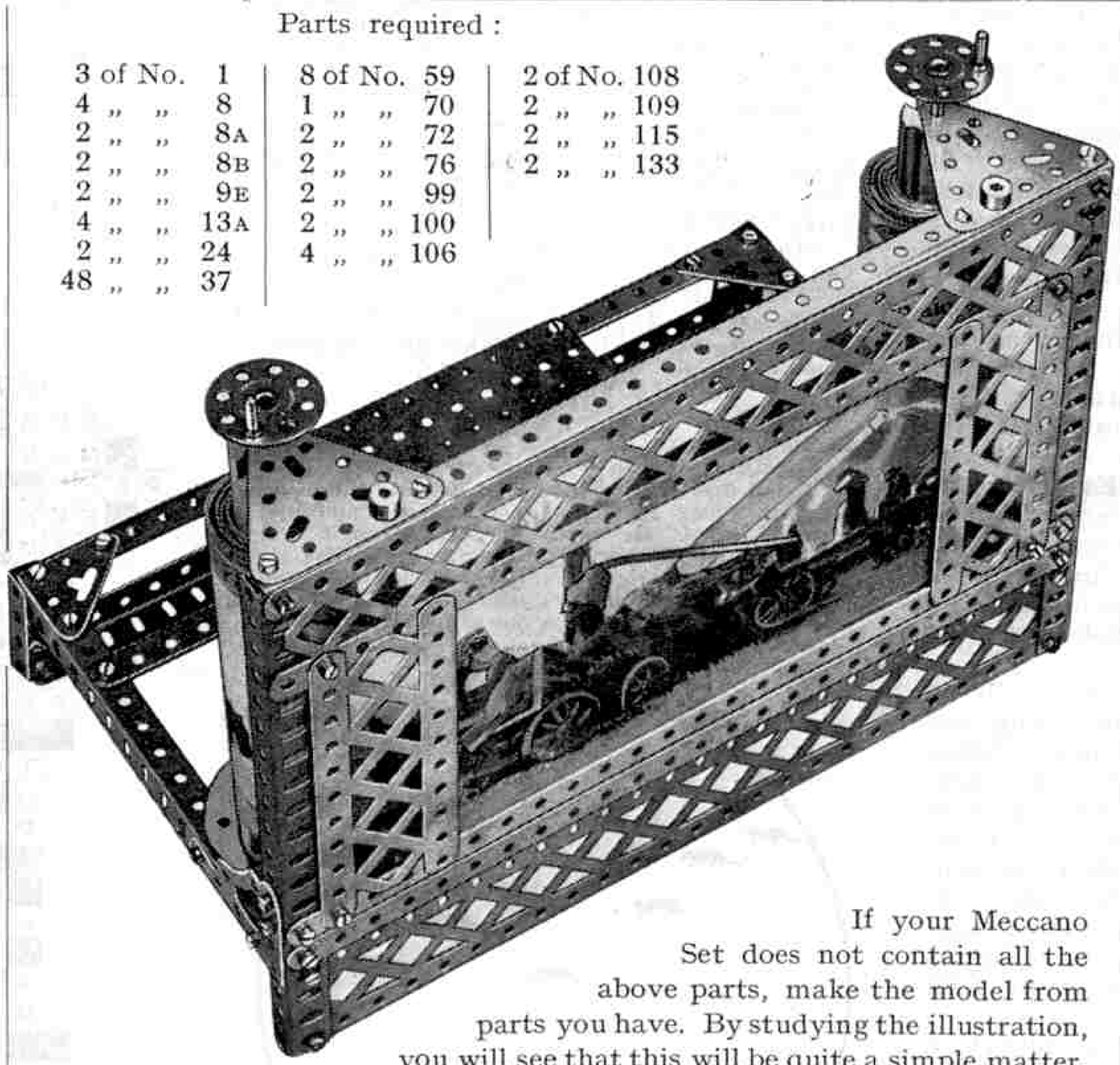
MAKE "FORCE" PANORAMA WITH MECCANO

Entertain your boy and girl friends with this wonderful "FORCE" panorama. You can make it from your Meccano set. Write to us for the panoramic picture strip. We will send it to you if you will enclose 6d. (with a "FORCE" packet top) towards the cost of it. This is surely the next best thing to a real cinema! Turn the handle and you unfold to your audience a wonderful panorama of the boundless wheatlands of Canada, where "FORCE" comes from. Here you see the scenes of ploughing, harvesting, threshing and all the other busy processes connected with the production of wheat for "FORCE." Let us imagine you are ready to commence:—

Down go the lights and your audience sits expectantly awaiting the thrilling moment when the pictures commence. You light up your stage and commence to turn the handle. Before them your audience will see first of all the ploughing. The great power driven ploughs will move across the scene to be followed by fields of ripening wheat; and so we move into the next scene. Now it is summer time and in the distance we see the reaping machines. Across the picture moves a procession of reapers and binders; and then we come to the shocked wheat ready for carrying to the threshing machines. Next come the heavily laden carts, and here is the wonderful scene of threshing. The grain is put into sacks, loaded into carts again, and off it goes to the elevators which line the railway siding. Here we find the train ready to complete the final stages of the journey. Elevators and siding give place to more fields of golden grain, and at last the "FORCE" mill comes into sight. Here the wheat is unloaded, cleaned and put through that wonderful process which turns the grains of whole wheat into crisp, nourishing and appetising flakes of "FORCE."

Parts required:

3 of No. 1	8 of No. 59	2 of No. 108
4 „ „ 8	1 „ „ 70	2 „ „ 109
2 „ „ 8A	2 „ „ 72	2 „ „ 115
2 „ „ 8B	2 „ „ 76	2 „ „ 133
2 „ „ 9E	2 „ „ 99	
4 „ „ 13A	2 „ „ 100	
2 „ „ 24	4 „ „ 106	
48 „ „ 37		



If your Meccano Set does not contain all the above parts, make the model from parts you have. By studying the illustration, you will see that this will be quite a simple matter.

How to Make the Model

The upright framework is constructed from two 9½″ Angle Girders joined at the top and bottom by 12½″ Strips and Braced Girders. A 12½″ Angle Girder is bolted in the fourth hole from the bottom of each of the upright members, at the rear of the lower Braced Girder. The platform, constructed from another 12½″ Angle Girder connected at each end to a 7½″ Angle Girder, the other ends of which rest upon the 12½″ Girder bolted to the upright framework, is supported at the rear by two 2″ Angle Girders which in turn are bolted to a further 12½″ Girder forming a base. The drums upon which the panoramic views are wound consist of two Meccano Wood Rollers butted together and secured to an 8″ Axle Rod by Collars and set-screws. A Face Plate is mounted at the base of each drum to support the scenes as they are rolled up. Two 2½″ Triangular Plates bolted to an Angle Girder secured to the top of the upright frame and 2½″ × 2½″ Flat Plates bolted in the front corners of the platform, provide suitable bearings for the drum shafts. Two further 8″ Rods are journalled in the fourth holes from the ends of the horizontal 12½″ Girders in the upright frame, and form guides round which the views are led from the rollers.

A 5½″ × 2½″ Flat Plate bolted at the back of the platform and further supported by a 12½″ Strip secured between the side 7½″ Girders forms a stand for a lamp, which illuminates the scenes as they pass from one roller to the other.

A bicycle-lamp, or pocket flash-light will serve this purpose quite well, or even a candle is sufficient. The effectiveness of the display is very much improved if a large sheet of cardboard is bolted to the face of the upright frame, and having a small piece cut away in order to reveal the pictures only. In this way, when the model is viewed from the front, nothing can be seen of the lamp, but only the illuminated scenes, and in a darkened room the result is very striking.

Still further fun may be had from this model if the rollers are driven by a clockwork or electric motor, and no doubt many Meccano boys will fix up such an arrangement.

