Vol. X No. 12 December 1925

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MECCANO MAGAZINE

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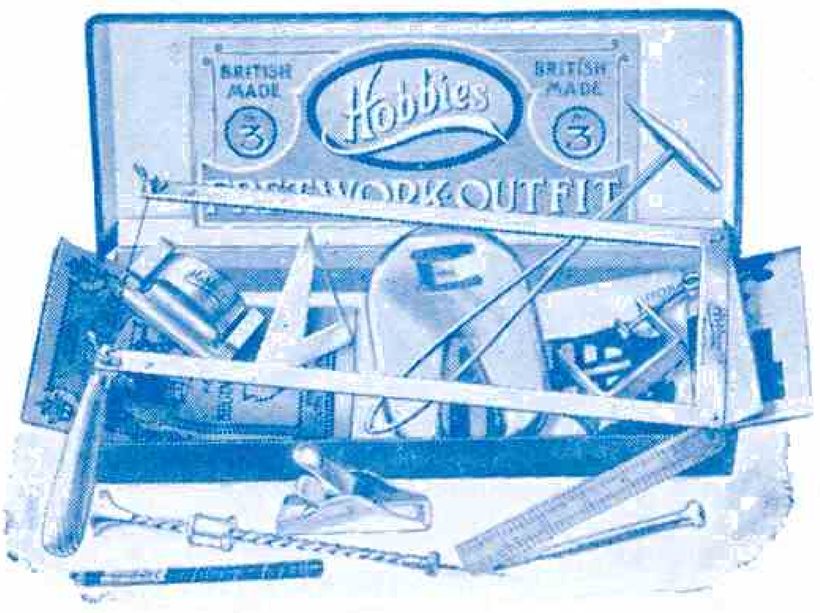

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EDITORIAL OFFICE
Binns Road,
LIVERPOOL

Vol X. No. 12.

MECCANO MAGAZINE

PUBLISHED
IN THE INTERESTS
OF BOYS

December 1925

With the Editor

Christmas Greetings to All My Readers

My first words in a Special Christmas number must always be to wish my readers "A Very Merry Christmas." On Christmas morning I shall be thinking of you all—100,000 or more happy "*M.M.*" readers in all parts of the world. I wish I could visit you all in your homes and share with you the great fun and frolic of this festive season. To do this would be impossible, but as I join in the revels in my own home I shall remember you all and wish that everyone of you will have a really jolly time during the Festive Season.

At this time of the year we invariably welcome to our ranks hundreds of thousands of new friends—those boys who have received a Meccano Outfit or a Hornby Train as a Christmas present. Each one joins the great brotherhood of Meccano boys, and each becomes a member of our world-wide movement, with great pleasures in store and many happy days ahead. Let us remember these new friends also on Christmas morning, when we all send out by our thoughts a cheery message of goodwill and friendship to all Meccano boys, young and old, wherever they may be.

A Cover with a Story

Many of our readers will no doubt have seen the photograph reproduced on this month's cover, as a very effective poster exhibited by the Southern Railway Company, by whose courtesy we are able to reproduce the subject as a cover design. The photograph was an amateur's happy "snap" taken when the little boy was unconcernedly chatting to the driver of one of the famous "King Arthur" locomotives. Both boy and driver were quite unaware of the fact that they were being photographed and that the result would become a famous poster!

When the possibilities of this photograph were realised, efforts were made to trace the boy. He proved to be Ronald, son of Mr. W. Witt, a former employee of the Company. Ronald and his parents are now in California, but an enlargement of the photograph, together with a framed photograph of the poster, has been sent to him by the Southern Railway. No doubt Ronald was as surprised as his parents were proud when the parcel arrived!

An Important Announcement

Last month we commenced a new feature, "Meccano Standard Mechanisms" which will be continued regularly each month in 1926. In this connection a supplementary Manual is in active preparation. This book will be of the same size of page as the Meccano Manuals and will consist of illustrated instructions for building mechanisms that are constantly required by keen model-builders. Different forms of gearing, brakes, pulleys, levers, belt and chain drives, ball and roller bearings, and other mechanisms will all be featured. Most of these mechanisms are standard—that is to say, they may be applied to one or more models—and it is with a view to making model-building easier that the book is being published.

We have had this series in mind for several years, and have been collecting material for it for some time. We feel sure that it will meet with an enthusiastic response from Meccano boys.

The Standard Mechanisms Manual will not be ready until next month, and further particulars regarding the price, date of publication, etc., will be given in our next issue.

Buy British Goods

The latest return of unemployed persons shows that 1,250,000 workpeople are walking the streets because no employer is able to find work for them to do. I feel sure that my readers sympathise with these unemployed—especially those with families—who, through no fault of their own cannot find work.

The cause and remedy of so much unemployment cannot well be discussed in these pages, but I take this opportunity of reminding my readers that at this season of the year there is at least one way in which they can very materially help. This is to "Buy British Goods" this Christmas, or—where possible—politely suggest to parents and uncles that they should give only British-made goods as Christmas presents.

During the next fortnight over £2,000,000 will be spent on toys. If foreign-made toys are purchased, at least half this sum will go out of Britain to pay the wages of foreign workpeople. On the other hand, if British toys are purchased, not only does the whole of the money remain in this country, but it will circulate again and again, passing through various hands, providing further employment and improving trade.

To buy British goods is no sacrifice. In fact, most British toys are vastly superior, both in regard to quality and ingenuity, to the best foreign-made articles. They are well-designed, well-constructed, well-finished, and there is the additional satisfaction of knowing that in buying British-made goods, the purchaser is helping in some small measure to remedy the great evil of unemployment. Buy British Goods.

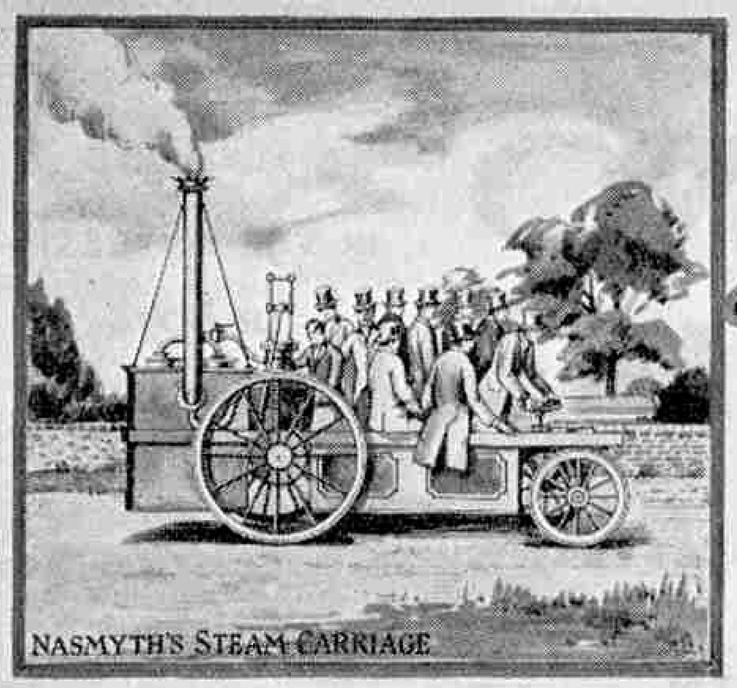
Our "Readers' Page"

A short time ago I announced that I intended to set aside a page each month for articles from my readers, such articles not to exceed 500 words in length and to be about matters of general interest. I should like to remind my readers of this, for I feel sure that a large number of them, who have ideas and the ability to write short interesting articles, have not yet considered the matter seriously.

From my correspondence it is evident that the personal touch about these articles is greatly appreciated. The "Readers' Page" affords a specially good opportunity to those who live overseas and in out-of-the-way parts of the world—where everyday life and surroundings are so different from those at home. Everyone is interested in hearing of these things, of the countries in which our readers live, and the people with whom they come in contact.

I feel certain that there are many readers at home and abroad whose fathers or brothers are engaged in some special kind of work that may be of interest, and if readers would send me short articles, they will enable others to share in this interest. Strange sights; hobbies; interesting experiences; local engineering achievements, and dozens of other similar things, all form suitable subjects for articles for the "Readers' Page."

As I have several times pointed out, no contributor should hesitate to send me an article because he has fears about his composition or spelling. I am always glad to revise such articles and put them into shape, and to have good drawings made from rough sketches. All articles used are paid for at our usual rates.



Lives of Famous Engineers

XXIII James Nasmyth and the STEAM HAMMER

NASMYTH'S Bridgewater Foundry developed steadily. The temporary buildings erected in the first place were gradually replaced by substantial brick structures and in a few years the locality became a thriving colony of skilled mechanics.

Nasmyth was struck with the high average ability of the workmen who came to him for employment, and he was greatly interested to find on investigation that this ability was most probably inherited from the Norman smiths and armourers introduced into the neighbourhood by Hugo de Lupus, chief armourer of William the Conqueror, after the battle of Hastings in 1066. According to the information obtained by Nasmyth from William Stubbs of Warrington, maker of the famous Peter Stubbs' "Lancashire Files," Hugo de Lupus, the first Earl of Chester, settled in north Cheshire soon after the Conquest. He occupied Halton Castle and his workmen resided in Warrington, Appleton, Widnes, Prescot and Cuerdley, where they produced coats of steel, mail armour and steel and iron weapons. In this manner was established a local manufacture that continued for many centuries, during which its character gradually changed, a steady development taking place from weapons of war to implements of peace. Thus was accounted for the unusual mechanical instincts and ability of the local workmen.

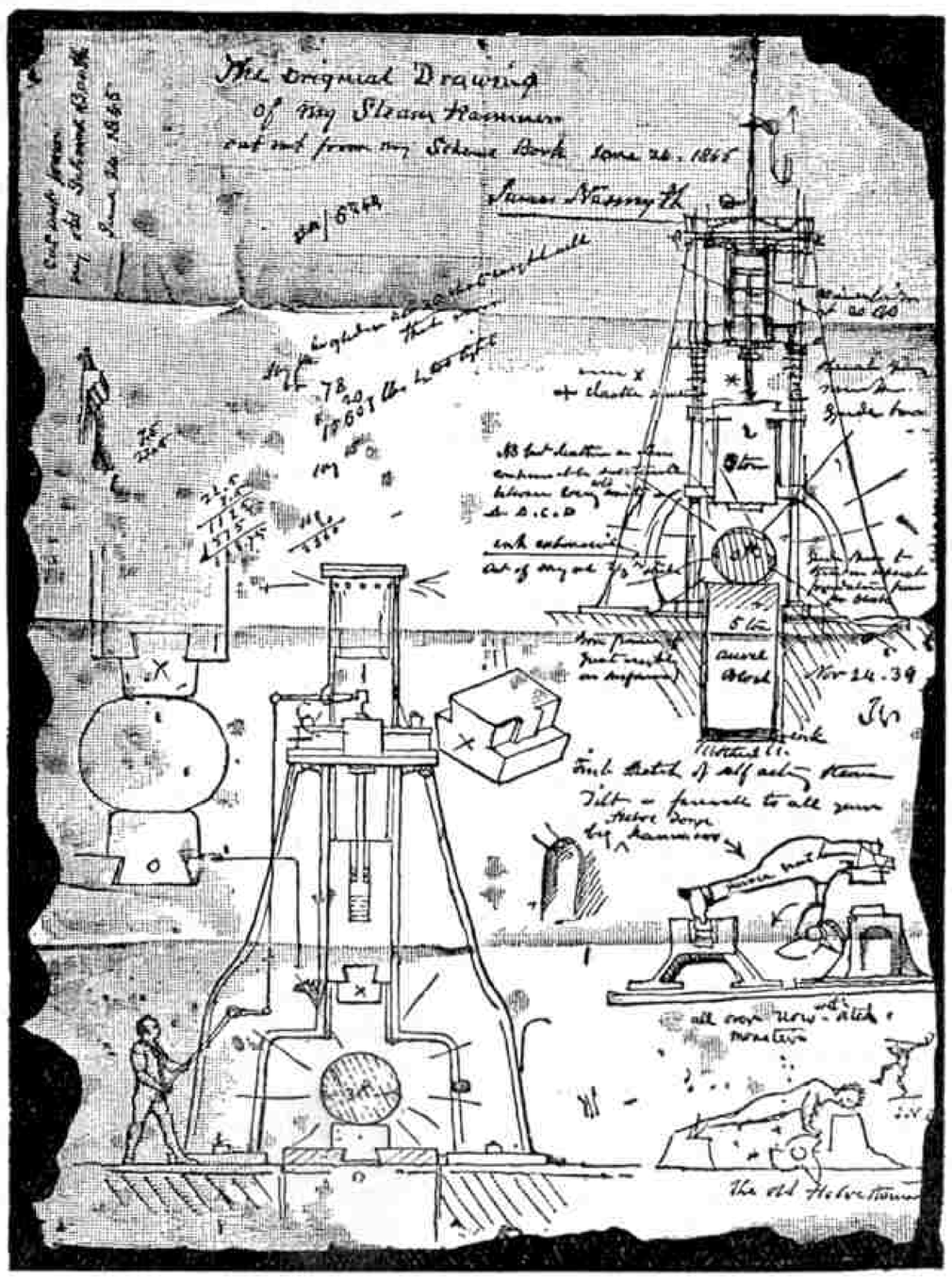
The Railway Mania

After the opening of the Liverpool and Manchester Railway on 15th September, 1830, railways began to take hold of the popular imagination, and before long railway building became a mania. Gradually coaches were driven off the roads and railway lines were built further and further into country districts, to the great astonishment of the inhabitants.

Nasmyth used to tell the story of a shepherd and his wife who came from beyond the Pentlands to see the first train pass at the opening of the line from Edinburgh to Glasgow. On came the train, and in a couple of minutes was out of sight. "How wonderful are the works o' man!" exclaimed the shepherd. "But what's a' the hurry for?" rejoined his wife!

Builds Locos for G.W.R.

As the railways extended, the demand for locomotives became very great, and during the ten years or so following the opening of the Liverpool and Manchester line Nasmyth's foundry carried out extensive orders for locomotives for the London and Southampton, the Manchester and Leeds and the Gloucester Railway Companies. He also was successful in tendering for the building of 20 locos for the Great Western Railway Company. This contract contained a very interesting condition, namely, that if, after a month's trial, the locos proved satisfactory, a premium of £100 was to be added to the price of each loco and tender. Nasmyth's locos not only won the premium but brought their builder a special letter from the directors of the company expressing their entire satisfaction with the workmanship and performance of the locos.



Nasmyth's First Drawing of his Steam Hammer (24th Nov. 1839)

A Forging Difficulty

This connection with the Great Western Company led to Nasmyth's greatest invention—the steam hammer. The directors of the company had been so satisfied with the success of their famous steamship "*The Great Western*" that they decided to order another and larger vessel, "*The Great Britain.*" Their engineer, Francis Humphries, consulted Nasmyth with regard to the unusual large machine tools that would be required for the proposed vessel. Nasmyth succeeded in producing machine tools capable of meeting all requirements and the construction of the engines for the vessel proceeded rapidly.

An unexpected difficulty was encountered, however, in regard to the wrought iron intermediate paddle-shaft. No paddle-shaft of such size had ever been forged and Humphries found to his dismay that he could not persuade anybody to undertake so large a forging. Writing to Nasmyth on 24th November 1839, he said: "I find that there is no forging hammer in England or Scotland powerful enough to forge the intermediate paddle-shaft of the engines for the "*Great Britain.*" What am I to do? Do you think I might dare to use cast iron?"

Invention of Steam Hammer

This letter made a deep impression on Nasmyth's mind and he asked himself why it was that no hammers were capable of forging a wrought iron shaft of 30 in. diameter.

He soon realised that this was simply because of the hammers' lack of compass, range and fall, in addition to insufficient power of blow. The obvious remedy was to contrive some method by which a heavy block of iron could be lifted to a sufficient height above the object upon which it was desired to strike the blow, and then allowed to fall upon the work being guided in its descent by some simple means. The more Nasmyth thought about the matter the more interested he became,

and presently he sketched out in a note-book his idea of a steam hammer. In little more than half-an-hour he had thought out the whole contrivance in all its details and had transferred his ideas to paper. The date of this first drawing, which we reproduce here, was 24th November, 1839.

The two mechanical hammers in general use at that time were known respectively as "helve" hammers and "tilt" hammers. The operation of the "helve" hammer is well illustrated in the accompanying diagram. The arrangement consisted of a long iron bar working on a pivot at one end and carrying a heavy head close to the other end. The head was raised by the cams of a revolving wheel placed in the position shown. The cams sloped away at one side and each one lifted the hammer head a distance of perhaps 20 in., and then, as it moved round, allowed the head to fall, the operation being repeated by the succeeding cams. The "tilt" hammer worked on a similar principle but was a lighter affair capable of more rapid action.

The First Sketch

It is interesting to notice in the right-hand bottom corner of Nasmyth's first drawing of his steam hammer a humorous sketch in which he represents himself as beheading the old helve hammer!

Nasmyth's steam hammer as first sketched consisted of a massive anvil upon which the work was to be placed, a block of iron forming the hammer, and an inverted steam cylinder to the piston rod of which the hammer-block was attached.

The hammer was operated very simply. First of all, steam at sufficient pressure was admitted to the cylinder. This steam acted on the under side of the piston and thus raised the hammer-block attached to the piston rod. By means of a slide valve the steam was then allowed to escape, thus permitting the block to descend by its own gravity upon the work resting on the anvil below. The speed of the blows depended upon the rapidity with which steam was permitted to enter and escape from the cylinder.

Engines Abandoned

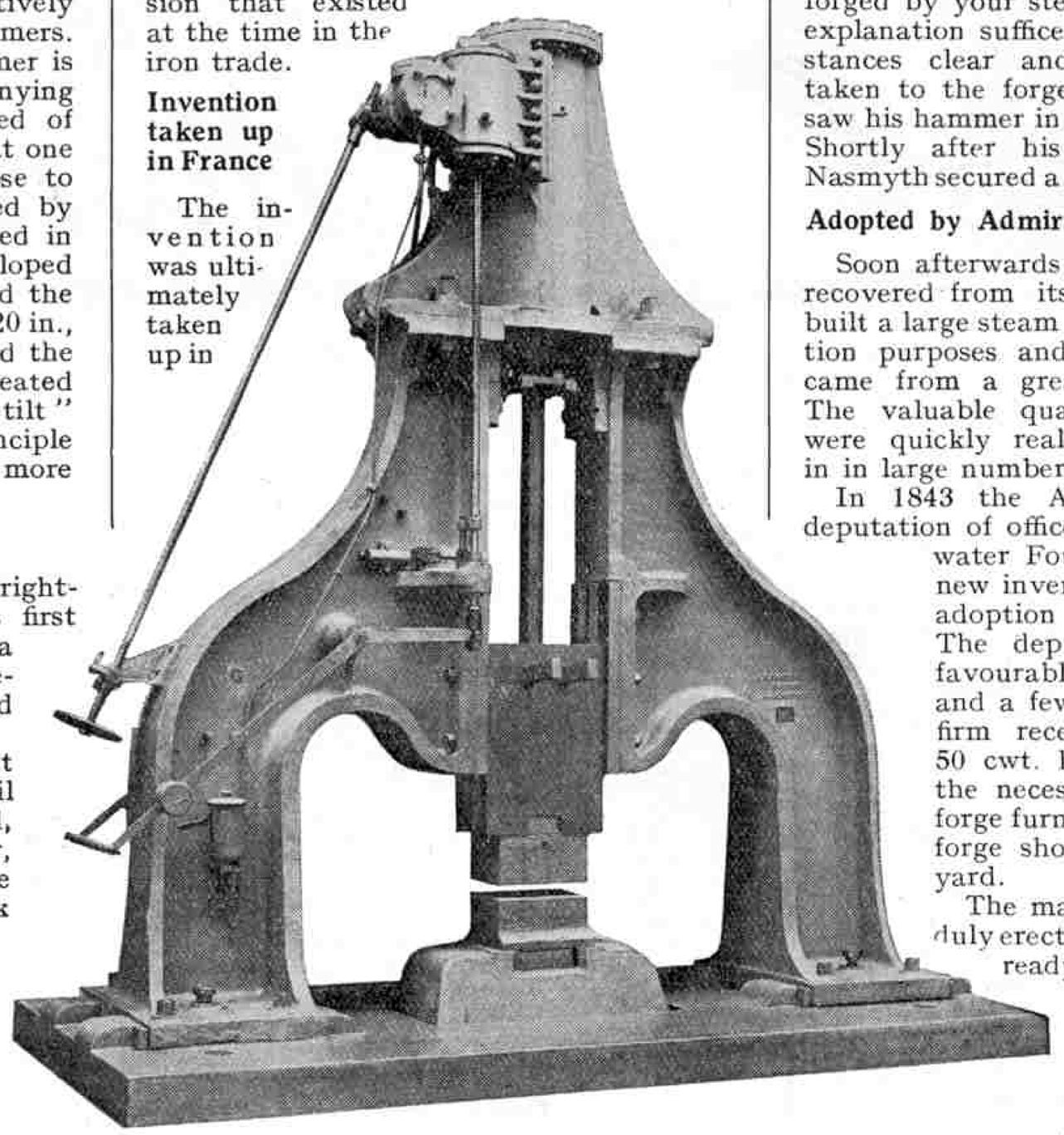
Nasmyth promptly wrote to Humphries enclosing a sketch of his proposed hammer. Humphries was delighted with the design and he showed it to Brunel, engineer-in-chief of the steamship "*Great Britain*," who also heartily approved of it. Nasmyth then gave the company permission to communicate the design to a forge proprietor who would undertake to erect the hammer, but the paddle shaft in question was never forged.

About that time Brunel was seriously considering the relative merits of the screw and the paddle-wheel as a means of propulsion and finally he became convinced of the superiority of the screw and persuaded the company to adopt it for the "*Great Britain*." As a result the engines that Humphries had so carefully designed were abandoned and he was asked to prepare fresh designs of engines suitable for screw propulsion. The abandonment of his almost completed engines was a bitter disappointment for Humphries and this, combined with the worry and anxiety of preparing new plans, was more than he could bear. He was attacked by brain fever, and died after an illness of only a few days.

In this way the steam hammer remained for the time being on paper, and there seemed little prospect of its coming into use on account of the widespread depression that existed at the time in the iron trade.

Invention taken up in France

The invention was ultimately taken up in an entirely unexpected quarter. One day M. Schneider, proprietor of the Creusot Iron Works in France, accompanied by M. Bourdon, his mechanical manager, called at the Patricroft works for the purpose of ordering certain machine tools. Nasmyth happened to be away at the time, but his partner received the two Frenchmen and in the course of the conversation produced Nasmyth's drawings of the steam hammer. They were greatly impressed with its possibilities and Bourdon took careful notes of the constructional details. When Nasmyth returned he was informed of the visit, but his partner omitted to mention that he had exhibited the drawings of the steam hammer. Nasmyth therefore was entirely unaware that the two foreigners had taken away with them all particulars of his invention.



Courtesy [*Messrs. B. & S. Massey Ltd.*

Two-ton Steam Hammer

In 1842, Nasmyth, while on a visit to France, visited the famous Creusot works and was shown round by the mechanical manager, Bourdon. In passing through one of the departments Nasmyth noticed a crank shaft of unusual size and inquired how it had been forged. To Nasmyth's astonishment Bourdon replied: "It was forged by your steam hammer." A brief explanation sufficed to make the circumstances clear and then Nasmyth was taken to the forge department where he saw his hammer in being for the first time. Shortly after his return from France, Nasmyth secured a patent for his invention.

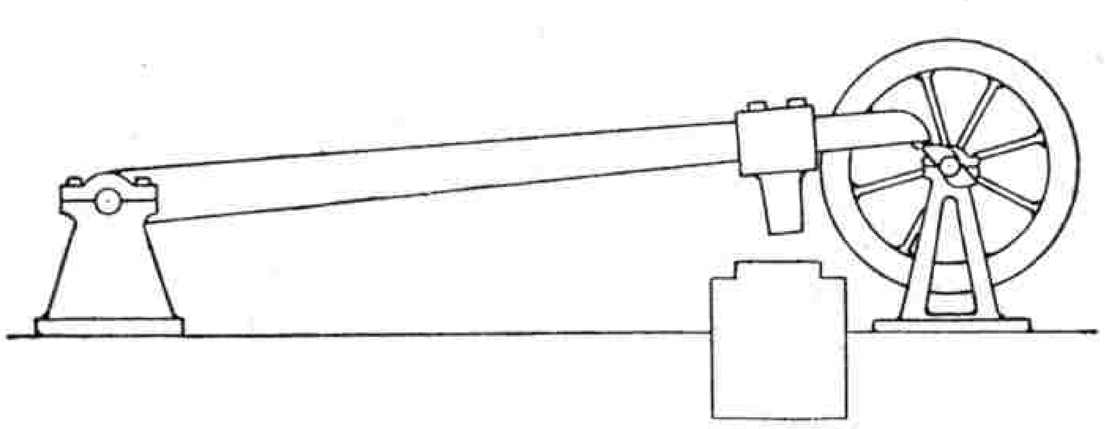
Adopted by Admiralty

Soon afterwards the English iron trade recovered from its depression. Nasmyth built a large steam hammer for demonstration purposes and engineers and others came from a great distance to see it. The valuable qualities of the hammer were quickly realised and orders came in in large numbers.

In 1843 the Admiralty appointed a deputation of officers to visit the Bridgewater Foundry and examine the new invention with a view to its adoption for marine forge work. The deputation reported very favourably to the Admiralty, and a few days later Nasmyth's firm received an order for a 50 cwt. hammer, together with the necessary boiler, crane and forge furnace to equip a complete forge shop at Devonport dockyard.

The machinery was made and duly erected, and on the day it was ready it was inspected by the Lords of the Admiralty. Nasmyth proceeded to put his hammer through its paces. "I made it break an egg shell in a wine glass without injuring the glass," he wrote afterwards. "It was as neatly effected by the two-and-a half ton hammer as if it had been done by an egg spoon. Then I had a great mass of white-hot iron swung out of the furnace by a crane and placed upon the anvil block. Down came the hammer on it with ponderous blows. My Lords scattered to the extremities of the workshop, for the splashes and sparks of hot metal flew about. I went on with the hurtling blows of the hammer and kneaded the mass of iron as if it had been clay into its devised forms."

This visit was followed by an order to supply all the Royal Dockyard forge departments with complete equipment of steam hammers and all the necessary accessories.

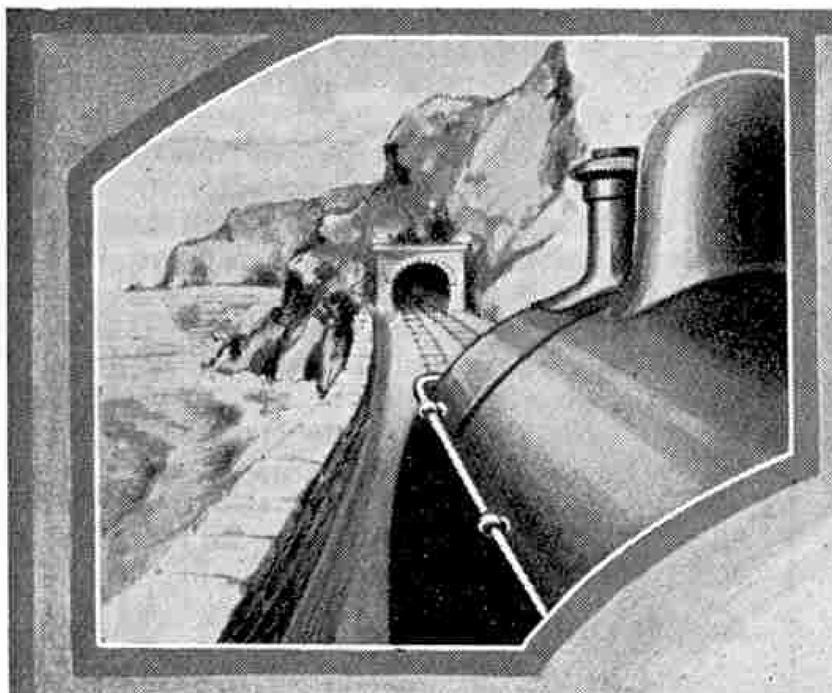


Helve Hammer worked by Cam-wheel

Nasmyth's Pile-Driver

Nasmyth subsequently applied the principle of his steam hammer in a machine for pile-driving. Previously piles had been driven by means of a small mass of iron falling upon the head of the pile from a considerable height. The raising of the iron mass to the necessary height occupied much time and labour and the results obtained were very unsatisfactory. Sometimes, indeed, the pile was shivered into splinters instead of being driven into the soil. Nasmyth

(*Continued on page* 690)



Railway News of the Month

Progress of the Cape to Cairo Railway

An important step towards the completion of a railway system of uniform gauge from the Red Sea coast to Capetown has been the decision to adopt the African standard gauge (3 ft. 6 in.) for the main lines of the Belgian Congo. The work of conversion will occupy several years since the necessity for moving a large tonnage of ordinary traffic limits the conveyance of construction material. The electrification of the Matadi-Kinshasa line, now being reconstructed, has been recommended by a technical committee and is now under consideration by the Belgian Colonial Office. Power would be derived from the falls of the Congo river.

The decision in regard to gauges may be taken as an indication that the Congo-Nile line will be built to the 3 ft. 6 in. gauge so that in the event of a southward extension of the Sudan system from El Obeid to Rejaf, through running from Port Sudan to Stanleyville, or whatever point on the Congo may be selected as the terminus of the Congo-Nile line, will be possible. Later, when the time comes for linking up the three detached sections of metre gauge which bridge the rapids of the upper Congo and connect the river with Lake Tanganyika and for extending them southwards to a junction with the Cape-Congo system at Bukama, these three short lines will doubtless be converted to 3 ft. 6 in. gauge, and a continuous system of this gauge from Cape Town to Port Sudan will then come into being.

* * * *

L.N.E.R. Notes

Former Great Northern Railway "Atlantics" are now met with in the Liverpool area working all kinds of traffic on the Cheshire Lines. Their work in hauling the East Coast expresses is now being largely taken over by the newer "Pacifics." Mixed traffic "Moguls" of Doncaster design are also stationed at Liverpool.

* * * *

"Pacifics" now working to and from Edinburgh (Waverley) include 2563, "*William Whitelaw*," 2564, "*Knight of the Thistle*," 2570, "*Tranquil*," 2571, "*Sunstar*," 2572, "*St. Gatien*," 2574, "*St. Trusquin*," and 2576, "*The White Knight.*"

* * * *

The winter services on the East Coast Route to Scotland include the daily Pullman Express between London and Edinburgh, which has been accelerated 20 minutes to compete with the 10 a.m. "*Flying Scotsman.*" The "Pullman" runs non-stop to Harrogate, 197 miles, in 3¾ hours, this being the longest non-stop Pullman service in the British Isles. To make up for the omission of the former stop at Leeds, that city now has a Pullman service of its own to London.

Railway Mileage in Europe

Albania ...	42	Lithuania	1,939
Austria ...	3,939	Luxemburg	334
Belgium ...	6,893	Malta, Jersey, Man	68
Bulgaria ...	1,624	Netherlands	2,141
Czechoslovakia	8,718	Norway ...	2,141
Denmark ...	3,086	Portugal ...	2,129
Esthonia ...	890	Roumania	7,325
Finland ...	2,666	Russia (Europe)	30,800
France ...	33,281	Poland ...	9,872
Great Britain	24,396	Spain ...	9,644
Germany ...	35,823	Sweden ...	9,436
Greece ...	1,983	Switzerland	3,323
Hungary ...	5,921	Turkey ...	257
Italy ...	12,501		
Jugoslavia	5,699		
Latvia ...	1,770	Total	228,641

G.W.R. Notes

The "Ocean Special" recently created a speed record in conveying mails and passengers off the Cunard Line steamer "*Mauretania*" from Plymouth to Paddington in 232 minutes. Despite a signal delay of three minutes, the express arrived exactly 15 minutes early.

* * * *

The new 0–6–2 tank locos of the "5600" class continue to be built at Swindon for working coal and mineral trains over the steep gradients in South Wales. Some of them are also starting a career of usefulness in large goods depots in various districts.

* * * *

Official contracts placed by the G.W.R. in October reveal the remarkable range of activities associated with the working of an up-to-date railway company. The following items are an example :—Overhaul of steamers; conversion of Swansea Channel buoys from gas to acetylene; equipment, including four single-phase transformers, for new loco erecting shop at Caerphilly; supply of two 9-ton "Simplex" petrol locos for engineering and signalling depots; renewal of river wall at Chelsea; supply of six Fordson tractors and twenty-one 30 cwt. Thornycroft lorries.

* * * *

The "*Cornish Riviera,*" also known as the "*10-30 Limited,*" now includes slip carriages left at Taunton for Ilfracombe and Minehead, and at Exeter for Dawlish, Teignmouth, and Kingsbridge. Such slip services take the place during the winter months of complete "Holiday" trains appearing in the summer time-tables.

* * * *

The old 4-4-0 "Brunel" locos, which have been rebuilt several times, have been classed uniformly with the "Flowers." They now appear as 4169, "*Brunel,*" 4170, "*Charles Saunders,*" 4171 (old No. 7) "*Armstrong,*" and 4192 (old No. 8) "*Gooch.*"

* * * *

L.M.S. Notes

One of the latest type of 16-inch naval guns was recently conveyed from Sheffield to Reedsmouth for a new battleship. The gun, which weighs 107 tons and is 63 ft. in length, was specially loaded on to one of the company's sets of gun-trucks, and was accompanied on its journey by an inspector. To ensure slow transit and safe negotiation throughout it was conveyed on a Sunday.

* * * *

The two Manchester stations, Exchange (formerly L. & N.W.R.) and Victoria (formerly L. & Y.R.) are being converted into one large station, which will be among the most extensive in the British Empire, and will have the longest single platform in the world.

In the course of a day's working at this point, it is possible to see locos of the Great Western Railway (from Chester) including 4–4–0's of the "City" and "Flower" classes and 2–6–0's and L.M.S. locos of the former L. & N.W., L. & Y., Midland, and Wirral sections.

* * * *

No. 1944, the only loco of the North Western compounds in her original form, is working local traffic in the Liverpool and Chester districts. No. 1074, a Midland-type 4–4–0 compound, is fitted experimentally with the Weir feed-pump and heater.

"Prince of Wales" class loco "*Tara*" is one of the few locos fitted experimentally with outside Walschaert's valve gear actuating inside cylinder valves. She has a special observation cab fitted round the front-end framing.

* * * *

New Locos for L.N.E.R.

In pursuance of the policy of adding considerably to the locomotive strength, the L.N.E.R. has placed an order at its Doncaster works for nineteen side-tank locomotives of the type used for shunting operations and for branch line work.

This follows orders recently placed for locomotives of the Pacific and Mikado type.

New Locos for the S. & D. Rly.

Five very powerful superheated locos have been put into service on the Somerset and Dorset Railway, which is jointly owned by the Southern and London, Midland, and Scottish Companies.

Built at Darlington by Messrs. Robert Stephenson and Co. the new locos are of the 2–8–0 wheel arrangement, and in general design are very similar to former 2–8–0's built by the old Midland Railway at Derby, and working successfully over the S. & D. line. The coupled wheels have a diameter of 4 ft. 7½ in., and the leading wheels 3 ft. 3½ in. The outside cylinders are 21 in. in diameter by 28 in. stroke, and the steam pressure is 190 lbs. per sq. in. In working order the weight of the locos is 111 tons, 5 cwt. and they are expected to deal most successfully with heavy traffic over the numerous and unusually severe gradients of the S. & D. Railway.

It is interesting to note that the railway in question retains a rich dark blue livery for its passenger locos.

* * *

Oil-Electric Passenger Cars in Canada

As a reply to the keen competition by road vehicles in the more populous areas, the Canadian National Railways have been conducting successful experiments with a new type of local passenger vehicle. Two oil-electric cars of different sizes were tried in place of branch passenger trains operated by steam at different points of the system, and they showed great economy in fuel costs.

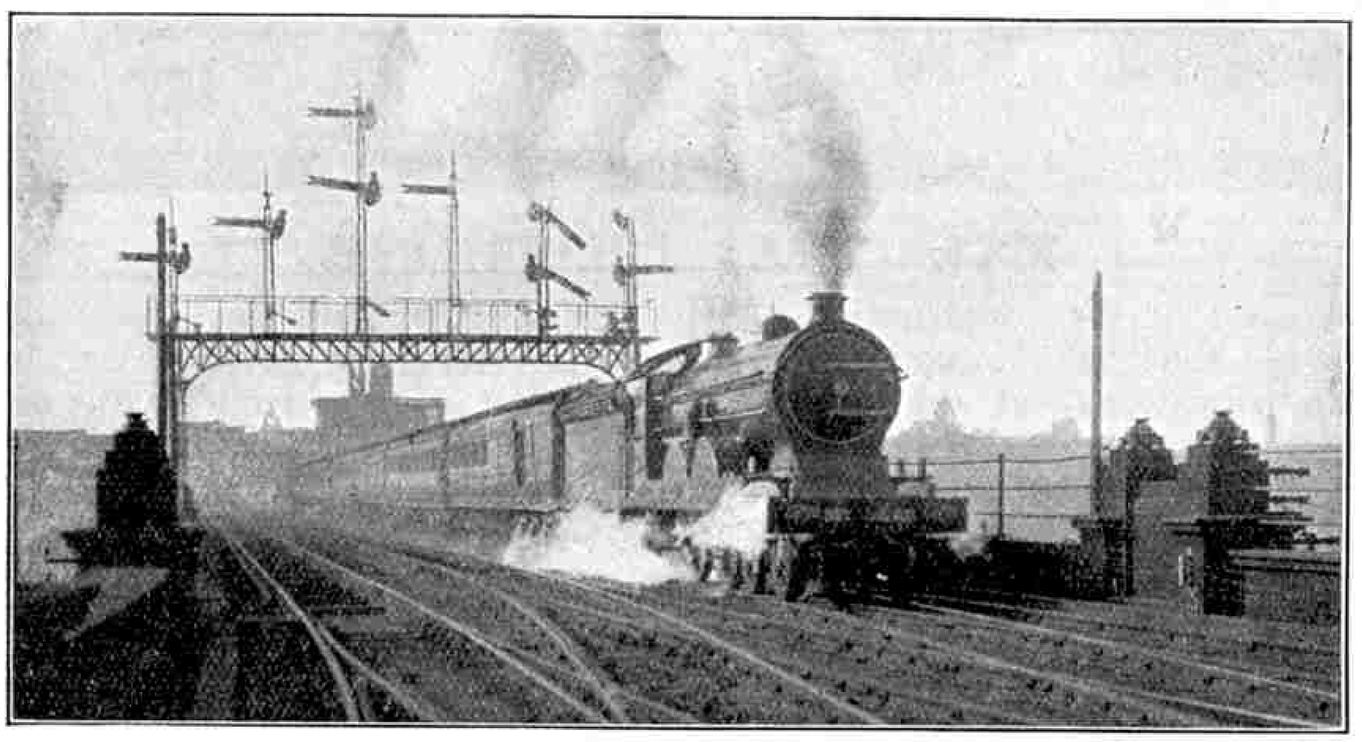
These new cars are operated by electricity produced by a generator, run by an oil engine of a type somewhat similar to that used in modern dirigible airships. The larger of the two engines has eight cylinders capable of developing 340 h.p. and its total weight is 5,450 lbs., or 16 lb. per h.p. It is of the Diesel type, four-stroke cycle, solid injection, and develops its maximum power at 650 r.p.m.

The electric equipment, which was supplied by the Westinghouse Company to the specifications of the C.N.R. engineers, consists of a specially-designed direct current 200 k.w., 600-volt generator. There are four driving motors of the railway type, 100 h.p. 600-volt, two mounted on each of the front and rear trucks. The car is operated by generator field control by means of a controller situated in the driver's compartment at each end of the car, in a similar manner to regular tramway or underground railway practice.

The larger type of car is 102 ft. in length, and has accommodation for 126 passengers. On the level it attains a speed of 60 miles per hour. Its fuel consumption is one gallon for 3½ miles, which represents a fuel cost in the Dominion of 1½d. a mile. Among the advantages claimed for this type of car are low cost of fuel oil, lubricating oil, and engine maintenance, uniform acceleration, and elimination of roughness of operation and of high maintenance cost of heavy mechanical transmission.

The car is mounted on three four-wheel trucks, the centre truck being attached in such a way as to permit it to take the curves. The superstructure and body are of steel.

The larger car recently made its trial trip from Montreal to Ottawa and back, a distance of some 235 miles. The actual running time of 2 hrs. 15 mins. each way represented the high average speed of 52 m.p.h. The smaller vehicle also did well on its trials between Hamilton, Ontario, and Guelph, and it has now been brought into permanent service on this line.



Edinburgh to King's Cross Express, on the High Level Bridge, Newcastle-on-Tyne

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A New Locomotive Carrier

A large motorship was recently launched from the Walker shipyard of Sir. W. G. Armstrong, Whitworth and Co., and is specially designed for the transportation of locomotives. This vessel, which was christened "*Belnor*," is able to carry 4,100 tons of cargo and her hatches, derricking machinery, etc., are of elaborate construction to deal with railway rolling-stock. These vessels enable fully-erected locos of the heaviest type to be transported overseas with the greatest facility, and on arrival at their destination the locos can be put into steam almost immediately following unloading. The "*Belnor*" is propelled by a single screw driven by an Armstrong-Sulzer Diesel engine and her length is 318 ft. 6 ins.

* * * *

Matchless Economy

A railway story from America is to the effect that a superintendent, in broadcasting to the staff of the line the need for all-round economy, pointed out that saving one match per day amounted to several boxes in the course of a year.

The result of this example of economy was not, however, what was desired or expected, for when the next requisition for general stores came in from agents, there were no less than 100 requests for boxes of matches from agents who until then had not been aware that the Company supplied matches as stores!