When sending for panoramic picture strip (it is 16 ft. long) address your request with 6d. and one "FORCE" packet top, direct to—

SUNNY JIM (Dept. M.C.8),
197, Great Portland Street,
LONDON, W.1.

HIS EVIDENCE

Mother: "I don't believe you have washed your face after all."

Son (indignantly): "But mother, look at the towel!"

* * * *

Farmer (to small boy in tree): "Look here, my lad, what are you doing up there?"

Small boy: "Please sir, one of your apples fell down and I'm trying to put it back!"

* * * *

Lady (to tramp): "A great strong man like you ought to get work."

Tramp: "Madam, I'll tell you my misfortune. I'm an unhappy medium."

Lady: "Whatever do you mean?"

Tramp: "I am too heavy for light work and too light for heavy work!"

* * * *

Customer: "I want a dress to put on round the house."

Shop Assistant: "How large is your house, madam?"

* * * *

THE MILKMAN'S TROUBLES!

Mrs. Smith: "Why are you so late with the morning milk nowadays?"

Milkman: "Well you see, ma'am, the law only allows us 25,000,000 bacteria to the gallon, and you wouldn't believe how long it takes to count the little beggars!"

* * * *

Millionaire (addressing meeting of students): "I wish to emphasise that the whole of my great success is due to one thing and one thing only—pluck, pluck and again pluck."

Student (at back of hall): "But how are we to find the right people to pluck?"

* * * *

Small Child: "Mother, if I died should I go to Heaven?"

Mother: "Yes, dear."

Small Child: "But suppose I died because a big bear swallowed me, would he have to go too?"

This Month's Short Story

Doctor Bell fell down a well
And broke his collar bone.
Doctors should attend the sick,
And leave the well alone.

* * * *

Brown: "How did you get that lump on your head?"

Smith: "Appendicitis operation."

Brown: "But what had that to do with your head?"

Smith: "They ran short of ether and hit me over the head with a hammer."

* * * *

Nervous Passenger (to captain): "What would happen, Captain, if we struck a large iceberg?"

Captain: "The iceberg, Madam, would pass along as if nothing had happened."

Nervous Passenger: "Thank you Captain, you have relieved me very much!"

* * * *

SOME BIRD!

The old lady had been given a parrot that had come from Africa, and she was proudly showing it to her gardener. "Do you know," she said, "this parrot has come all the way from Africa, and it is so intelligent that when it sings 'Home, Sweet Home,' tears run down its cheeks."

"Yes, mum," replied the gardener, "I know those African parrots well. I had one some years ago, and it used to whistle 'The Village Blacksmith' so realistically that streams of sparks used to fly from its tail!"

* * * *

Bobbie: "Please can I change my name to-day, mother?"

Mother: "What on earth for?"

Bobbie: "Because Dad says he will whip me when he gets home as sure as my name's Bobbie!"

* * * *

Family Cat (inspecting new mouse trap): "I wonder if that is a labour-saving device for my benefit, or whether I am going to lose my job!"

* * * *

George: "Do you know why cats are so musical?"

John: "I haven't the least idea."

George: "Well, my grandfather says it is because they have so many violin strings curled up inside them."

STICKY!

Teacher: "What is a compound word?"

Boy: "Two words joined together so as to make one."

Teacher: "Give me an example."

Boy (after prolonged thought): "How would 'molasses and me' do?"

* * * *

First boy: "It says in this paper that a codfish lays more than a hundred eggs at a time."

Second boy: "What a good thing it doesn't have to cackle for each one!"

* * * *

Diner: "Here waiter, I thought I ordered a chop?"

Waiter: "Yes sir, there it is."

Diner: "Oh, you surprise me, I thought it was a crack in the plate!"

* * * *

She: "How is your bachelor friend going on?"

He: "When I saw him last he was mending very slowly."

She: "I did not know he had been ill."

He: "He hasn't, he was darning his socks!"

* * * *

OBVIOUSLY!

Teacher: "In which battle did General Wolfe, on hearing that victory was won, cry, 'I die happy.'"

Tommy: "I think it was his last battle."

* * * *

Tommy (looking up from his book): "Mother, Robinson Crusoe must have been a contortionist."

Mother: "Whatever makes you say that?"

Tommy: "Well, it says here that after he had finished his day's work he sat down on his chest!"

* * * *

Bilious Individual (to chemist): "Will you give me something for my head?"

Chemist: "I wouldn't take it as a gift."

* * * *

Q. When is an umbrella like suet?
A. When it is dripping.

* * * *

Q. Why must a fisherman be wealthy?
A. Because his is all net profit.

HORNBY CLOCK WORK TRAINS

THE TRAINS WITH THE GUARANTEE

YOU can have any amount of fun playing with a Hornby Train. Shunting, coupling-up the rolling stock and making up trains will give you hours of pleasure. Hornby Trains are beautifully finished, strongly made, and will last for ever. One of their most valuable features is that all the parts are standardised, and any lost or damaged part may be replaced with a new one.

Every train is guaranteed, and you are therefore sure of satisfaction if you buy a Hornby.

No. 2 PULLMAN SET

No. 2 Pullman Set

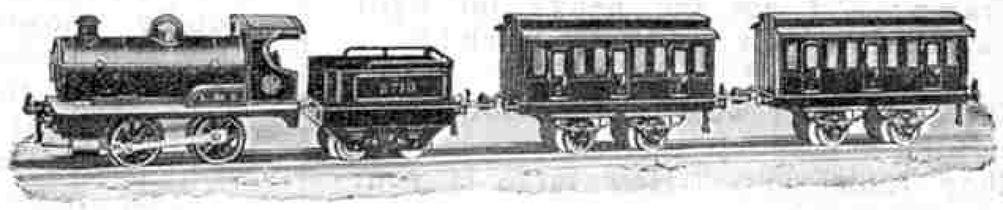
The No. 2 Loco with Tender measures 17 in. in length. The Loco is fitted with superior mechanism and the accurately-cut gears ensure smooth running. Loco, Tender and Coaches are superb in appearance and finish, enamelled in colours and stoved at a high temperature to ensure durability. The Loco is fitted with reversing gear, brake and governor.

Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling-stock. Each set contains Loco, Tender and two Coaches, with set of rails to form a circle of 4 ft. diameter. Price 60/-.

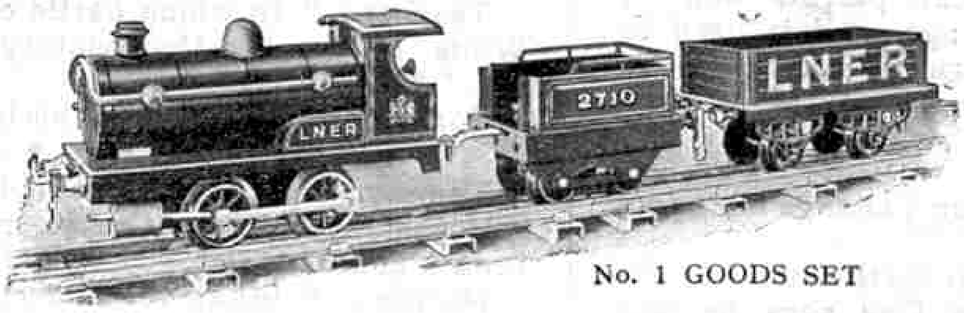
No. 1 Passenger Set

The Loco is fitted with reversing gear, brake and governor. Loco, Tender and Coaches are superb in appearance and finish, enamelled in colour and stoved at a high temperature to ensure durability. The doors of the Coaches open.

Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling-stock. Each set contains Loco, Tender, two passenger coaches and set of rails consisting of two straights and curves to form a circle of 2 ft. diameter. Price 30/-



No. 1 PASSENGER SET



No. 1 GOODS SET

No. 1 Goods Set

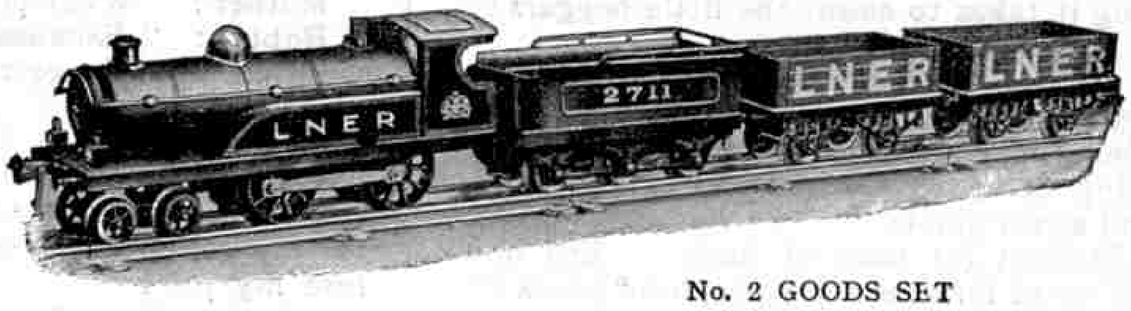
Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling-stock. Each Loco is fitted with reversing gear, brake and governor. Each set comprises Loco, Tender, one Wagon, and set of rails as in the No. 1 Passenger Set. Price 22/6

No. 1 Hornby Loco	Price 15/-	Hornby Passenger Coach	Price 5/-
" " Tender	" 2/6	No. 1 Hornby Wagon	" 2/6

No. 2 Goods Set

Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling stock. This set contains Loco, Tender and Rails as in the No. 2 Pullman Set, and two Wagons. Loco fitted with reversing gear, brake and governor. Price 37/6

No. 2 Hornby Loco ...	Price 22/6	Hornby Pullman or Dining Car ...	Price 15/-
" " Tender	" 3/6	No. 2 Hornby Wagon	" 2/6



No. 2 GOODS SET

Ask your Dealer to show you the Hornby Trains

MECCANO LTD., BINNS ROAD, LIVERPOOL

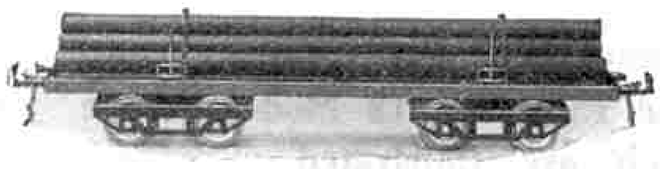
ROLLING STOCK AND ACCESSORIES

(HORNBY SERIES)

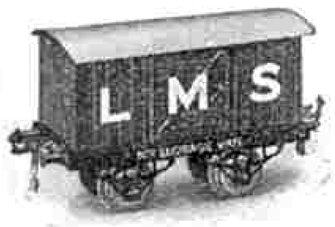
There are now 50 different train accessories—Stations, Signal-boxes, Lamps, Wagons, Level-Crossings, Foot-Bridges, Turntables, etc. Further accessories will be added to the system from time to time, and will be announced in the pages of the "*M.M.*"

All Hornby Rolling Stock and Accessories are built in correct proportion to the size, gauge, method of coupling, etc., of the Hornby Trains and all have the uniformly beautiful finish that is the great feature of the Hornby series. With these accessories you can build up a most realistic railway system, and the splendid range of rails, points, and crossings make possible endless variety in rail layout. Hornby Trains are British made, and your dealer will be able to show you specimens of the new products.

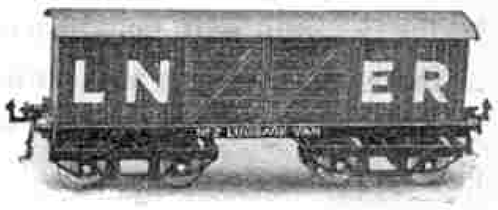
SIDE TIPPING WAGON
Excellent design and finish.
Price **3/6**



No. 2 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Suitable for 2 ft. radius rails only. Price **5/-**

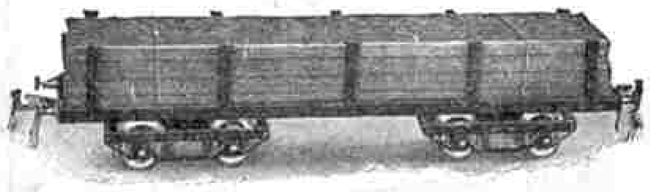


No. 1 LUGGAGE VAN
Representative colours.
Price **4/-**



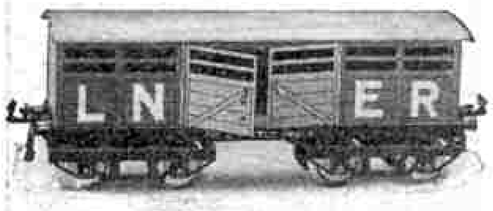
No. 2 LUGGAGE VAN
Finished in colour. Fitted with double doors. Suitable for 2 ft. radius rails only. Price **6/6**

SECCOTINE VAN
Price **4/-**



No. 2 TIMBER WAGON
Beautifully enamelled in colour and stoved. Suitable for 2 ft. radius rails only. Price **4/6**

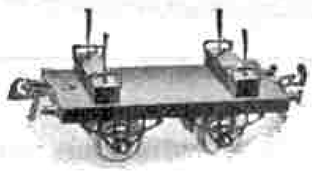
No. 1 CATTLE TRUCK
Fitted with sliding door. Very realistic design.
Price **4/-**



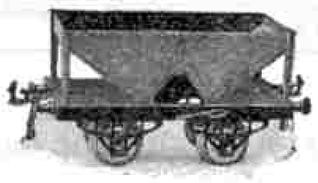
No. 2 CATTLE TRUCK
Splendid model fitted with double doors. Suitable for 2 ft. radius rails only. Price **6/6**

MILK TRAFFIC VAN
Fitted with sliding door, complete with milk cans. Price **4/6**

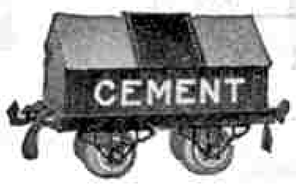
ROTARY TIPPING WAGON
Finished in colour.
Price **4/-**



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



HOPPER WAGON
Mechanically unloaded. Finished in colour. Price **4/-**

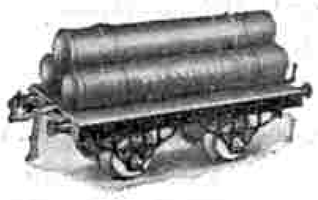


CEMENT WAGON
Finished in colour.
Price **4/-**

GUNPOWDER VAN
Finished in red.
Price **4/-**

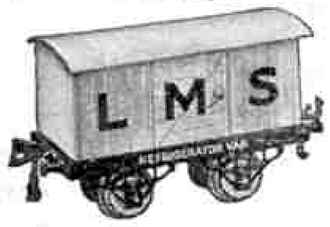
BISCUIT VAN
Price **4/-**

No. 1 TIMBER WAGON
Beautifully enamelled in colour and stoved. Price **2/-**

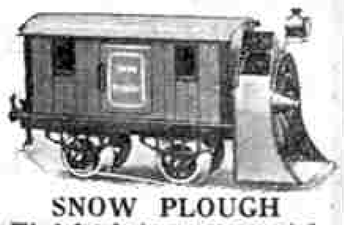


GAS CYLINDER WAGON
Finished in red, lettered gold.
Price **3/-**

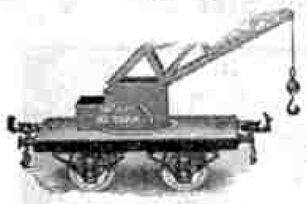
PETROL TANK WAGON
Finished in colour.
Price **3/-**