New Model Petrol Shunting Loco

An improved petrol shunting loco has been designed by the Four Wheel Drive Lorry Co. Ltd., Slough. Built for the standard gauge, this loco has a length of 19 ft. 2 in., and four wheels each 2 ft. 9½ in. in diameter. The engine has four cylinders, 4¾ in. bore by 5½ in. stroke and a clutch of the multiple disc pattern, running in oil. Four speeds in either direction of 16, 8, 4 and 2.6 miles per hour are obtained. All four wheels have drum-brakes and sanding apparatus.

Special features of the new loco are a winch and winding-drum, which are fitted at the rear. The drum carries 250 ft. of ⅝ in. diameter cablewhich may be used for a variety of purposes. The winches or "nigger heads" on the outside ends of the drum shaft are invaluable for roping wagons on adjacent lines.

The working weight of the Four-Wheel Drive shunting loco is 12 tons. While its normal load capacity is 70-80 tons, on trial it moved 13 loaded wagons totalling 180 tons.

There are three differentials fitted, one being placed on the front axle, one in the rear, and the third in the gear-box between the front and rear axle. Each wheel, therefore, has an independent action so that there is little or no sliding on the track in rounding curves.

* * * *

6,000 Miles Without Moving

Many readers of the "*M.M.*" have seen the L.N.E.R.'s famous Flying Scotsman engine at Wembley and not a few must have speculated on the distance travelled by the ever-revolving wheels.

The official figures show that by the time the Exhibition closes, the wheels will have travelled the equivalent of 6,000 miles in the two seasons, though, of course, the engine itself has not moved, it being raised above the track. It is interesting to know that the speed of revolution is 2½ miles an hour.

* * *

Interesting Goods Locos

In a recent number of the "*M.M.*" particulars were given of a large number of Midland Railway goods locos that were sold to the Italian Railways many years ago, and still perform good work. As an interesting complement to the Midland locos in Italy may be mentioned the case of some useful 0–6–0 locos now working on the London-Tilbury section of the L.M.S. These machines were constructed in England for export to Turkey some years ago, but were never despatched. They are now very similar in appearance to most L.M.S. (Midland) standard locos, but may be distinguished by the roomy cabs with which they are provided.

Electricity

XXI. THE TELEPHONE

THE first successful attempt at the construction of an electric telephone—that is an instrument by means of which vibrations set up by the voice or by some musical instrument are transmitted by electricity—was made in 1860 or 1861 by Johann Philipp Reis, science master in a school at Friedrichsdorf, Germany. In his apparatus the voice was made to act upon a point of loose contact in an electric circuit and which, by bringing those parts into closer or less close contact, varied the resistance offered to the current.

Reis's Apparatus

Reis's transmitter consisted of a box having a hole covered by a tightly-stretched membrane to which was attached a little strip of platinum. When the membrane was caused to vibrate by sounds produced close to the box, the platinum strip moved to and fro against a metal point that closed the circuit of a battery. The receiving instrument consisted of a soft iron wire fixed upon a sounding board and surrounded by a coil of insulated wire. The vibrations of the membrane of the transmitter opened and closed the circuit at a great speed and the rapid magnetisation and demagnetisation of the wire produced a tone of the same pitch as the one that originally set the membrane vibrating.

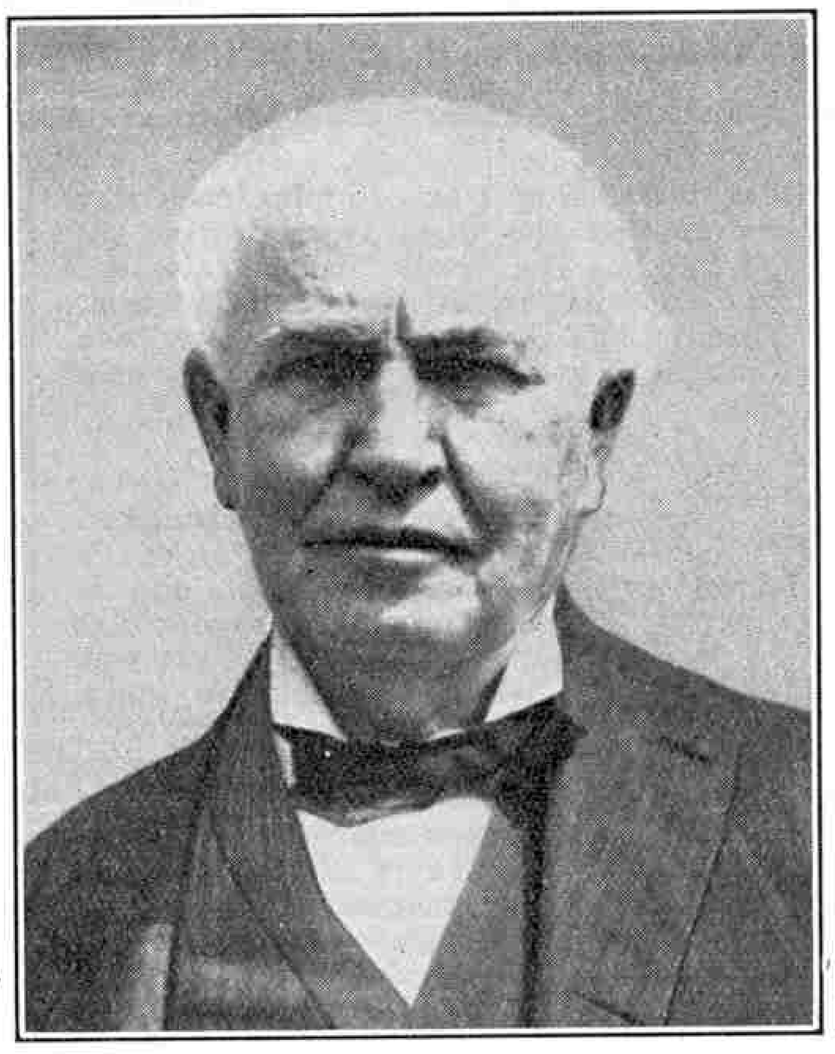
This apparatus transmitted musical sounds and melodies with considerable accuracy, but there is great difference of opinion as to whether it was able to transmit speech. Professor Silvanus Thomson states that Reis's telephone could and did transmit speech, but other experts dispute this. Probably the truth of the matter is that this telephone was able to transmit words, but so imperfectly as to be of no practical value. This defect was admitted by Reis himself in a lecture delivered in 1861 before the Physical Society of Frankfort.

"Hitherto," he said, "it has not been possible to reproduce human speech with sufficient distinction. The consonants are for the most part reproduced pretty distinctly, but not the vowels as yet in an equal degree." It is interesting to note that the term "Telephony" was first used by Reis on this occasion.

The inhabitants of Friedrichsdorf appear to have thought a great deal of the work of Reis, for they erected a statue to him.

Bell's Musical Telegraph Scheme

The first really successful telephone was invented by Alexander Graham Bell, who was born at Edinburgh on 3rd March, 1847. He studied at the Universities of Edinburgh and London and adopted the family calling, that of a teacher of elocution, in which sphere of work his grandfather and his father had achieved success. In 1870 the family removed to Canada and two years later Bell was appointed Professor of Vocal Physiology in the University of Boston.



Thos. A. Edison

Previous to this appointment Bell had given a great deal of thought to the possibility of a musical telegraph. To use his own words: "I imagined to myself a series of tuning forks of different pitches, arranged to vibrate automatically . . . each fork interrupting at every vibration a voltaic current, and the thought occurred, 'Why should not the depression of a key like that of a piano direct the interrupted current from any one of these forks, through a telegraph wire, to a series of electro-magnets operating the strings of a piano or other musical instrument, in which case a person might play the tuning-fork piano in one place and the music be audible from the electro-magnets in a distant city?'. . . I saw no reason why the depression of a number of keys at the tuning-fork end of the circuit should not be followed by the audible production of a full chord from the piano in a distant city."

Bell's work at the University left him little time for experiment, but before long he gave up his post and commenced giving private lessons. One of his pupils at that time was Mabel Hubbard, whom he afterwards married, and whose father assisted him considerably

by financing his experiments.

A Fortunate Incident

Bell now had more time to devote to experimental work on his telegraph. He succeeded in attracting the attention of Professor Henry, the famous American scientist, and through him he obtained an assistant, Thomas A. Watson, who will always be remembered as the first person to hear a clearly-spoken message over the telephone. Bell and Watson worked together for three years trying to perfect the musical telegraph, never thinking that they would end by inventing the first practical telephone.

On a hot and oppressive afternoon in June 1875, Bell and Watson were toiling away as usual, testing some new arrangement of their apparatus. Watson, who was working in a room by himself, was experiencing a great deal of trouble with the spring of his instrument which, instead of vibrating freely, was continually sticking to the pole of its magnet. After this had gone on for a while Watson naturally became irritated and plucked repeatedly at the spring to make it free itself. Suddenly Bell, who was working in another room, came running into Watson's room in a state of great excitement, shouting: "What did you do then? Don't change anything. Let me see!" He had heard in his room a faint reproduction of the twanging of the spring as Watson plucked at it! The vibration of the spring over the pole of its magnet had generated an electric current and thus transmitted the sound.

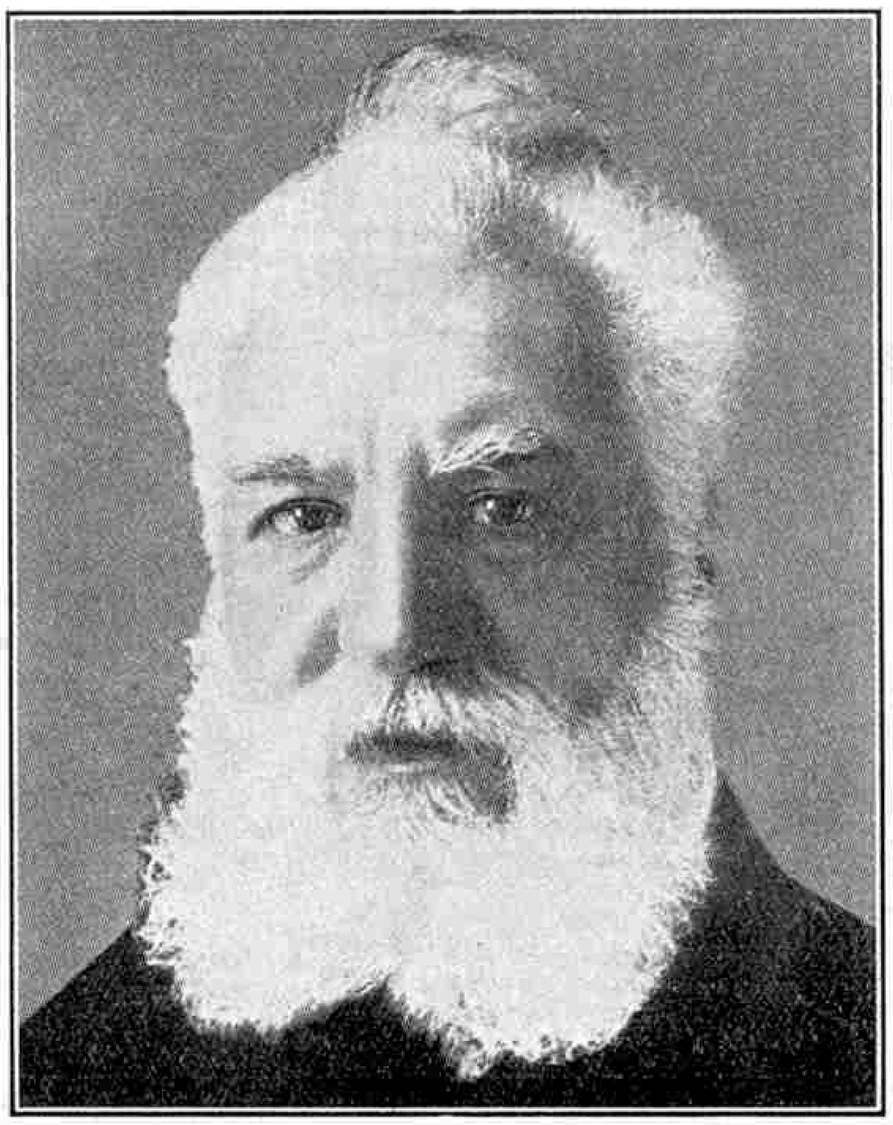
It was fortunate that the man who heard the reproduction of the sound of the twanging spring had sufficient imagination to be able to realise the enormous importance of this occurrence. Bell saw at once that, if this sound could be transmitted, there was no apparent reason why a more perfect apparatus should not transmit any other sound, a melody, or even speech.

First Sentence Transmitted

The musical telegraph was now quickly forgotten and the two men worked desperately hard to produce a telephone that could transmit music and speech. For nine months they toiled, and on 10th March, 1876, Bell spoke the first words that ever passed clearly and distinctly over a pair of electric wires. They were simple words—words similar to those that are now uttered over the telephone countless times every day—but nevertheless they deserve to be remembered. They were: "Mr. Watson, please come here, I want you."

An Emperor Startled

After a few more weeks spent in making improvements in certain parts of the apparatus, Bell decided that the time was ripe for introducing the invention to the public. At that time the Centennial Exposition was just about to open at Philadelphia and Bell erected his telephone in an obscure corner in the Education Building. No one took much notice of it, however, and when the judges arrived at this exhibit at the end of their day's work they were tired and hungry and disinclined to trouble about such an apparently insignificant affair. They stared at the apparatus in a lifeless sort of manner and were just thinking of departing for their hotels when in walked Dom Pedro, Emperor of Brazil, accompanied by the Empress Theresa and their suite.



Alexander Graham Bell

The Emperor had once visited Bell's class at Boston University, and he now greeted him warmly and asked to be told about the new invention. Bell explained briefly and told the Emperor to listen while he himself went to the other end of the wire and spoke into the transmitter. Almost immediately the weary judges were galvanised into activity, for the Emperor, dropping the receiver in his excitement, called out: "It talks, it talks!"

Scientists Convinced

The judges had now forgotten all about such things as fatigue and hunger and one by one they listened to the marvels of the instrument. Professor Henry took up the receiver and was followed by Sir William Thomson (afterwards Lord Kelvin), who said most emphatically: "It is the most wonderful thing I have seen in America."

On the following day the exhibit was moved from its out-of-the-way corner to the most prominent position in the exhibition. This brought Bell immediately into public notice, and in response to a great demand he delivered a large number of lectures in various parts of the United States, on the proceeds of which he married and sailed to Europe for his honeymoon.

Bell's father-in-law now took in hand the commercial exploitation of the invention and one or two small exchanges were soon established. The first great success was won when one of the largest subscribers to the Western Union Telegraph Company asked for telephones to be installed as a substitute for the printing telegraph. After legal arguments it was decided that the Bell Telephone Company had the right to instal the telephones in preference to the Western Union, and thus the telephone commenced its upward path to success. Soon afterward Bell and Watson sold their shares in the company and retired from active work in connection with the telephone.

Bell's application for a patent for his telephone was filed in the Patent Office of the United States on 15th February, 1876, and it is an interesting and remarkable fact that on the same day an American inventor, Elisha Gray, of Chicago, also lodged a patent for an instrument for electrically transmitting the human voice. Careful inquiry was made, it was proved that Bell's application was the first to be lodged, and the patent was therefore awarded to him.

Edison's Experiments

While Bell was at work upon his telephone, the famous

(*Continued on page* 671)

Raising the German Warships

Extraordinary Salvage Work at Scapa Flow

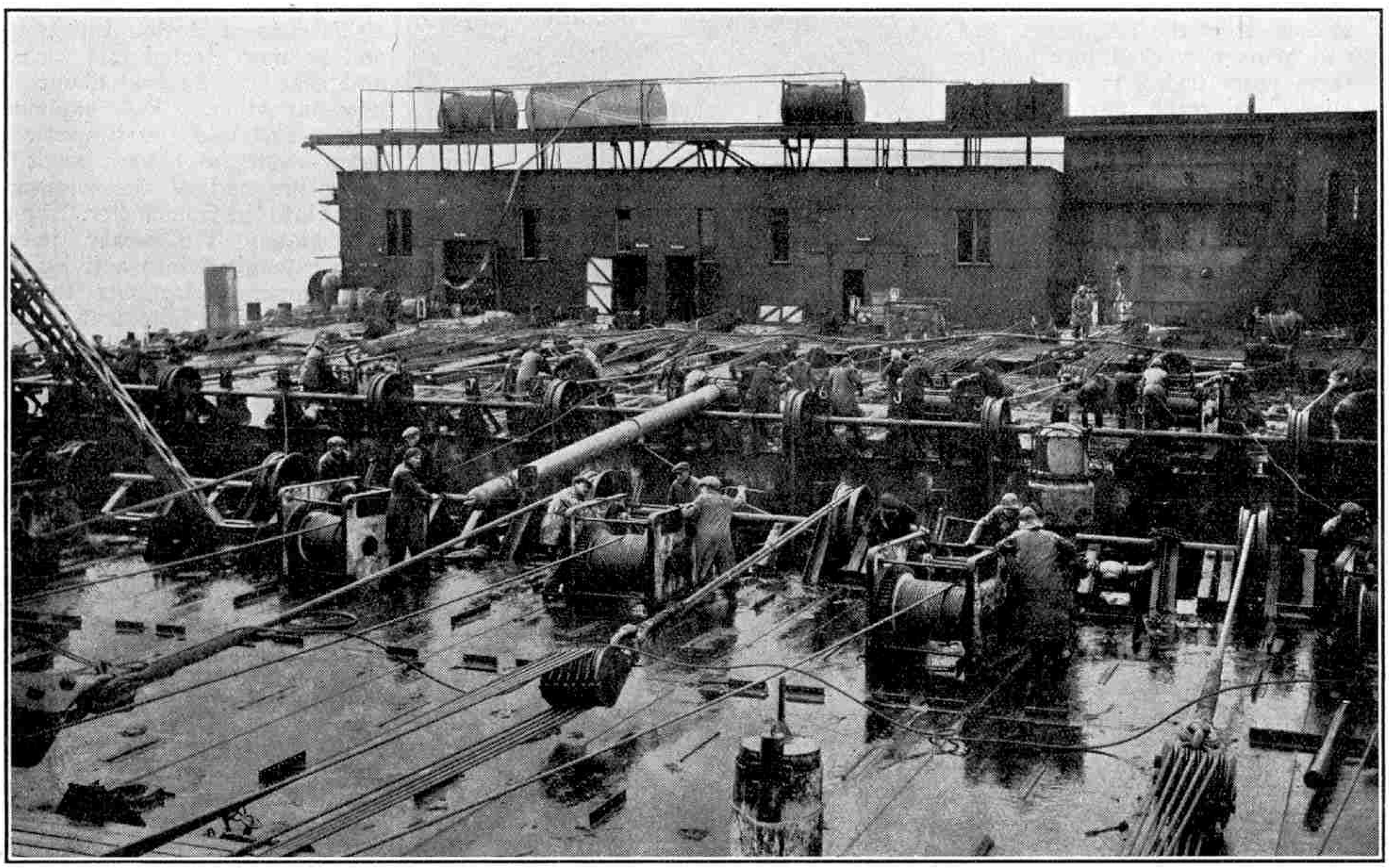


Photo courtesy ["*The Engineer*"

Pontoon showing winches and lifting blocks

IN June 1919 occurred the greatest scuttling in the history of shipping. The surrendered German fleet was assembled in the waters of Scapa Flow in the Orkney Islands when suddenly, by order of the German admiral, the sea cocks were opened, with the result that the ships filled with water and sank.

Probably this scuttling was prompted by some wild idea of cheating their British conquerors at the last moment. For five years the ships lay there beneath the sea and were regarded by salvage experts as a hopeless proposition. In July 1924, however, the greatest salvage feat in history began, and by the irony of fate this was made possible by German mechanism.

A Huge Submarine Testing Dock

Towards the end of 1918, shortly before the close of the war, the Germans had completed a gigantic floating dock designed specially for testing submarines. This dock was over 400 ft. in length and 130 ft. in width, and running along the whole of its length was a huge cylinder 40 ft. in diameter and weighing some 2,000 tons.

The dock could be submerged in order to receive submarines into its chamber in order that they might undergo hydraulic tests. If the submarine successfully withstood the pressures applied to it, which were such as it would have to withstand on active duty, then all was well. In addition, the dock was capable of acting as an ordinary floating dock, and it could drydock two submarines, one being berthed between the walls and the outside of the cylinder on each side.

After the armistice this dock came into the hands of the British Admiralty and was towed to England. The Admiralty had no use for it and it was offered to shipbreakers. Ultimately it came into the possession of Messrs. Cox and Danks Ltd., and was towed to their shipbreaking yard at Queenborough.

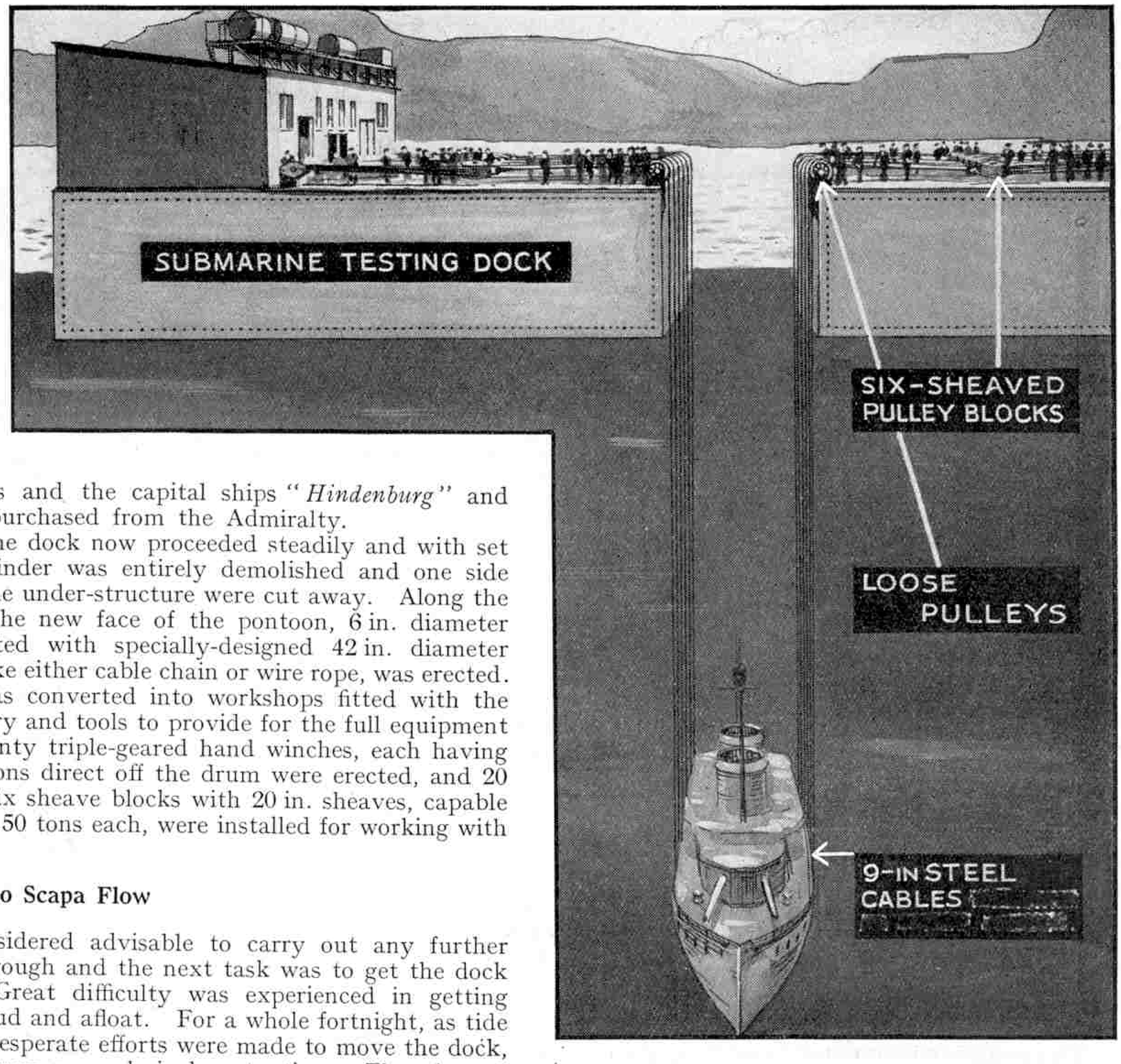
Self-Confidence Rewarded

Demolition of the dock commenced shortly afterwards and the great cylinder began to disappear, its plates going to British mills for re-rolling. While this work was going on Mr. E. F. Cox, Managing Director of the firm, became more and more impressed with the enormous lifting capacity of the dock and convinced that this capacity could be used to good purpose.

It was not long before his thoughts turned to the sunken warships at Scapa Flow, and after journeying

northward to see things for himself, he made up his mind that these warships could be lifted and that the ex-German dock was capable of carrying out the work. The opinion of the salvage experts in general was against the idea, but Mr. Cox's confidence remained unshaken, and four of the sunken German destroyers and the capital ships "*Hindenburg*" and "*Seydlitz*" were purchased from the Admiralty.

Operations on the dock now proceeded steadily and with set purpose. The cylinder was entirely demolished and one side wall and part of the under-structure were cut away. Along the 400 ft. length of the new face of the pontoon, 6 in. diameter steel shafting, fitted with specially-designed 42 in. diameter pulleys faced to take either cable chain or wire rope, was erected. The other wall was converted into workshops fitted with the necessary machinery and tools to provide for the full equipment of the dock. Twenty triple-geared hand winches, each having a capacity of 10 tons direct off the drum were erected, and 20 pairs of five and six sheave blocks with 20 in. sheaves, capable of a lift of nearly 150 tons each, were installed for working with the winches.



The above drawing illustrates the principle adopted in raising the sunken vessels

Towing the Dock to Scapa Flow

It was not considered advisable to carry out any further work at Queenborough and the next task was to get the dock to Scapa Flow. Great difficulty was experienced in getting the dock off the mud and afloat. For a whole fortnight, as tide after tide flowed, desperate efforts were made to move the dock, but the rate of progress was only inches at a time. Then dogged determination had its effect and by the combined efforts of tugs, winches and men, the dock was re-floated.

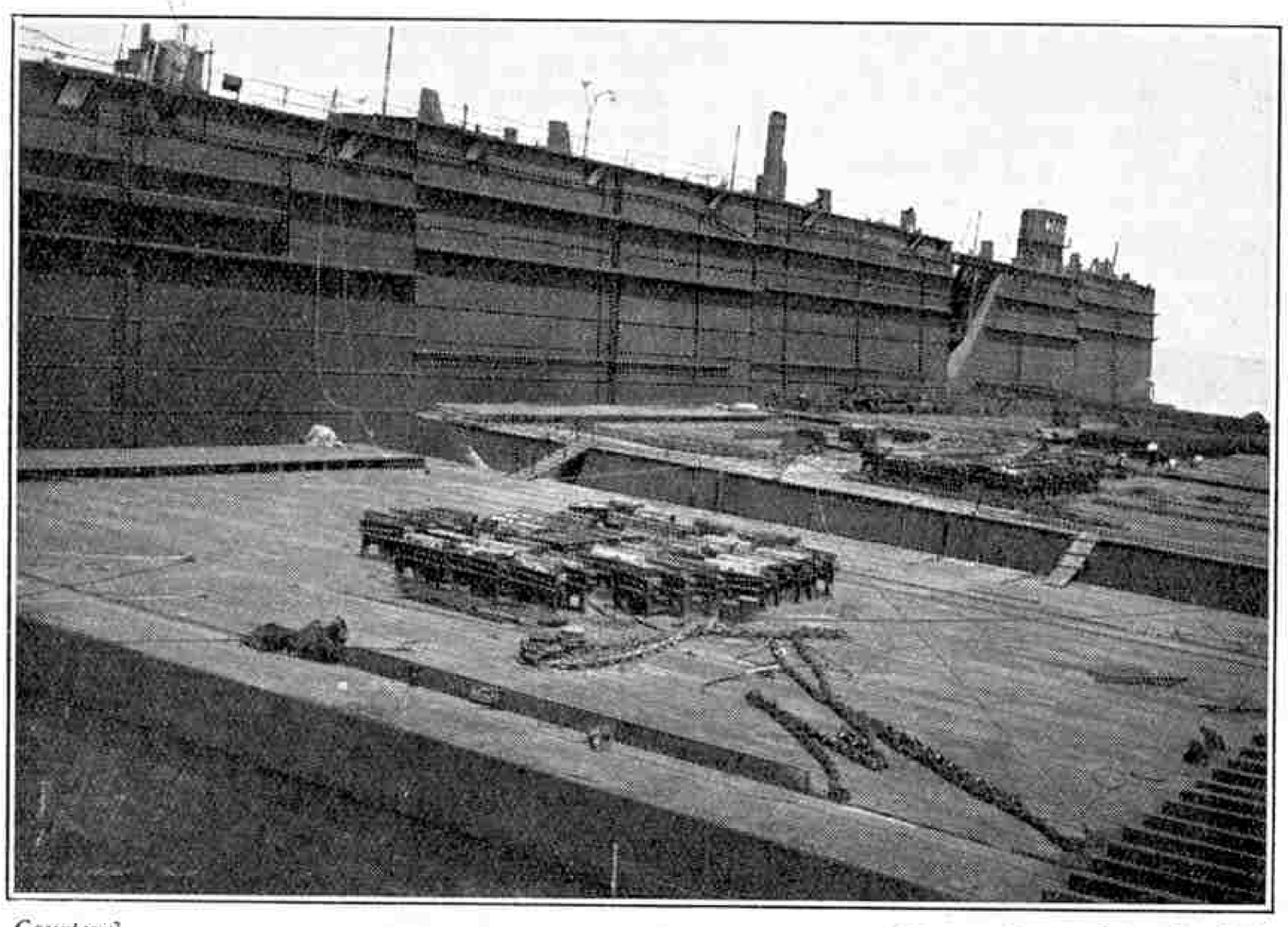
Three tugs took charge of her and the voyage of 700 miles up the North Sea was commenced. The dock was an awkward thing to tow, but fortunately the weather remained fine and after a voyage of eight days Scapa Flow was reached safely.

In order to carry out the projected lifting operations it was necessary to cut the dock into two pieces so as to turn it into two pontoons. This work was carried out by means of the oxy-acetylene flame. One half of the dock was then swung round so that shafting and pulleys faced one another, each pontoon having its own set of 10 winches and 10 pairs of lifting blocks.

It was decided to take first the destroyer V.70 and the pontoons were moored over her, one on each side of her position.

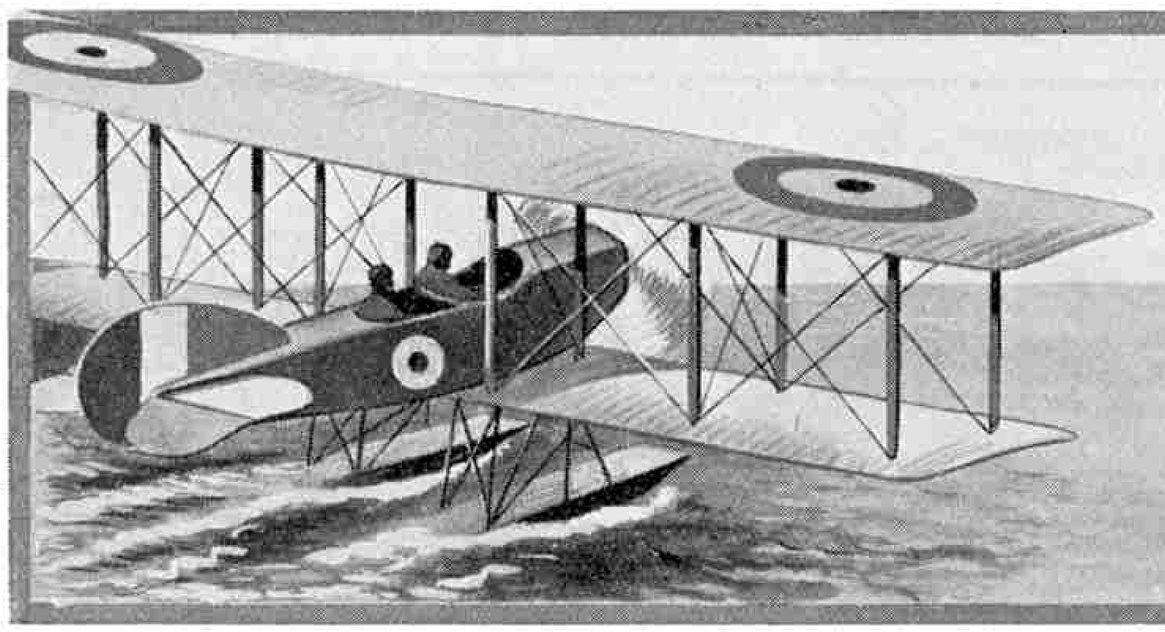
Next month we shall describe how the various difficulties were overcome and how, after an alarming accident, the destroyer was finally brought to the surface.

(To be continued)



Courtesy] [*Messrs. Cox and Danks, Ltd.*

The German Submarine Testing Dock During Reconstruction



Air News of the Month

A New Handley-Page

A Handley-Page fitted with three air-cooled Siddeley-Jaguar engines of 400 h.p. each, is the latest addition to Imperial Airways fleet. From the point of view of regularity and reliability the installation of three motors is a big advance from the twin, water-cooled engines of the earlier types. One of the most interesting features is that the new machine can fly for considerable distances on one motor only and can fly on any two engines if the third should fail.

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German Air Developments

To cope with the ever-increasing traffic at the Tempelhofer Aerodrome, Berlin, extensive alterations are contemplated, and the Berlin Air Port Company is to be reorganised. Hitherto the company has been the joint property of the Berlin Municipal authorities and the German Air Ministry. Under the new scheme the Prussian Government will take a substantial share.

The Prussian Government already subsidises a number of air lines and in general matters, such as supplying meteorological reports, gives considerable assistance to Central European Aviation.

The recent disputes between the Allies and Germany on the subject of airship building restrictions is the more interesting in view of the latter's constant endeavours to gain control of the Central European commercial air traffic.

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Another Polar Expedition

It is announced by the Norwegian Air Navigation Union that a gift of 100,000 dollars has been received from Mr. Lincoln Ellsworth, toward the cost of a Polar airship expedition that will start next year. Mr. Ellsworth will be the only American member of the party, but one of the conditions of his gift is that the expedition must sail under the Norwegian flag. The expenses of the expedition are estimated at 1,500,000 kroner (£78,000) and the Ellsworth gift represents approximately a quarter of this sum.

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Air "Flivvers"

It is announced that a Ford "all-metal" monoplane, equipped with a 400 h.p. Liberty engine has now become a regular stocked article in a New York general store. The machine is equipped to carry passengers and freight, is fitted with a 400 h.p. Liberty engine and has a wing spread of 700 inches and the price "over the counter" is £5,000.

London–Africa by Air

In our last issue, comment was made on the French seaplane experiments that were being made with a view to establishing a speedier air service to France's Northern African possessions. It is interesting to learn in this connection, that at the conclusion of the conference held at Lyons to discuss the legal aspects of aviation, the view was expressed that it was regrettable that an air route between London and Northern Africa did not exist. It was pointed out that the missing section was Paris–Lyons–Marseilles and that the establishment of such a Service would be of international importance, especially as it would link up with the Lyons–Geneva-Basle-Zurich and Central European systems.

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No More Air-Sickness?

A new wing design which is the invention of three Italian engineers is shortly to be tested by aviation experts in this country. It is stated that the yawing and pitching of an aeroplane in rough weather is eliminated by this design, and the possibility of all weather flying is brought nearer to realisation as a consequence.

Fitted to a machine of the triplane type, the upper set of wings extend rearward, being in parallel with the body of the 'plane, and form a highly practical stabiliser, the centre of gravity of which is slightly above but to the rear of that of the machine. By means of movable sections in the leading edges these auxiliary wings may be adjusted to overcome varying conditions.

If the machine fulfils its early promise, flying will be possible in the roughest weather and air-sickness caused by the rolling of the 'plane, will be eliminated.

* * * *

European Flying Combines

The Conference recently held on the Continent to discuss the organisation of Air Services is likely to lead to the grouping of the various operating companies into one or two large organisations controlled by one international combine.

At Dresden a proposal was forwarded by the Central and Southern European Aircraft Manufacturers with the object of forming one big company to employ only one type of machine. This would have the effect of standardising the type of aeroplane operating over the Southern parts of the Continent. In the meantime the Junkers Co. has obtained a controlling interest in a company formed recently, comprised of fifteen aeroplane and air navigation companies, in Switzerland, Scandinavia and various of the Baltic Provinces.

The aim of this big enterprise is to monopolise the air service over the Southern part of the continent, and French aircraft manufacturers are viewing the developments with considerable apprehension.

The French aeroplane industry, developed almost entirely with the aid of State subsidies that had for their object the improvement of Military Aviation, find themselves practically without the means of fighting the rigid competition involved. It is to be feared that unless French constructors receive stronger private financial assistance the French will find themselves eventually far behind the German industry.

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Trans-Indian Mail

The Royal Air Force recently carried out in India a very interesting experiment by means of which two small packets of Official Mail were carried from Quetta to Simla by air in eight hours fifteen minutes. A Bristol fighter machine left Quetta at 6 a.m., arriving at Dera Ismail Khan at 9 a.m. when the packets were transferred to a D.H.9 machine attached to the 60th Squadron. This reached Lahore 2½ hrs. later when another transshipment was made to a Bristol fighter machine of the 31st Squadron, the bags safely arriving at Simla shortly after 3 p.m.

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Luxury Travel

The Pullman Company of America announces its intention of manufacturing and staffing aeroplanes fitted with sleeping berths. The proposal is to lease these luxury coaches of the air to various aviation companies for use on the long distance air routes. It would seem that the aerial Pullman will soon be as well known as its railway prototype, for the Company have already received requests for numbers of this new type of air coach on loan.

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Surrender by 'Plane

In our November notes we recorded the story of a chauffeur who obtained a situation by using an aeroplane. Now we hear of a motorist who was involved in a motoring accident in Ireland and left shortly after for Egypt. On arrival in the Soudan and hearing that the victim of the accident had died he chartered an aeroplane and flew home. Two days after leaving the Soudan the motorist surrendered to the Irish police to face a charge of killing.

The Schneider Cup Race

The 1925 race for the Schneider Cup will go down in history as one of the most sensational competitions in the annals of this event. Often we have heard of British "luck" but there is no doubt that throughout the chapter of this year's race, the British team of flyers have encountered a full measure of bad luck.

The story of the disaster to Supermarine-Napier S.4 is related elsewhere on this page and it need only be written here that the crash came at a moment when prospects seemed brightest.

The second Gloster-Napier III., to be piloted by Mr. Hinkler, was prepared hurriedly to enable the machine to qualify for the race. Bad weather damaged the machine. It was repaired but further gales prevented the trials and even caused a postponement of the race. Mr. Hinkler made a third attempt, on the morning of the race, but the roughness of the sea damaged the machine as soon as it entered the water and Great Britain was left with only one machine with which to fight out the race. The sportsmanship of the American and Italian teams in persuading the referee to permit Mr. Hinkler to make his qualifying efforts is only another example of the extreme chivalry displayed by airmen, one to another, and it was unfortunate that their action was unavailing.

The race itself was flown in beautiful weather; five machines, three American Curtiss-Racers, one Italian Macchi flying boat and the British Gloster-Napier piloted by Captain Broad, facing the starter. From the outset Lieut. Doolittle, an American Army pilot, set the pace, eventually winning with an average speed of 232.5 miles an hour. Capt. Broad was second, his speed being 199.1 m.p.h. and the Italian third with a speed of 168.1 m.p.h. The remaining American machines withdrew; one with engine trouble after flying six laps at 220.4 m.p.h. and the other after five laps at 218.3 m.p.h.

The course was triangular in shape and it was stated that the manner in which Doolittle roared around the corners meant a saving of 30 miles in comparison with the more cautious of his rivals.

Some idea of the abnormal weather conditions prevailing during the days prior to the race, will be gained when it is said that seventeen out of twenty-three American seaplanes which had arrived at Baltimore for the Naval Pageant, held after the race, broke from their moorings during a 75 m.p.h. gale that raged during the previous night. Seven of the machines were completely wrecked but it is hoped to salve parts of the others.

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The German air lines are proposing to establish three important new routes across the Alps via the St. Gothard, Simplon and Brenner Passes.

South African Air Mail

Negotiations between an English company and the South African Government are believed to be so far advanced that in the early part of next year a regular air mail service will be inaugurated. The Fokker Company were the first to open up discussions with the S.A. Government but their demand for a subsidy of £40,000 was considered to be too high. The English company (whose name cannot be disclosed yet), undertook to carry out the same contract for a subsidy of £6,000 yearly. It is proposed to start a weekly service between Johannesburg, Cape Town and Durban for the transport of mails, passengers and general freight, the timetable being arranged to meet the inward and outward ocean mail steamers.

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Commercial Air Statistics

The statistics recently issued in respect of passenger and freight air traffic in the year 1924 show a marked decline when compared with the corresponding figures for 1923. Only firms operating from fixed bases are included.

	1924	1923
Companies	60	124
Machines	217	429
Mileage flown ...	922,000	3,014,000
Passengers	48,904	80,888
Freight (including mails) lbs. ...	159,000	208,000

As will be seen the drop is principally in the passenger figures and this is attributed to the fact that air travel is no longer a novelty, the public having ceased to be attracted out of curiosity. This drop has forced a number of the lesser companies into liquidation, a point that is reflected in the decrease in the number of companies operating.

* * * *

Torpedo Seaplane

The first British seaplane to carry a torpedo was recently completed and is undergoing tests in the air. The machine, a Blackburn-Napier, is able to carry a standard 30-cwt. torpedo beneath its body. By co-operating with a "mother-ship," which would act as a 'plane carrier, the use of a number of seaplanes of this type would enable large areas of the sea, far removed from land, to be searched in in a very short time.

The Supermarine-Napier S.4

The hope of the British flying world that the Supermarine–Napier S.4 monoplane would recover the Schneider Cup for Great Britain received a sad blow on the eve of the race when it became known that the machine had been wrecked beyond repair as a result of a forced landing during a trial trip.

The machine, built under instructions from the Air Ministry, is constructed to a new design which incorporates a considerable number of novel and interesting features. Among these, special mention must be made of the wings, the tail unit and the engine. The wing is built in one piece to a section specially tested by experts at Farnborough aerodrome. It is interesting to learn that a wing of this type stood up to tests involving all normal strains and stresses and finally was only destroyed under extraordinarily abnormal conditions.

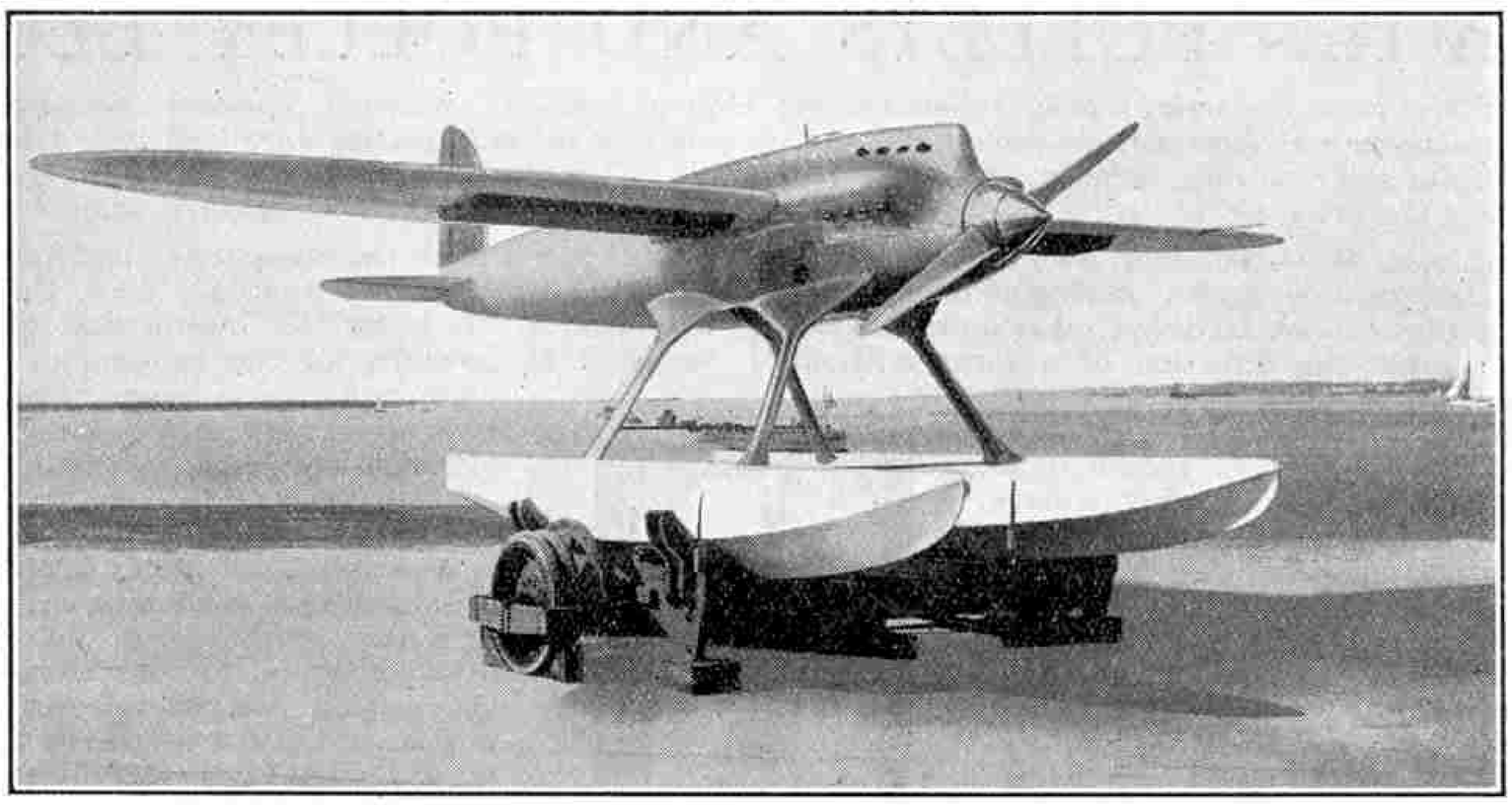


Photo courtesy [*Messrs. Supermarine Aviation Works Ltd.*

The British Supermarine-Napier S.4, completely wrecked in America

The tail unit includes both fin and tail 'plane and is built in one piece with the fuselage. The engine is a special direct drive Napier "Lion" and a Bristol gas starter is used for starting up.

Other interesting points are:

The floats are of wood. Every component is covered with either wood or metal and no fabric has been used. The landing speed is reduced by flap gears. All controls are operated internally, thus reducing head resistance. The propeller is all metal. Wing radiators are fitted.

The order for the construction was placed on 18th March and the first flight was made on 25th August, 1925. To design and construct a machine embodying so many constructional novelties would be a matter for pride under any circumstances but when it is remembered that, less than three weeks after its trial flight, the machine attained a speed of 226.75 m.p.h., breaking all previous sea-plane speed records, the constructors, The Supermarine Aviation Works Ltd., can justly claim a triumphal achievement.

For some time after its trial flights considerable secrecy was maintained concerning S.4 but it became known that the "Lion" engine was working wonders. Rated at 630 h.p. it developed 700 h.p. in speed tests.

From the time the machine left England en route for Baltimore, ill luck seemed to dog its chances. On the voyage across the Atlantic on the S.S. "*Minnewaska*," Capt. Henri Biard, S.4's pilot, slipped and broke a bone in his right hand. Later a terrific snow storm raged over the aerodrome in which the British machine was stationed in a canvas hangar, a pole from the roof of the hangar falling across and seriously damaging the machine's tail plane. Repairs were effected but it seems very probable that this extensive "patching-up" had the effect of weakening the machine as a whole.

MECCANO
STANDARD MECHANISMS

Section III. PULLEYS AND PULLEY BLOCKS

This article is the second of a series reprinted from the new Manual entitled "Meccano Standard Mechanisms," now in course of compilation. Pulleys were the subject of an article published in the Magazine some time ago; this has been considerably amplified and re-written, however, and the present article will be found to contain many novel features. The simple demonstration of the principle of "energy" applied to Pulleys should prove interesting to every student of Mechanics.

PULLEYS are a development of the lever, and when scientifically employed make possible a great saving of labour and energy. A fixed pulley cannot be described as a mechanical power, for it simply changes the direction of a force without increasing it—in fact, a small amount of energy is lost in its use owing to friction. The combination of a rope with several pulleys, however, produces a mechanical power, and with the help of a few experiments we shall endeavour to explain as simply as possible some of the interesting results so obtained.

A man carrying a sack of cement to the top of a building has to carry his own weight in addition to that of the sack. If he attaches a rope to his load and passes the rope over a pulley fixed at the top of the building, he is then able to raise the load by hauling on the other end of the rope while he remains on the ground. This is an example of the pulley used as a convenient method of changing the direction of a force, for it changes the man's downward pull to an upward force by which he is able to raise the sack of cement. It must be remembered that although the man has eliminated his own weight, he has not diminished his load. On the other hand he has increased it, for the energy he now exerts must not only equal the weight of the load but must also overcome a certain amount of friction.

The Meaning of "Energy"

The amount of work, or "energy," of which a machine is capable is measured by "foot-lbs." The unit of this is based on the amount of energy necessary to raise a 1 lb. weight through a height of 1 ft. For example, suppose a weight of 2 lbs. has to be raised through a height of 1 ft.; the energy required would be exactly equal to that necessary to raise a weight of 1 lb. through a height of 2 ft.—namely, 2 foot-lbs.

If 10 lbs. be lifted 100 ft., 10 foot-lbs. are required for the first foot, the same for the second, third, and so on up to 100 ft., making a total of 1,000 foot-lbs. of energy.

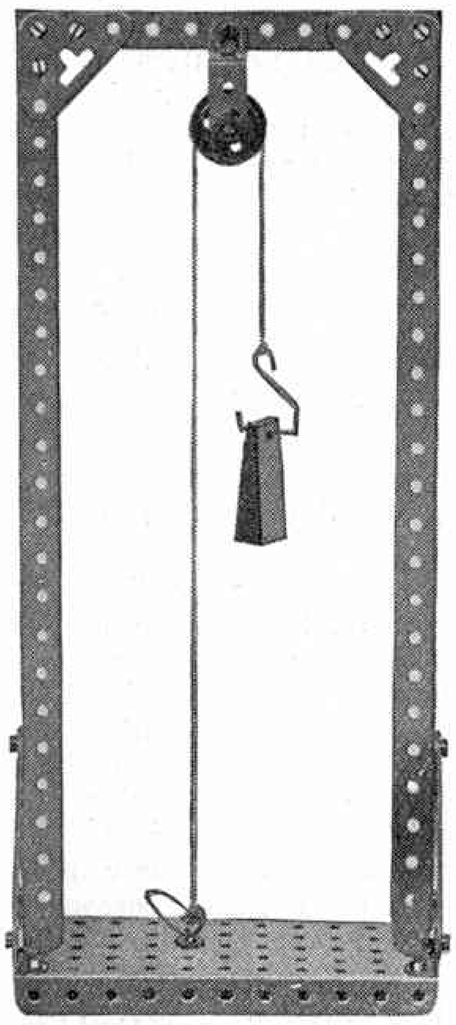


Fig. 1
Single Fixed Pulley

Supposing a man, by hauling on a rope, lifts 1 cwt. to a height of 20 ft. The energy he expends should be sufficient to raise a load of one ton through a height of 1 ft., but it is impossible, of course, for a man to move a direct load of one ton, however short the height through which it is to be moved, although he can create sufficient energy (2,240 foot-lbs., or 1 foot-ton) when moving a load of 1 cwt. through a height of 20 ft. With the aid of a series of pulleys, however, he is able to arrange a contrivance with which he may lift one ton through 1 ft. by the same means; i.e. by moving a smaller weight, or exerting a smaller pull, through a greater height.

Friction in Pulleys

Friction plays an important part in calculating the advantages of pulleys, although in the majority of Meccano models its effect is naturally very small. In every pulley there is a slight loss of power from the necessity of bending the rope, and in actual practice, where heavy ropes are used, this loss becomes of great importance. It is for this reason that pulleys are usually made as large as possible, for the bending of a rope around the circumference of a large pulley creates less friction than when used with a smaller pulley. Small pulleys also cause damage to the rope by excessive bending.

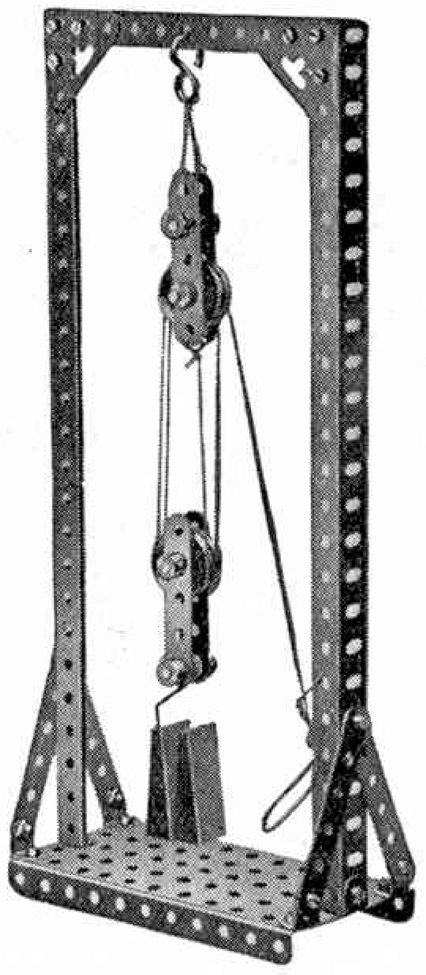


Fig. 3
The Two-Sheave Pulley Block

Example 1

A simple fixed pulley is shown in Fig. 1.

If we attach a hook to the rope at the point where it is tied to the base, and suspend from this hook a weight equal to that already shown, we find that the original weight remains suspended in mid-air, in spite of the law of gravitation by which the highest weight should fall, thereby raising the lower weight.

Because this is the case, we know that there must be some force that is retaining the suspended weight in position. This force is friction, created by the bending of the cord and from the contact of the pulley on its bearings. If a 50-gramme weight is attached to each hook, we find that the addition of five Washers is required to the uppermost hook to cause the weight to fall, so raising the other hook supporting the lower weight. Thus the amount of friction present in our model is equal to the weight of five Washers.

Example 2

In Fig. 2 we have a moveable pulley B in addition to our fixed pulley A. The rope is fastened to the cross beam, passed (or "rove") through the moveable pulley B, and over the fixed pulley A.

With this arrangement it will be found that a power load of, say, 11 lbs. attached to the free or "running" end *a* of the rope will raise a weight of 20 lbs. suspended from the moveable pulley B. Here, then, the moveable pulley B is employed as a mechanical power and gives an advantage of nearly double the available force. To this mechanical advantage the fixed pulley A does not contribute, but only changes the direction of the force, converting a downward pull on the rope at *a* to an upward force at *b*.

The explanation of the increased power, or mechanical advantage, obtained is as follows. In our model we find that to raise the load 1 in. the power must descend 2 in.—for it is clear that if B is to rise 1 in. the lengths of rope *c* and *b* must each be shortened by 1 inch—therefore *a* must be lengthened by 2 in. To raise 20 lbs. through 1 ft. requires 20 foot-lbs. But the power load of 11 lbs. descending through twice that distance—2 ft.—yields 22 foot-lbs. This is 2 foot-lbs. more than is actually necessary; hence it may be stated that friction has absorbed 2 foot-lbs. of the energy exerted.

From this we learn that a moveable pulley enables a force to move through a greater distance than that moved by the load it lifts. We also know that the energy exerted by a force is increased proportionally to the distance through which it moves. Therefore by using a single moveable pulley we may almost halve the force that would be necessary

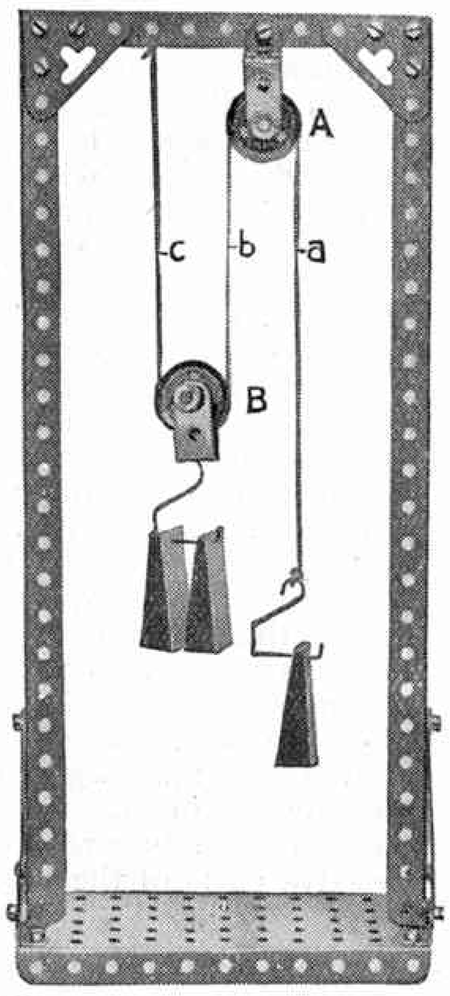


Fig. 2
The Single Moveable Pulley

without it, for it enables us to move the force through a distance twice as great. It should be noted here that in all the mechanical powers, the force is increased always at the expense of speed, since it must move through a greater distance than the load it lifts

Example 3

The principle in Fig. 3 is the same as in Example 2, but two further pulleys have been added. The rope is rove through one of the pulleys, or "sheaves" as they are termed, situated in the fixed pulley block, thence under one of the sheaves in the lower moveable block, over the second fixed sheave, and down to the second moveable sheave. From there it is led up and secured to the framework of the fixed pulley block.

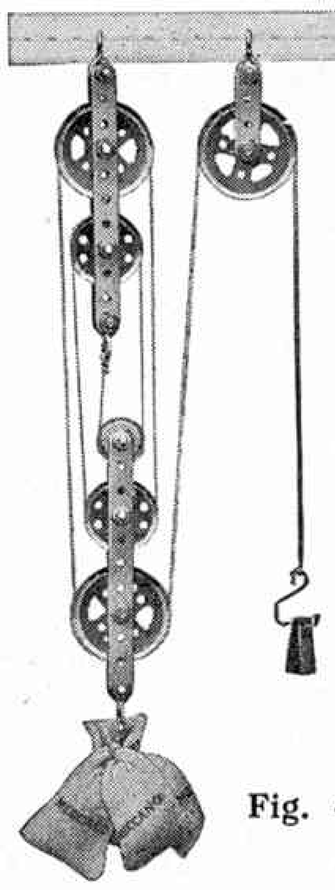


Fig. 4

The load is thus supported by four lengths of rope, and to raise the load through one inch, each of the four parts of the rope from the upper block to the lower block must be shortened one inch. Therefore, the running end of the rope must be lengthened by four inches, from which it may be calculated that, eliminating friction, one quarter of the load attached to the running end would be sufficient to raise the load, for, as we have already seen, the energy exerted by a force is increased proportionally to the distance through which it travels. In actual practice it will be found that a little more than a quarter of the load is required to raise it, the surplus being absorbed by friction.

Example 4

A popular arrangement of pulleys is well illustrated in the Meccano Model No. 709, Stiff-Leg Derrick Crane As shown in S.M. 31 the tackle here consists of two pulley blocks, one fixed and one moveable, as in Example 3. The upper block contains two sheaves or pulley wheels, while the lower or moveable block has three sheaves. The end of the cord that passes over the large pulley in the jib of the crane is the running-end.

The model shown in Fig. 4 makes the relative arrangement of the sheaves and cords easier to understand. As will be seen, instead of all the sheaves in one block being on the same axle they are separated in this model one from another. The action of the pulleys in Fig. 4 is similar to that in the Stiff-Leg Derrick.

In this case we have six lengths of cord supporting the moveable pulley block, so by a similar calculation to that made in Example 3, it will be seen that we obtain a mechanical advantage of six—that is, a force equal to one sixth of the load will be sufficient to raise it (ignoring friction).

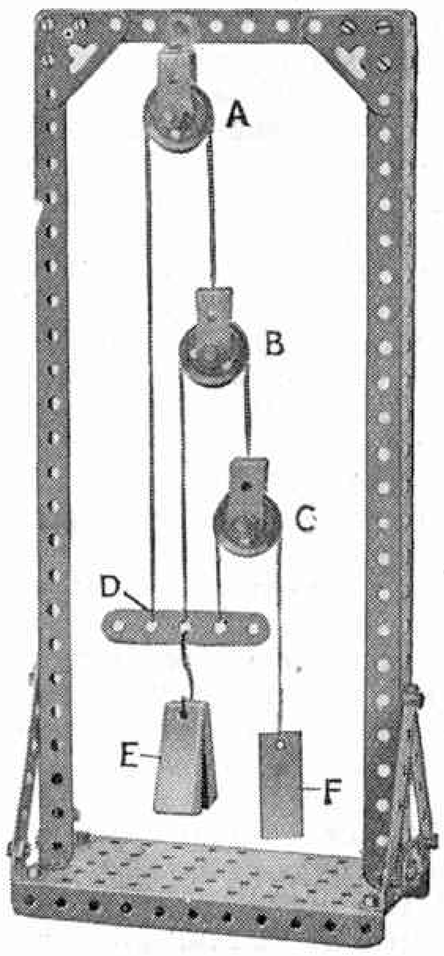


Fig. 5
Separate Cord System

Example 5

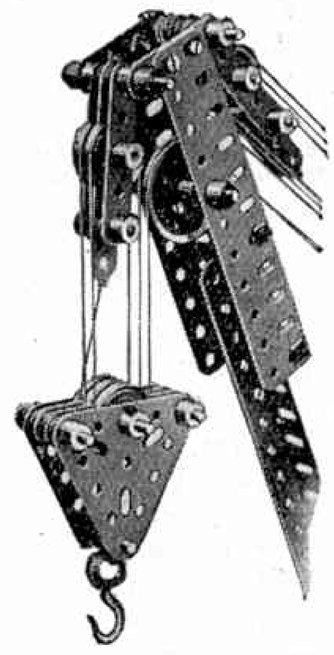
In Fig. 5 separate cords are substituted for the previous continuous single cord. One end of the outermost cord is attached to a Strip D and the cord then passes over the pulley A, which is bolted to the upper framework. The other end of this cord is fixed to the block B. The centre cord is also fastened to D and then passes over the pulley B to be secured to the block C. The remaining cord passes over the pulley C, and serves as the running or pulling-end of the tackle. The load E is suspended from the Strip D, and the power F is attached to the running-end of the cord C.

With this ingenious arrangement we obtain a mechanical advantage of seven; that is, it enables a load of, say, 70 lbs. to be lifted by an applied force of only 10 lbs. (ignoring friction).

The explanation is not quite so obvious, perhaps, as in our previous examples. If D is raised 1 in. the block B, suspended from the first cord that passes over A, must fall 1 in. Since the pulley B descends 1 in. that part of the second cord between B and C must be lengthened by 2 in. (We learned in Example 2 that to raise a moveable pulley 1 in., 2 in. of cord must be drawn up—therefore to drop a moveable pulley 1 in., 2 in. of cord must be let down). We must remember that D has risen 1 in., so that the second cord has been lengthened by a further inch between B and C. Therefore the pulley C has dropped 3 in. altogether. From this, again working on the theory of the moveable pulley, we find that the running end of the third cord, which passes over the pulley C, must descend through 6 in. Finally, by adding to the running end the additional length of 1 in. derived from the movement of D, we arrive at the total movement of the power load F, namely, 7 in.

Therefore if the power load is 10 lbs., it exerts 70 foot-lbs. energy for every foot the load is raised.

It should be mentioned that in the Meccano model it is first necessary to balance the weight of the pulley blocks B, C. This may be done by suspending a weight of approximately 75 grammes from the Strip at D. Then having attached a load, say, of 175 grammes, at E we find that 25 grammes on the power hook F is sufficient to balance it. By the addition of about eight Washers the load is raised; therefore the loss by friction is equal to the weight of the Washers.



S.M. 31
Arrangement of Pulleys in Stiff-Leg Derrick (Model No. 709)

This arrangement of cords and pulleys, though using a smaller number of sheaves than the continuous cord system, is seldom employed by engineers for the reason that the continuous cord is more convenient to fix and use.

Example 6

Our final example deals with a very ingenious contrivance, known as Weston's differential pulley block. This apparatus consists of three parts—an upper fixed pulley block, a moveable pulley and an endless chain (Fig. 6). In our Meccano model, the load C may be raised or lowered by a slight pull on the chain at A or B.

The principle on which this pulley block is based will be understood from the diagram shown in Fig. 7. Two Gear Wheels, D (57 teeth) and E (50 teeth), are employed as the sheaves in the fixed pulley block, in order that their teeth may prevent the chain from slipping. They are both secured to the axle F, and must therefore turn together at similar speeds. The chain passes from the hand at A over the larger sheave D, then downwards at G, and under the moveable pulley H, which supports the load. It passes up again at K, over the smaller sheave E, and then back again by B to the hand at A.

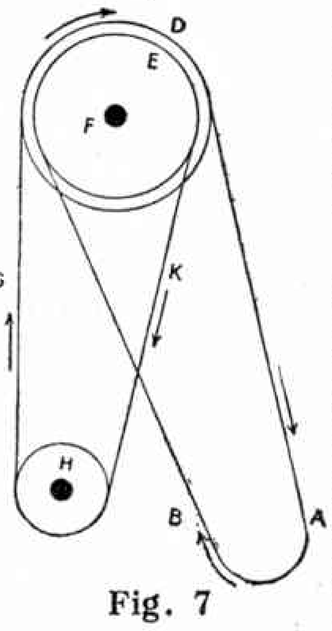


Fig. 7

When A is pulled downwards, the sheaves D and E must both rotate in the direction indicated by an arrow in the diagram. The larger sheave D is therefore winding up the chain at G while E is lowering at K.

The effective circumference of D is $4\frac{1}{2}$ in. and that of E is 4 in. In one revolution of the axle F, D must draw up $4\frac{1}{2}$ in. of chain; but in the same time E has lowered 4 in.; hence the length of chain between the two must have been shortened by $\frac{1}{2}$ in. (the difference between $4\frac{1}{2}$ in. and 4 in.) This can only have taken place, however, by raising the moveable pulley H through half that amount, that is, $\frac{1}{4}$ in. Therefore the power at A has moved through a distance 18 times greater than that through which the load moves, for in order to rotate the axle F once, A must have pulled out $4\frac{1}{2}$ in. (the circumference of D). This means that the theoretical mechanical advantage in our model is 18, and by it a load of, say, 1,800 lbs. could be

(*Continued on page* 699)

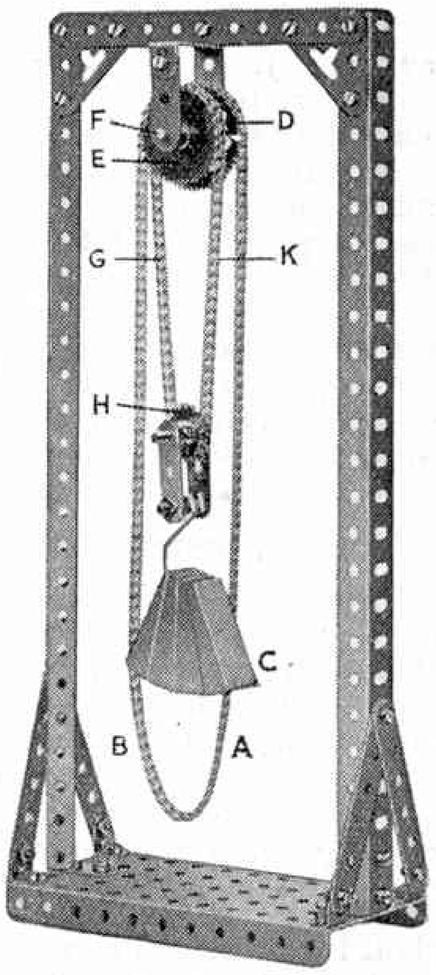
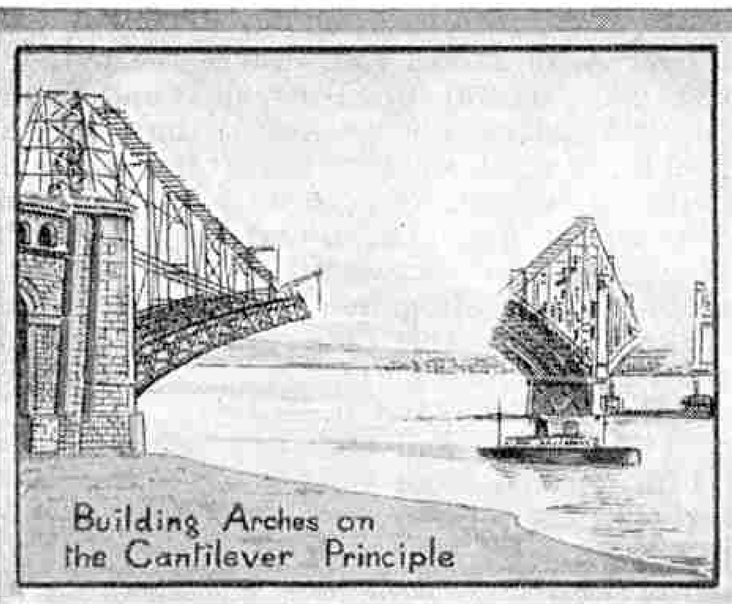


Fig. 6
Differential Pulley Block



Engineering News of the Month

Boilers for Leeds Generating Station

Two Babcock and Wilcox cross-type marine boilers have recently been installed in the Leeds Corporation electric generating station, and are now undergoing final tests. There are now thirty-eight boilers in the station, twenty-four in the old section, and fourteen in the heavy duty bay, while the present capacity of the station is 82,000 kw., with one Parsons' turbo-generator in process of erection, 15,000 kw. in capacity.

The new boilers differ from those already installed, in that they operate on balanced draught, and are fitted with an epicyclic drive for the travelling chain grate stokers. This gearing gives a range of eight speeds as against four ordinarily available.

* * * *

Attempt to Recover £1,000,000 Specie

It is reported that Japanese engineers are to attempt to salvage £1,000,000 treasure that went down with the ill-fated "*Egypt*," sunk in collision with the French cargo steamer "*Seine*" during a dense fog on the night of 20th May 1922. The engineers in question recently succeeded in salvaging specie from the sunken "*Yasaka Maru*," and the divers who worked on that wreck are to have a year's rest before commencing work on the "*Egypt*."

* * * *

Engineers for the Mersey Tunnel

Mr. Basil Mott, C.B., of Westminster and Mr. J. A. Brodie, the Liverpool City Engineer, have been appointed engineers for the £5,000,000 Mersey Tunnel Scheme.

Mr. Mott, who is to be the Chief Engineer, is an acknowledged tunnel expert and is president of the Institute of Civil Engineers. He rebuilt the Waterloo Bridge, London, and is now engaged in the protective work at St. Paul's Cathedral. He hopes to make a report at an early date with regard to a start being made upon the construction of the tunnel.

* * * *

New Pneumatic Grain Discharging Plant

The London and North Eastern Railway have recently placed a contract with Messrs. Henry Simon Ltd., of Manchester, for a large travelling pneumatic grain discharging plant, for use at King George Dock, Hull. The plant is intended for lifting grain from vessels at various points along the quayside and discharging same to the granary and silo.

The most important feature of the new plant is that it will be mounted on railway wagons and so will be able to travel around the dock and deal with vessels on either the north or south sides. The turbo-exhauster, receiver, rotary seal, dust filters and electric motor will all be carried in one covered wagon. The pneumatic pipes will be telescopic so as to reach the bottom of the holds of large vessels, and the maximum capacity of the plant will be 60 tons per hour.

* * * *

From Hull to Nottingham by Water

In opening Gunthorpe Lock, the third of four required to equip the Newark-Nottingham stretch of the Trent as a commercial waterway, Mr. H. B. Betterton, Parliamentary Secretary of the Ministry of Labour, said the scheme when completed would be of illimitable benefit to Nottingham and Nottinghamshire. Already new factories were springing up on the banks of the river, and many more would be built before the project was complete.

Mr. Betterton drew attention to the value placed by France, Germany, Belgium and Holland, on the carriage of goods by water, and remarked that when the present scheme was completed it would be of great advantage in lowering the cost of transport, which was essential if the cost of production was to be reduced.

Only the Hazleford Lock remains to be completed and when this is opened it will enable vessels laden with 120 tons of merchandise to go through from Hull to Nottingham. The Gunthorpe Lock is 190 ft. in length and 20 ft. in width and its capacity allows a tug and three barges to pass through at one operation.

* * * *

A Sunday Surprise

The workpeople of a Stockport engineering firm were recently told that they might bring their friends on the following Sunday to see a very large and powerful Diesel engine at work. The engine, which develops 1,000 b.h.p. at 125 r.p.m. is suitable for driving factory machinery or for ship propulsion, and it was expected that perhaps 100 people would take the opportunity of seeing it work. Great was the surprise of the management, however, when a crowd of 2,000 turned up! The engine was operated by Mr. G. E. Windeler, the company's chief engineer and the crowd listened intently while the working of the engine was explained to them.

* * * *

70 m.p.h. on Water

Considerable curiosity is being manifested in France with regard to the invention of a Russian engineer, M. Georges de Gasenko, former representative of the Ukrainian Republic in London. M. Gasenko claims to have built a machine that can travel on water at a speed of about 70 miles per hour, but which is neither aeroplane, seaplane nor glider. The "Oceanplane," as the machine is called, has been constructed at Lyons, and consists of a hull, surmounted by a plane, and a propellor driven by a 180 h.p. motor. The most peculiar feature of the machine is the manner in which it travels, neither gliding on the surface of the water, nor flying above it, but hopping. The inventor is said to have drawn his inspiration from a curious creature known as a "sea flea," which progresses along the surface of the water by using its long spidery legs.

The machine is fitted with skates 10 ft. in length, jointed in the middle and terminating with floats filled with helium, enabling the machine to jump from one wave to another. The inventor proposes, should the trials be successful, to cross the Mediterranean and proceed down the African coast.

* * * *

New Rhodesian Hydro-Electric Plant

The Rhodesian Broken Hill Development Company has recently carried out a big hydro-electric scheme in South Africa, that of the Mulungushi dam in the Broken Hill district of Northern Rhodesia. The plant has been erected for the production of electricity to supply the company's general mining equipment at Broken Hill, including particularly the electrolytic production of zinc.

A great dam 110 ft. in height and about 250 ft. in breadth has been built across the River Mulungushi. It impounds the water and creates a lake holding 6,000,000,000 gallons of water. The outflow of this lake passes down what was once the bed of the river to the hydro-electric station at the bottom of the valley from where the current is sent 40 miles through cables to the mines.

Two of the main contractors for the plant and equipment were the Metropolitan Vickers Company and Messrs. Armstrong, Whitworth. For the pipeline, Messrs. Glenfield and Kennedy have supplied a 24 in. internal diameter "Johnson-Boving" cast-steel valve the internal parts being lined with gunmetal to avoid corrosion.

A pilot and operating valve permits of control at any distance, while an indicator shows the position as regards the degree of opening or closing at any time. A filter on the supply pipe leading to the pilot valve prevents any foreign material from interfering with the efficiency and accuracy of the control. The complete valve operates at 502 lb. pressure, and before dispatch was tested at the works in Kilmarnock to 1,250 lb. pressure.

Boring the Mersey Tunnel

The construction of the great tunnel under the Mersey will be commenced this month by the sinking of two shafts, one on each side of the river. By boring a preliminary small tunnel, the engineers will gain valuable data as to the different strata that will have to be penetrated in the construction of the larger tunnel. The small boring, probably 9 or 10 ft. in diameter, will be constructed under hydraulic pressure, and later will be incorporated in the larger tunnel.

* * * *

Devonport's Floating Dock

A new floating dock has recently arrived at Devonport and is to be moored in the Hamoaze, it being estimated that the cost of preparing a suitable berth and moorings will be £60,000. Even though the dock has a lifting capacity of 30,000 tons, and a housing length of 680 ft., it will not be capable of accommodating the "*Hood*" (41,200 tons and 810 ft. in length). Rosyth remains the only naval establishment that is able to dry-dock this ship, although she is maintained at Devonport.

* * *

Our Last Wooden Walls

The internal restoration of Nelson's "*Victory*" is now completed and it is suggested that the workmen thus discharged should now be employed in restoring the old "*Implacable*," the only other survivor of Trafalgar. This vessel was recently rescued from the ship-breakers at Falmouth and is now at Devonport. She ran away at Trafalgar as the "*Duguay Trouin*," only to fall into the hands of Strachan a few days later. The Admiralty have consented to patch her up under water to keep her afloat.

* * * *

Proposed New Broadcasting Station

Now that the high-power station has been moved from Chelmsford to Daventry, certain areas on the East Coast have found that they cannot clearly receive either 5XX or 2LO. The B.B.C accordingly proposes to ask the Postmaster General for permission to erect another broadcasting station on the eastern or south eastern outskirts of London.

Such a station could be received clearly by those listeners on the East Coast who cannot now hear Daventry, while London listeners would have the choice of another programme instead of that transmitted from 2LO. The B.B.C. however, cannot do anything in the matter without the necessary permission, but if this is granted work on the new station will probably be commenced immediately.

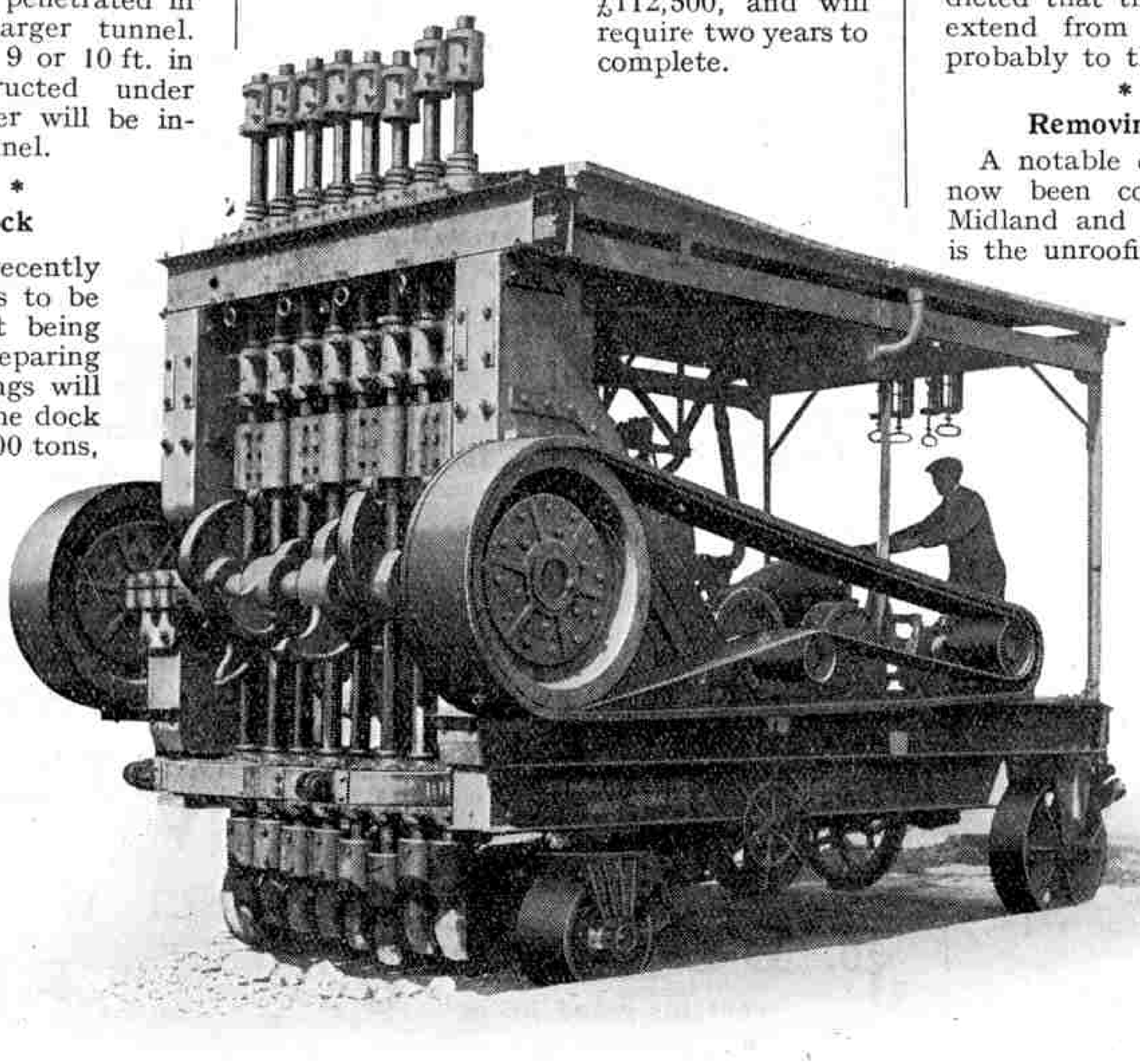
* * * *

Improvements at Scarborough

A scheme for the carrying out of various improvements at Scarborough is at present being considered. The scheme provides for lifts on the cliffs of the town, improvements to streets and the construction of a boulevard.

New Bridge at Boothferry

A contract has been awarded to the Cleveland Bridge and Engineering Company Limited, of Darlington, for the construction of a new bridge over the River Ouse at Boothferry, near Goole. The scheme is estimated to involve an expenditure of £112,500, and will require two years to complete.



A huge Road-breaking Machine recently tried in London

Eight loaded hammers, operated by cams, attack the concrete or road surface, which is speedily broken up by the terrific force and frequency of the blows it receives

New Thames Lock

A scheme has been prepared for the construction of a new lock on the south side of the existing lock at Sunbury, on the Thames. Reporting on the defective condition of the present lock, the Navigation Committee pointed out that considerable difficulty is experienced by large barges and other vessels in entering and leaving the lock on the upstream side owing to the angle at which it is constructed, a delay of one or two hours sometimes being caused by the congestion. The new lock, which will cost £17,500 will be 205 ft. in length and 25 ft. in width, and will be constructed so as to form a more convenient angle for approach and exit.

* * * *

Russian Orders for British Machinery

Machinery to the value of nearly £1,000,000 has already been ordered from this country for Russia, and according to a recent statement, it is more than possible that further orders will be placed in the near future. The deciding factor will be the question of credit, and the opinion in Lancashire, where the present contracts have been placed, seems to point towards a renewal of trade with Russia. The fact that Russia is endeavouring to re-establish her industries is confirmed by the news that a Russian-German Company, having a capital of £250,000, has been formed to erect factories and engineering works in that country.

New Lancashire Road

The construction of a new road from Liverpool to East Lancashire will shortly be commenced. The road will cost £2,750,000 and will be 26 miles in length. It will shorten the distance from Liverpool to Manchester by six miles and it is predicted that this new road will eventually extend from Salford to Yorkshire and probably to the East Coast.

* * * *

Removing 700,000 Tons of Rock

A notable engineering task, which has now been commenced by the London Midland and Scottish Railway Company, is the unroofing of Cofton Tunnel on the Birmingham and Bristol main line. The tunnel will be converted into a cutting 80 ft. in depth so that it will then be one of the deepest in England. The work will be carried on without interruption of the train service, and will involve the removal of 700,000 tons of solid rock.

* * *

Overseas Power Supply Scheme

New Zealand is spending ten millions on laying down plant to develop hydro-electrine motive power in many areas. It is predicted that the time is not far distant when every dairy farm will be driven by electricity and when farms as well as towns will use electric power instead of coal for cooking, heating and lighting. Electric appliances of all kinds, from the heavy machines used in butter and cheese factories to toast racks and coffee pots, will then be in great demand throughout the country.

* * * *

New French Floating Dock

According to a Berlin message, the Bordeaux municipality have placed an order with the Vulkan yard at Hamburg for the construction of a 25,000 ton floating dock. Such is the present position of the Hamburg yards, that the Senate, with a view to giving work and preventing further increase in unemployment, has decided to expend over 1,000,000 marks on the construction of small Customs vessels. The order for the new dock is, therefore, more than welcome.