REFRIGERATOR VAN
Enamelled in white, lettered black. Price **4/-**

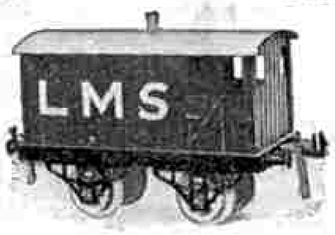


SNOW PLOUGH
Finished in grey, with revolving cutter driven from front axle.
Price **5/6**

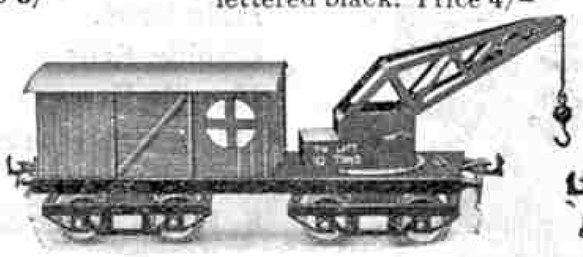


CRANE TRUCK
Working model.
Finished in colours.
Price **4/6**

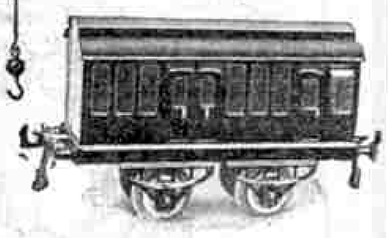
TROLLEY WAGON. Finished in colour. Suitable for 2 ft. radius rails only. Price **6/-**



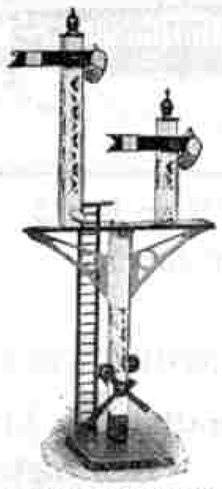
BRAKE VAN
Finished in colour.
Price **4/-**



BREAKDOWN VAN AND CRANE
Excellent finish. Beautifully coloured. Suitable for 2 ft. radius rails only. Price **7/-**

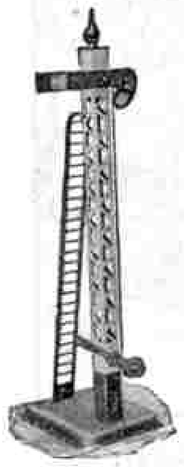


GUARD'S VAN
Price **5/-**

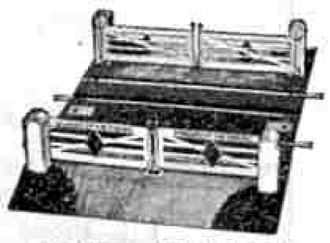


JUNCTION SIGNAL
Signal arms operated by levers at base. Very realistic model standing 14 in. in height. Price **5/6**

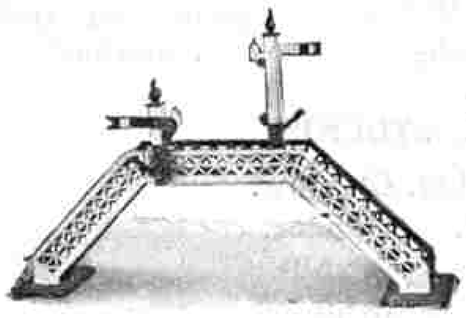
SIGNAL CABIN
Dimensions: height 6½ in., width 3½ in., length 6½ in. Finished in colour and lettered "Windsor." Roof and back open to allow signal-levers to be fitted inside cabin if desired. Price **6/6**



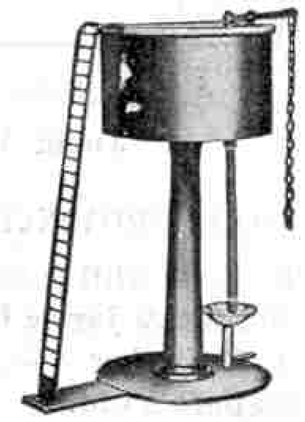
SIGNAL
Price **2/6**



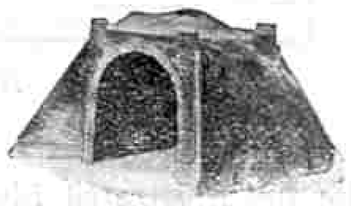
LEVEL CROSSING
Beautifully designed in colour. Measures 11½ in. × 7½ in., with Gauge 0 Rails in position.
Price **6/6**



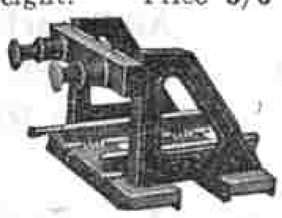
FOOT-BRIDGE
No. 1. With detachable signals. Price **6/-**
No. 2. Without signals. Price **3/6**
Signals, per pair **2/9**



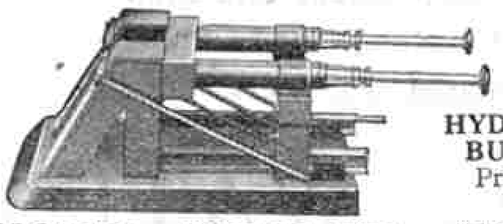
WATER TANK
Brightly coloured in red, yellow and black, 8½ in. in height, with flexible tube and pump lever.
Price **6/6**



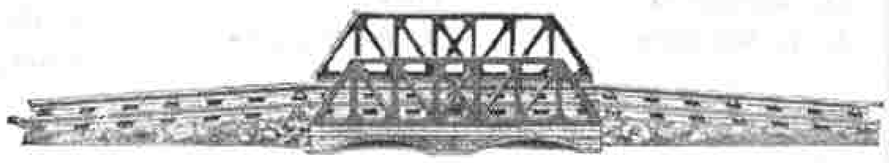
TUNNEL
Price **7/6**



SPRING BUFFER STOP
Price **1/6**



HYDRAULIC BUFFERS
Price **5/-**



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LOTT'S BRICKS

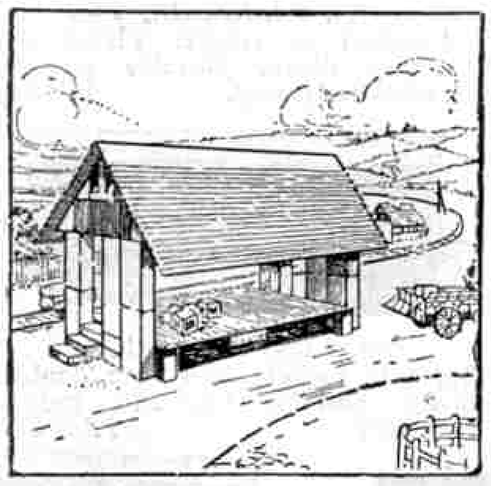
OF STONE

THE NEW RAILWAY BOX "OA" IS NOW READY

Price 3/3

The box is self contained and complete with designs, bricks, and roofs for 12 Models, three of which are illustrated

If you have not already added these Bricks to your Model Railway, you will be surprised at the extra pleasure and amusement, a single box even, will give you.