* * * *

Big Madeira Harbour Scheme

The Portuguese Government has placed a contract with a London firm for the construction of a harbour at Funchal. The new harbour, the plans for which were drawn up by the famous consulting engineer, Sir Murdoch Macdonald, M.P., will cost £1,500,000, and will take three years to construct. When completed, it will enable the largest liners in the world to dock at Madeira. The work will be supervised by British experts, and large quantities of cement will be shipped from this country to Madeira.

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Air Stamps are *the* most popular stamps to-day.

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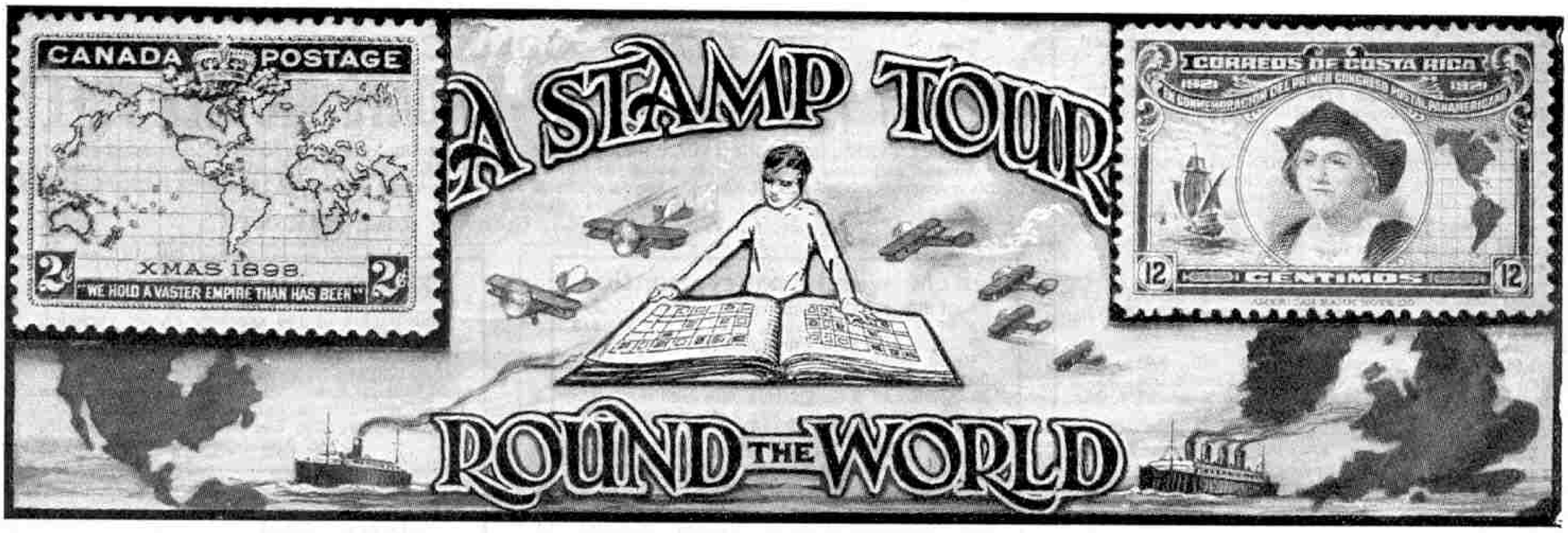


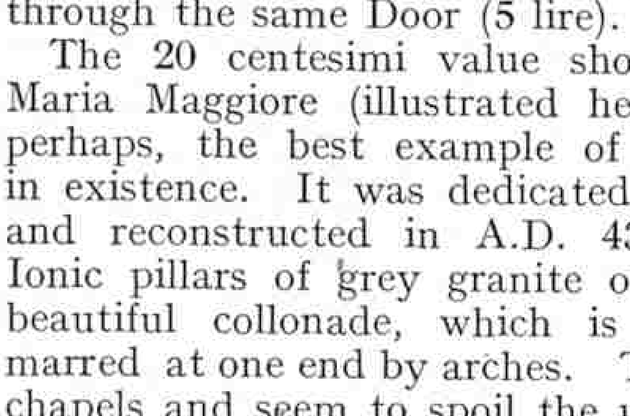
XV. BEAUTIFUL CHURCHES OF ITALY

FROM Bosnia we fly in a south-westerly direction across the Adriatic Sea to Italy and across the Apennines to Rome, the capital of the Kingdom of Italy. Rome to-day is famous for many things. Here lives the Pope, the head of the Roman Catholic Church. In the past, of course, Rome was the centre of the Roman republic and the vast Roman empire, and it remains to-day the best locality in the world for interesting relics of ancient days.

At the end of 1924, Italy issued a series of stamps to commemorate the Holy Year, "Anno Santo, 1925," showing views of various churches at Rome, and the Pope opening the Holy Door (1 lira) and the Pope passing through the same Door (5 lire).

The 20 centesimi value shows the Church of St. Maria Maggiore (illustrated here), which building is, perhaps, the best example of a three-aisled basilica in existence. It was dedicated in the year A.D. 365, and reconstructed in A.D. 432. There are twenty Ionic pillars of grey granite on each side forming a beautiful collonade, which is unfortunately slightly marred at one end by arches. These open into different chapels and seem to spoil the uniformity of the scene. The chord of the apse is 250 ft. in length by 100 ft. in breadth. Beneath the windows in the clerestory are some wonderful mosaic pictures of Old Testament history that are believed to date from about the year 440.

The 30c. value (also illustrated) shows the building of St. John Lateran, the earliest Christian basilica to be erected in Rome. Frequent restoration and alteration, has, however, so changed its appearance as to completely destroy its old form.



The 50c. shows the basilica of S. Paulo fuori le Mura, which was burnt in 1823, rebuilt during the ensuing thirty years, and reconsecrated in 1854. It is a huge building giving an appearance of cold splendour. The pillars are of grey granite from the Alps, while rosso, verde antico, Egyptian alabaster, lapis lazuli, and malachite are used in various parts of the building.

The last view, the 60 centesimi, shows one of the most famous churches in the world, St. Peter's. The work of Bramante, Raphael, Peruzzi, Sangallo and Michelangelo between the years 1505 and 1590, it is so designed that in spite of being the largest church in the world it appears to be quite small and visitors have the greatest difficulty in believing that it is twice as large as St. Paul's, London.

The dome consists of two shells, the outer one being higher than the inner and connected to it by ribs. The construction is brick, the ribs however being of stone, and the diameter 140 ft.

The Principality of Monaco

From Rome we fly due north-west over the Mediterranean Sea towards Monaco, a distance of about 300 miles, passing on the way the island of Elba and the northernmost point of Corsica, C. Corso. Monaco is an independent principality, the prince being absolute ruler. There is no parliament, the small council of state, the maire and other authorities being appointed by the prince.

The 1922-24 issue shows four views of the district. The Rock, a level projecting headland about 200 ft. above the sea, is the site of the town of Monaco and was pictured on the values from 60c. to 2fr. On the Rock is the Royal Palace (5fr. to 10fr.), an excellent example of Renaissance architecture. The Oceanographic Museum (30c. and 50c.) stands on the edge of a cliff and was opened in March 1910 by the Prince. It was designed to hold the specimens found by the ruler during twenty-five years' research work in the depths of the sea and is a fine building in every respect. The 40c. (illustrated in our September issue) shows the railway viaduct at Monte Carlo and the chapel of S. Devote, the patron saint of Monaco. It is one of the favourite views of the inhabitants. This series of stamps was designed by H. Cheffer and printed by Messrs. Enschedé and Sons, Haarlem, Holland.

Monaco first issued stamps in 1885 when a series

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Packets, 250 diff., 1/–; 500, 1/9; 1,000		4/–

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New Zealand,	½d. bright yellow-green	1d.
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Large new list of King George British Colonials tabulating the New Script Watermarks and the Old Multiple C.A. All values from ¼d. to £1 are priced from Antigua to Zanzibar.

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EIGHT DIFFERENT GUATEMALA FREE!

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References or deposit please.

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appeared showing the portrait of Prince Charles III., followed in 1890 by a series showing a portrait of Prince Albert, in 1901 by several values of this series in new colours, and in 1919 by a War Charity series.

Our next stage takes us to Switzerland and the heart of the Alps. Here, 13 miles south-east of Interlaken, on the boundary between the cantons of Bern and Valais, is the famous mountain, the Jungfrau. It is 13,670 ft. in height and is the third highest peak in the Bernese Oberland. It was first climbed in 1811 by the brothers Meyer, but soon it will be possible to ascend it with comparative ease and safety for the last section of a marvellous railway is now being completed up its sides, as was described in the article on "Swiss Mountain Railways" in our June issue (page 266).

The Jungfrau is pictured on the 10fr. value of the 1914 issue of Switzerland. The 3fr. shows the Mythenstein and the 5fr. the Rütli, both peaks near the Lake of Lucerne, the most beautiful lake in Switzerland, towards which we now turn. The Mythenstein is a solitary rock on which there is an inscription in honour of Friedrich Schiller, the author of the play "William Tell," for it is in this district that Tell's legendary feats of skill were performed.

The Austrian Town Views

From Switzerland we fly eastwards to the Austrian Republic to visit the various towns pictured on the series of charity stamps issued by that country early in 1923. Designed by F. Schirnbock and engraved by Herr Rudolph Junk, the stamps are printed in deep colours by the line-engraved process and are perforated 12½. They were sold for charity at six times their face value.

Our first visit is to Bregenz situated at the southern end of the Lake of Constance, 24 miles by rail from Feldkirch. It is the capital of the province of Vorarlberg and was pictured on the lowest value of the series, the 100 kronen (illustrated), which shows the ancient castle in the old portion of the town and also the beautiful parish church on the extreme left.

From Bregenz we continue eastward to Innsbruck (200 kr.) about 80 miles distant by air, situated at the junction of the important highway joining Germany with Italy. It is the capital of the Tyrol province and is an important political position. It is situated on the right bank of the river Inn and near the main bridge over this river, and it is due to this that it carries the name of Innsbruck. It is one of the prettiest towns in Europe being situated at the foot of lofty mountains that give the impression of actually overhanging the town. The view on the stamp shows one of the balconies for which the town is famous. In the Franciscan church there is a bronze statue of King Arthur of Britain, this being one of twenty-eight statues surrounding the cenotaph of the Emperor Maximilian, who died in 1519. Twenty-three of the statues are of his ancestors, but the remainder, of which the Arthur statue is one, are of the emperor's favourite heroes.

Continuing in a more or less easterly direction, we make our way to Salzburg (120 kr., illustrated here), beautifully situated on the river Salzach where it flows between two isolated hills near the German boundary. The large building shown on the summit of one of these hills on the stamp is the imposing citadel of Hohen-Salzburg, first built in the 9th century, although the present buildings originated in the 15th century. The towers rise 400 ft. above the town. Below we see one of the many large and interesting buildings of the city and also one of the many fountains that have given the town the name of "the German Rome."

From Salzburg we turn due south-east and continue in that direction for about 100 miles until we arrive at Klagenfurt (180 kr., illustrated), a town of many notable buildings and the capital of the Austrian duchy of Carinthia. Our next call is at Graz (Gratz) which is 60 miles due north-east of Klagenfurt and which was pictured on the 400 kr. value illustrated here. In the view shown on the stamp may be seen one of the principal streets of the town, and the mountain Schlossberg, 1,545 ft. in height, on the top of which is a bell-tower 60 ft. in height and a curious clock-tower 52 ft. in height. Up the Schlossberg is a cable tramway and beautiful parks have been cultivated on the sides of the mountain.

The Parliament House of Vienna

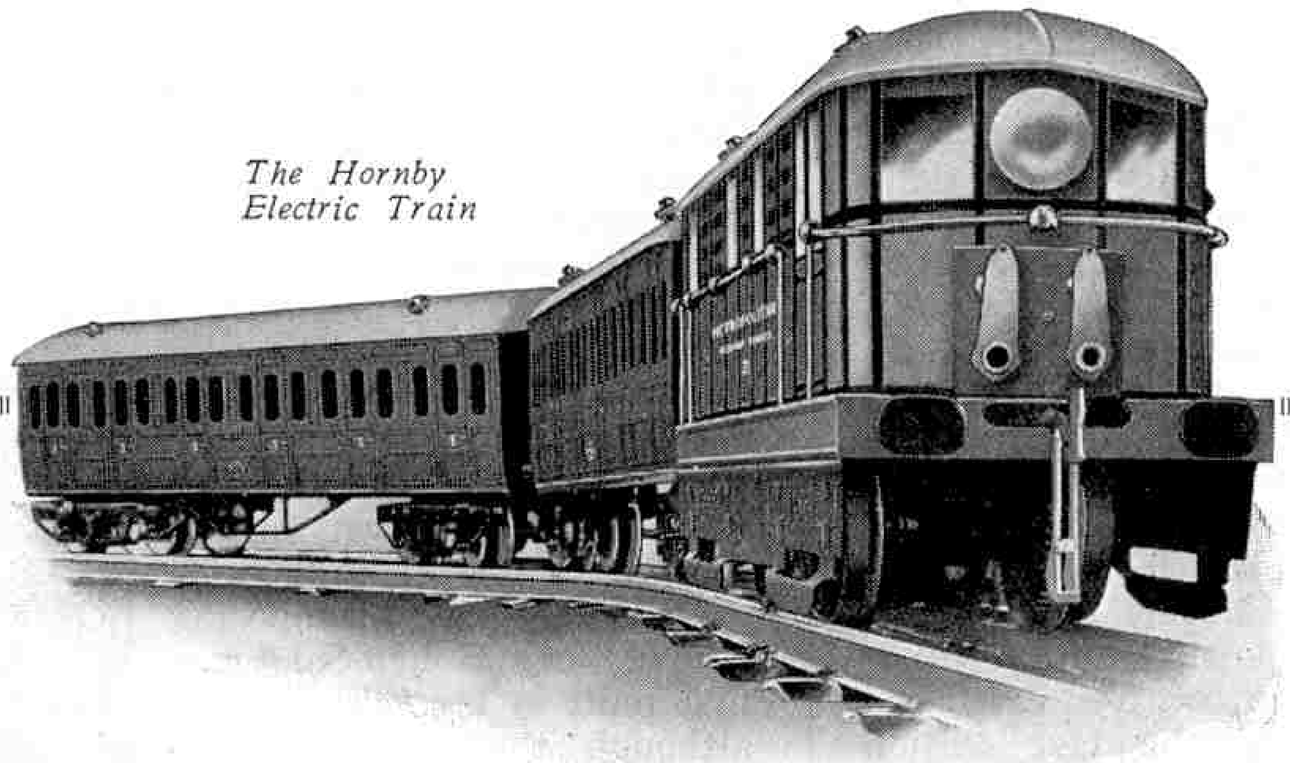
We now continue north-east in the direction of Vienna, calling on our way at Eisenstadt (Kismarton) situated at the foot of the Leitha mountains. A view in this town was pictured on the 160 kr. value of the series.

A scene in a park at Vienna was pictured on the 1,000 kr. value of the series, but in addition a view of the Parliament building was shown on all the values of the 1919-21 oblong series of stamps. The type is illustrated here. These buildings are the work of Theophil Hansen and were erected in 1883. They are an excellent example of the way in which the Grecian style of architecture can be combined with the requirements of modern organisation.

The Parliament buildings are situated on the Ring, the world-famous boulevard that encircles the older portions of the city of Vienna.

NEXT MONTH:—

CENTRAL EUROPE AND HOME



The Hornby Electric Train

What fun it is to sit by the regulator and with a touch of the finger send this superb model electric train gliding along the track—to stop it—to start it up gradually—to watch it accelerate !

THE

HORNBY ELECTRIC TRAIN

The Latest Hornby Thrill

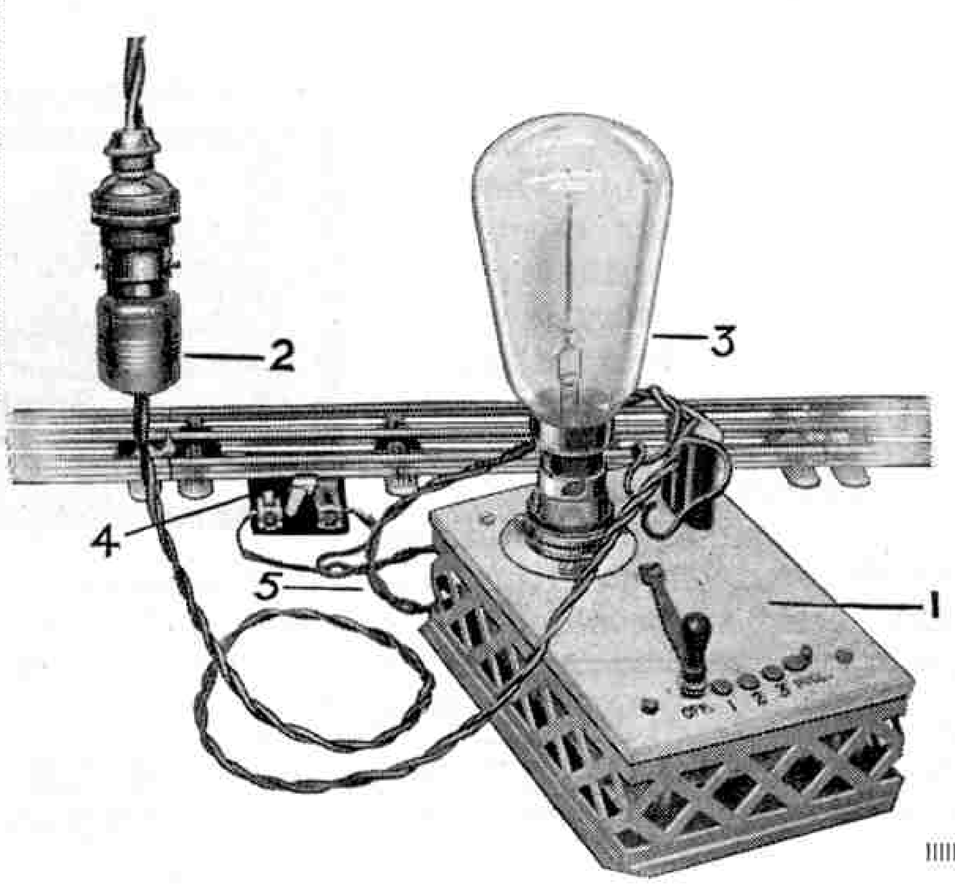
THE Hornby Electric Train is modelled on the lines of the well-known Metropolitan Railway, and is most realistic in appearance. Both Loco and Coaches are fitted with electric lights, which may be switched on and off at will. The finish and workmanship are of the highest quality.

Any boy can fit up the track and operate the train. Full instructions accompany each set, and there are no difficulties or dangers. All the regular Hornby Series rolling-stock and practically all the accessories, may be used with the Hornby Electric Train.

Loco, Coaches and rails are fully covered by our usual guarantee.

HOW THE TRAIN IS CONTROLLED

The motor is the most efficient ever fitted into a model loco. It is adapted to be used on the ordinary town current of 100 to 240 volts, either alternating or direct. Neither accumulators nor dry batteries are needed. We illustrate the rheostat, which is included in every set. This is connected to the house supply by means of the adaptor (2), and the current is brought down to the correct pressure through a 60-watt lamp (3) of the same voltage as the supply. (This lamp is not supplied in the set. Everything else necessary is included). The rail terminal plate (4) may be connected to any part of the track. The rheostat provides for four variations in the power supplied to the train.



The set contains Electric Loco, two Metropolitan Passenger Coaches, and Electric Rails to form a circle 4 ft. in diameter, together with a rheostat, with adapter and length of flex, and rail terminal plate. The Loco is fitted with reversing gear.

Complete set, in strong box: Price £5 10s. 0d.
Hornby Electric Loco .. .. Price 52/6
Hornby Coach, Metropolitan .. „ 18/–
Rheostat, with adapter and length of flex .. .. „ 16/–

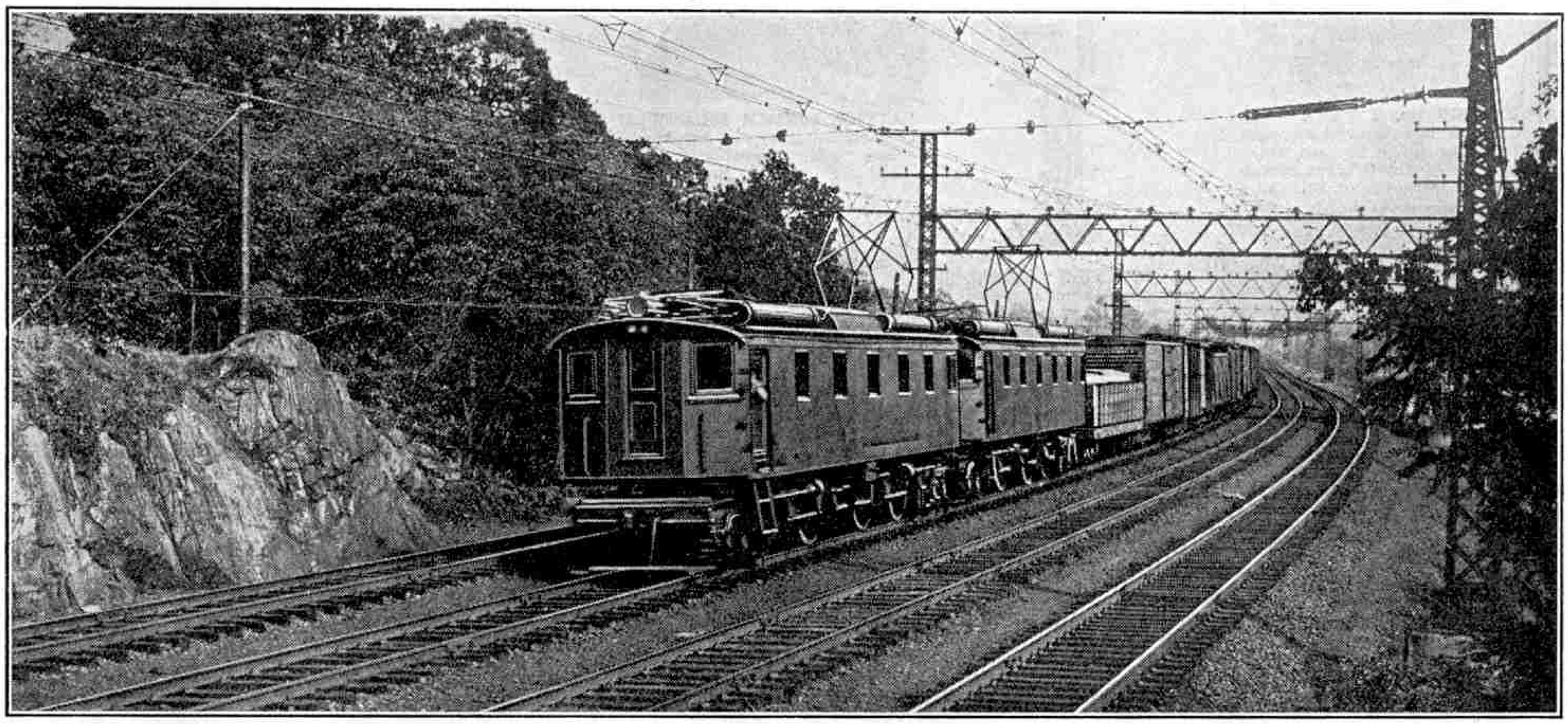
MADE BY

MECCANO LIMITED

BINNS ROAD : LIVERPOOL

Electric Trains and Their Story

The Development of Electric Traction from 1885 to the Present Day



Two Baldwin-Westinghouse, on the New York, New Haven and Hartford Railway, operating as multiple units, hauling a freight train

PART II.

THE world's pioneer tube railway was the City and South London, and it paved the way for the amazingly efficient system that is to-day one of the most striking features of London. The original method of working was the two-wire system of distribution at 500 volts. The conductor rail was laid on glass insulators and all the permanent way was of light construction.

The first electric locos for this line were built in 1889 by Messrs. Mather & Platt. Carried on four wheels and weighing 10 tons 7 cwt., their maximum speed was 26 m.p.h. A motor drove each axle, and together they were capable of producing 100 h.p., the armature being mounted directly upon the axle, thus dispensing with intermediate gearing. It is interesting to note that loco No. 10, which hauled the Royal train on the occasion of the opening of the line, was named "*Princess of Wales.*" All the locos were reconstructed in 1905-6 and did good work until the line was rebuilt on the tube principle quite recently. Loco No. 1, which is to be kept at the South Kensington Museum as a relic, was at Darlington for the Railway Centenary last July.

Electric Locos capable of 65 m.p.h.

The latest electric locos of the Metropolitan Railway have been rebuilt from earlier machines. They are 39½ ft. in length, with a total wheel base of 29½ ft. Four series-wound traction motors give a total of 1,400 h.p.

The Company's standard brake-tripping apparatus is fitted with an improved electric interlocking arrangement, making it impossible for the motorman to set the loco in motion without first having his brake apparatus ready for immediate use. The rate of acceleration of these locos is such that within 25 seconds from a dead stop they can attain a speed of 25 m.p.h. Their maximum speed is 65 m.p.h. and tractive effort 22,000 lbs.

A Notable Advance

The largest British electric loco is a 4–6–4 main line loco, designed by Sir Vincent Raven for experimental work on the old North Eastern Railway. So far, this fine loco has had practically no chance to show its capabilities owing to the absence of a suitable length of electric track. At the Railway Centenary celebrations it took part in the Procession but was ignominiously hauled along by a triumphant little shunting engine.

There are three pairs of motors giving a total of 1,800 h.p., their arrangement allowing of a wide range of speed by grouping the six motors (a) all in series, (b) three in series, two in parallel or (c) two in series, three in parallel. Twelve different speeds are available.

Each motor pair is mounted in the framework immediately above the corresponding driving axle. Concentric with this axle is a hollow shaft, or quill, carrying at each end a "spider," which is similar to a wheel without a rim. The arms of the "spider" mesh with the spokes of the driving wheels, being connected to them by a clever arrangement of springs. The quill carries a gear-wheel, which engages with the two motor pinions.

The loco is designed for D.C. at 1,500-volts, has an over-all length of 53 ft. 6 in. and weighs 102 tons. It is equipped with a small electric boiler for supplying steam for heating the train, and in every way is a notable advance on previous practice.

An American Monster

The world's largest and most powerful electric loco commenced work in May of the present year on the Virginian Railroad, U.S.A. It is 152 ft. in length, and consists virtually of three vehicles. Rated at 7.125 h.p., each unit has the 2–8–2 or Mikado wheel arrangement. The total weight of this giant is 637 tons. Power is transmitted to the 5 ft. driving wheels by means of side-rods working from special gear shafts.

It is estimated that this mammoth can deal with a freight train up to two miles in length, and its working is said to be very successful.

The "Dead Man's Handle"

Most electric locos are fitted with air compressors for operating the brakes, and compressed air is also often used for working the whistle or horn, which is an essential part of a locomotive's equipment.

The driver or motorman controls the power through the medium of what is called the "Dead Man's Handle." This is the master controller, and to keep the power on, the driver must grip it with sufficient force to keep a spring in tension.

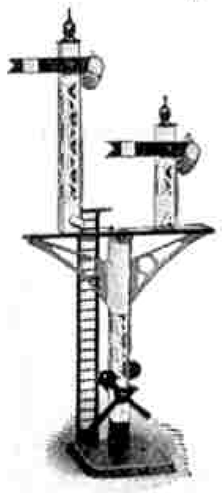
(*Continued on page* 647)

ROLLING STOCK AND ACCESSORIES

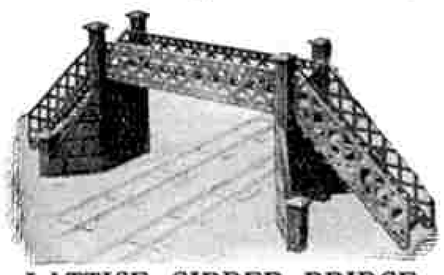
(HORNBY SERIES)

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. Ask him for a complete illustrated price list of Hornby Accessories, or write for one to Meccano Ltd.

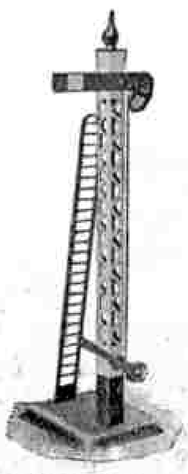
HORNBY No. 1 TANK LOCO
Gauge 0, in colours to represent L.M.S. or L.N.E.R. Companies' Locos. Fitted with brake, reversing gear, and governor. Price **12/6**



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

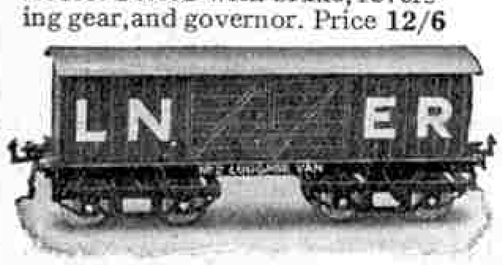


LATTICE GIRDER BRIDGE
Constructional type. Strong and well proportioned. Price **10/6**

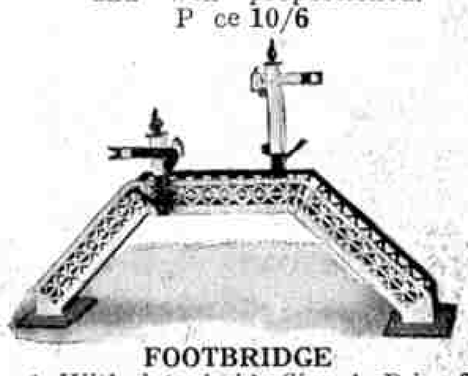


SIGNAL
Price **2/6**
All Hornby Signals are fitted with imitation lamps, ladders, etc., and are beautifully coloured.

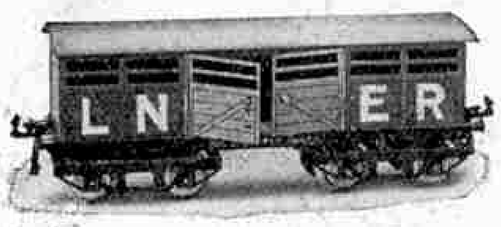
HORNBY No. 2 TANK LOCO
Beautifully finished in colours to represent L.M.S. or L.N.E.R. Companies' locos. Fitted with reversing gear, brake and governor ... ... Price **30/–**



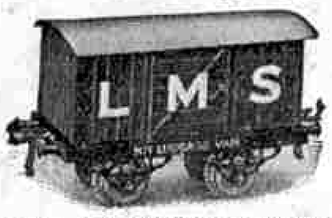
***No. 2 LUGGAGE VAN**
Finished in blue and green. Fitted with double doors. Suitable for 2-ft. radius rails only ... Price **6/6**



FOOTBRIDGE
No. 1. With detachable Signals Price **6/–**
No 2. Without Signals ... ,, **3/6**
Signals only ... per pair **2/9**

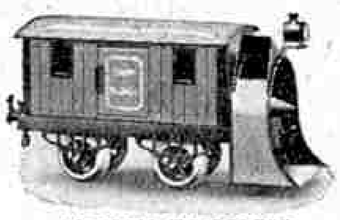


***No. 2 CATTLE TRUCK**
Splendid model fitted with double doors. Suitable for 2-ft. radius rails only ... ... Price **6/6**



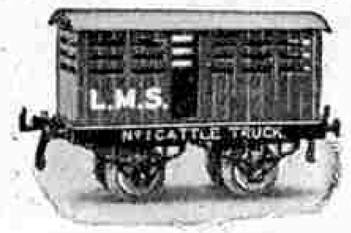
***No. 1 LUGGAGE VAN**
With opening doors. Price **4/–**

BRAKE VAN
Finished in grey, with opening doors. Price **4/-**

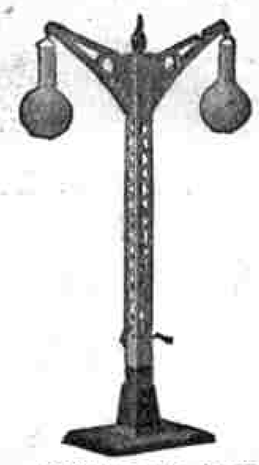


***SNOW PLOUGH**
With revolving plough driven from front axle. Price **5/6**

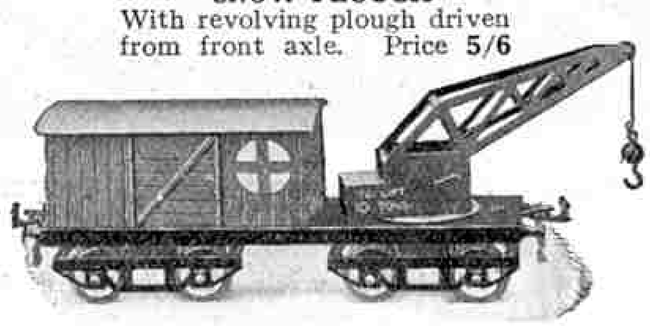
SIDE TIPPING WAGON
Excellent design and finish. Price **3/6**



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

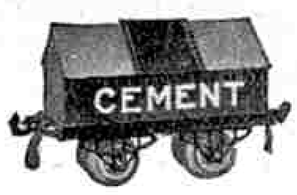


DOUBLE LAMP STANDARD
Four-volt bulbs may be fitted into the globes. Price **4/**

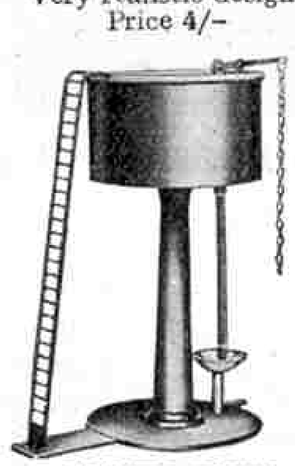


***BREAKDOWN VAN AND CRANE**
Beautifully coloured in grey and black, with opening doors. Suitable for 2-ft. radius rails only ... ... Price **7/–**

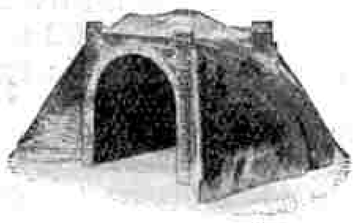
PETROL TANK WAGONS
'Shell,' "National Benzole" or "Pratts")
Price **3/-**



***CEMENT WAGON**
Finished in grey and black Price **4/–**

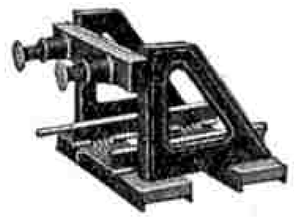


WATER TANK
Brightly coloured in red, yellow and black, 8½ in. in height, with flexible tube and pump lever. Price **6/6**



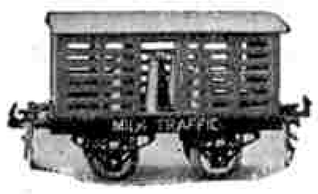
TUNNEL
Realistic and finished in colours ... Price **7/6**

***TROLLEY WAGON**
Finished in grey and red. Suitable for 2-ft. radius rails only ... Price **6/–**



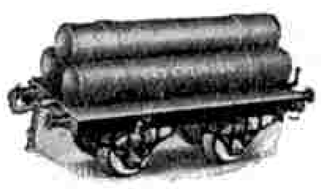
SPRING BUFFER STOP
Price **1/6**
HYDRAULIC BUFFER STOP
Price **5/–**

BISCUIT VANS
(Crawford's, Carr's, or Jacob's)
Finished in red, with opening doors ... Price **4/–**



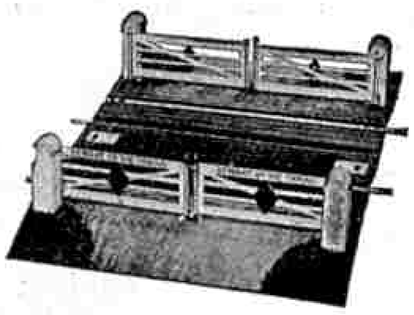
***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans. Price **4/6**

PLATFORM ACCESSORIES
No. 3. Platform Machines, etc.
Price per set **2/–**

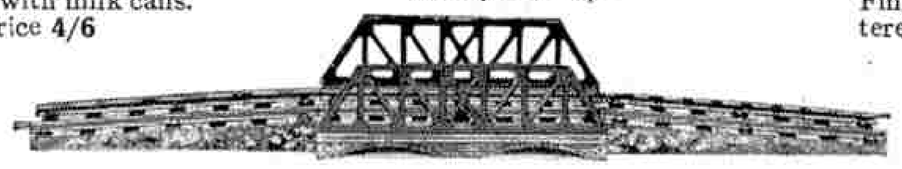


***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price **3/–**

***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **3/6**



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



VIADUCT. Price **7/6.** Centre section only. Price **4/6**
ELECTRICAL VIADUCT. Price **8/–.** Centre Section only. Price **5/–**

RAILWAY STATION. Excellent model, beautifully designed and finished. Dimensions Length 2-ft. 9-in., breadth 6-in., height 7-in. Price **12/6**
** Lettered L.M.S. or L.N.E.R.*

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**

Electric Trains and Their Story—

(*Continued from page* 645)

Should his grip become released owing to sudden illness or any other cause, the spring operates a switch that turns off the current and applies the air brakes.

The interior of an electric loco almost resembles a museum of delicate scientific instruments in glass show-cases, and there are elaborate safety arrangements for operation in case of fire, short circuit, etc.

Classification of Electric Locos

The general method of wheel classification is at present similar to the system adopted for steam locos, although in America an elaborate and somewhat cumbersome scheme has been devised to denote full particulars of the type and power classification of the loco.

Multiple Unit Trains

A great advantage of electric locos is that for working a heavy train more than one loco may be used in a train and all worked under the control of a single driver.

The use of the multiple unit system is much more universal than that of single electric locomotives. The train, made up of a convenient number of motor and trailer cars, may be driven from either end, an economical possibility that makes it particularly convenient for working into terminal stations.

The system was first seriously developed by Frank Sprague, a Chicago engineer, some thirty years ago. In its earliest form each motor car had a cylindrical controller placed under the floor, the cylinder being revolved by means of a pilot motor controlled by a small commutator on the driver's platform. As trains got heavier and more powerful motors had to be fitted, it was found that this type of controller was inadequate, and a group system of switches was devised by means of which the motors were started and regulated.

A multiple cable with suitable plug connections is run from end to end of the train to various master controllers, any one of which may be used to work the train. The contactors belonging to similar circuits operate in unison. As the master controller handle is turned, instead of a number of heavy switches being moved by hand, they are operated by means of electrical relays. Although at first sight the diagram of switches for a multiple-unit train seems to resemble an elaborate Chinese puzzle, it is, in reality, quite simple.

The Last Word in Electric Railways

The most up-to-date and efficient all-electric services of to-day are probably those in the London area, and the latest of these is the recently electrified suburban system of the Southern Railway. The change-over from steam began on the former London and South Western line in 1915, when the "Riverside Electric" ran as far as Shepperton, Claygate, and the Kingston "Roundabout" stations. This section has now been extended to Guildford and Dorking North, and there is now a 20-minutes' service from Waterloo.

The suburban lines of the old South Eastern and Chatham Railway will be entirely electrified by the end of 1926, and at the present time there is a 20-minutes' service from Holborn Viaduct and/or St. Pauls' to Crystal Palace and

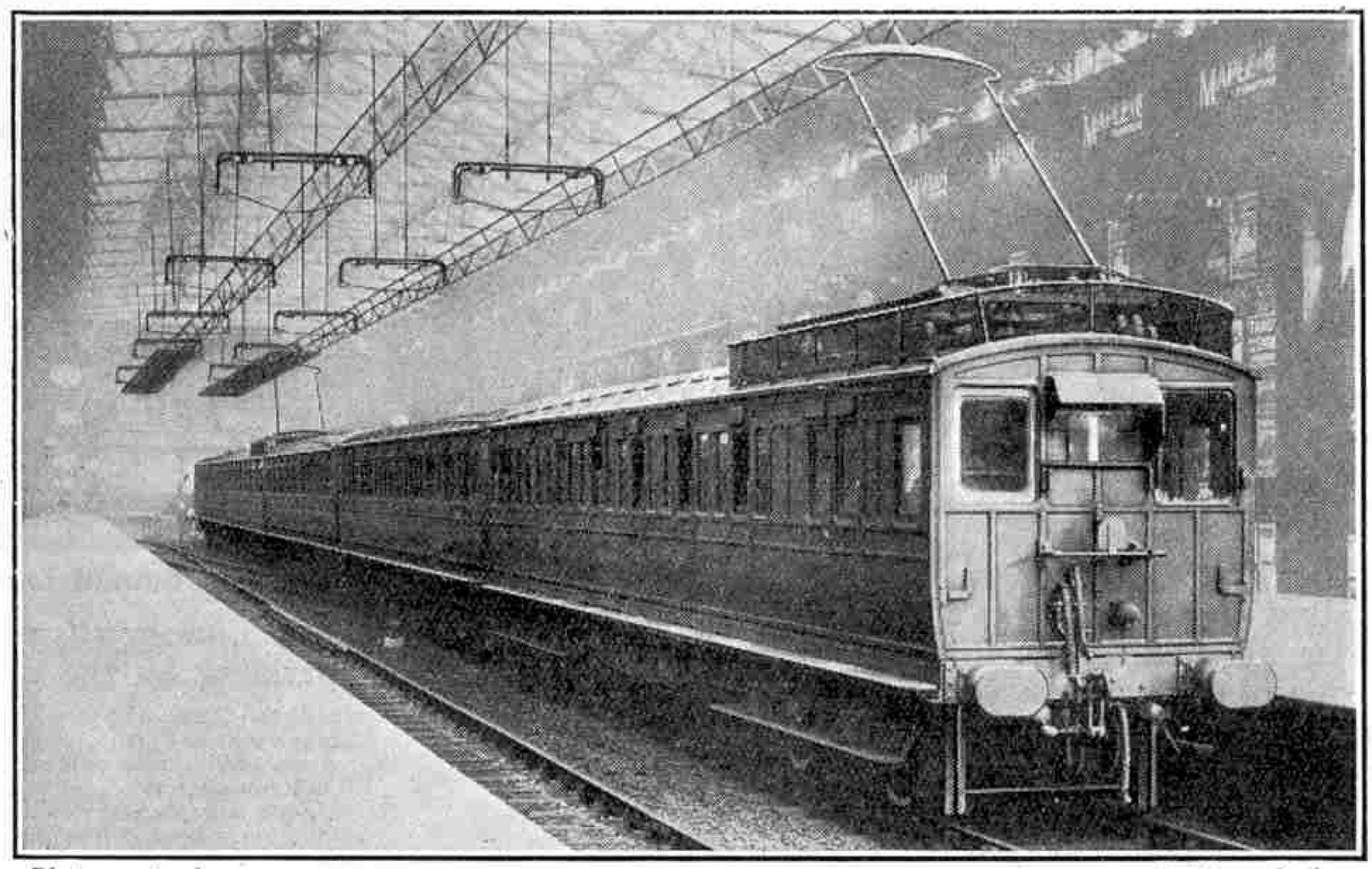


Photo courtesy [*Southern Railway*

Electric Train on Central Section of the Southern Railway, where the Overhead Wire System is used

via the Catford loop to Orpington, also by combined sections from Holborn Viaduct and Victoria to Herne Hill. On this section the trains at present consist of four-coach units, singly or in pairs, but as time goes on additional train-sets will be available.

The electric system in use on both sections of the Southern (apart from the older high-tension overhead trains of the Brighton line) is that of a third rail supply and running-rail return. At some points of the South Eastern section it has been necessary to add a fourth rail to amplify the capacity of the running rails for the return current where distances from the sub-station are considerable. There is, however, no contact between the passing train and this fourth rail. Current for the South Western electric lines is generated at Durnsford Road Power Station, Wimbledon, while that for the newer section is purchased from the London Electric Supply Corporation.

The new electric rolling stock is of remarkably handsome appearance, and the upholstery and general furnishings of the passenger compartments will compare with any rolling stock on a British railway. The motor ends of the South Eastern trains are rounded to a less extent than the earlier "Riverside Electric" vehicles, but in general there is a close resemblance. A number of the trailer coaches have been reconstructed from the bodies of two six-wheeled carriages placed on a new 62-ft. frame but the motor coaches are entirely new.

Eliminating Danger

Much has been done to eliminate the danger of live rails and overhead wires, and although "familiarity breeds contempt," especially in the railway men employed on electric sections, there are surprisingly few casualties. In the past, the straying of animals on to electrified track has been a difficulty but live conductor rails are carefully protected with wooden shields and in some instances current is collected from the almost inaccessible underside. This latter system is also an advantage in severe climates where a film of ice or snow prevents smooth collection of current from the top surface of the rail.

The fitting of collector shoes at more than one point on the loco or train has removed the difficulty of stopping on a dead section where there are level crossings or points. In the case of overhead equipment the difficulty is overcome by means of multiple "pantographs" or bows, as the collecting gear is termed. On the high-tension overhead section of the old Brighton line there are "dead" sections in the vicinity of bridges and stations.

Electric Railways in Europe

On the Continent, electricity is used widely for tunnel and suburban railways, and in recent years very severe tests to determine the relative economy and power of the system as against steam have been carried out in Germany, Italy, and Switzerland.

Holland has a notable high-speed passenger line radiating from Rotterdam. This line was one of the earliest successful examples of electric traction in Europe.

Trial between Electric and Steam Locos

The United States possesses every type of electric railroad, and reference is made elsewhere to the splendid long-distance expresses operated over the mountain ranges. A remarkable freight line is the Norfolk and Western Railroad, which deals with 35,000 tons of coal a day from the 86 collieries in the rich Pocahontas coalfield. Some special locos of the Baldwin-Westinghouse type weighing 270 tons are kept employed in propelling coal trains over the heavy grades. Two of these monsters—one pulling and one pushing—move a train of 3,250 tons over the Elkhorn Gradient of 1 in 50 at a speed of 14 m.p.h.

Some months ago, interesting tests were carried out between a new electric loco and one of the colossal Mallet steam "pushers." Although the steamer belched forth great clouds of smoke and steam in exerting itself to push against the electric, finally it had to give way. Afterwards the Mallet was pitted against the other to try to propel it faster when the regenerative brakes were applied at a speed of 25 m.p.h. and once again it had to acknowledge defeat. And the source of this vast power was a slender and harmless-looking wire!

Speeds of 70 miles are regularly attained in hauling heavy expresses on the trans-

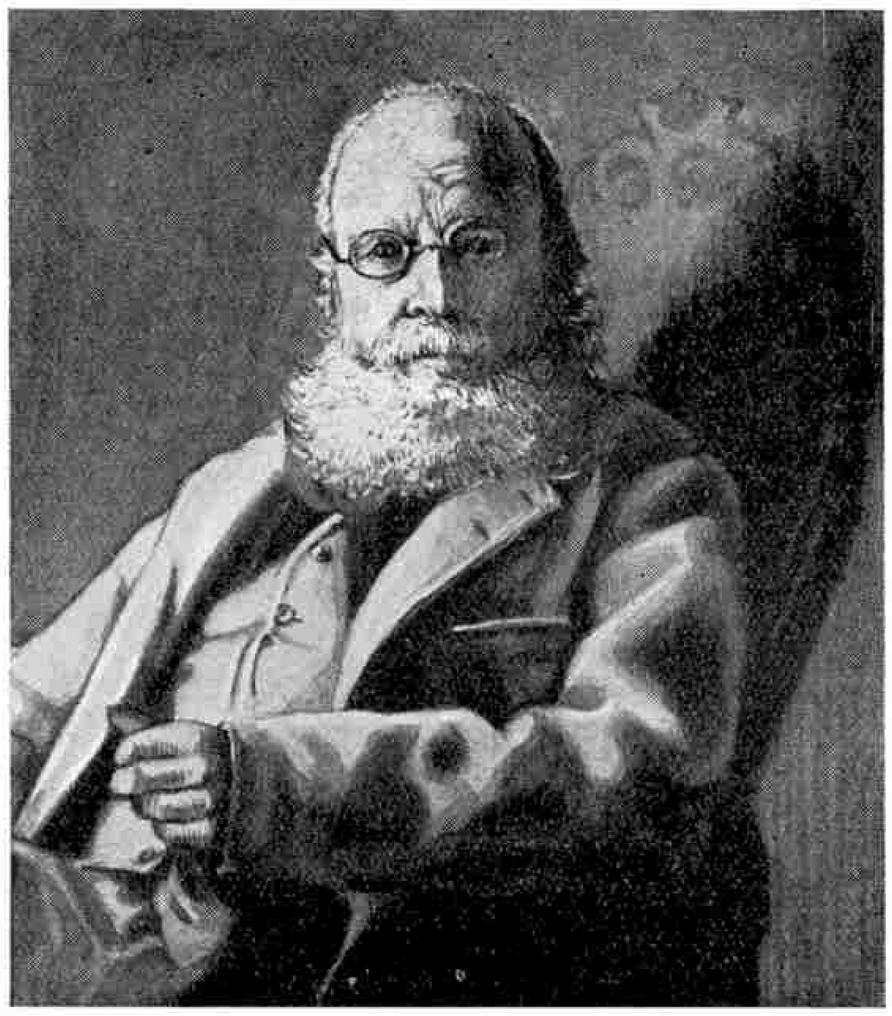
(*Continued on page* 693)

Edward Lear:

Maker of

Merry Verses

There was an Old Derry down Derry, who loved to see little folks merry;
So he made them a Book, and with laughter they shook
At the fun of that Derry down Derry.



Edward Lear

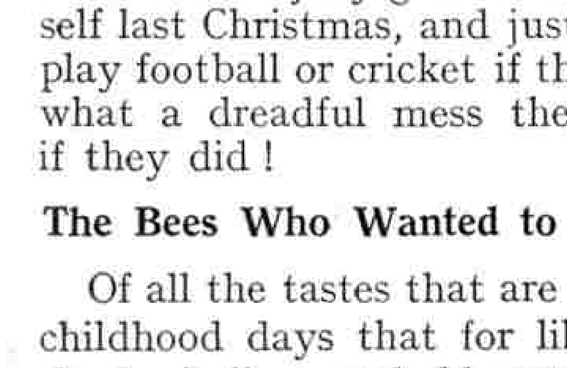
MAN is after all only a boy grown up, and although as we grow older we shed certain of our boyish tastes there is much even of our extreme youth that we retain throughout our lives. I remember seeing a Meccano advertisement some years ago that read "You buy it for your boy and you play with it yourself."

I know no end of men who regularly play with Meccano and toy railway trains and enjoy doing so; who go to pantomimes; and who decorate the house with streamers at Christmas. They all say they do it to entertain the children, but I know better! They do it because they like doing it, just as they like playing blind-man's-buff and musical chairs and all the other jolly games that I played myself last Christmas, and just as they would play football or cricket if they didn't know what a dreadful mess they would make if they did!

The Bees Who Wanted to Swarm

Of all the tastes that are acquired in our childhood days that for lilting verse and rhythmic lines probably retains its longest and strongest hold upon us. We commence with the nursery rhymes taught us by our mothers and nurses, and we progress through Lewis Carroll to Sir W. S. Gilbert, who—as we all know—wrote the words of all the famous Gilbert and Sullivan operas.

Gilbert's jingling and tuneful lines are read by children from ten to seventy years of age, who chuckle over them and take a delight in reading them over and over again. His verses bubble with wit and humour, and although they contain much shrewd wisdom, they are really nursery rhymes grown up a little.



"I will sit on this stile and continue to smile"

Take, for instance, his way of dealing with the trouble that occurred in the hive when the bees themselves wanted to suggest a day when they might swarm—a decision generally supposed to be left to the Queen Bee.

". . a regular brute of a bee"

Surely this is only a nursery rhyme's bigger brother, made lilting and sparkling by the genius of a Gilbert.

Outspake the Queen and thus spake she
This is a matter that rests with me.
Who dares opinion thus to form?
I'll tell you when it's time to swarm.
Her majesty wore an angry frown,
In fact, her majesty's foot was down.
Her majesty sulked, declined to sup,
In short her majesty's back was up—
Her foot was down and her back was up.

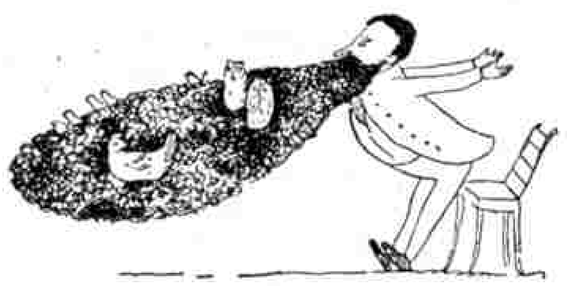
The First Nonsense Writer

A rhymester who came before Gilbert's time and who exercised a much greater influence on children's verse was Edward Lear, who was both an artist and an author.

Lear was born in Holloway, London, on 12th May 1812 and was of Danish descent. He was the youngest of 21 brothers and sisters and at the early age of 15 was obliged to earn his own living. Being very fond of drawing and painting he conceived the idea of making tinted drawings of birds, which he sold to shops and to some doctors who were interested in him.

One day while sketching at the Zoo an event happened that was to have a great influence in his life. A gentleman noticed the lad and got into conversation with him. The stranger turned out to be the Earl of Derby who, in 1832, invited Lear to his residence Knowsley Hall, near Liverpool. Here Lear soon became a great favourite with the Earl's grandchildren, for whom he wrote his famous "*Book of Nonsense.*"

Lear's rhymes, which were always illustrated by his own quaint drawings, achieved an extraordinary popularity, for such clever verses had never been published before. Even the statesmen and the great ones of the land read them with eagerness. The famous Ruskin—surely the most solemn of our writer geniuses—said of Lear's book, "The most beneficient and innocent of all books yet produced is the "*Book of Nonsense,*" inimitable and refreshing and perfect in rhythm. I really don't know an author to whom I am half so



There was an old man with a beard

grateful for my idle self as Edward Lear. I shall put him first of my hundred authors." Tennyson also wrote a famous lyric in praise of Lear.

Original Limericks

I am not sure whether or not Edward Lear was the originator of the well-known type of verse called the limerick, but I am quite sure that it was he who was responsible for its great popularity. Here are one or two well-known examples of his efforts in this direction.

There was an old man in a tree
  Who was horribly bored by a bee.
When they asked "does it buzz?
  He replied, "yes it does—
It's a regular brute of a bee!"

* * *

There was an old man who said: "How
  Shall I flee from this horrible cow?
I will sit on this stile and continue to smile,
  Which may soften the heart of that cow!

* * *

There was an old man with a beard,
  Who said "It is just as I feared.
Two owls and a hen, four larks and a wren
  Have all built their nests in my beard!

Lear wrote hundreds of such limericks, all of them ingenious and amusing. Without doubt his verses were the parents of the many clever limericks we hear to-day.

The "Pobble who Had no Toes"

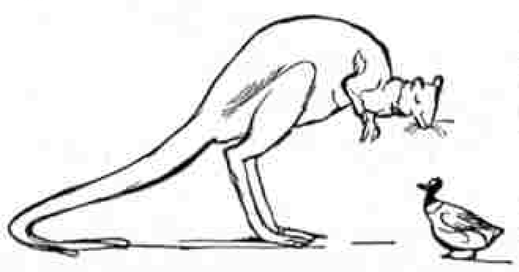
Although his limericks were good, Lear will doubtless be remembered as long as the English language lasts for his nonsense rhymes. There is something captivating in their quaint imagery and in their perfect rhythm. Children read them with delight and even their parents find keen pleasure in them. We know that the "Pobble who has no Toes," the Jumblies, the Attery Squash, the Bisky Bat, and the Dong with the Luminous Nose are absurdly impossible creatures, but we feel sure that we should immediately recognise them if ever we were to visit the Torrible Zone or the Hills of the Chankly Bore where they live.

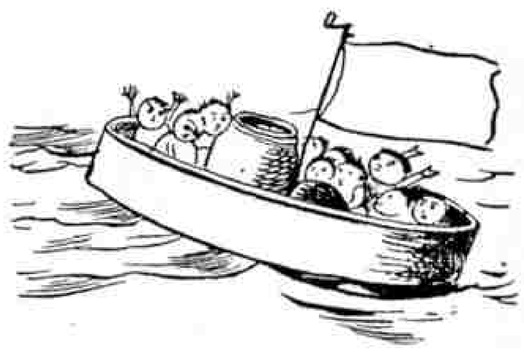
The owl and the pussy cat

Of the famous Pobble, Lear wrote:—

"The Pobble who has no toes
  Had once as many as we;
When they said, "Some day you may lose them all;"
  He replied, "Fishiddle de-dee,"
And his Aunt Jobiska made him drink
  Lavender water tinged with pink;
For she said, "the World in general knows
  There's nothing so good for a Pobble's toes!"

The Pobble's adventures began when he set out to swim the Bristol Channel. Before he started his wonderful Aunt wrapped his nose in a piece of scarlet flannel, saying that no harm could come to his toes if his nose were warm, it being "perfectly known that a Pobbles toes are safe provided he minds his nose." But as he approached the opposite shore a sea-green porpoise carried away his wrapper of scarlet flannel, when he immediately perceived that all his toes were gone! At the end of it all, he was rowed back to his Aunt Jobiska and after a feast of eggs and buttercups fried with fish, they both came to the conclusion that a Pobble is really happier without his toes!


"My life is a bore in this nasty pond"


They went to sea in a sieve

The Jumblies Go to Sea

The adventures of the Jumblies are no less exciting. Of these daring explorers, Lear says:—

They went to sea in a sieve, they did;
  In a sieve they went to sea:
In spite of all their friends could say,
  On a winter's morn, on a stormy day,
In a sieve they went to sea.
  And when the sieve turned round and round,
And every one cried "You'll all be drowned,"
  They called aloud, "Our sieve ain't big;
But we don't care a button, we don't care a fig:
  In a sieve we'll go to sea!"

So away they sailed to the land where Jumblies live, with only a beautiful pea-green veil tied with a ribbon by way of a sail to a small tobacco-pipe mast. And they whistled and warbled a mooney song to the echoing sound of a coppery gong, and they bought an owl and a useful cart, and a pound of rice and a cranberry tart and a hive of silvery bees. After sailing for twenty years they all came back, and every one said "How tall they're grown, for they've been to the Lakes and the Torrible Zone, and the Hills of the Chankley Bore!" The wonderful adventure of these desperadoes makes very entertaining reading.

The Quangle Wangle's Beaver Hat

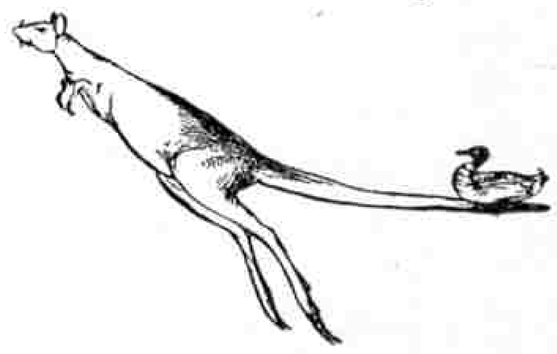
Another quaint creature who originated in Lear's fertile brain was the Quangle Wangle. We have never been able to imagine just what the Quangle Wangle was like, because all we can see of him is his hat. Here is the first verse, which gives the key to his troubles.

His face you could not see

On the top of the Crumpetty Tree
  The Quangle Wangle sat,
But his face you could not see,
  On account of his Beaver Hat.
For his hat was a hundred and two feet wide,
  With ribbons and bibbons on every side,
And bells, and buttons, and loops, and lace,
  So that nobody ever could see the face
Of the Quangle Wangle Quee.

Life on the whole was far from gay, but soon Mr. and Mrs. Canary came along and were charmed with the Quangle Wangle's hat and asked his permission to build on it a nest of whatever material suited him best. Then came the Stork, the Duck, and the Owl; the Snail and the Bumble Bee; the Frog and the Fimble Fowl (The Fimble Fowl with a Corkscrew leg). All of them said: "We humbly beg we may build our homes on your lovely Hat—Mr. Quangle Wangle grant us that!" After that came the Golden Grouse and the Pobble who has no toes, and the small Olympian Bear, and the Dong with the luminous nose; and the Blue Baboon who played the flute, and the Orient Calf from the land of Tute, and the Attery Squash and the Bisky Bat—all came and built on the lovely Hat of the Quangle Wangle Quee.

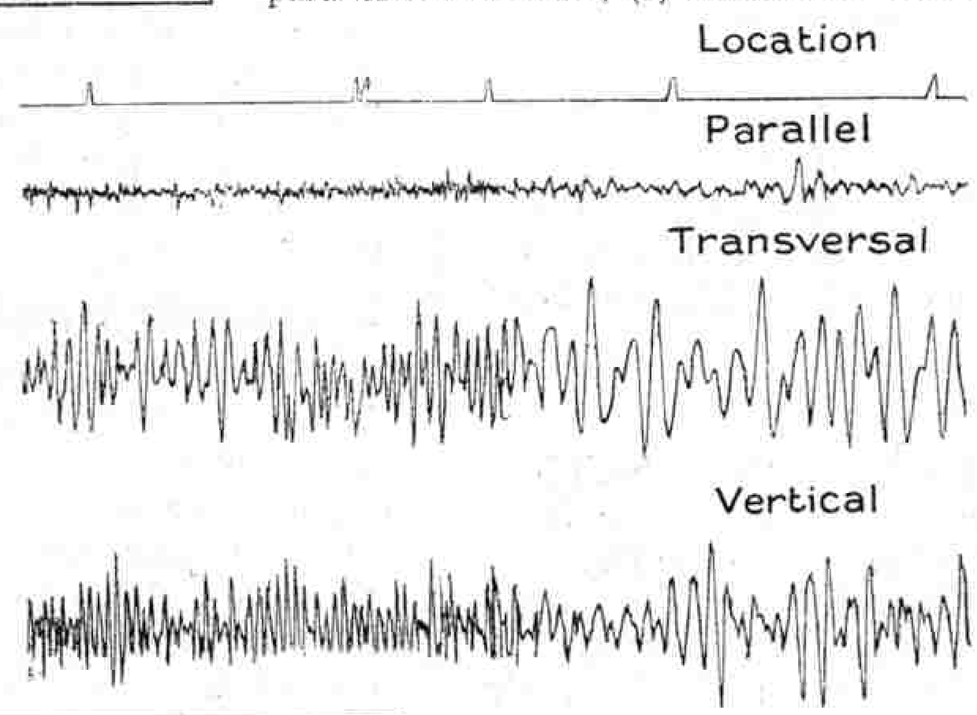
I hope I have told you enough of the amazing happenings on the Quangle Wangle's hat to make you wish to know more about the wonderfully-named creatures who come into this laughable lyric.


Hopped the whole world three times round

(*Continued on page* 650)

Machine as Railway Inspector

The Hallade Track Register



(Above) The Hallade Track Register in action, and (right) fac-simile record showing movements recorded by the machine

AN ingenious instrument, invented by a French railway engineer, has been introduced into England by the London and North Eastern Railway Company to act as an inspector of the permanent way.

The Track Register, placed on the floor of a railway carriage—generally one immediately above the wheels—faithfully records the jolts and jars that occur at high speeds. These oscillations are recorded in three directions (1) movements parallel to the track, (2) transverse movements and (3) vertical movements. A record is also made of the quarter mile posts and the stations passed, which record is controlled by an operator who presses a pneumatic bulb when one or the other is sighted, and thus the irregularities of the track are quickly located.

The movements are recorded by three needles, working through sheets of carbon, which mark a thin strip of paper mounted on a drum rotated by geared clock-work mechanism. The result is a chart something similar to that of a barometer record composed of lines of varying amplitude. Each portion of the record can be interpreted at a glance by the engineers, and any portion of the track requiring attention is easily picked out at the end of the journey. It is interesting to know that the instrument often reveals defects that are not visible to the eye.

It is important to note that the Hallade track register does not replace the daily inspection of the track by permanent way inspectors. It supplements their work and the considerable distance over which it may be travelled in a day enables a great deal of time to be saved with it, for instance, it is possible to "examine" the whole of the track between say, Leeds and London, both on the up and down lines in the course of a day.

In the accompanying illustration the instrument is shown in position on the floor of a carriage and one of the operators is standing at the door holding the pneumatic bulb in his hand. He is about to give the signal that the train is leaving King's Cross. Pressure on the bulb causes one of the needles to make a notch in what would otherwise be a straight line. These notches are seen in the top line of the accompanying diagram and indicate the "location" of the train. In the diagram the next three lines show the record made by the three needles—parallel, across, and vertical to the track.

Edward Lear—(*continued from previous page* 649)

Lear has also given us an interesting conversation between the Duck and the Kangaroo, the former being very anxious that the latter should take him for a ride on his back; for, said she:—

"My life is a bore in this nasty pond;
And I long to go out in the world beyond."

The kangaroo had his doubts about the matter though and said,

"This requires some little reflection.
Perhaps, on the whole, it might bring me luck:
And there seems but one objection;
Which is, if you'll let me speak so bold,
Your feet are unpleasantly wet and cold."

The duck, however, had already considered that matter and he explains his views in the following verse:—

Said the Duck, "As I sate on the rocks,
I have thought over that completely;
And I've bought four pairs of worsted socks,
Which fit my web-feet neatly;
And, to keep out the cold, I've bought a cloak;
And every day a cigar I'll smoke.

That settled the matter, of course, so away they went with a hop and a bound, and they hopped the whole world three times round!

The Owl and the Pussy Cat

One of Lear's best known rhymes is perhaps that concerning the Owl and the Pussy Cat, who went to sea in a beautiful pea-green boat, and sailed away for a year and a day to the land where the bong-tree grows. After being married by the Turkey who lives on the hill

"They dined on mince and slices of quince,
Which they ate with a runcible spoon;
And hand in hand, on the edge of the sand,
They danced by the light of the moon."

I could tell you a good deal more about Edward Lear's wonderful characters—about the Dong with the luminous nose, the Yongby-Bongy Bo, the Pelican Chorus, and Mr. and Mrs. Discobbolos—but I will leave you to find out all about these interesting people yourselves.

I am glad to pay tribute to Edward Lear in these pages and I am sure you will enjoy reading his amusing verses. In later life Lear had to leave England, for reasons of health. For many years he lived in Rome and then wandered, with his beloved sketch book, through southern Europe and Palestine. His "*Book of Nonsense*" was first published in 1846, since which date it has continued in circulation, its popularity having called for a large number of editions to which has since been added his "More Nonsense." This gifted man died at San Remo in Italy, on 29th January 1888, but his works will live for ever.

NOTE:—*The illustrations are reproduced in miniature from "The Book of Nonsense" and "Nonsense Songs and Stories" by permission of the Copyright holders, Messrs. Frederick Warne & Co. Ltd.*—EDITOR.

OUR BUSY INVENTORS

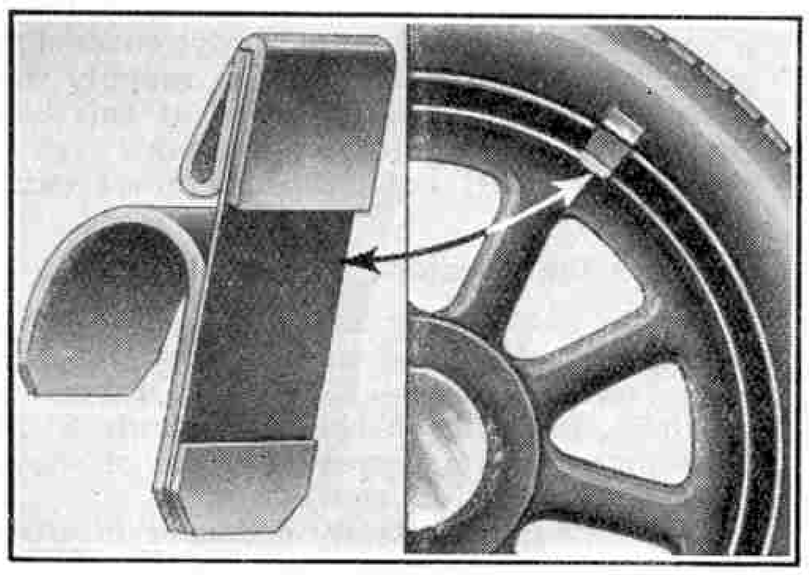
RECENT INTERESTING PATENTS

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.

Puncture Alarm for Motor Cars

In order to prevent a motorist running for any distance with a flat tyre or with his tyres too soft, a device has recently been produced which automatically gives the alarm should the pressure in the tube be reduced by ten pounds or more.

The device is fitted between the tyre and the wheel rim and, as soon as the tyre softens, gives an alarm twice with every revolution of the wheel. It can be mounted on either side of the rim and its warning, it is claimed, can be distinctly heard even above the noise of surrounding traffic.

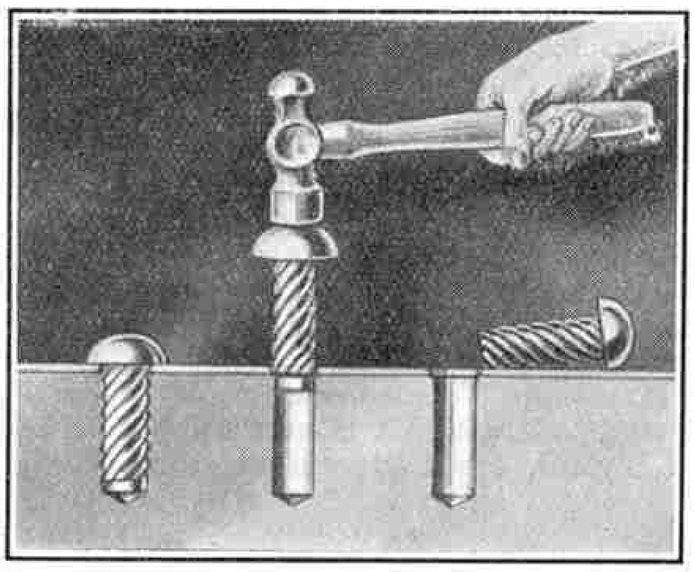


Economising Tooth-Paste

A useful tip for dealing with troublesome tooth paste tubes which decline to roll up neatly and at the same time force the contents to the top, is to use a tin opener—of the type provided for sardine tins—as a roller. Insert the bottom of the tube into the slots of the tin opener and twist in the usual way. This has the effect of rolling the tube and preventing waste.

Screw that can be Hammered into Metal

Here is a new form of screw, one that can be driven into metal with a hammer, as if it were a nail. A hole is bored in the metal in the first place, but no tapping is needed, for the screw twists round as it is driven home and cuts threads in the metal. This form of screw should be useful for permanent work as it is almost impossible to remove it when once in position.



A Hygienic Cup

For years past the use of public drinking fountains has been avoided by the vast majority of thinking people, solely on account of the risk of contagious disease to which they would expose themselves in using the cups usually provided. A recent invention designed to eliminate that danger and consisting of individual paper drinking cups has been placed on the market.

These cups, sealed by a strip of metal and with a double thickness at the edge to prevent cutting the lips, are stored in a sanitary cabinet which may be placed near to the fountain. A turn of a crank inserted in the side of the cabinet shapes the cups, which are designed to eliminate the use of glue and the necessity of touching the cups with human hands before they reach the drinker.

Each container is cone-shaped and at the turn of the handle on the cabinet is cut from a roll of sterile paper long enough to make 1,000 cups. It is delivered to the user through a slot at the front of the box. The cabinet may be used as a vending machine by fitting a coin-receiving mechanism to it, to release the crank. Even hot drinks may be held in the strong, clean paper without danger of leaking. The rim of the cone is kept open, making the cup easy to fill and drink from, and its shape fits the hand.

A New Use for Sand Blast

Sand blasting, an effective method of cleansing the exterior of buildings from soot and dirt, is now being brought into use for interior work. With apparatus consisting of an ordinary air compressor and blast equipment, five men recently removed the varnish from nearly 18,000 sq. ft. of oak in two weeks and the cleansing was so thorough that the natural colour and texture of the timber was revealed. Previously eight men had worked for a week at the same work, using only scrapers, sandpaper and varnish removers, and cleaning only two sides of the ceiling beams in that time. It would seem that sand blast cleaning for large interiors has come to stay.

One-Hand Wrench

A new type of wrench, which should prove very useful to anyone working in a position where it is necessary to hold on with one hand, has recently been produced.

The wrench consists of a ring which slips over the nut, or whatever has to be gripped, pressure on the nut being applied by a cam which closes the ring. The tool can easily be used with one hand and will fit any size of nut up to its capacity. At the same time the harder the pressure required to turn the nut, the harder does the tool grip.

An Automatic Gas Ring

Amazing ingenuity is displayed by the modern home appliance inventor in designing apparatus to overcome absent-mindedness. The latest idea in this connection is intended to counteract the annoying habit of some people in placing the kettle or saucepan upon the gas ring and forgetting to light up!

The new gas ring automatically lights and extinguishes itself when the cooking utensil is placed upon or removed from the stove. This is accomplished by means of a small pilot flame, somewhat similar to that in use in a gas-lit railway carriage roof light, and consuming approximately one pennyworth of gas per week.

The weight of the kettle or pan automatically opens the gas cock and, similarly, the removal of the pan releases a spring which immediately adjusts the cock to its normal closed position.

The Growth of the American Patent Office

Recently there have been issued some very interesting statistics which serve to illustrate very forcibly the growth of the American Patent Office. Ninety years ago the work of registering applications for, and the hundred and one formalities incidental to the issue of patents from this office required the attention of only one clerk. In the meantime the department has grown to such an enormous extent that the staff now numbers 1,250!

During the past 13 years as many patents were issued as were allowed during the first 57 years of the department's existence, and in 1924 every State in the union and more than 60 other countries were represented among the masses of successful applicants. An average of 80,000 applications for patents is received yearly, and the American Government has issued about one-third of the 4,800,000 patents recorded for the whole world. A collection of 150,000 models is in the possession of the bureau, although since 1880 they have not been required as part of an application except in unusual cases where mere pen work is not sufficient. Two fires, one in 1836 and the other in 1877, destroyed great numbers of the earlier models gathered in the bureau. The activity of modern genius resulted in loading the office with a waiting list of over 75,000 applications for patents, but, by adding to the clerical force, this volume has been reduced to 52,000 handled at the rate of 2,000 a month.

WONDERS OF *the* SNOW FLAKE

by

W. Coles Finch

AMONG the many things associated with Christmas—turkey, mince-pies, holly and mistletoe—perhaps the one that does most to help us to enjoy a "real old fashioned Christmas" is the snow. Apart from the fact that nearly all pictures of Father Christmas show him in the snow, and that on most of our Christmas cards we find scenes depicting snow, the idea seems to be well-established that a Christmas is not really enjoyable in the good old way unless the ground is white, and sledging and skating are the order of the day.

Snow Not Always Welcome

It is to be feared that although snow delights most, if not all, readers of the "*M.M.*" it adds to the difficulties and hardships of the poor and is a source of considerable inconvenience to some people. Farmers, for instance, and those who live in lonely places find it very difficult to maintain communication with the outer world after a heavy fall of snow, whilst often a snowstorm causes great havoc among the sheep and lambs. Then again, snow sometimes means that certain classes of work have to cease entirely, and as a result, men are thrown out of employment with consequent hardship and distress.

Apart from these considerations, snow is very wonderful and has formed a theme for many poets, its beauty having been recognised from very early times. In the Bible we read of Job asking, "Hast thou entered into the treasures of the snow or hast thou seen the treasures of the hail."

Where Snow is Never Seen

It is marvellous to think how the appearance of the country-side is completely and quickly changed by a fall of snow. In an hour or two, unsightly mud flats, dirty roads and sombre-looking trees are silently transformed into veritable scenes from fairyland. On a frosty night, when the moon is shining, a landscape covered with a sparkling mantle of snow, is a sight never to be forgotten.

I am afraid we never quite regard it as a privilege that we are able to see snow and to enjoy the sport it makes possible. We should remember that there must be many readers of the "*M.M.*" who have never yet seen snow, for there are over two-thirds of the earth's surface on which it never falls For instance, snow has never yet been seen at Buenos Ayres (Lat. 30° 36′) and south of Lat. 33° it never remains on the ground long enough for sledging or snow fights!

The lowest latitude in the northern hemisphere at which snow has been seen (except as mentioned later) is Canton in China (Lat. 23°,) while in the southern hemisphere it has been known to fall at Sydney, Australia (Lat. 34°).

Within the tropics, near the Equator, the snow line is at a height of about 18,000 ft. above sea-level, but in the Alps the line is found at a height of from 7,500 to 9,000 ft. The snow line is the limit of perpetual snow, or the line above which mountains are always covered with snow. At the equator this is roughly about three miles above sea-level and at this height the snow may evaporate or the sun's rays may melt some of it, but the snow never entirely disappears.

Snow on the Equator!

We do not usually associate snow with the tropics but there are snow-covered mountains almost on the equator—Kilimanjaro, for instance, in Africa, 19,400 ft. in height and only 3° from the equator, has a perpetual crown of snow, in spite of the tropical sun.

The snow-line gradually decreases in altitude as we travel towards the poles, until in the chilly Polar regions it is at sea-level, where we find perpetual snow and ice. Here the snowfields are of enormous area and hundreds of feet in depth.

In this country the freezing point in summer is a mile-and-a-half from the ground but in winter, of course, the line is lower. Although Ben Nevis, our highest mountain, is below the line of perpetual snow, snow is to be found there in sheltered hollows all the year round.

How Snow is Formed

Snow is formed from the invisible water vapour that ascends from both sea and land into the atmosphere, where it floats as tiny globules of moisture, which measure, on an average, one three-thousandth of an inch in diameter. In certain circumstances—as, for instance, when the vapour enters a region that is of a different temperature—this moisture condenses and becomes visible as clouds. If the temperature of the atmosphere in which the clouds float becomes lowered from any cause, or should the clouds ascend to a higher altitude where the temperature is lower, the water vapour freezes and forms innumerable clear and transparent crystals. The name "crystal" is derived from the Greek word "Krystallos," meaning "ice" or "frozen water," although it is now applied to any form of crystal, apart altogether from the fact that

there may be no water in it. Snow differs from hail, which may be described more accurately, perhaps, as frozen rain-drops, whereas snow is frozen water vapour.

Although the minute particles of ice into which the water vapour is transformed are so small as to be almost invisible, they serve as a nucleus of the snow crystal. This nucleus, a mere dot of ice, descends, but is caught up again and again by rising currents of air and buffeted about among the clouds, perhaps for many days. It meets with ever-changing currents of air, electricity, and moisture and slowly develops its six-sided prism-like rays. Moving about in this manner, and being buffeted by the wind and by air currents, causes these ice crystals to cling together in families of perhaps a hundred or more and so a snow-flake is formed.

An Amazing Variety of Designs

Snow-flakes vary in size from those no larger than the head of a pin to large flakes a quarter of an inch in diameter. The size depends chiefly on the atmospheric conditions under which they were formed, the smaller ones being formed at a very low temperature, and the larger ones at a temperature of nearly 32°F.

Snow crystals are seen to exhibit the most beautiful forms, a few of which are illustrated around the previous page. The minute crystals are always arranged at an angle of 60° or 120° about a centre, and they are always either six-pointed stars or extremely thin plates of hexagonal shape.

The infinite variety of unique patterns given to us by the snow-flakes is greatly appreciated by artists, for no human being could imagine one quarter of the beautiful forms they exhibit. Snow flake patterns are often used as a basis for designs by decorators, jewellers, and other craftsmen.

If we wish to see these beautiful stellar shapes at their best, we must go out of doors on a calm day and collect a few flakes as they fall, on the coat-sleeve or on some soft black cloth upon which they will alight without injury. The smaller flakes are better than the larger flakes, which do not so clearly reveal the beautiful designs, because the delicate outlines have been blurred by the mass formation. The perfect star-like forms are clearly visible to the naked eye, but a hand magnifying glass will at once reveal a great deal more of their beauty. When viewed under a microscope of moderate power the individual crystals resemble tiny sparkling jewels, and we cannot but agree that they are among the most beautiful examples of nature's art.

After the Snow Storm

Nature's Secret Design

As already mentioned it will be found that each crystal has six rays, arranged geometrically about a centre. Incidentally it may be mentioned that the hexagonal form seems to be very popular in nature, for we find it in the petals of flowers, in the cells of the wasp, the honeycomb of the bee, and in many other forms. Why this should be we do not know, but it can scarcely be a coincidence that of all the polygons inscribed in a circle, the hexagonal is the only form in which the sides are equal to the radius of the circle, thus enabling the maximum space to be obtained with the minimum of matter. Those who study Geometry may be interested further to investigate the subject.

The infinite variety in the form and design of snow crystals is well illustrated by the fact that one student, Mr. W. A. Bentley (who kindly supplied the illustrations of crystals used in these pages) has devoted over 20 years to a study of snow crystals and has come to be known as "the snow-flake man." He has photographed over 2,000 perfect forms, and has never yet discovered two crystals exactly alike!

In this connection it is interesting to note that there is a strong similarity in the form of the crystals associated with different falls of snow. Professor Tyndall explains this mystery by the analogy of a magnet. "Every magnet possesses two poles," he tells us, "and if iron filings be scattered over a magnet, each particle becomes also endowed with two poles. Suppose such particles devoid of weight and floating in our atmosphere . . . the repellent poles will retreat from each other, while the attractive poles will approach, and finally lock themselves together. Supposing the particles, instead of a single pair, possess several pairs of poles arranged at definite points over their surfaces and you can then picture them building themselves together to form masses of definite shape and structure in obedience to their mutual attractions and repulsions. Imagine the molecules of water in calm cold air to be gifted with poles of this description, which compel the particles to lay themselves together in a definite order, and you have before your mind's eye the unseen architecture which finally produces the visible and beautiful crystals of snow."

To a certain extent this explanation helps us to understand the formation of snow crystals, but it is well to remember that the forces concerned with the birth of an apparently simple snow-flake cannot really be understood even by our cleverest scientists. They know what happens, but why it happens they cannot definitely tell, and we have to accept the mystery of crystallisation as we do the mystery of the origin of life, electricity, gravitation, and many other things.

Although "as white as snow" is a common expression snow is really colourless, its apparent whiteness being produced by the reflection and refraction of light from the minute surfaces of the crystals. I expect that most of my readers will be surprised to hear that there is such a thing as red snow. It is very rare certainly, but has been seen in this country more than once. An experience I had with it is perhaps worth relating.

On 24th April 1908 snowballing was in full swing and some mischievous boy, with a well-planted shot, hit me full in the face with a real beauty! Of course, I knew I couldn't catch him, so I didn't try! As I was wiping my face with my handkerchief I suddenly noticed that the interior of the snowball was tinged pale pink. At first I thought the boy who threw it must have cut a finger, or that the red colour might be a stain from his glove. I was about to dismiss the apparently trifling matter when I remembered reading of an experience of Darwin in his passage (in March 1835) of the Cordilleras, when he noticed that the snow crushed by the footsteps of his mules was stained pale red. I quickly gathered up some of the clean snow, compressed it into a snowball, broke the ball and found the centre had assumed an even more vivid pink colour, which showed me that the snow was the same kind as that which Darwin had noticed.

The phenomenon of Red Snow, scientifically known as *Protococcus nivalis*, owes its colour to the presence of a minute plant. This plant, one of the simplest forms of vegetable life, consists of groups of microscopical spheres, contained in colourless cases and measuring less than one thousandth part of an inch in diameter. These tiny spheres are not unlike red-currants—and are so prolific that they have been known to redden an Arctic or Alpine landscape in a night.