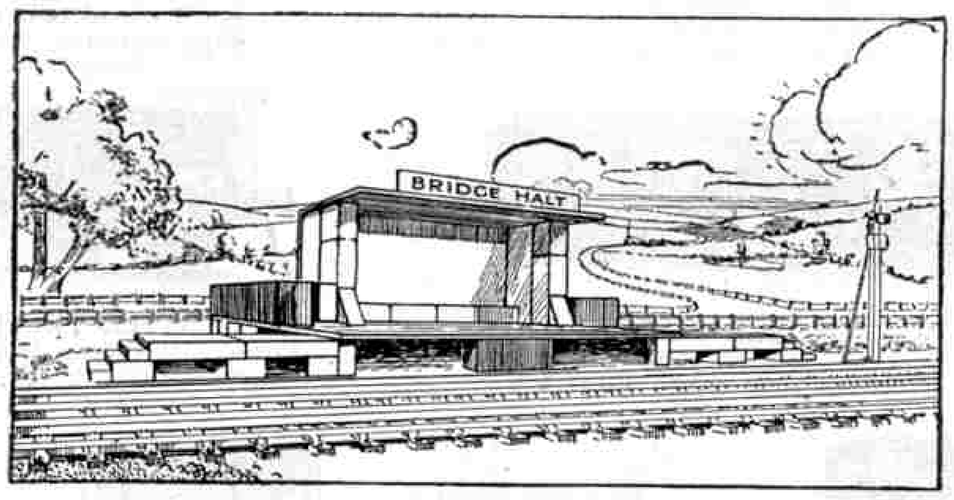


Goods Shed

SERIES "B."

2/–	Box,	6	Models.
3/3	,,	12	,,
5/–	,,	12	,,
10/–	,,	18	,,
17/6	,,	49	,,
37/6	,,	71	,,

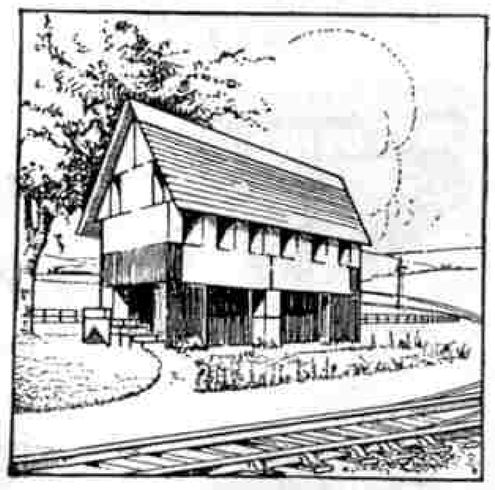
A Model from Box 2
Tudor Blocks



Halt

Start now with one box. You will soon want some more.

The Bricks that will make your Railway like the real thing. White Paling Fences, Trees and Golden Sand, as found in the Garden Sets, give a delightful finish and charm, that nothing else can.



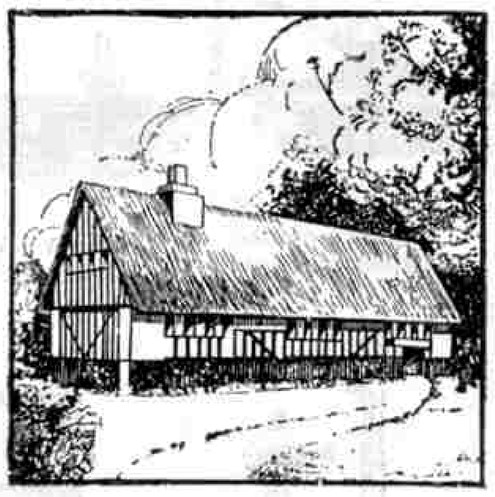
Signal Cabin

"TUDOR BLOCKS"

Box 1.	6 Models	...	3/6
,, 2.	12 ,,	...	7/6
,, 3.	18 ,,	...	17/6

GARDEN SETS.

Box 1 contains Trees, Fences, Roofs, Shrubs, Shells, and Golden Sand	4/–
Box 2. Larger Size ...	6/–



A Model from Box 3
Tudor Blocks

A FEW STOCKISTS IN THE U.S.A.

For the benefit of readers there.

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Abraham & Straus – – –	Brooklyn, N.Y.
Gimble Bros. – – – –	Philadelphia, Pa.
May Dept. Stores Co. – –	St. Louis, Mis.
Hamburgers – – – –	Los Angeles, Cal.
Hale Bros. – – – –	San Francisco, Cal.
Gimble Bros. – – – –	Milwaukee.
Mandle Bros. – – – –	Chicago, Ill.
May Dept. Stores Co. – –	Cleveland, O.
M. O'Neil Co. – – – –	Akron, Ohio.
S. Kann, Sons & Co. – –	Washington, D.C.

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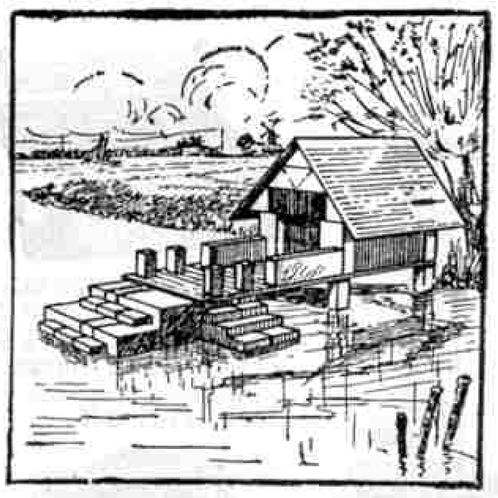

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A. V. Worden – –	St. Annes-on-Sea.
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By FRANK ELIAS

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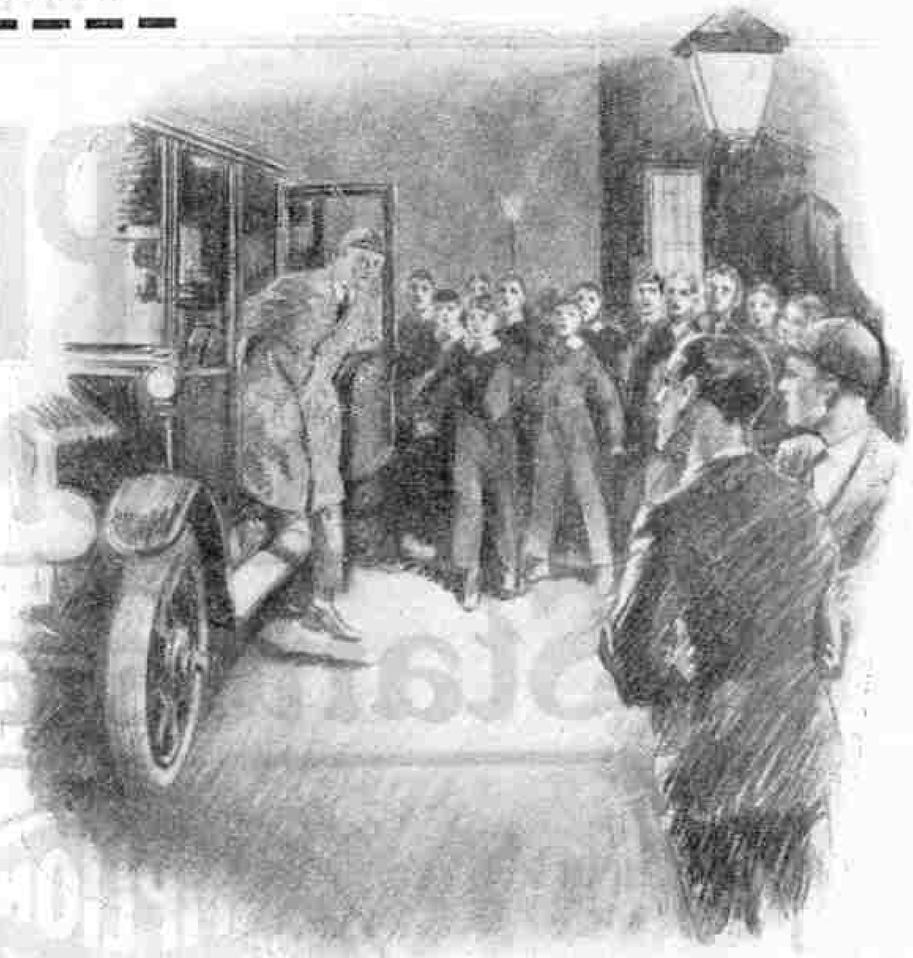

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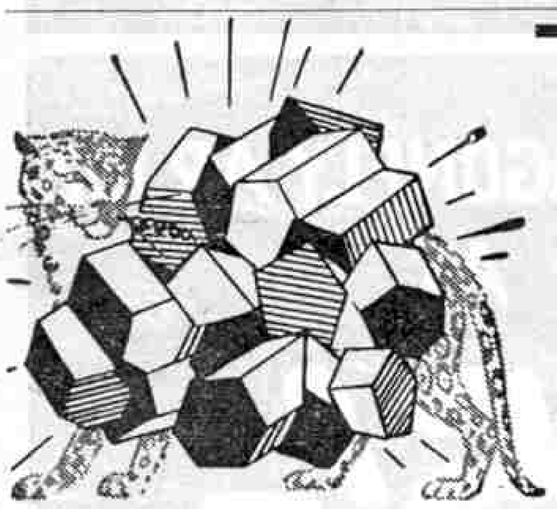

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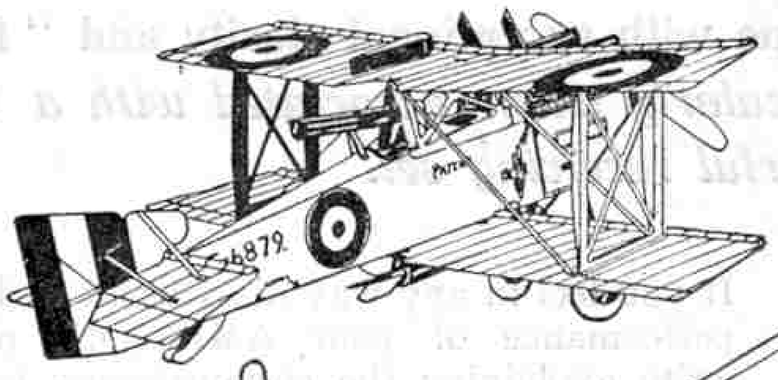

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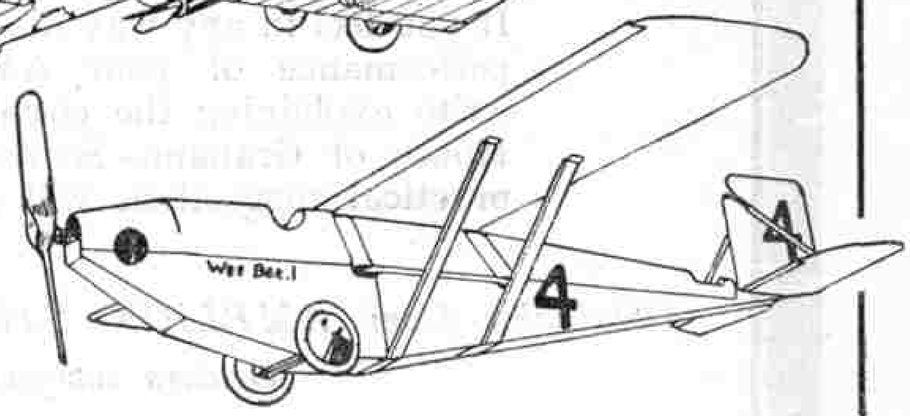

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FINISHED MILITARY GLIDER ...	**4/6**	Postage and Packing 1/9 extra
Set of cardboard parts with all necessary elastic, wood, wire and book of Instructions	**1/-**	Postage and Packing 4d. extra
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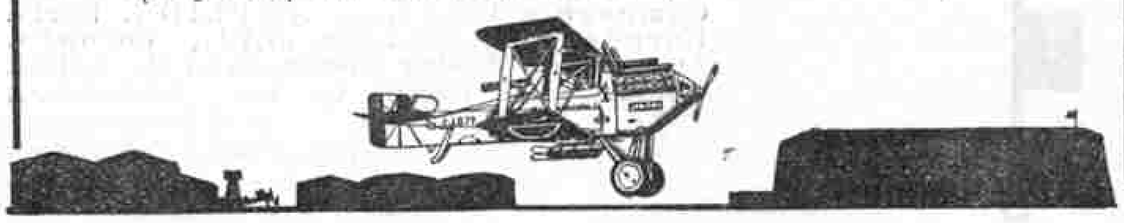