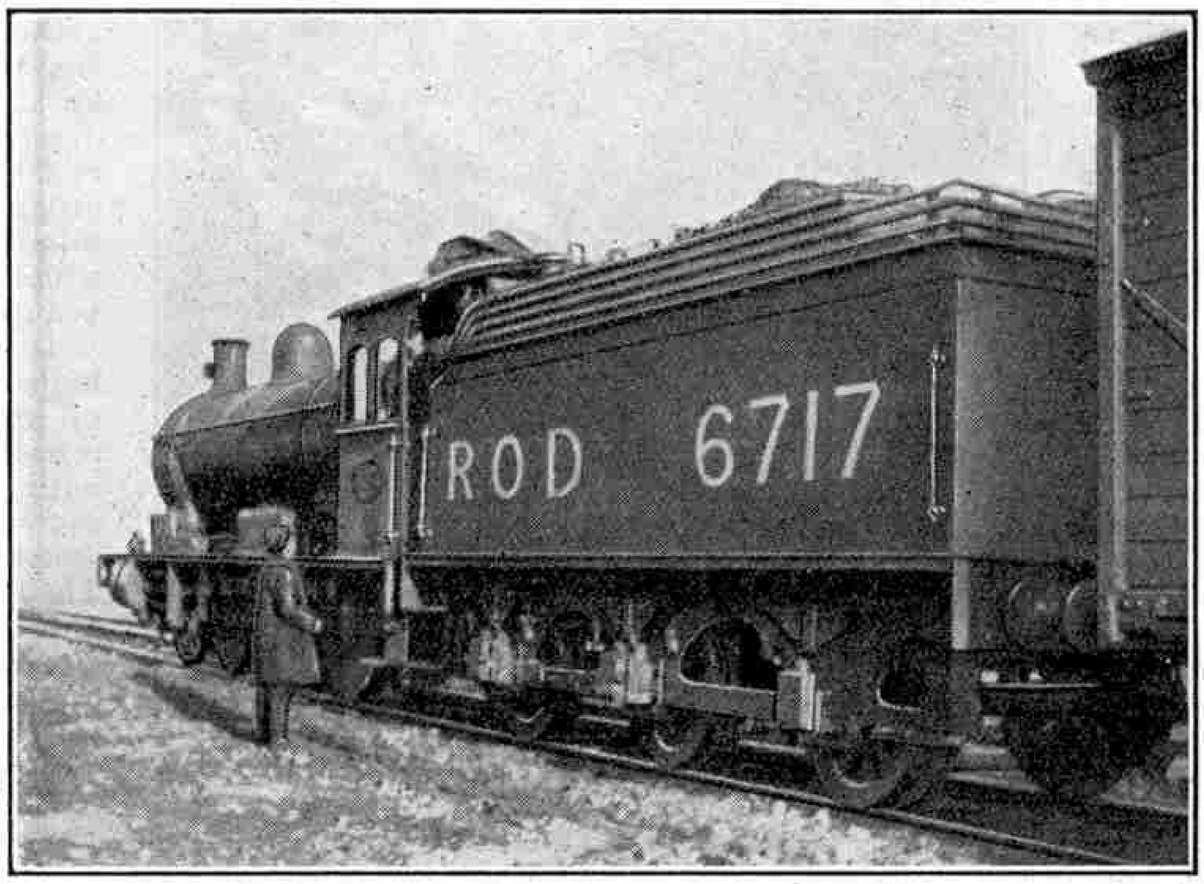
Snow is nature's winter mantle for the earth and no imagination can conceive of a more wonderful garment.

Veterans of the War

Some Interesting Particulars of British Locos Overseas

THE Railway Centenary celebrations served at any rate to turn our thoughts to the immense part the locomotive has played in the world's development. In this connection the service of our "iron steeds" in the Great War should not be forgotten.

Behind the Western front was to be seen a remarkable army of British, Belgian, French, American, Dutch and even Australian locos. They were all painted a sombre black, with "R.O.D." (Railway Operating Division) in huge white letters on the tender or tank sides. A treasured snapshot taken by the writer shows a leave-train being shunted by an American 2–6–2 tank loco with the official symbols elaborated into "Roll on Demobilisation!"



A N.E. Rly. Loco (0-8-0) at Cambrai, 1918

Handling Strange Locos

The first locos to cross from England were eight 0–6–0 tankers from the South Eastern and Chatham Railway, and these were used for shunting at Boulogne. In 1916 a batch of 70 six and eight-coupled goods locos were sent by the L. & N.W.R., and these were followed by some of the numerous Government-built 2–8–0 Great Central type engines that did most of the hauling of troop trains.

Other British railways sent goods locos of some kind and there were no complaints as to lack of variety! Indeed, the variety of types was an actual source of trouble, and for an ex-driver of, say, the Great Western Railway to be out on a dark night (no lights allowed) to take over an American freight loco on an unknown section of French line was no uncommon experience. Fortunately, speeds were very low and only experts were employed.

The Dutch locos were very powerful 4–6–4 passenger tanks built by a British firm but never delivered to Holland. They were used for specials and hospital trains, while one worked Sir Douglas Haig's Headquarters' train towards the latter part of the war. These locos were kept beautifully polished and wore a special green livery. After the Armistice they were taken over by the Nord Railway.

Special Devices Fitted

Some powerful 2–8–0 locos built in Scotland for the New South Wales Government were commandeered. They had exceptionally small coupled wheels and were not popular with the drivers. The Baldwin and Canadian classes were tremendously heavy and very powerful, and they had very fine large cabs, which, in bad weather, made them much sought after by the drivers.

The French and Belgians seemed to have searched through their railway scrap-heaps and museums for all the oldest souvenirs of locos they could find. When pressed into war service, however, these veterans did their bit, though they made alarming noises and earned a series of good-natured nicknames!

Many of the locos had special fittings for their war-work. Some, for instance, had pipes that discharged the exhaust from the cylinders on to the track behind the tender. In such cases it was no joke to ride in the first trucks of the train, and gas masks seemed to be necessary! Even that was better, however, than making it possible for an enemy balloon to spot the steam from the funnel and telegraph the glad news to the gunners!

Special filters and hose pipes were also fitted to enable rain water—of which there was plenty—to be collected from great shell craters in the forward areas.

Hauling Heavy Trains in War Time

Considering all things, casualties were very few, but some English engines had a gruelling time. Of the 70 old Midland goods 0–6–0's with outside cranks, one was captured in 1917 when the Germans made a "push" at Cambrai. She was standing without steam and when last seen was under a very heavy barrage. When the Armistice arrived, great was the amazement of our troops to find the old loco doing hard work for the Germans! It would be interesting to know if she came back to "Blighty."

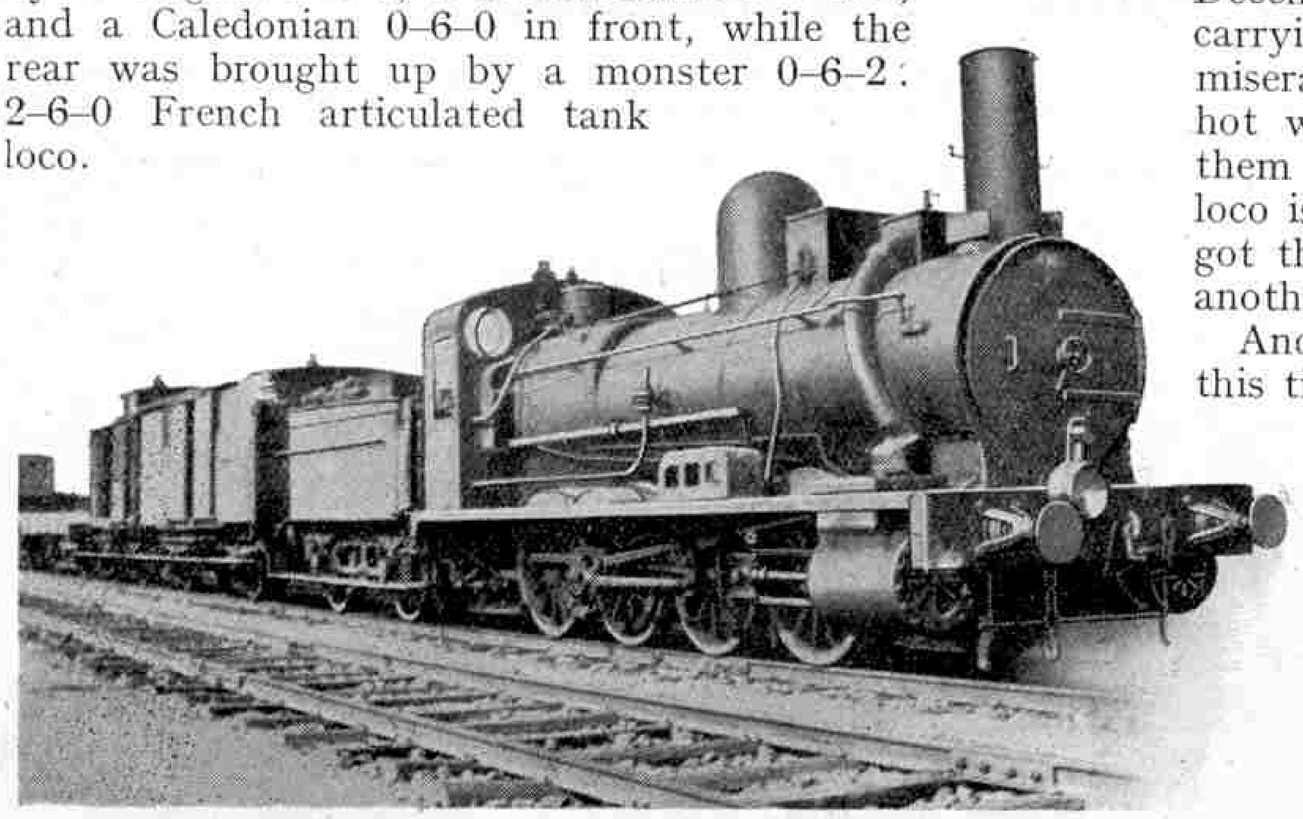
A Great Western 2–6–0 of the mixed-traffic class—of which 11 were in France with 61 of that company's 0–6–0's—was caught in a barrage when hauling a coal train near Ypres, and she was decidedly battle-scarred when she came back for repairs.

Number of British Locomotives on War Service

(WESTERN FRONT ONLY)

War Office Type	(2–8–0)	...	520
,, ,,	(0–6–0T)	...	10
Midland Rly.	(0–6–0)	...	77
L. & N.W. Rly.	,,	...	70
G.W.R.	(2–6–0)	...	11
,,	(0–6–0)	...	61
G.E.R.	,,	...	43
L. & Y.R.	,,	...	32
G.N.R.	,,	...	26
N.B.R.	,,	...	25
Caledonian	,,	...	25
G.C.R.	,,	...	17
N.E.R.	(0–8–0)	...	50
L. & N.W.R.	,,	...	26
G.C.R.	,,	...	15
S.E. & C.R.	(0–6–0T)	...	8
L.B. & S.C.R.	(0–6–2T)	...	10

Firebox troubles were the chief difficulty, for the fuel was of poor quality and sometimes a loco was under steam for many days on end. Heavy trains were handled, and on some occasions trains had three locos at the head and two behind. One day a French Infantry brigade was being propelled in a huge train by a Belgian 0–6–0, a North Eastern 0–8–0, and a Caledonian 0–6–0 in front, while the rear was brought up by a monster 0–6–2 : 2–6–0 French articulated tank loco.



An old 0–8–0 Goods Loco (Nord) doing her bit during the war. Note the outside eccentrics

Return of the Veterans

In 1919 most of the British locos came back. Those on the N.B.R. received names to commemorate their service abroad, and visitors to Scotland may still see "Ole Bill," "Ypres," "Byng," etc.

Most of the American types were absorbed into the depleted French stocks, as they were built to the Continental loading-gauge. The Government 2–8–0's, as is well known, were sold to various British companies, though a lot went to Rumania.

The French gauge is about 3/16 in. wider than the British gauge, so that no difficulty was found in running on the Continent.

British Locos still Overseas

British locos were employed also in other theatres of war, and it is possible that even at the present time certain British locos continue to work in out-of-the-way spots of the world whither they went "On Active Service." For example, ex-Great Western locos are still at work in Serbia and many old South Westerns in Palestine and the East.

Many British soldiers who found war-time railway experiences of great interest were surprised to find 4–6–0 express locos of the Highland Railway "Castle" type working fast trains on the Etat Railway, France. On proceeding to the Italian Front they came across old Midland 0–6–0's working troop trains in that country. Both these classes, however, were British locos sent abroad prior to the War.

Humour of Military Railways

In addition to the standard gauge locos working in France and Belgium, there were many different types built for the light railways, the commonest gauge for which was 1 ft. 11½ in. Particularly in and behind the Ypres Sector these small and easily-laid lines were everywhere in use.

Many of the locos were of the totally-enclosed tram type, but a large number of little 4–6–0 Tanks were built by John Fowler & Co. Ltd. (Leeds) and the Baldwin Works (U.S.A.) Internal combustion locos were employed in great numbers, but they are scarcely within the scope of the present article.

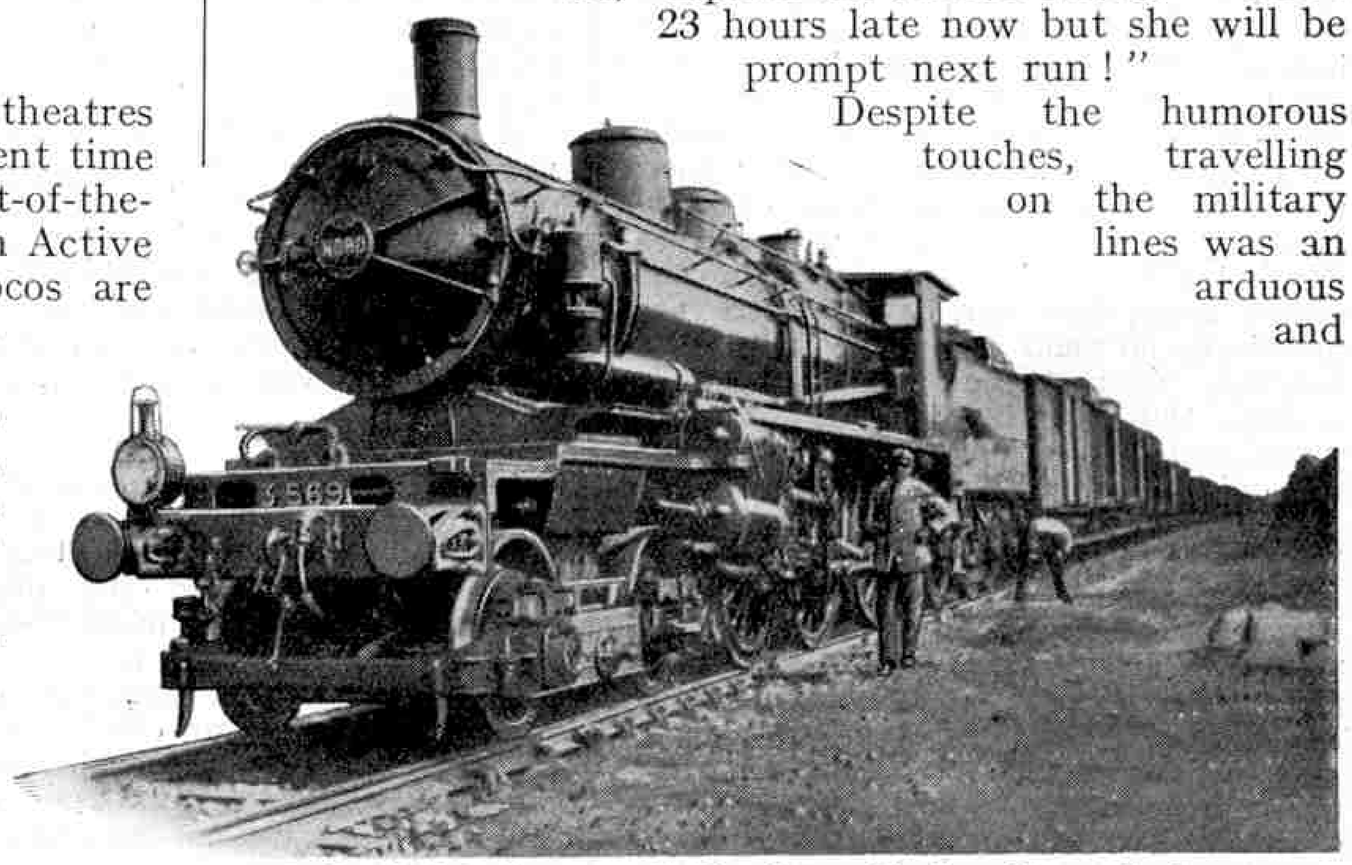
Railway travelling in the War zone was full of adventure and many humorous episodes took place. One cold December day, for instance, a light railway train was carrying a squad of sappers who were wet through and miserable. At a halt they raided the little loco for hot water to make a beverage commonly known to them as "tea." The boiler capacity of a narrow gauge loco is strictly limited, however, and although the men got their "tea" the train had to await the arrival of another loco in order to complete the journey!

Another memory also concerns "tea" and an engine—this time a French one. The 40 occupants of a jolting covered goods wagon decided to pool their tea, sugar and condensed milk rations. These were forthwith put into a "dixie" or large boiling pot, and one of the soldiers took advantage of a halt to trot along to the loco for boiling water. Now French locos invariably carry their sand-boxes in the form of a second dome (this being to keep the sand dry) and the "Tommy" was not quite used to the Continental design. He saw a pipe leading apparently into the boiler through the steam dome and promptly put the dixie under its end. The French driver did not encourage the view that his loco was a tea-kettle, so to emphasise the point he juggled with a handle and—but we cannot describe the warm welcome awaiting the "tea" orderly when he returned with the dixie half full of sand!

The "Prompt" Leave Train

Then there was the celebrated Leave Train that was supposed to start for Boulogne from a forward area every 24 hours at midnight. On every journey something delayed the train. One night the loco backed on at 11 p.m. An officer sarcastically enquired whether it was proposed to start the train an hour early? "No sir," replied the station N.C.O. "She's 23 hours late now but she will be prompt next run!"

Despite the humorous touches, travelling on the military lines was an arduous and comfortless experience, particularly during the winter. The rolling-stock was often in bad order, and slow-moving troop trains would stop for interminable periods during the night, to start off without warning with a jerk that wakened all sleepers and knocked over



No. 3569, 4–6–0 Compound (Nord) working a Troop Train near Mons, 1918

(Continued on page 665)

The Conquest of the Air

IX. Vickers "Vimy" Ambulance

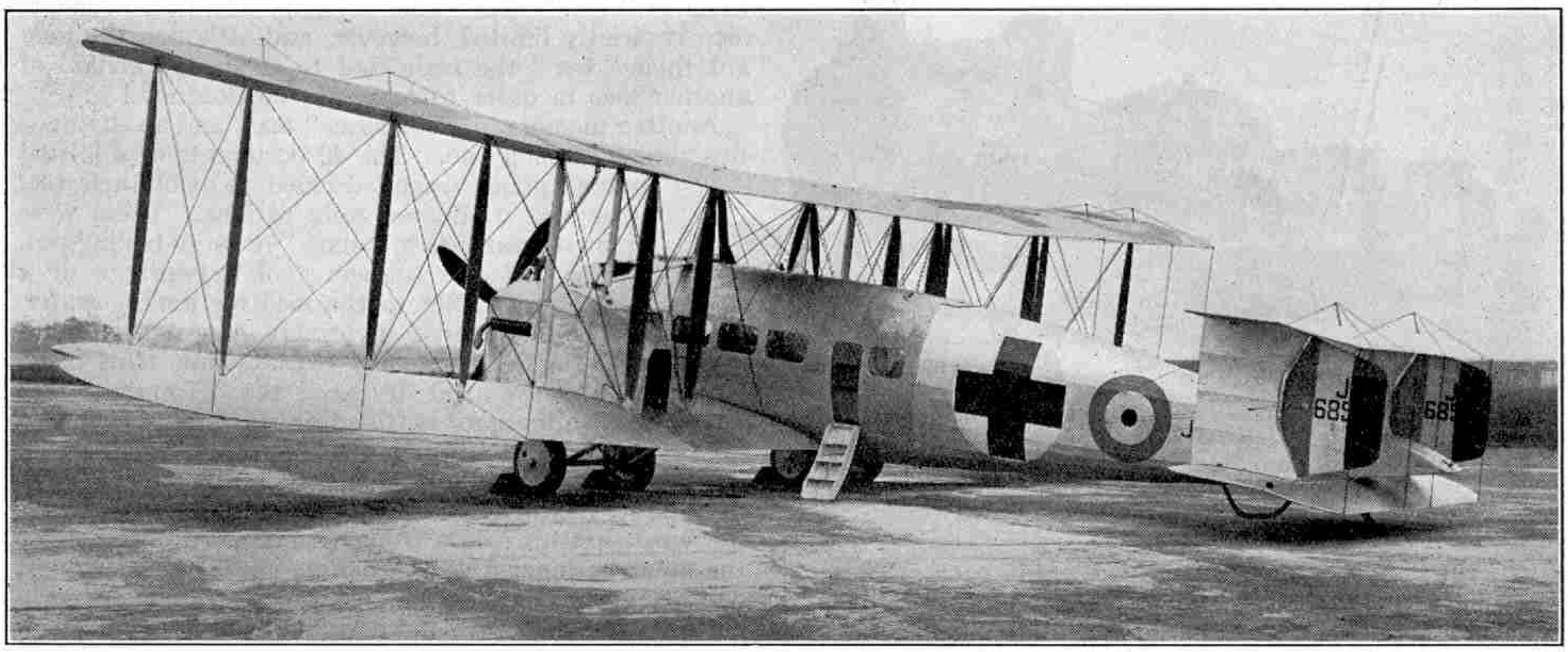


Photo courtesy] [*Vickers Aviation Dept*

The Vickers "Vimy" Ambulance Aeroplane

IN view of the extensive development of aircraft, and their increasing use for almost every conceivable purpose, it was only a question of time before aeroplanes should be used as ambulances. More especially was there need for such transport in campaigns in which operations were conducted at a considerable distance from a hospital base. In France, for instance, the aeroplane ambulance would not have been of such great value as in the case of fighting in Mesopotamia. In France there are comparatively good roads, and fast motor ambulances were able to move the sick and wounded to hospital without loss of time. In the desert areas, however, where there are practically no roads and where the nearest hospital, apart from field-stations, is perhaps 100 miles in the rear, the aeroplane ambulance is of great value for the quick transport of wounded.

Aeroplanes to the Rescue !

The machine illustrated is the Vickers Vimy Ambulance, a number of which were supplied to the Royal Air Force for work in the East. Fitted with 450 h.p. Napier "Lion" engines, these ambulances have accommodation for a crew of two and a doctor, nurse, and four stretcher cases or eight "sitting-up" cases. When not in use for hospital purposes the Vimy may be used for troop-carrying. Similarly, the Vickers Vernon troop carriers may also be used as ambulances when the occasion arises.

In the campaign in Iraq the use of aeroplanes enabled the number of troops to be reduced to a minimum. Aeroplane ambulances were also of great value affording a rapid means of evacuating the sick and wounded.

The first occasion on which aircraft was so employed on a large scale was during April 1923 when there were 200 cases of dysentery in a column of British troops operating in Northern Kurdistan. The troops concerned were on a return march from Rowandurz, and the conditions were such that ordinarily the only available transport was by means of pack animals.

A number of Vickers Vernon aeroplanes were despatched from Baghdad to Kirkuk on the 28th April. The landing place was selected at a point near Serkhuma, the selection of a suitable site being a matter of considerable difficulty, a further handicap being the unusual atmospheric conditions prevailing at the time.

A Disaster Averted

The evacuation was successfully concluded on the 2nd May. During the first two days extremely bad weather was experienced and the pilots were called upon to exercise more than ordinary skill. The conditions were particularly bad for the type of aeroplane used, and it was necessary to climb to at least 5,000 ft. in order to maintain control when crossing the Adghiar Dagh Mountain Range. Here the air currents were so strong that on one occasion an ambulance aeroplane with patients on board was forced down from 3,000 ft. and crashed in inaccessible country. The machine was so skilfully managed by the pilot, however, that none of the sick were injured. Indeed, it is stated that after the aeroplane had come to rest on the ground one of the patients had to be awakened, and told to get out !

The location of the damaged machine was such that it was impossible for other aeroplanes to land in order to pick up the patients. A smaller aeroplane, with a Royal Air Force medical officer on board, was successfully piloted so as to land close to the crashed ambulance, however, and one of the patients who was very dangerously ill was taken on board the second aeroplane. This then flew away, leaving the medical officer with the sick. It is satisfactory to learn, in conclusion of this incident, that the remainder of the patients successfully accomplished the long and difficult journey from the scene of the accident to Koi on donkeys and ponies, with the medical officer in attendance.

On the occasion in question, 198 cases were evacuated to Kirkuk and thence to Baghdad, the entire journey being completed by air in 128 hours 45 minutes actual flying time. The mileage covered amounted to 9,615 miles. All the patients stood the journey well—in fact, the majority seemed to enjoy the experience of being transported by an air-ambulance ! During the following two months over 160 patients were brought in to Baghdad by air-ambulance from outlying stations.

It is interesting to note that the serious cases are generally evacuated in the early morning or late afternoon, in order to lessen the possibility of air sickness, which generally occurs during the hot period of the day when "bumps" in the air are experienced.

Description of the Vickers Vimy

The Vickers Vimy air ambulance is a twin tractor biplane, fitted with two Napier "Lion" low compression engines.

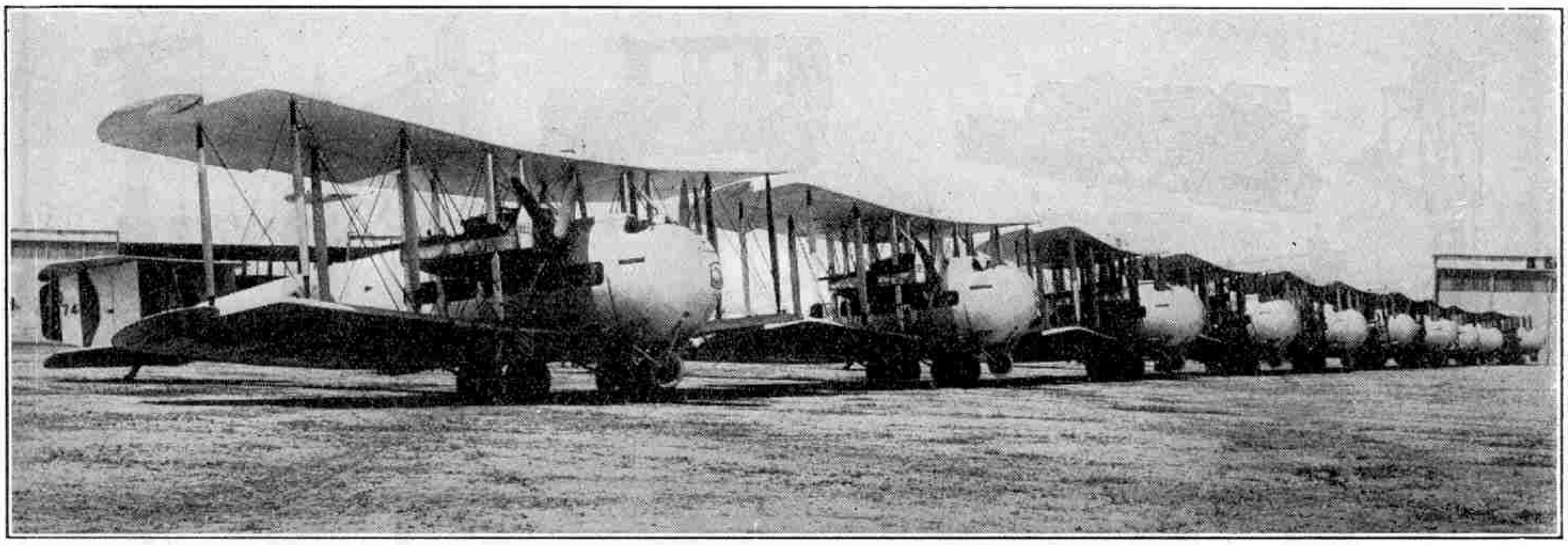


Photo courtesy] [*Vickers Aviation Dept.*

A Squadron of Vickers "Vernon" Troop Carriers and Ambulances in Iraq

It has an open cockpit for the pilot and his assistant, and an enclosed cabin for patients and attendant. It is fitted with a lavatory and water supply, and carries medical stores and wireless equipment.

Its overall length is 43 ft. 8 in., height 15 ft. 3 in., and span 68 ft. The area of the main planes is 1,330 sq. ft. and the loading per horse-power is 13·5 lbs. The total weight of the machine, including instruments and cooling water for the radiators, is 7,860 lbs. Fully laden—including the pilot and assistant, attendant, nine patients, wireless equipment, medical stores, rations, drinking water, 167 gallons of petrol and 14 gallons of oil—its weight is just over 12,000 lbs.

The guaranteed full speed near the ground is 114 miles per hour with a minimum speed of 50 miles per hour. It will climb to 5,000 ft. in 12 minutes and its cruising capacity is 390 miles.

Its construction is very substantial, the spars and ribs being of spruce and 3-ply wood bound with fabric. The interplane struts are of hollow spruce, except in the engine bay, where the struts are of round steel tube, reinforced where necessary with wooden fairings.

The fuselage shell is of laminated sewn spruce and ply wood, made watertight to insure floating in case a forced descent on the sea is necessary. The large windows and doors in the side are designed to prevent the entry of water in the event of this mishap. The after part of the fuselage is of wood and swaged tie rod construction. Throughout the machine, streamline steel tie rods are used in external bracing, and round steel rods in all internal bracing.

The engine mounts are carried on four struts each side, and the chassis is attached below the engine mountings, thus minimising the load in the anti-lift wires. The landing gear is of steel tube and the springing by rubber cord. The engine mounting bearers are of ash with bracing of swage tie rods, and a metal cowl is fitted to the engine.

Petrol feed is by fan-driven centrifugal petrol pump, with regulating valves to maintain a constant flow to the service tank. There is an overflow return to the main tanks and an auxiliary petrol supply by hand-pump is also provided for emergencies.

The machine is controlled by standard side by side dual controls, all flying controls being very light in operation due to the provision of balancing surfaces where necessary.

The instrument board in the pilot's cockpit contains the following equipment:—Air-speed indicator, radiator, thermometers, lateral inclinometer, altimeter, compass, revolution counter and watch. Oil-pressure gauges are also located in view of the pilot.

A weight of 360 lbs. is allowed for internal fittings, which include medical chest, medicine cupboard, 5-gallon tank for drinking water, two stretchers and brackets, nine deck chairs, ice-chest, and two fire extinguishers.

The two pilots are accommodated in the pilot's cockpit in the nose of the aeroplane. They sit side by side, and are provided with full dual control, a wide unimpaired view of the ground being obtained.

Racks for four stretchers are fitted on the side of the cabin opposite to the doors. There is a 9″ clearance space between the ends of the cabin, and the stretchers, and also between the stretchers themselves, the racks being so arranged that there is sufficient lateral floor space to allow of lifting the stretchers on to the racks without tilting them.

A door is provided in the front of the luggage compartment and under the pilot's seat, allowing of the loading and unloading of the stretchers, thereby effecting a direct and straight entrance to the cabin.

A fan with suitable drive is fitted in the front wall of the cabin, driving air through a screen, down which a constant drip of water can be maintained. This fan is capable of operation when the aeroplane is stationary on the ground. The rate of flow of the water is easily regulated from inside the cabin, an even and cool temperature can therefore be maintained in tropical countries.

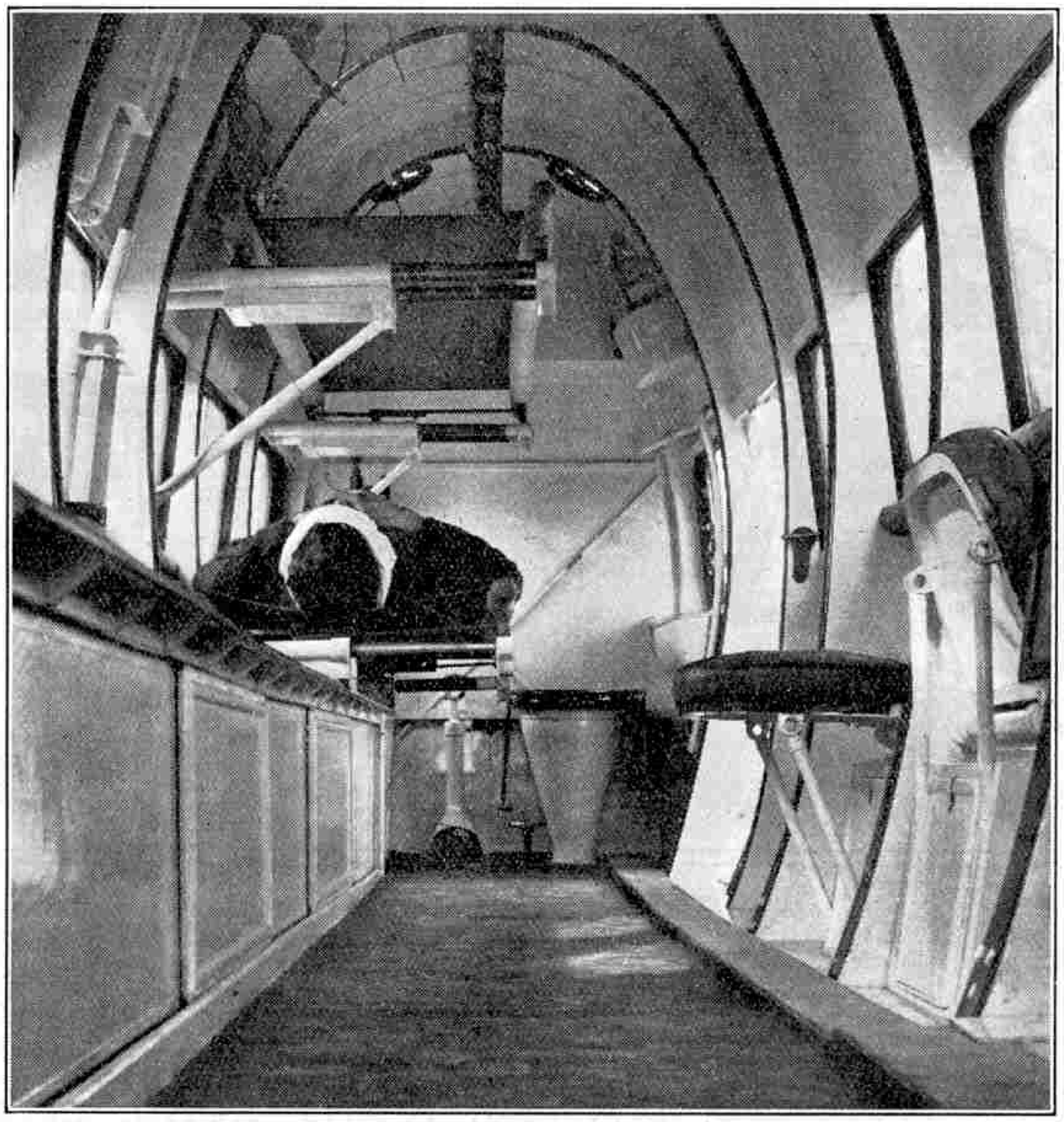
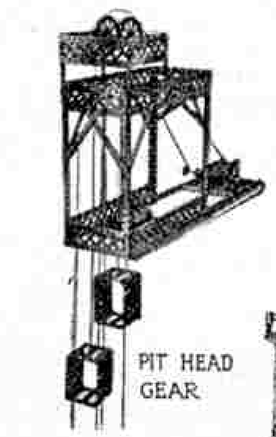
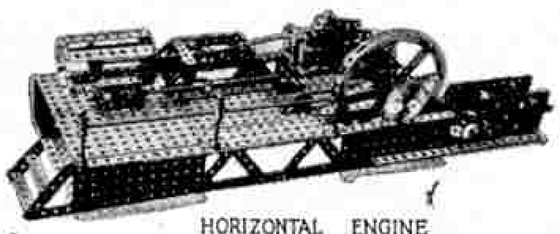
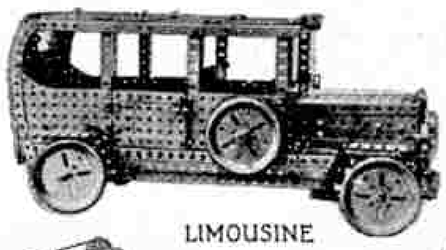


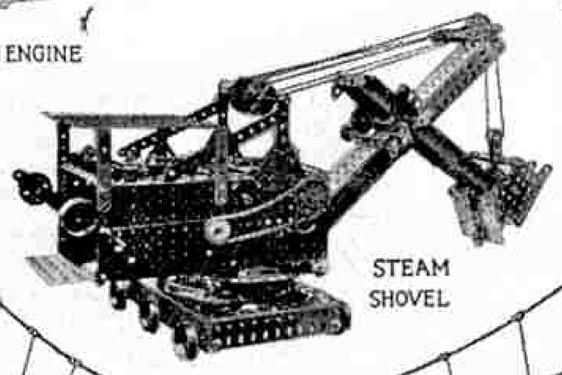
Photo courtesy] [*Vickers Aviation Dept.*

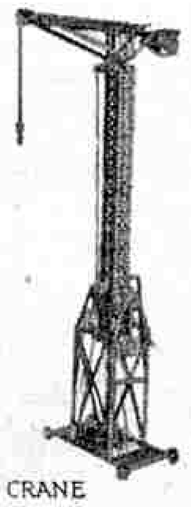
Interior of Vickers "Vimy" Ambulance

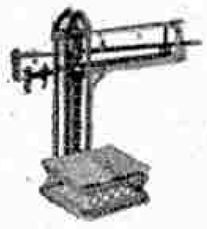

PIT HEAD GEAR

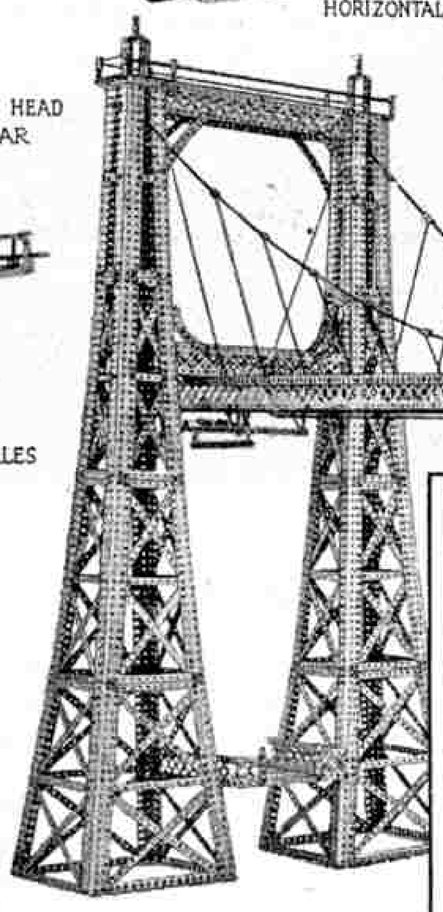

HORIZONTAL ENGINE


LIMOUSINE

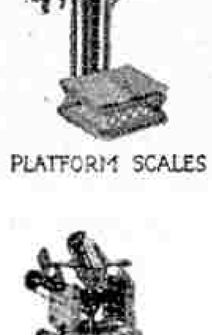

STEAM SHOVEL


CRANE


PLATFORM SCALES



TRANSPORTER BRIDGE


SEARCHLIGHT

MECCANO

is always new. It brings a new interest into your life from the start. You become at once an engineer, a builder, an electrician, an architect, a motor mechanic, an airman, a weaver, and a shipwright.

Through the long winter evenings it teaches you to solve intricate problems, and to think *constructively*. Whilst giving you endless hours of pleasure, it is the while training eye and hand and brain—all the time keeping them tuned up and fitting them for whatever career you may adopt later in life.