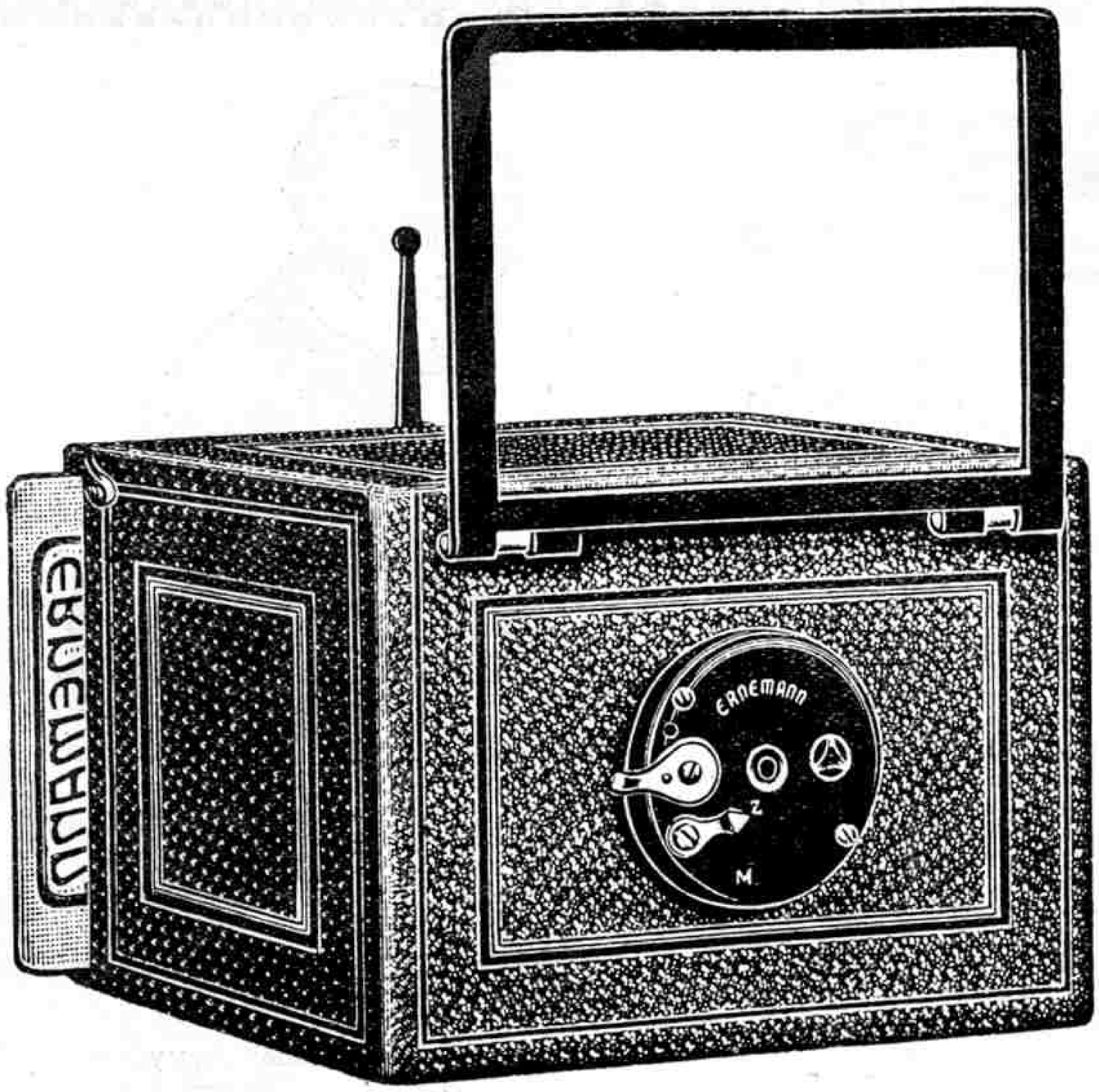

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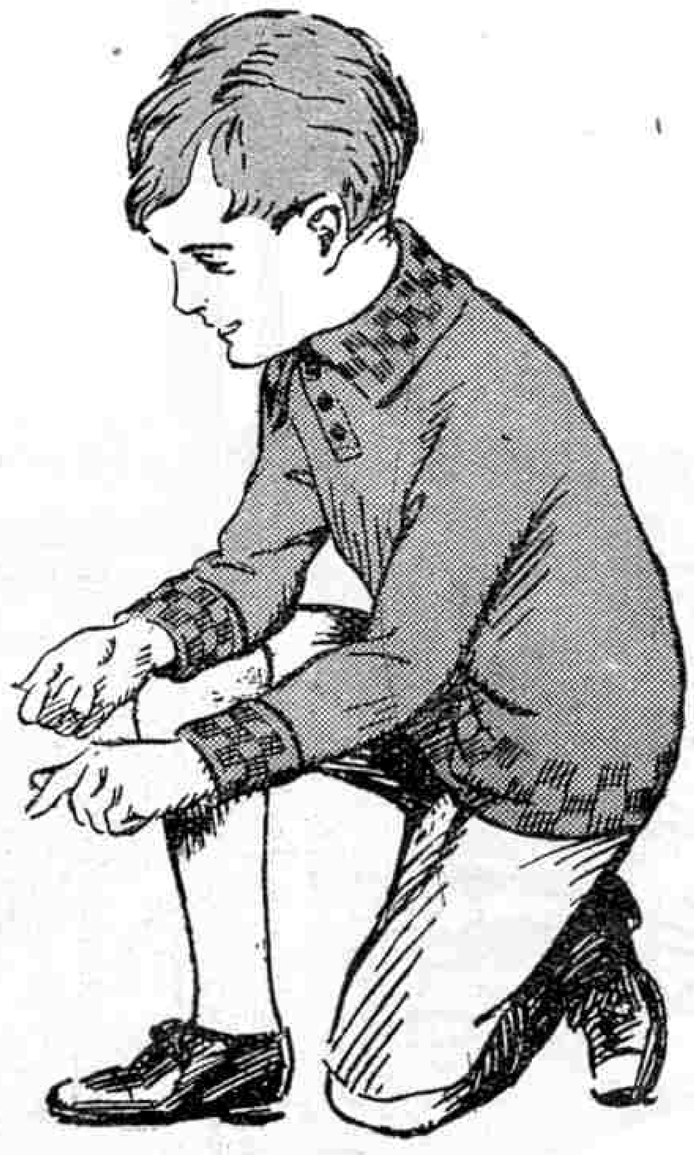

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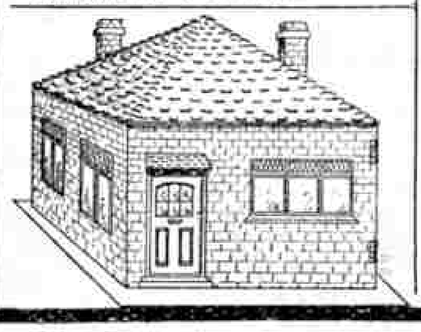

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Colored Sticks of Wood for Window Frames and Door Posts.

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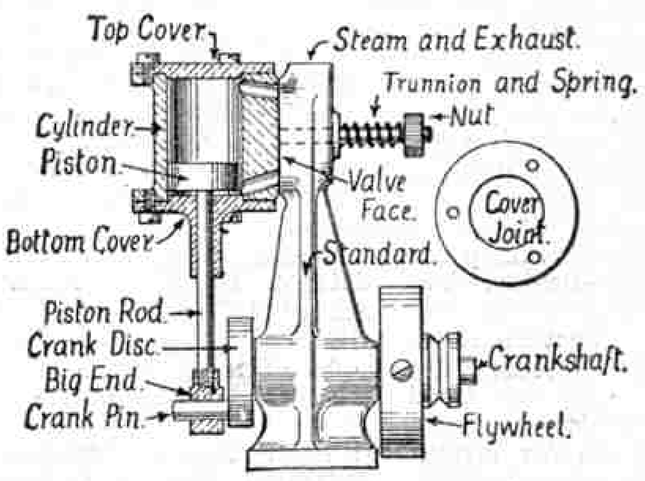

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The rates are one penny per word, with a minimum of 1/- (cash with order).

Your advertisement must be received before the 10th of the month for insertion in the following month's issue.

If a Box Number is used, 4d. should be added to cover the cost of postage of the letters to the advertiser from this office. The letters will be posted one week after the advertisement appears, and a second batch a month after the advertisement appears. They will be sent more frequently if additional postage is included with the advertisement.

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I find your periodical very satisfactory. W.D.Ltd.

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Copies of "Chums," "Scout," "Meccano Magazine," etc. What offers.—D. Pritchard, Hollies, Carmarthen.

256 different Photographs of footballers, etc., in two albums. Good condition, 7/6.—Crossland, Fauvel Road, Glossop.

Briton Air Pistol, cost 10/6. New at Christmas. What offers?—Willie Ballantyne, Mosside Cottage, Bathgate, Linlithgowshire, Scotland.

For Sale. 444 Cigarette Cards, 6d. dozen.—S. Forbes, 17, Kilnburn, Newport, Fife.

Cigarette Cards and Albums for sale, six Albums holding 200, 1/6 with cards, one holding 400, 2/6 with cards.—Hills, 45, Bell Street, Henley-on-Thames, Oxon.

Sale. Volume Chums, unbound, 6/6. Also Primus Motor, nearly new, 7/6.—Box No. 504.

Horizontal Steam Engine, slide-valve cylinder. As new. Cost 30/-. Will exchange for good Air Rifle.—Evans, Bryn Fawnog, Maenan, Llanrwst.

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Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES :—

BINNS ROAD, LIVERPOOL.

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 3d. per copy. It will be mailed direct from this office, 2/- for six issues and 4/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest; payment will be made for those published. Whilst every care will be taken of those submitted, the Editor does not accept responsibility for any loss or damage. A stamped addressed envelope should be sent where the contribution is to be returned if unacceptable.

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Readers Overseas and in foreign countries may order the *Meccano Magazine* from regular Meccano dealers, or direct from this office. The "*M.M.*" is sold Overseas at 3d. per copy, or mailed (post free) direct from Liverpool, 2/- for six issues, or 4/- for twelve issues.

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Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. 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.

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The **FAIRYCYCLE** is a **real** Cycle—**not** a make-believe. **It is** beautifully constructed, **runs** with remarkable ease, and is **safe** because the low riding **position** makes it easy to control. **And** it is BRITISH.

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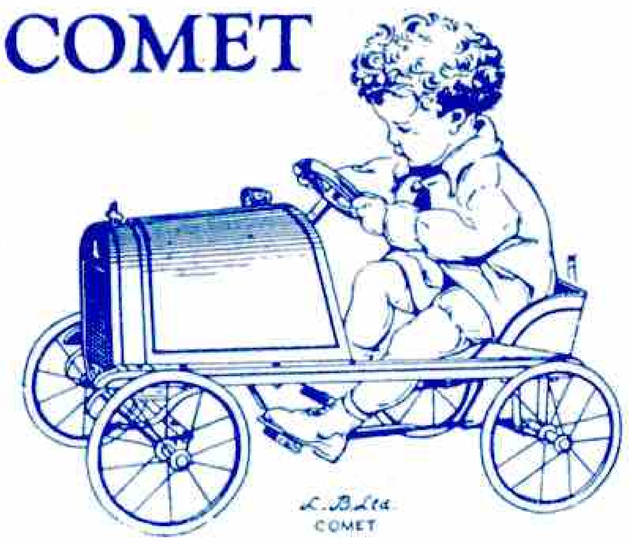

This natty little racing model is the very thing for the youngsters. It is built for sturdy boys and girls, and will stand any amount of rough wear. The double crank movement makes it very speedy.