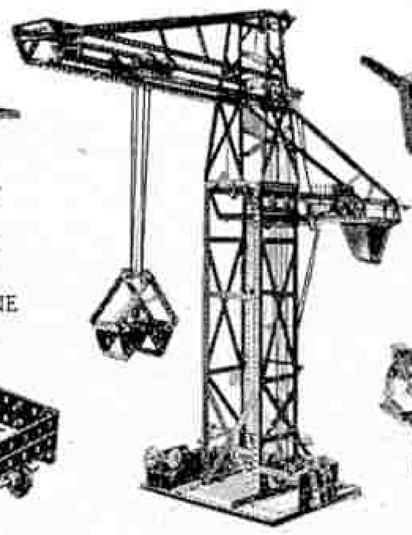
MECCANO IS ENGINEERING FOR BOYS

RAILWAY FOOT BRIDGE AND SIGNALS

TOWER WAGON

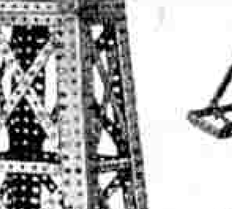
COT

BEAM ENGINE


HIGH-SPEED SHIP-COALER

BARROW

PULLMAN CAR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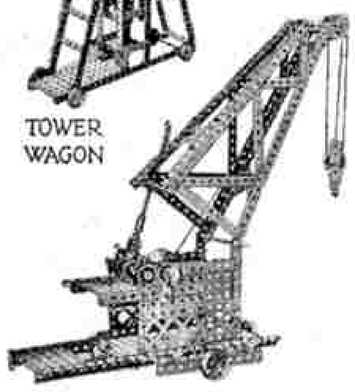
PIT HEAD GEAR

TIP WAGON

AUTOMATIC GONG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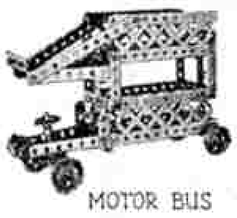
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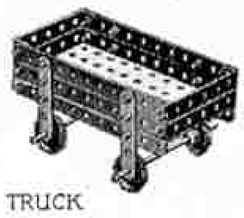
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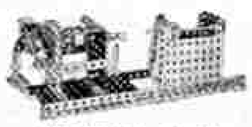
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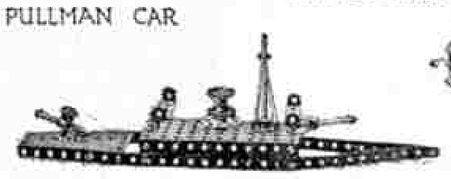
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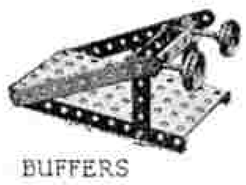
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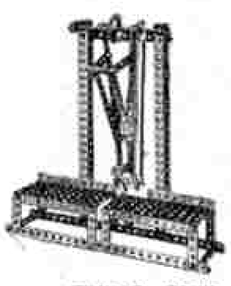
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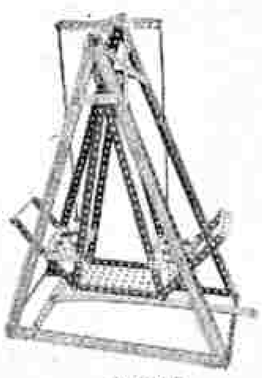
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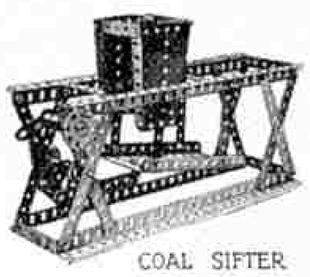
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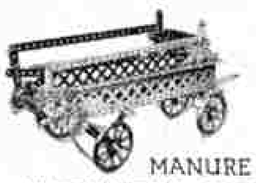
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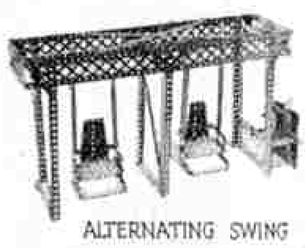
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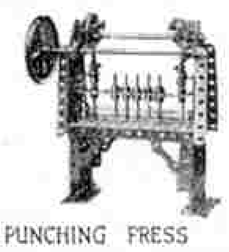
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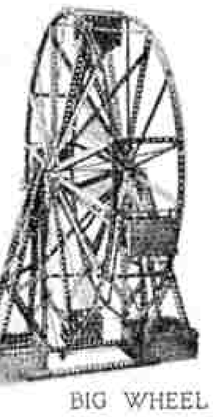
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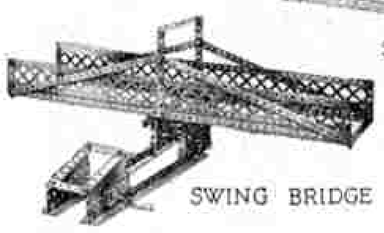
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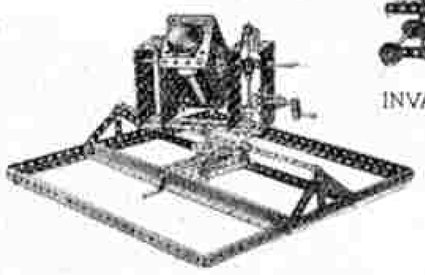
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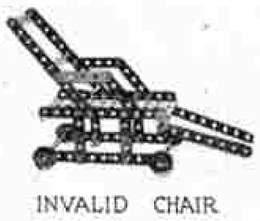
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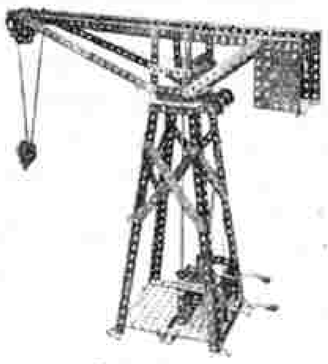
SAILING BOAT


GIRDER CRANE

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GIANT HAMMER-HEAD CRANE

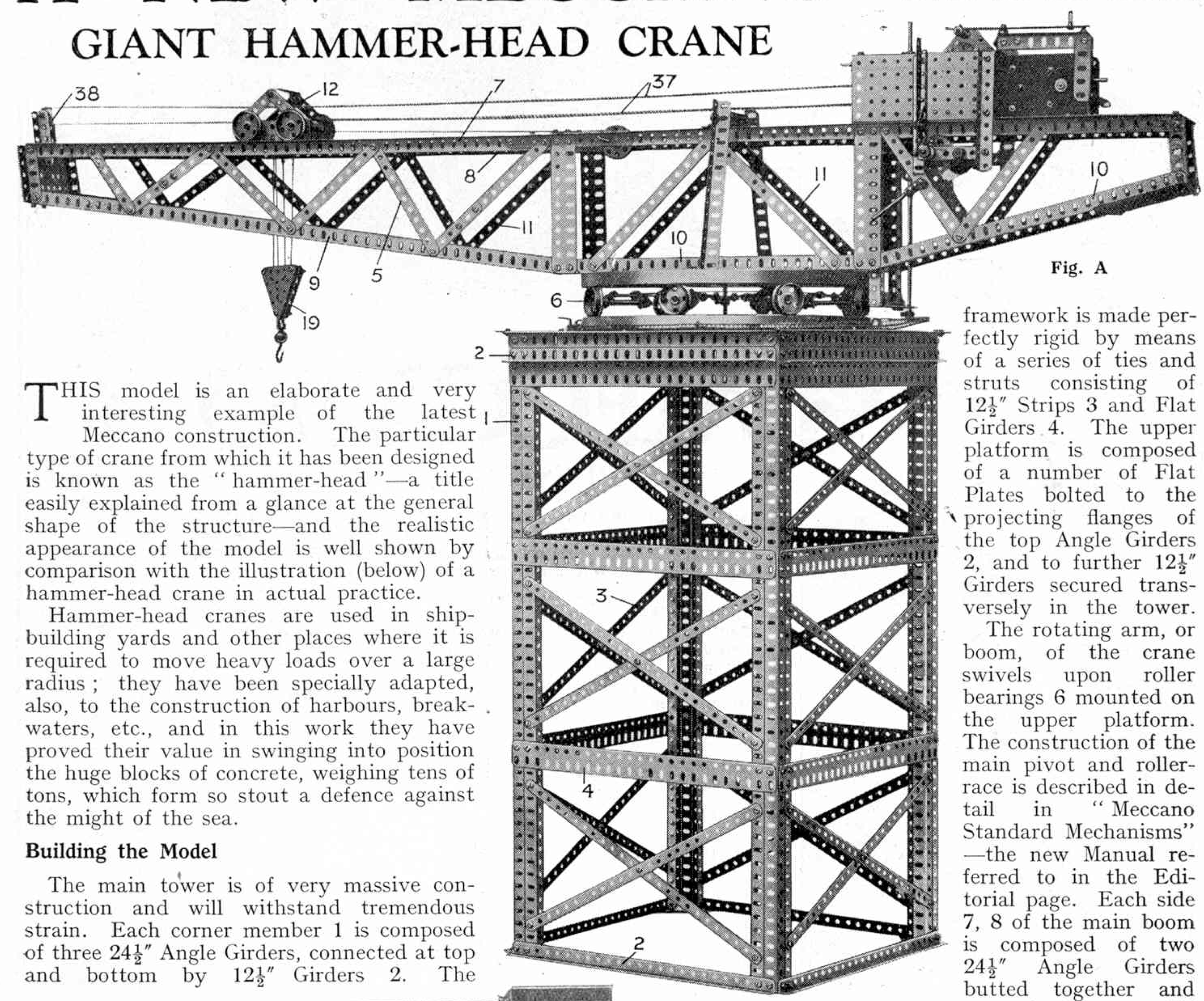


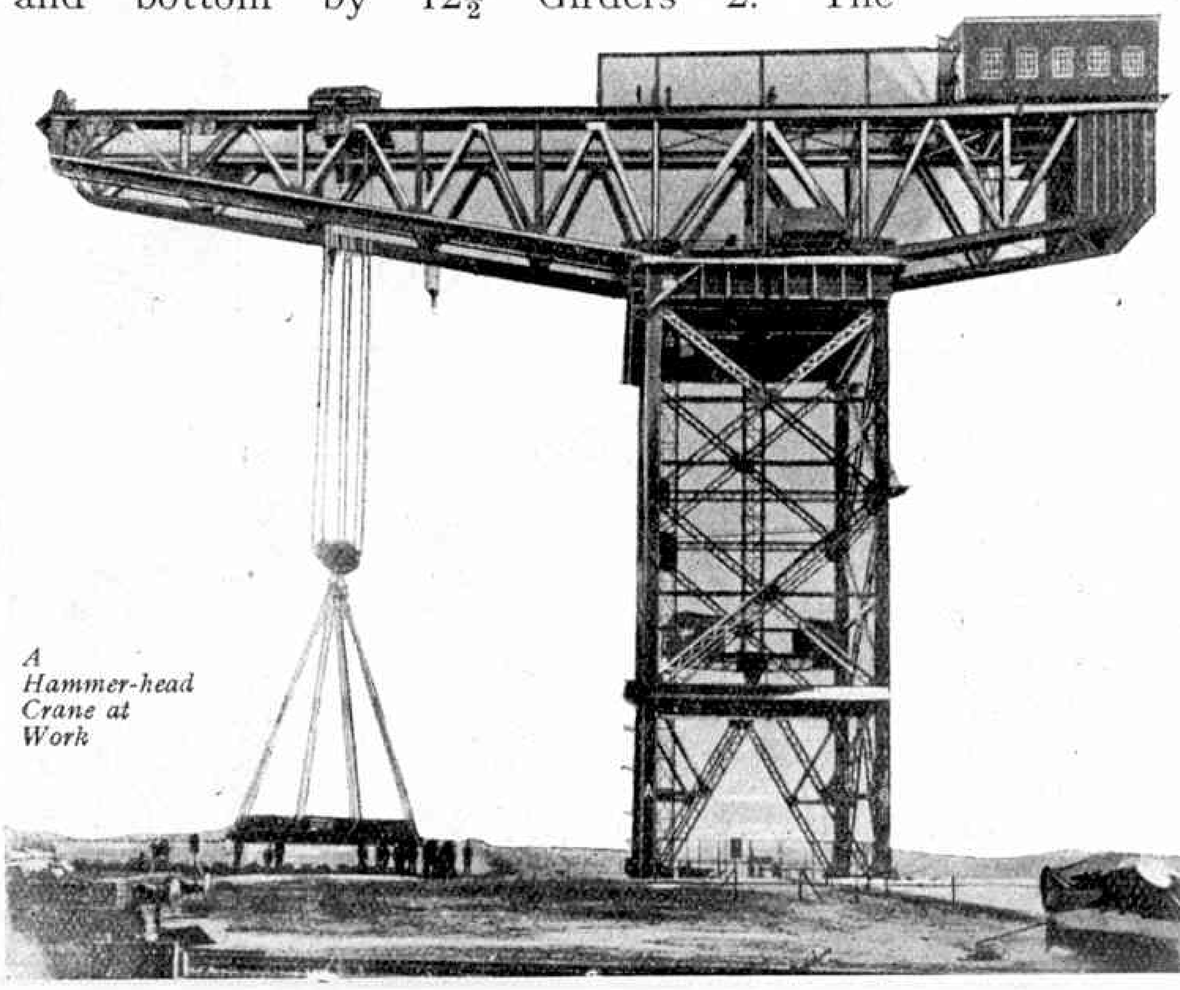
Fig. A

THIS model is an elaborate and very interesting example of the latest Meccano construction. The particular type of crane from which it has been designed is known as the "hammer-head"—a title easily explained from a glance at the general shape of the structure—and the realistic appearance of the model is well shown by comparison with the illustration (below) of a hammer-head crane in actual practice.

Hammer-head cranes are used in shipbuilding yards and other places where it is required to move heavy loads over a large radius; they have been specially adapted, also, to the construction of harbours, breakwaters, etc., and in this work they have proved their value in swinging into position the huge blocks of concrete, weighing tens of tons, which form so stout a defence against the might of the sea.

Building the Model

The main tower is of very massive construction and will withstand tremendous strain. Each corner member 1 is composed of three 24½" Angle Girders, connected at top and bottom by 12½" Girders 2. The framework is made perfectly rigid by means of a series of ties and struts consisting of 12½" Strips 3 and Flat Girders 4. The upper platform is composed of a number of Flat Plates bolted to the projecting flanges of the top Angle Girders 2, and to further 12½" Girders secured transversely in the tower.

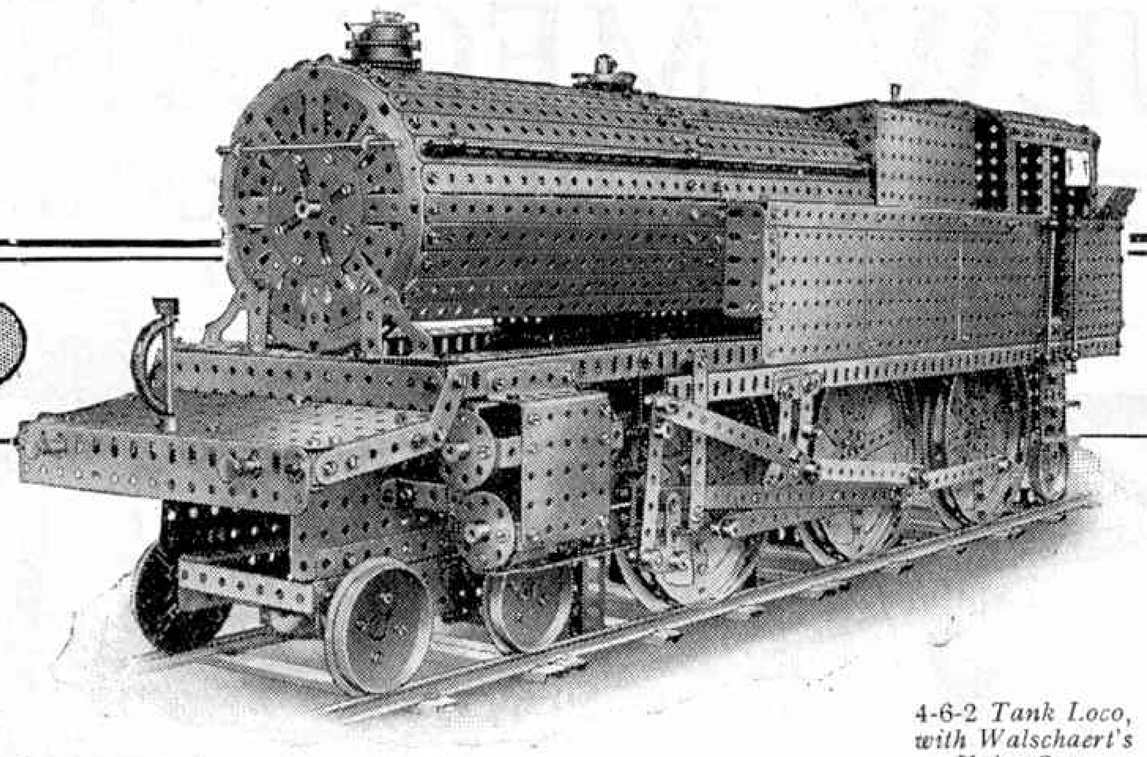


A Hammer-head Crane at Work

The rotating arm, or boom, of the crane swivels upon roller bearings 6 mounted on the upper platform. The construction of the main pivot and roller-race is described in detail in "Meccano Standard Mechanisms"—the new Manual referred to in the Editorial page. Each side 7, 8 of the main boom is composed of two 24½" Angle Girders butted together and secured by a 5½" Girder at the centre. The lower portions of the frame consist of 24½" Girders 9 and 12½" Girders 10, braced by a series of ties and struts 5 and 11.

The three movements of the model—hoisting, racking and slewing—are driven and controlled from the Electric Motor and gear box secured upon the upper side of the boom. The Motor (12, Fig. B) is bolted to large Flat Plates 13 carried on the main girders 7, 8, while the sides of the gear box 14 are bolted directly to the girders 7 and 8. A general view of the driving mechanism and controls is shown in Fig. C.

The hoisting gear is operated as follows: the Motor, by means of a ½" Pinion 15 (Fig. C) on its armature, drives a 57-teeth Gear Wheel secured to an axle carrying the 1" Sprocket Wheel 16. This Sprocket Wheel is connected by a short Sprocket Chain to a similar wheel mounted on a Rod 17 (Fig. B), and a Pinion 18 secured to the latter drives a 57-teeth Gear Wheel 19 on the winding shaft 20. The hoisting-



4-6-2 *Tank Loco, with Walschaert's Valve Gear.*

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		s.	d.
19A.	Wheels, 3", with set screw ... ... each	0	8
20.	Flanged Wheels ... „	0	6
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
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
63B.	Strip Couplings	0	8
63C.	Threaded Couplings ...	0	6

		s.	d.
64.	Threaded Bosses ... each	0	2
94.	Sprocket Chain per length	0	6
96.	Sprocket Wheels, 1" ... each	0	3
109.	Face Plates, 2½" diam. „	0	4
114.	Hinges... ... ... per pair	0	4
115.	Threaded Pins ... ... each	0	2
116.	Fork Pieces ... ... „	0	3
118.	Hub Discs (5½" diam.) „	1	3
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127.	Simple Bell Cranks ... each	0	3
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132.	Flywheels, 2¾" diam.... „	2	3
136.	Handrail Supports ... „	0	3
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144.	Dog Clutch ... ... „	0	6
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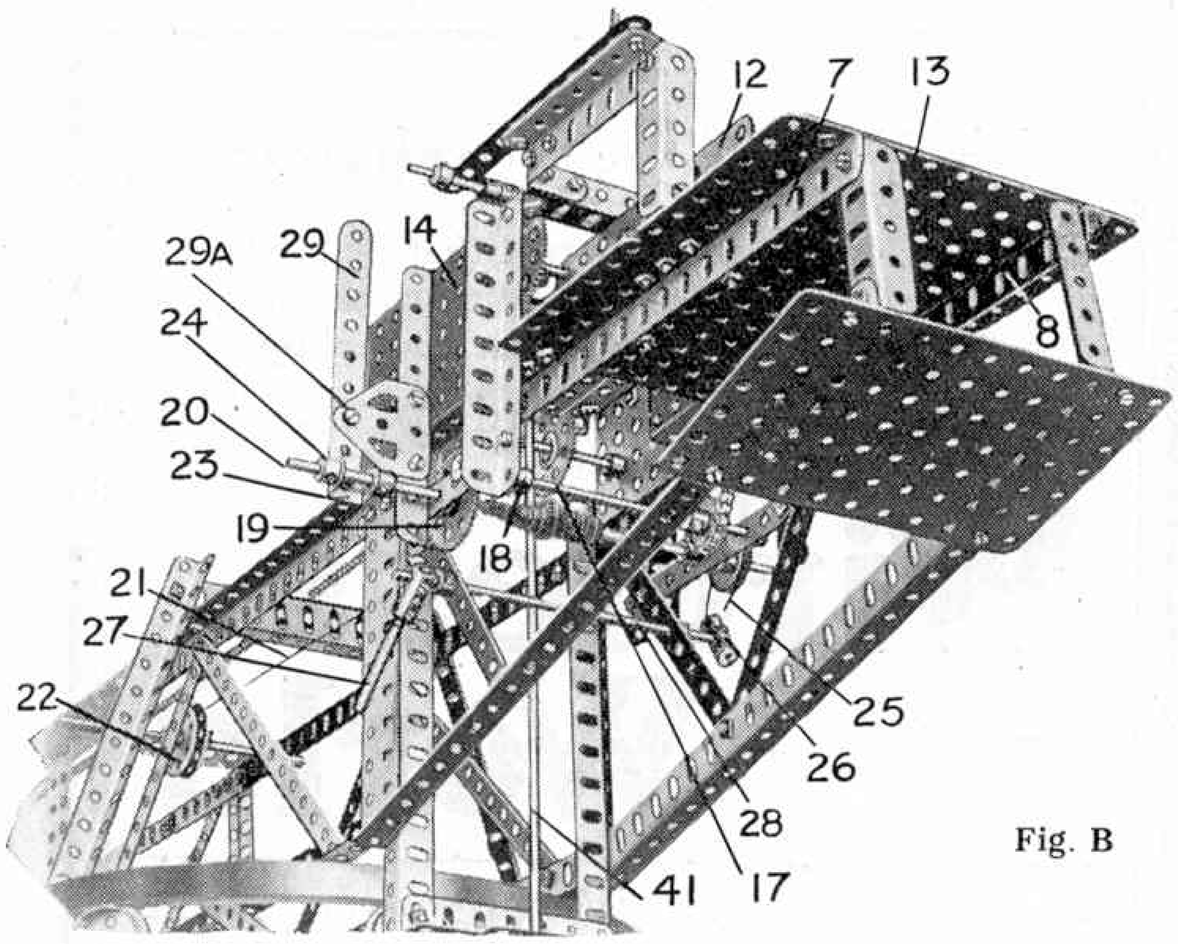

Fig. B

cord 21 passes from this shaft over a guide pulley 22, and over a sheave 1a in the traveller (Fig. D) ; from thence it is led round one of the sheaves of the two-sheaved pulley block 5, back round the other sheave 1a, then over the second-sheave in the pulley block, and is finally secured to a hole in a Bush Wheel 1. The Bush Wheels 1 do not revolve with the sheaves 1a.

The Gear Wheel 19 may be moved in or out of engagement with the Pinion 18 on operation of a lever 29 ; the latter is pivoted at 29a and engages the Rod 20 by means of a Double Bracket 23 mounted between Collars 24. The movement of the load is controlled by a friction brake consisting of a piece of cord 25 tied to the end of a Coupling 26, and engaging a 1″ Pulley secured to the winding shaft. The grip of the cord 25 about the Pulley is relaxed on lifting the lever 27, which consists of a short Rod attached to the shaft 28 carrying the coupling 26.

Rotating and Traversing Movements

The 57-tooth Gear Wheel (already mentioned) mounted immediately behind the Sprocket Wheel 16 on the shaft 42 (Fig. C), is driven by the Motor Pinion 15, and engages with a further ½″ Pinion secured to a short Rod journalled in the end of the Motor 12. The latter Rod carries at its other extremity a further ½″ Pinion meshing with a 57-teeth Gear Wheel 43 secured to the Axle Rod of two Bevel Wheels 44. This Axle Rod may be moved to and fro in its bearings on operation of a lever 45. The end hole of a Crank 32 is threaded on the axle, between the bosses of the Bevel Wheels 44, and is retained in its position by means of two or three Washers placed on either side of the Crank. The latter is secured to a Rod 31 sliding in Trunnions 46, and the lever 45, pivoted at 45a, rests between two Collars 30.

The Bevel Wheels 44 are so arranged on their shaft that, on moving the lever 45, one or other may be brought into engagement with one of the two further Bevel Wheels 33, 34, mounted on secondary shafts 47, 48. This type of drive-changing gear is described more fully under Standard Mechanism No. 69. Shaft 47 carries a Worm 35 driving a 57-teeth Gear Wheel on the Rod 36. A 1″ Sprocket Wheel 49 on this Rod engages a length of Sprocket Chain 37, which passes round a similar Sprocket Wheel 38 (Fig. A) at the outer end of the crane arm. The ends of the chain are attached to the carriage (or "traveller") ; hence rotation of the Sprocket 49 moves the traveller to and fro on the girders 7.

The head of the crane is rotated about the roller-bearings 6 by means of the secondary shaft 48. This carries a Worm 39 engaging with the 57-teeth Gear Wheel 40 on the vertical shaft 41 ; the latter carries at its lower end a 1½″ Sprocket Wheel rotating in a Sprocket Chain which grips the circumference of the lower fixed guide of the roller-race (see S.M. No. 101).

It will now be seen that a slight movement of the lever 45 connects the main drive from the Motor with either of these two operations—rotating the crane or propelling the traveller 12 along the rails 7.

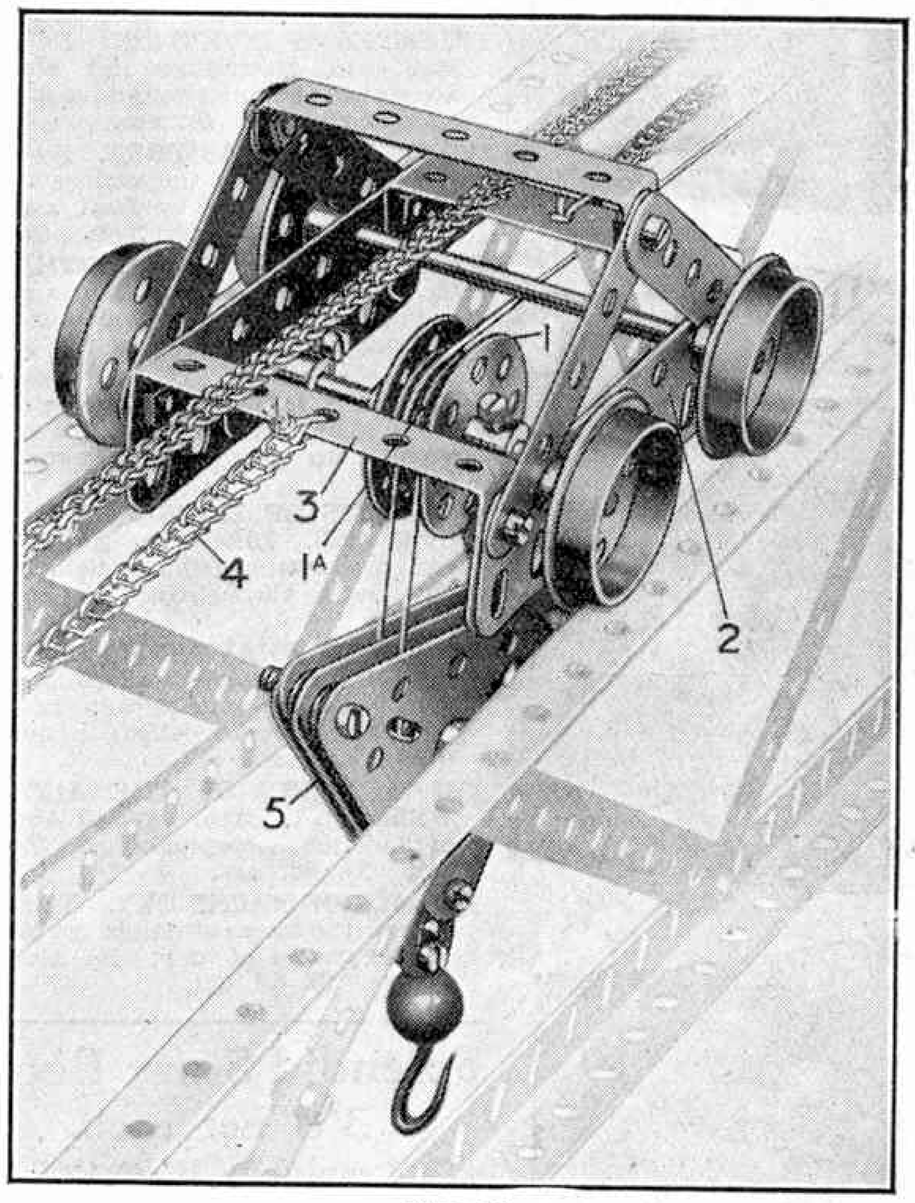

Fig. D

Fig. C clearly shows the construction of the traveller, and reference to the following Standard Mechanisms will solve any constructional difficulties that are not sufficiently clear in this article ; S.M. 32 (Two-sheave Pulley Block), S.M. 39 (Guide Pulley), S.M. 69 (Drive-changing Gear), S.M. 101 (Roller Bearings), S.M. 155 (Overhead Trolley), and S.M. 169 (Traversing Gear), etc.

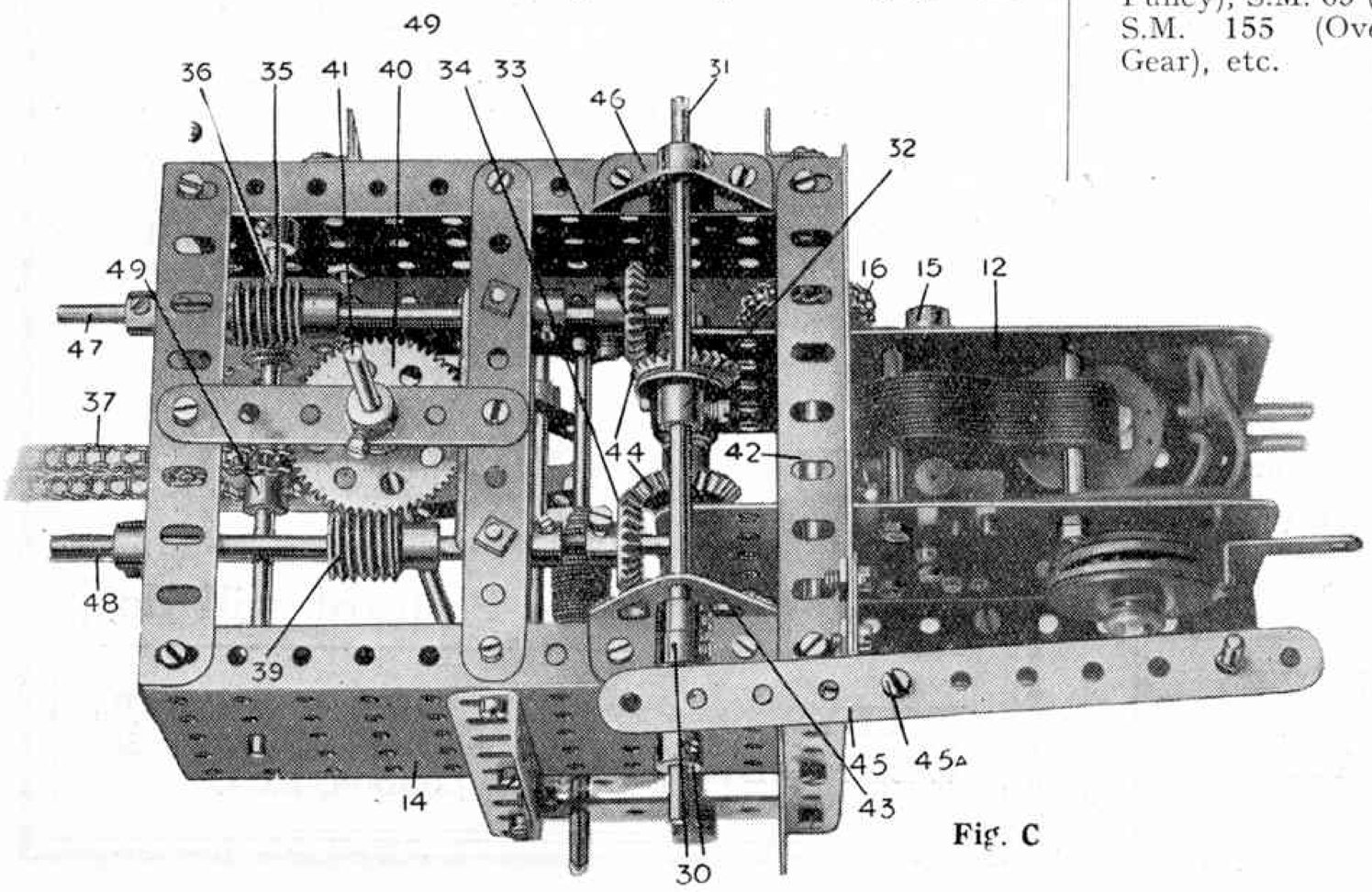

Fig. C

Parts required :

24	of No.	1	2	of No.	14	2	of No.	52
4	„ „	1B	5	„ „	15	8	„ „	52A
3	„ „	2	3	„ „	16	2	„ „	53A
10	„ „	2A	8	„ „	16A	1	„ „	57B
14	„ „	3	3	„ „	16B	32	„ „	59
7	„ „	4	1	„ „	17	1	„ „	62
8	„ „	5	1	„ „	18A	3	„ „	63
5	„ „	6A	12	„ „	20	4	„ „	70
18	„ „	7	1	„ „	22	3	„ „	76
20	„ „	8	5	„ „	22A	2	„ „	94
4	„ „	8B	4	„ „	24	1	„ „	95A
5	„ „	9	4	„ „	26	3	„ „	96A
15	„ „	9A	5	„ „	27A	4	„ „	103
2	„ „	9B	4	„ „	30	12	„ „	103B
7	„ „	9D	2	„ „	32	1	„ „	103C
2	„ „	9F	447	„ „	37	2	„ „	103D
1	„ „	10	5	„ „	37A	1	„ „	103H
1	„ „	11	44	„ „	38	2	„ „	109
4	„ „	12	1	„ „	40	3	„ „	111
2	„ „	12A	1	„ „	45	8	„ „	119
16	„ „	12B	2	„ „	46	8	„ „	125
1	„ „	13	8	„ „	48	2	„ „	126
1	„ „	13A	1	„ „	48A	1	„ „	126A

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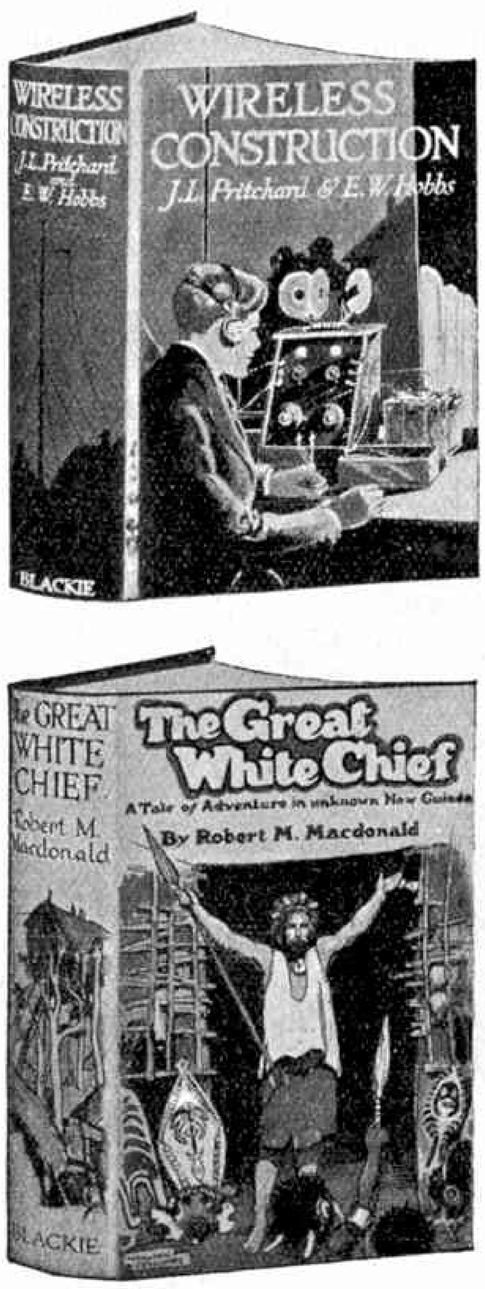

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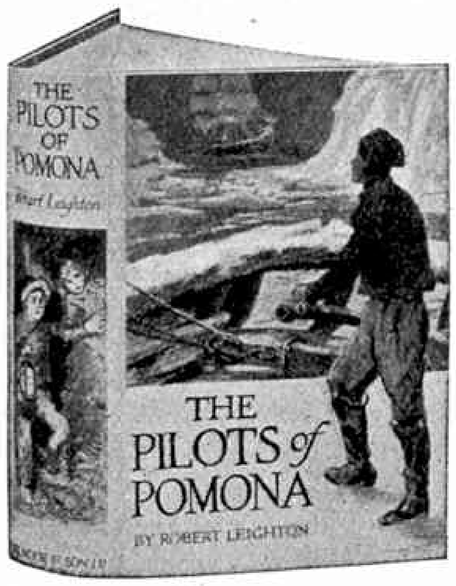

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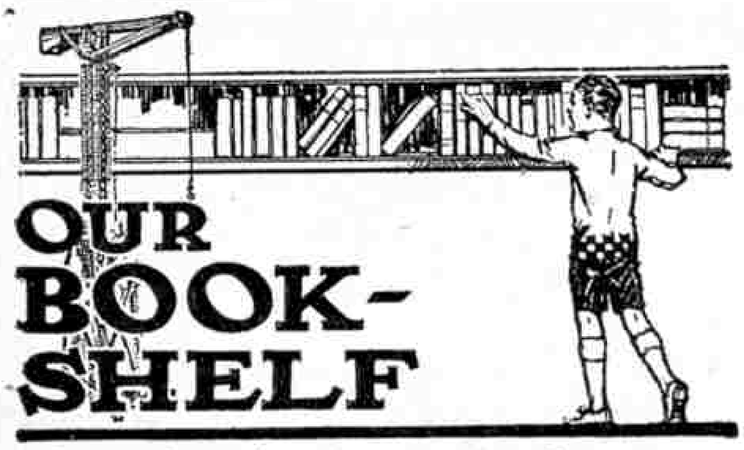


Readers frequently write to me asking if I can recommend books that are both of interest and of use. In this column I review books that I consider specially appeal to Meccano boys. I do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

"Talks About Wireless"

By Sir Oliver Lodge.

(Cassell & Co. Ltd., price 5/– net).

This book is one of the most notable of recent publications dealing with wireless. Its first five chapters contain a great deal of historical matter that previously has not received sufficient attention, and in particular Sir Oliver places before us the pioneers of wireless in correct perspective. The remainder of the book covers a very wide field and every chapter will be read with interest by all students of wireless.

The book is written in Sir Oliver's familiar lucid and chatty manner, and it is obvious that this famous scientist has lost none of his skill in explaining the most complicated matters in a few clear-cut phrases. This is not a beginner's book, but it can be recommended to the serious amateur who desires to know more of the fundamentals of wireless and of its scientific basis.

Fishes of the British Isles

By J. T. Jenkins, D.Sc.

(Fredk. Warne & Co. Ltd. Price 12/6)

This splendid handbook (pocket size) will make an excellent Christmas gift for readers interested in the aquarium. Many of the 278 illustrations are beautifully reproduced in colour and the book is noteworthy for the fact that it deals with all British fish—in fact, it claims to be the only book doing so.

Nearly everyone knows some species of fish by sight, even if they are not familiar with the scientific names. Mr. Jenkins suggests that his readers should further their knowledge first by noticing the external characters of known species, carefully observing the points that are important for identification. The identification of strange forms then soon becomes a comparatively easy matter. In the book he arranges the fish in families, and clearly indicates the distinguishing marks of the various species. In each case the common and scientific names are given and also full details as to spawning habits, habitat, etc.

The new volume forms an excellent addition to the "Wayside and Woodland" series, which series includes other books on nature study and kindred subjects.

Three Fine Annuals

(Published by the Fleetway House, London E.C.4. Price 6/– each net).

"Answers" Annual is certainly one of the most interesting of this year's publications. The variety of subjects covered is really astonishing and the illustrations are numerous and attractive. The book will make a strong appeal in particular to boys who are keen on "doing things" or "making things."

The Greyfriars Holiday Annual specializes in school and adventure stories and its 360 pages contain a very interesting collection of both. Coloured and photogravure plates form a notable feature of the book and the humorous drawings are exceedingly well done.

The Champion Annual appears to be even better than usual which is saying a good deal. It contains some 15 rattling good adventure stories and also a number of highly interesting articles on sports, pets, etc. This annual is an ideal Christmas gift for any boy.

"Wireless Construction"

By J. L. Pritchard and E. W. Hobbs

(Blackie & Sons Ltd. 6/– net).

This book embraces the theory and the practice of "Wireless" science. It is intended to acquaint amateurs with the "wireless" work of those who discover and design and also with that of the man who "puts the thing together."

Theory, and the symbols it uses, are first explained—then follows full and detailed information about such subjects as Circuit Diagrams, Materials used in "Wireless," Tools, Metal-Working, Ebonite, &c., &c.

Later chapters still deal with Aerials, Condensers, Coils, Switches, Batteries, and Accumulators, with the assembling, tuning, and general management of many kinds of sets.

A feature of the book is the illustrations—half-tone plates, diagrams, &c.—which allows of every subject dealt with being pictorially presented.

"Colin the Scout"

By Lt.-Colonel F. S. Brereton

(Blackie & Son Ltd. 5/– net).

Regret reigns amongst the Blowmoor Scouts when their popular member, Colin Field, joins his grandparents in Japan. Little did they think of the adventures that were to befall him. To get him out of the way while an attempt is made to impersonate him, Colin is sandbagged at Singapore, and shipped on board a coasting steamer. This boat is captured by Chinese pirates, and taken by them to their island base. Colin's innate powers of leadership reveal themselves, however, and after a most thrilling series of incidents, he and the crew escape. Meanwhile the hero's impersonator is suspected by the old grandparents and a telegram to his scoutmaster brings that enterprising leader with one of the other scouts out to Japan at once. They arrive in time to take an exciting part with Colin in the defence of a bank's strong room, during the awful scenes subsequent to the Yokohama earthquake, and to come to the rescue of Colin's grandparents, in imminent danger at the hands of the desperate arch-plotter. All ends well, after a book of breathless adventure vividly described.

"The Whip Hand"

A School Story by Walter Rhoades

(Blackie & Son Ltd. 6/– net).

While games and the usual schoolboy ragging have their part in this book, the tale is chiefly concerned with the efforts of the smooth-tongued scamp, Tregallis, to make young Franklin his accomplice in various shady escapades. For a time he seems likely to succeed—holding over the boy's head the threat of revealing to the school the fact that Franklin's real name is Bradhurst, and that his father is undergoing a term of imprisonment on a charge of forgery. Franklin's rescue of a little girl from the rising tide leads to a friendship with her father, a barrister, who turns out to be closely associated with the misfortunes of Mr. Bradhurst, and eventually proves him innocent. The revelation of the identity of the real criminal comes as a most dramatic surprise. The magnanimous spirit displayed by Mr. Bradhurst, and imitated by his son, is likely to leave a deep impression on the reader, and to make the book of more than temporary value.

"East in the 'Golden Gain'"

By Percy F. Westerman

(Blackie & Son Ltd. 5/– net).

This is an excellent example of Mr. Westerman's up-to-date sea stories, in which he shows that there is still the possibility of excitement and romance and play of character in the life of the mercantile marine. His hero, with no taste for the chemist's shop which seemed to be his fate, is allowed by a wise father to follow his bent. The boy goes as a cadet on the tramp steamer *Golden Gain*, and very soon finds his feet amongst a cheery lot of shipmates under a sound if peppery skipper. Sharks, storms, a man overboard, Chinese pirates, a shooting expedition ashore that nearly ended disastrously, and an ocean race—these are amongst the features of a story that loses nothing in interest by its actuality.