ℂ Look for the Triangle Trade Mark on all these toys

The PEDAL FAIRYKAR

Regd. Trade Mark

Baby will love this Pedal Fairykar. There is nothing to beat it. It is beautifully painted a bright red with nickel-plated handle bar and stem, rubber pedals, etc. A splendid health-giving toy.

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Sole Manufacturers:

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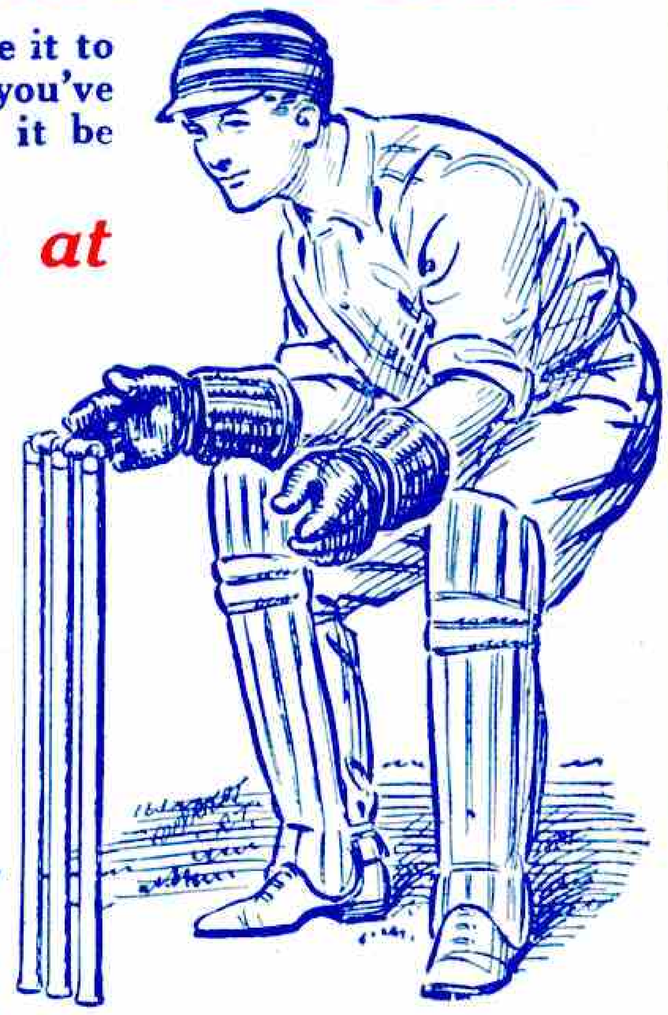
Just come along to Holborn and take a look round Gamages! . . You'll declare it to be an afternoon WELL SPENT, and what's more, you'll see all those things you've been wanting for so long but have been unable to get elsewhere. Whether it be Fishing, Cricket, Tennis, Cycling, Chemistry, Photography you'll find

All Your Requirements for Summer are at

GAMAGES



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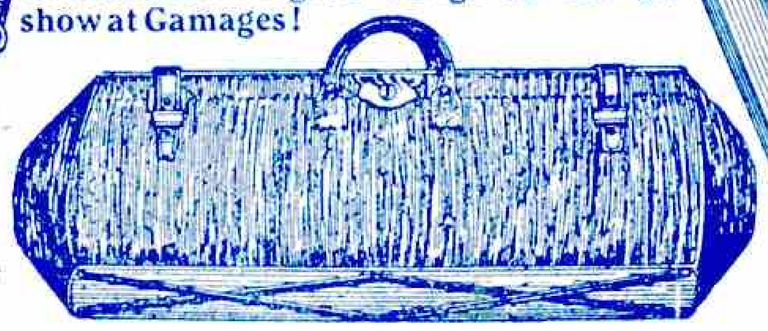

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The very thing for a Junior Club. Strong Brown Canvas, whole cut, double handles, two straps and buckles, top lock and key, good lining. Size 36"×12"×8" **12/6**

Strong Carpet Bag, full size, double handles, lock and key, two end straps, strong lining, leatheroid bottom. Size 36"×12"×5". Price **18/6**

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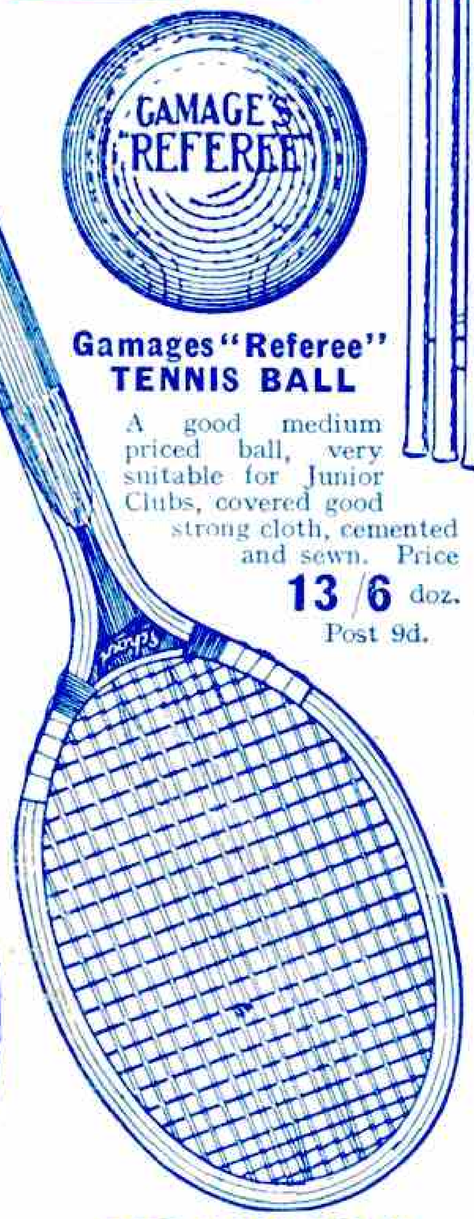
A good medium priced ball, very suitable for Junior Clubs, covered good strong cloth, cemented and sewn. Price **13/6** doz. Post 9d.



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This is the best equipment of its kind on the market, yet prices are low. Visit us to see the value offered.

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Special Tan Cape Gauntlets, very strong and serviceable for the wicket keeper Well ventilated rough palm. Youths' size, per pair ... **8/6**

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Youths' Strong White Drill Leg Guards, 14", per pair **6/6**

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Well made, very comfortable and smart in appearance. All sizes, in white matt.

Prices **6/6 5/6** and **4/6**

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Youths' White Cricket, made from thoroughly shrunk cloth. Side straps and permanent turnups. Sizes to fit boys from 10 to 18 years in three qualities.

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In various colours. All-wool flannel to fit ages 4 to 18 ... **14/6** each

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7 oz. Tin, each **8d.** Pint Tin, each **1/9**
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Uppers of the finest quality Stout White Canvas, stout ⅜" Butt leather soles, heavily stitched, splendid wearing and very comfortable. Boys' sizes 2, 3, 4 and 5 per pair **14/9**

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Featherweight, good tan cape, hair stuffed fingers, strong elastic.

Youths' size, per pair ... **4/6**

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Daylight Loading Roll Film Camera, 2½"×1⅝" (Standard Vest Pocket Size) film. Covered black leatherine, splendid lens, Dimensions 2½"×3½"×4⅛". Price **7/-** Post free.

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