In the new edition thousands of prices have been changed and many new items of information added. Many countries, such as Portugal and Dantzig, have been completely revised and the catalogue shows evidence of a great deal of new and up-to date information. The price of Part 1, British Empire only, is 6/10; Part 2 foreign countries, 10/6; and of the two parts bound in one volume, 17/3 (all post free).

The publishers announced that during the past year the demand for the early issues of British Colonial stamps shows no sign of abatement, and consequently many stamps have risen in price. Keen interest continues to be shown in King George stamps and renewed attention is being paid to King Edward stamps and the later issues of Queen Victoria. The stamps of the Irish Free State also are very popular and all issues of Rhodesia are keenly sought after. Owing to the increased demand for specimens, it is anticipated that the present steady rise in the value of stamps will in all probability continue in the future.

The Wonder Book of Then and Now

(Published by Ward, Lock & Co. Ltd. Price 6/– net).

Do boys of to-day, with wireless and motors and telephones realise what life was like, say a hundred years ago, when railways were just beginning? The contrast is wonderful—almost unbelieveable—for a century, after all, is a very short time in the world's long story. Boys of all ages, fathers and uncles, will alike be fascinated by this unique and handsome volume with its hundreds of quaint and interesting pictures and its brightly-written stories of past and present. Some of the articles included are Early Railways, Trams and 'Buses, The Story of the Cycle, Other Days at School, When Policemen wore Top Hats, London a Century Ago, The Games of our Grandfathers, Boy Workers in the Old Days, Some Old-Time Punishments, Tools of Yesterday and To-day, A Cricket Match of 1848, Time Signals Old and New. Over 300 illustrations, twelve full plates in colour, make everything plain and include some of the latest machines and appliances.

"The Boy's Own Annual"

(B.O.P. Office. Price 12/6 net).

At this time of the year one instinctively looks round for the "Boy's Own Annual," which is indeed almost a national institution. The 47th annual volume now available maintains fully the traditions of the past, while at the same time it is thoroughly up to date in every respect. The serial stories are particularly good and practical articles on various mechanical and scientific subjects are a notable feature. The illustrations, especially the coloured plates, are all that could be desired and from every point of view the volume forms an ideal Christmas present.

"Engineering Feats"

By Archibald Williams

(Nelson & Sons Ltd. 10/6 net).

One always expects something good in the engineering publications of Messrs. Nelson & Sons, and "Engineering Feats" is no exception to the rule. In simple and straightforward language the author describes the greatest achievements of engineering from the pyramids to sky-scrapers, tube railways and aeroplanes. The various chapters are well illustrated and special praise is due to the coloured plates. The book has been prepared with Mr. Williams's usual accuracy in detail and is sure to make an instant appeal to every mechanically-minded boy.

"The Testing of Jim Maclean"

By Dillon Wallace

(B.O.P. Office, price 3/6 net).

This is a tale of the wilds of Labrador, and it has an outdoor atmosphere that is quite exhilarating. There is plenty of adventure and excitement in the book and the interest never flags from beginning to end. It is in short a rattling good story.

"Out of the Straight"

By Frank Elias

Twenty-six School Stories for Boys.

(B.O.P. Office. 3/6 each net).

School stories lose nothing of their fascination and it is unlikely that they will do so as long as schools remain as they are to-day. It is not the easiest thing in the world to write a good school story, but in "Out of the Straight" the author has certainly succeeded in producing the right atmosphere and also in maintaining the interest to the end. There is not a dull chapter in the whole book and many of the incidents are distinctly thrilling.

Another book that can be thoroughly recommended is "Twenty six School Stories for Boys." These stories have been carefully selected for quality and variety and all are good. Additional interest is given to most of the stories by excellent illustrations.

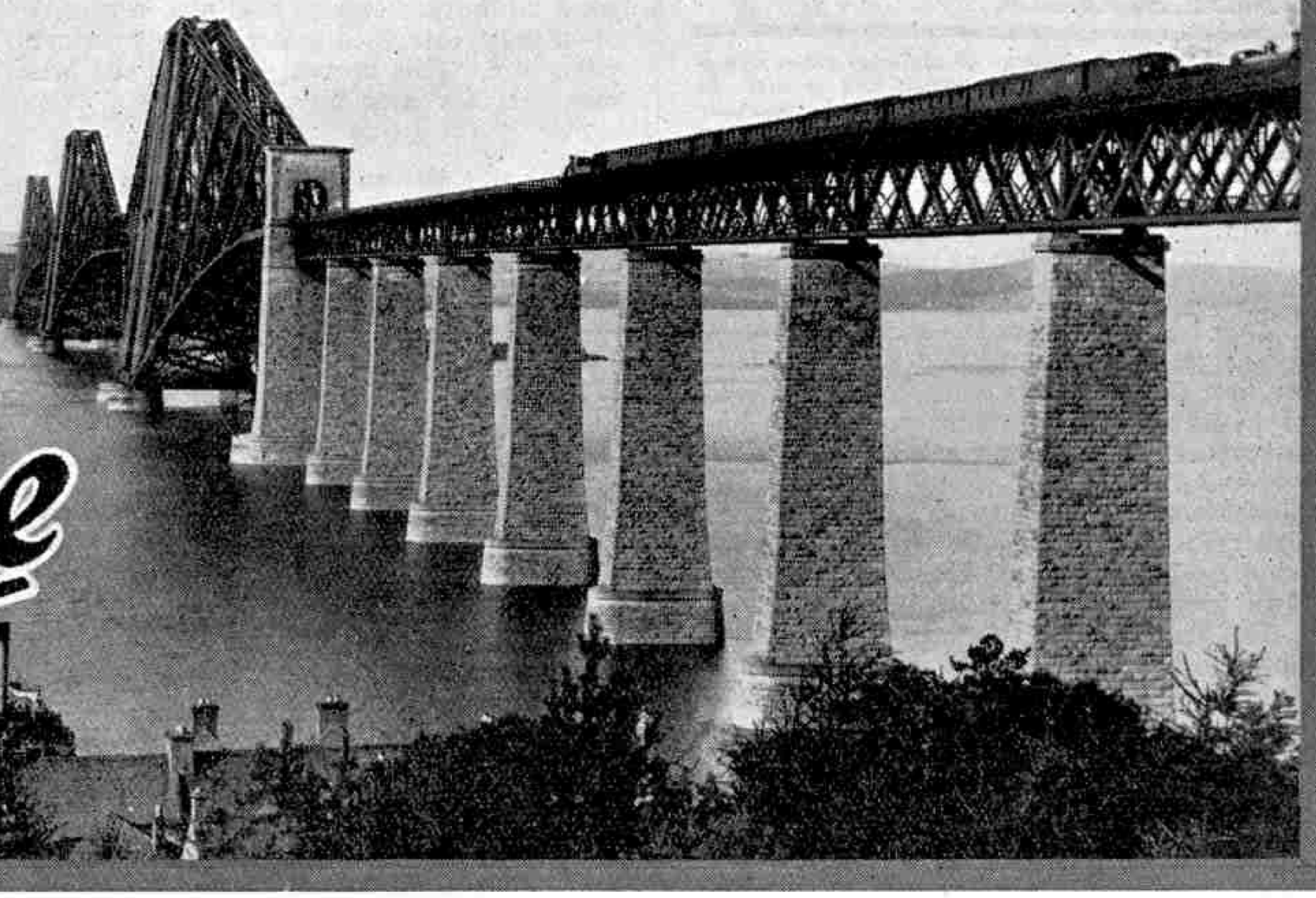
"Robinson Crusoe"

(B.O.P. Office. Price 2/6).

Year by year new editions of "Robinson Crusoe" appear and are quickly absorbed, thus showing that this fine old book appeals to boys of to-day as much as it did to those of previous generations. The edition now put forward from the "B.O.P." has many points to recommend it. It is lavishly and excellently illustrated by Stanley L. Wood, the print is good, and last but not least the price is low. One envies those boys who, this Christmas, will read this wonderful story for the first time!

FAMOUS BRIDGES VII.

The Story of the Forth Bridge



PART III.

THE two cantilever piers, one on the Fife shore and the other between 400 and 500 yards from the Queensferry side, are similar in appearance, rising to a total height of 209 ft. above high water. Provision was made in these piers for attaching the end of the cantilever by means of a series of holding-down bolts, anchored securely in the masonry itself, but yet arranged in such a manner as to allow of the horizontal movement produced by expansion and contraction.

Erecting the Cantilevers

Perhaps the most interesting task of all was that of erecting the cantilevers. Commencing with the vertical columns, we first come to the bed-plates. These were composed of several thicknesses of steel and were placed on the piers, supported by blocks, and riveted by hydraulic machinery working simultaneously from both the upper and lower sides. All the rivet heads were countersunk in order to provide a perfectly smooth surface. The bed-plates were then lowered on to the masonry in which holes had been cut previously for the holding-down bolts. In a similar manner the upper bed-plates were put together and placed upon the lower.

These plates provided the base for the "skewbacks," each of which formed the point of the junction of the five different compression members, which were connected with the skewbacks in such a manner as to transfer to them all strains. In any movements of the cantilevers produced by contraction or expansion the skewbacks slid with the upper bed-plates.

When the skewbacks were in position the junctions of the compression members were fitted and the vertical columns and struts were built up to as great a height as the cranes permitted. The height that could be attained in this manner was very limited, and it soon became necessary to adopt some method by which cranes, platforms, etc., could be raised together. Finally an ingenious scheme was put into operation. In the vertical columns, at a height of about 30 ft. above the surface

Last month we dealt with the preparation of the foundations of the Forth Bridge and with the building of the piers. In this article we describe the construction of the giant cantilevers and the final completion of this engineering masterpiece, which stands to-day a fine monument to the imagination of its designers and to the engineering skill of its builders.

of the pier, one plate was omitted on each side and in the gaps thus formed were built two box girders about 5 ft. by 2 ft. Upon these girders were erected what were known as the lifting platforms, composed of material that was ultimately to be worked into the permanent structure and through which the upper ends of the vertical tubes and struts projected. The actual lifting was done by means of powerful hydraulic jacks.

An Error of Two Inches

In this manner the work progressed, the structure grew steadily in height and the great arms reached out towards one another.

The building of the giant cantilevers is well described by Mr. W. Westhofen, who was in special charge of the operations on Inchgarvie. In this account he draws attention to the tremendous effects of sun and wind on such a huge structure. He writes :—"By this means was achieved the successful building out of these arms, nearly 700 ft. in length and weighing some 5,400 tons, with an error of only 2 in. For an error there is and, curiously, it exists in nearly all the six cantilevers and in the same direction, namely, to east. Whether this is due to the prevailing westerly winds, and the fact that the total west pressure upon the structure in the course of a twelvemonth must be probably 50 times as great as the total from the east, or whether the fact that the lateral deflections due to the sun's rays are always so much greater from the west than from the east has something to do with it, the writer will not take upon himself to say, but appearances decidedly point in that direction."

The Central Girders

The central girders which connected the cantilever arms resembled in appearance those forming the main spans of the new Tay Viaduct. Each was 350 ft. long and over 30 ft. broad at the rail level, the depth varying from 40 ft. at the point of connection with the cantilever arms of 51 ft. in the centre.

It was a matter of great speculation among the general public as to how these girders were to be erected, and the prevailing idea appears to have been that they would be built on shore, floated out into the river to their positions beneath the ends of the cantilevers and raised to their proper level by hydraulic power. This method had been adopted in the case of Robert Stephenson's Britannia Bridge across the Menai Straits and also in the building of the new Tay Bridge, but it was impossible to adopt it in this case. the amount of traffic passing up and down the river was so great as to make it impossible to close the waterways even temporarily, and it was a condition imposed by the Board of Trade that no such interference with navigation should occur.

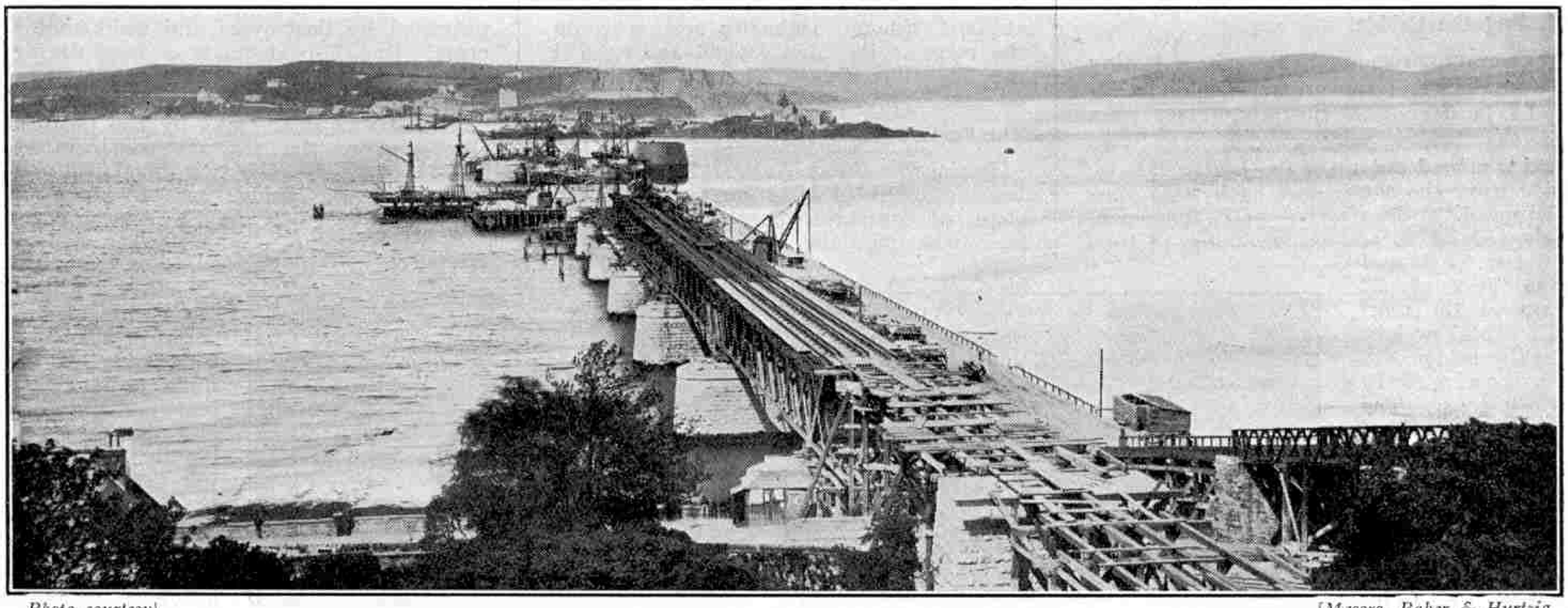


Photo courtesy] [*Messrs. Baker & Hurtzig*

The Foundations of the Forth Bridge as seen from the South Shore on 9th June 1885

An entirely different method had to be found, and the difficulty was finally solved by the adoption of an overhang system similar to that on which the cantilever arms themselves were carried out. The girders were temporarily connected with the cantilevers, thus becoming for the time being a continuation of the arms. When the ends of the girders were in position, the top and bottom members with struts and ties were carried out from each cantilever arm until they almost met in the centre, when a connection was made by permanent central plates. Afterwards the temporary connections at the ends were removed so that the girders rested on the ends of the cantilever arms.

Electric Light Adopted

The lighting of such an enormous working area was, as may be imagined, a great problem. In addition to lighting the actual points where work was proceeding, which of course changed day by day, there was the necessity for lighting all the approaches to these points and all stores, engine houses, workshops, landing places, etc. Electric lighting was decided upon, employing arc lamps for the shops and outdoor work and incandescent lamps for interiors. Incandescent lamps proved of great value in lighting the interior of the air shafts and air chambers of the caissons, and were used also with great success by divers under water. The arc lamps had the disadvantage of glare combined with the throwing of dense black shadows, and Lucigen oil lamps were introduced to overcome these defects.

A Disaster Narrowly Averted

During the whole time that the bridge was under construction navigation proceeded as usual, and after a while it was found that the constantly changing positions of the lights on the piers, etc., as work proceeded, introduced a serious problem for navigators. On a very dark night it was extremely difficult to ascertain the exact position of all the piers. One night, when there was a slight mist, the captain of a tug coming down river towing a barque mistook the lights on the Fife erection for those of Inchgarvie and steered his ship straight for the hamlet of North Queensferry, which at the time was entirely hidden in mist. He found out his mistake in time to back out his tug and slip the tow rope, but the barque went on and damaged itself and the jetty very considerably.

It was apparent that an accident of this kind might occur again at any time, and therefore it was decided to build a lighthouse at the north-west corner of the island of Inchgarvie, with a revolving light giving five-second flashes and visible for twelve miles up and down stream.

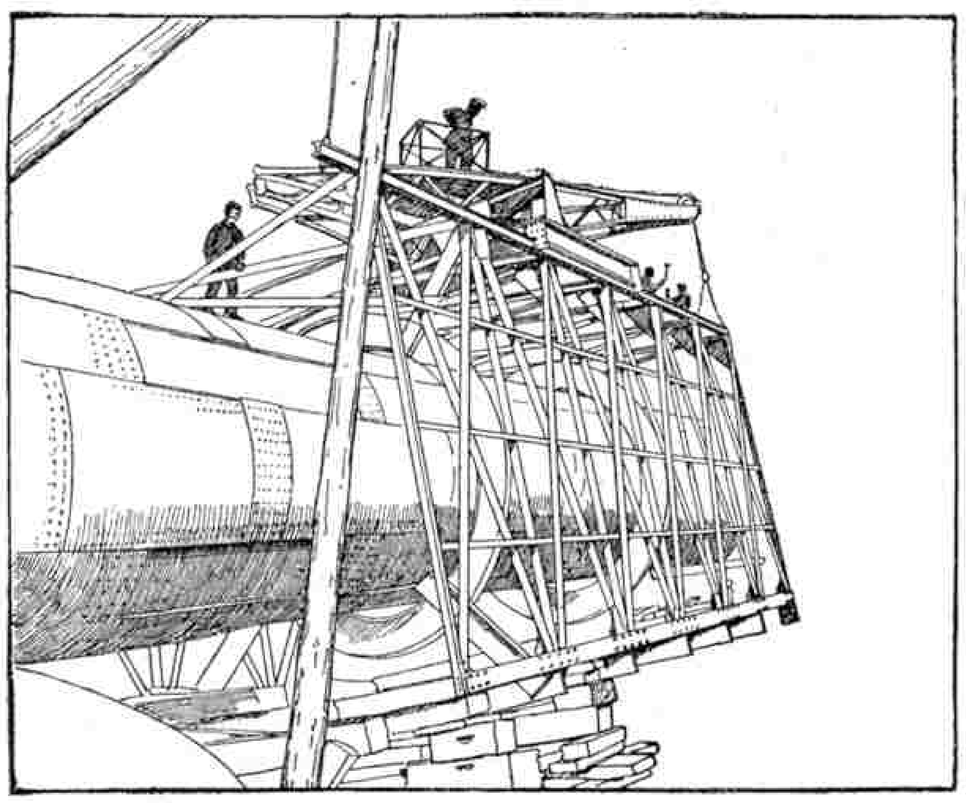
Heating the Rivets

About half the riveting of the bridge was carried out by means of hydraulic riveting machines. At first ordinary coal-fired furnaces were used for heating the rivets and these proved satisfactory for a time. Later, as the work progressed, however, it became clear that these furnaces could not be moved with safety to outlying platforms. In addition to the tremendous weight of the furnace itself, there was also the weight of the fuel, and a further objection lay in the danger of timber-staging being set on fire by hot ashes from the furnace.

In the end small oil-fired furnaces were used with great success. These little furnaces, constructed of iron lined with brick, weighed rather more than half-a-ton. They could be placed in any position required by means of a crane and all that was required for their working was a small pipe to supply compressed air and a small tank of oil. One of these furnaces could heat 200 rivets per hour easily.

A great advantage of these oil furnaces was that when a furnace had finished a spell of work, and the air and oil were turned off, everything was cold in about five minutes and there was no possibility of fire breaking out after the workman had left.

For hand rivetting in the struts and lattice-girders small hand or treadle-operated forges were used. If an oil furnace was within reach it was used for pre-heating the rivets for the hand workers.



Building out one of the Lower Booms

(From the Editor's book "Engineering for Boys," by permission of the publishers, Messrs. T. C. & E. C. Jack Ltd.)

How the Bridge was Painted

As soon as they had passed through the shops or yards, all the plates, bars, angles and other parts of the super-structure were thoroughly scraped with steel scrapers and steel wire brushes. They were then given a coat of boiled linseed oil, which was applied as hot as possible. The next step was to give them a coat of red lead paint, and this was done as soon as possible after the parts were erected, and in some cases before erection. Subsequently a second coat of red lead was given followed by two coats of an oxide of iron paint, the first a priming coat of dark chocolate and the second a finishing coat of bright Indian red. The inside of the tubular members of the bridge was given one coat of red and two coats of white lead paint.

In order to prevent rain water from finding places where it could lie and cause rust, all places in which water could not of its own accord drain away were filled with asphalt-concrete. In certain cases, where it was not possible to adopt this course, holes were drilled and the asphalt was so laid that the water was drained to the holes and away through them.

Testing the Bridge

There now remained the task of testing the stability of the mighty structure.

In January 1890 the preliminary tests of the bridge were carried out. Two trains moved out upon the bridge side by side from the south end, each train consisting of two locomotives of 72 tons each, followed by 50 wagons weighing 13 tons 10 cwt. each and one loco of 72 tons at the rear. The total weight on the bridge was approximately 1,800 tons. The trains were moved forward very slowly and minute observations were made as to the effects upon the bridge when the huge weight reached the most unfavourable positions of loading for the cantilevers. The various deflections were carefully noted and it was satisfactory to find that in every case these were well within the calculated limits.

Another very severe test, this time not by officials, occurred about this time during a severe storm in which wind gauges on Inchgarvie recorded a pressure of 37 lb. per sq. ft.—7 lb. per sq. ft. more than the estimated force of the wind during the storm that wrecked the first Tay Bridge. The Forth Bridge stood this severe weather test without sustaining damage of any kind, and the greatest lateral movement of the central cantilever was under 1 in. As a matter of fact the bridge was constructed to withstand a wind pressure of 56 lb. per sq. ft.

Further exhaustive trials were carried out later by Board of Trade officials, who reported after their final inspection that: "This great undertaking, every part of which we have seen at different stages of its construction, is a wonderful example of thoroughly good workmanship with excellent materials, and both in its conception and in its execution it is a credit to all who have been connected with it."

Opening by Prince of Wales

On 8th March, 1890, the Forth Bridge was opened by King Edward VII., then Prince of Wales. The ceremony took place during a fierce gale, the sound of which, roaring through the steel framework, made a great impression on the spectators and provided an object lesson in the enormous strength and stability of the giant structure.

The Forth Bridge is of never-failing interest to the thousands who cross it by rail. The north-bound expresses run due west for some distance after leaving Waverley station, Edinburgh. They then part company with the Glasgow line and turn away towards the Forth, running along an easily graded line. At Dalmeny there is a junction with the Glasgow-North direct line and numerous single lines and sidings serve the naval base at Port Edgar. Dalmeny station is on the verge of the high ground and from it the line runs almost directly on to the viaduct approach of the bridge.

The Forth Bridge in War Time

During the Great War the Forth Bridge became a link of vital importance in the chain of communications, and when we look back upon the conditions existing it appears remarkable that more attacks were not made upon it by aircraft or submarines. When the Grand Fleet established its bases in the far north at Cromarty and Scapa Flow, vast supplies of coal and general stores and large numbers of men had to be constantly passing over the bridge, and in the event of an invasion by the enemy it would have been a matter of the utmost importance to maintain the crossing of the Firth of Forth. If any further test of the strength of the great bridge were needed it was supplied during this period by the heavy coal trains from South Wales and Yorkshire.

The great height of the bridge above the level of high water enabled the largest warships to pass beneath it, and the important Naval base at Rosyth, with its great dry-dock and repair basin, was in great demand. Rosyth lies quite near the northern extremity of the Forth Bridge and its great hammerhead cranes and forests of masts and funnels are to be seen on the landward side from trains crossing in a northerly direction.

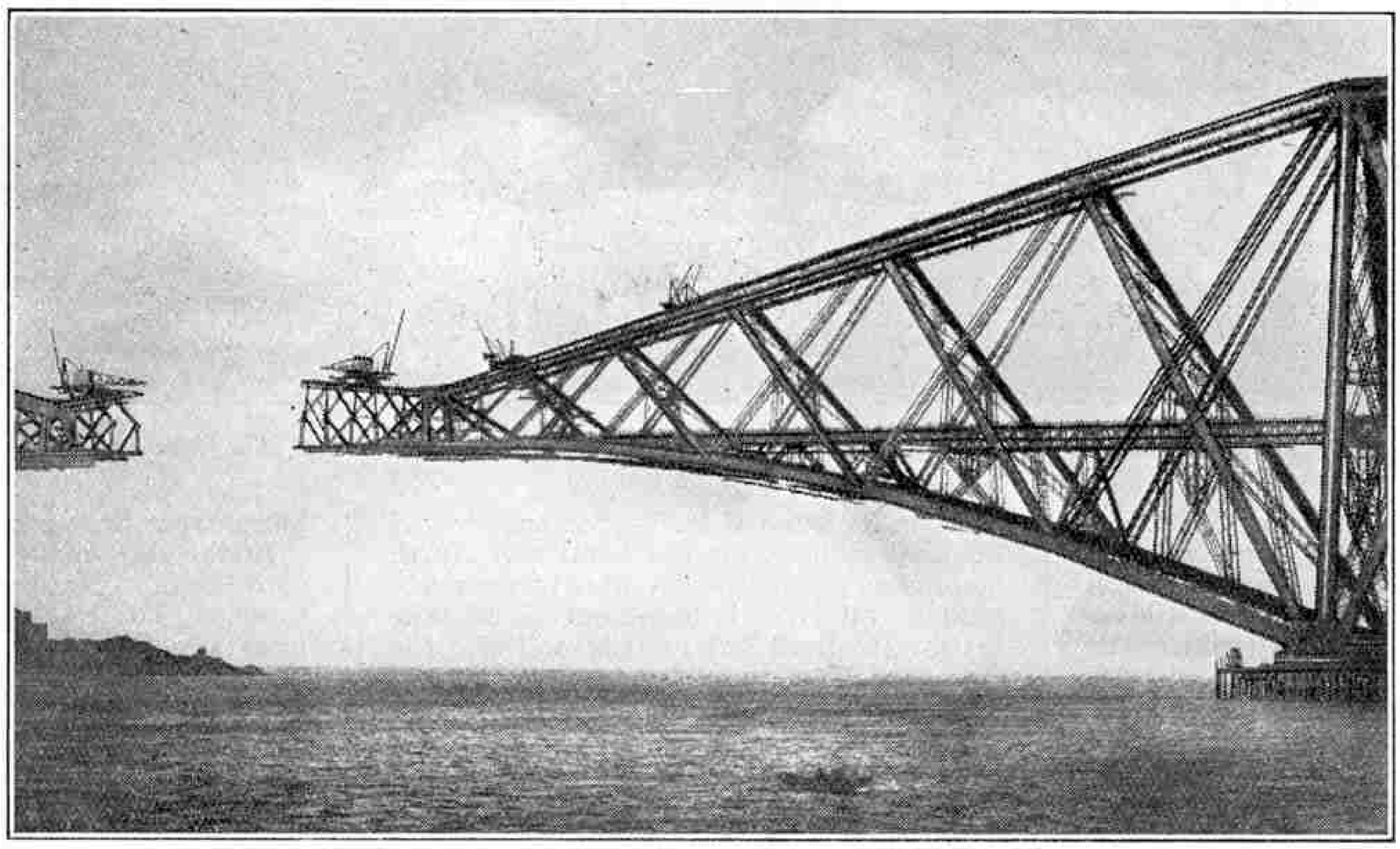
A large fleet of destroyers and various auxiliary craft had a base at Port Edgar, which adjoins South Queensferry at the south end of the bridge. As both Port Edgar and Rosyth are higher up the Forth than the bridge, it will be seen readily that the destruction of the bridge would have been a great disaster.

Elaborate steps were taken to protect the bridge from submarine attacks and the defences were not complete until the middle of 1917. Powerfully-armed forts were established on the north and south shores, and also upon Inchgarvie and other islands in the estuary. An extensive layout of steel-meshed nets prevented any raiding submarines from entering the Forth except by one or two narrow channels, which were constantly patrolled by destroyers and swift motor craft. One U-boat made a very daring attempt to reach the bridge, but when almost at her goal she fell a victim to the nets and was dealt with by the patrols. Danger from the air was considerable, but only one extensive raid developed and fortunately the bridge escaped damage.

The Bridge seen from the Railway

When actually crossing the bridge it is difficult to form an adequate impression of its huge proportions, and perhaps this is done most readily by looking upward from the carriage window to the giant super-structure towering above. If a great warship happens to be passing up the Forth at the time it also serves to help one's sense of proportion.

Leaving the bridge at the northern end the train plunges through a series of tunnels in the solid rock and descends steeply towards the junction for Dunfermline. During this run along the Fife coast the train remains for many miles in view of the bridge it has recently crossed, and some extremely picturesque glimpses are obtained of its massive and yet graceful proportions as seen from varying angles.



Building out the Central Girder to connect with Cantilever

The Story of Railway Signalling—

(*Continued from page* 669)

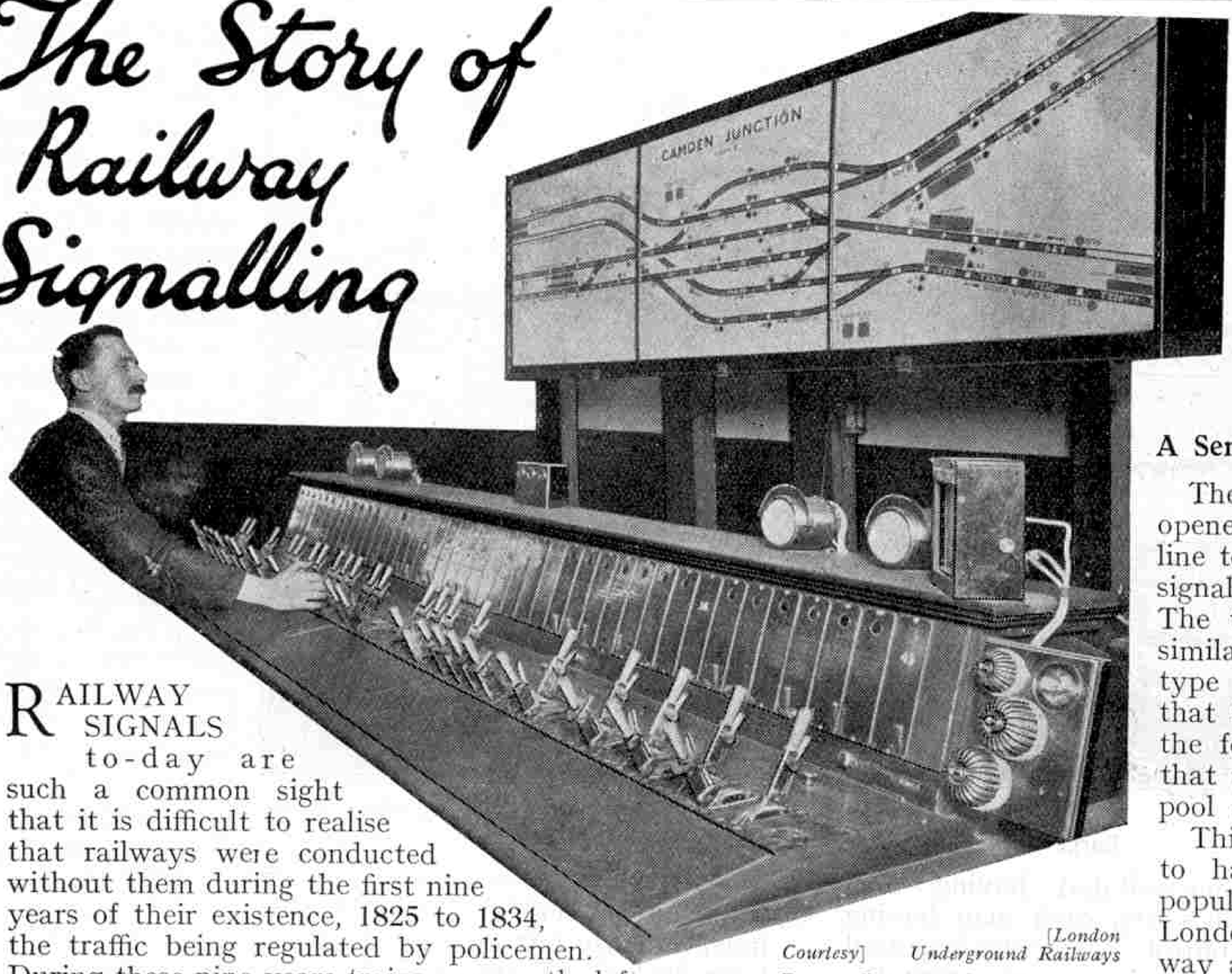
catch by the side of the line striking a trigger on the train and actuating the brake apparatus.

On some lines a three-aspect colour-light is installed, the third aspect showing whether the next signal ahead is at "clear" or "danger." An even later development is four-aspect signalling, which is now being installed on the electrified sections of the Southern Railway. The indications are as follows:—Red, "Danger, stop"; Yellow, "Caution, next signal shows 'Danger'"; Double Yellow, "Caution, next signal shows 'Caution'"; and Green indicating that the track is clear for at least two sections ahead.

Another development of automatic signalling is the automatic operation of points. This method was first used at a terminal station on the Mersey Railway. When a train arrives at the platform it operates the apparatus, but the actual movement of the points does not take place until 30 seconds have elapsed. Thus, if the train should happen to over-run the platform it would enter a siding, and not cross over to the departure line where another train might be standing.

With these and other improvements in automatic train control it is possible to secure the most intensive train service not only without any increase in danger to the travelling public, but actually with a great decrease, owing to the elimination of the human factor in the various operations.

The Story of Railway Signalling



Courtesy [*London Underground Railways*

Power Interlocking Frame, Camden Town Signal Cabin

RAILWAY SIGNALS to-day are such a common sight that it is difficult to realise that railways were conducted without them during the first nine years of their existence, 1825 to 1834, the traffic being regulated by policemen. During these nine years trains apparently left the stations when they were ready to do so, quite irrespective of whether the line ahead was clear or not. This naturally led to complications on single track, and it was by no means an uncommon event for two trains to come to a standstill and remain there with the locos facing one another while the drivers had a fight to settle the argument as to which train must go back to the loop line!

The First Signal

In 1834 the Liverpool and Manchester Railway introduced the first form of fixed signal. This consisted of a red flag stretched on a wooden frame fixed on a vertical rod that was pivoted on bearings on the signal post. At the bottom of the post there was a handle by means of which the flag could be turned either to face the driver, indicating "danger," or to be parallel with the track, indicating "line clear." It is obvious that when the flag was parallel with the track it would be practically invisible to the driver of an approaching train, so that the system really amounted to a permit to keep on going until the flag was seen across the track.

Soon afterward Edward Woods invented an improved type, employing a wooden board painted red in place of the red flag. The fixed portion of the signal post in this case was a hollow tube something like a lamp post, through which passed the revolving spindle carrying the board. A slot was cut in the tube to the bottom to allow a handle to be attached to the spindle in order to rotate the board, and lamps were added to show the state of the road at night. Later a fixed projecting board was fitted to one side of the post so that the signal would be noticeable when in the "off" position.

The early forms of signal evidently did not give satisfaction, for we find that many new types were introduced within a very short period. A unique signal was designed by the Great Western Railway in 1837. This consisted of a fixed upright post provided at the top with carrying pulleys. A cord passed round these pulleys and by this means a ball was hoisted to the top of the post to indicate "line clear" and lowered to indicate "danger."

A Semicircular Signal

The Grand Junction Railway, opened in 1838, was the first line to be properly equipped with signals from its commencement. The type of signal adopted was similar to the revolving board type already described, except that in this case the board took the form of a semicircle, a type that was used also on the Liverpool and Manchester Railway.

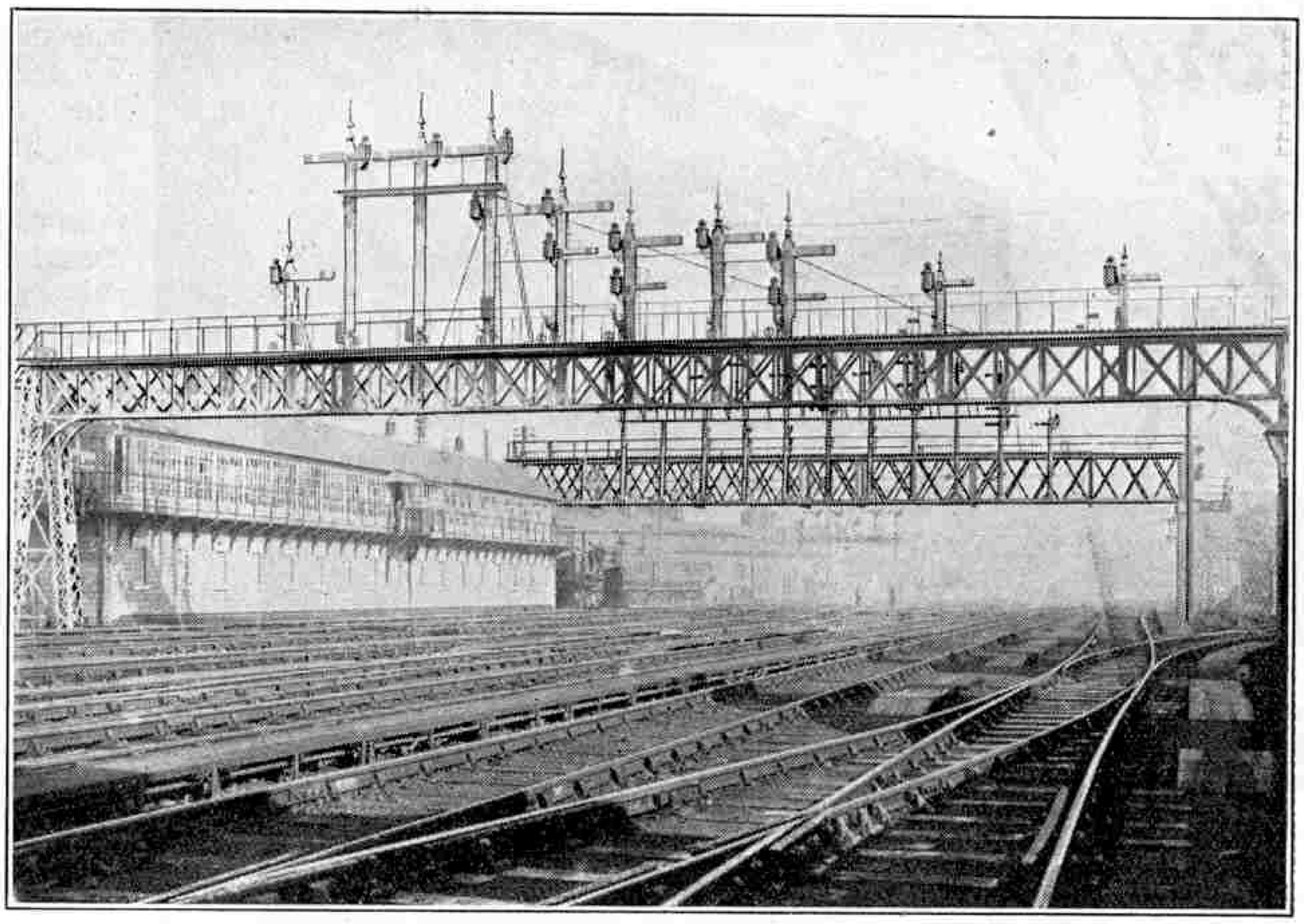
This semicircular signal appears to have met with considerable popularity for we find that the London and South Western Railway adopted a modification of it two years later. The alterations from the old type were designed to promote economy, for one instrument signalled both running tracks at the same time. It consisted of a ring of iron, half of which was filled in with tin or canvas and the other half left hollow. Thus there was a semicircle of tin and a semicircle of "space." The whole was pivoted on the centre of the circle and normally fixed facing along the line. The closed part was turned to the left when the left-hand line only was blocked, to the right when the right-hand line was blocked, and to the top when both lines were blocked. To indicate that both lines were clear the whole disc was turned through a right-angle so that its edge was presented to trains approaching from both directions.

The disc type of signal evidently proved too complicated for everyday use and in the next year a new pattern was introduced on the same railway. This model consisted of a disc fixed on the upper end of an upright rotatable rod, which also carried a cross-bar below the disc and at right angles to it. When the disc was facing an on-coming train, only the edge of the cross-bar was visible and "line-clear" was indicated. When the rod was turned through an angle of 90 degrees only the edge of the disc could be seen and the cross-bar was visible, a position that indicated "danger." This form of signal was used on the G.W.R. for many years but was eventually superseded by the semaphore type.

The Semaphore Signal

The first semaphore signal was erected by Sir C. H. Gregory in 1841 at New Cross on the London and Croydon Railway. It consisted of a wooden post with a slot at the upper end in which were pivoted two arms, one to control each line of track. Each arm was attached to a pulley operated by a lever attached to its axle. When an arm was horizontal it indicated "danger"; when inclined downward at an angle of

45 degrees "caution;" and when allowed to fall down and disappear in the slot of the post, "line clear." The ropes were replaced later by rods and levers and, by providing the arm with counterweights, provision was made for returning the signal to the danger position automatically should any connection give way.



Courtesy] [Westinghouse Brake & Saxby Signal Co. Ltd.

Large Gantry carrying Mechanically Operated Signals

Signal Control from Cabins

All the signals so far described were operated by levers fixed to the signal post itself. This necessitated having men stationed at the foot of the posts, each man having one or two posts under his control. As traffic increased at junctions it was found very inconvenient for the signalmen to have to walk to each signal when it became necessary to move the arm.

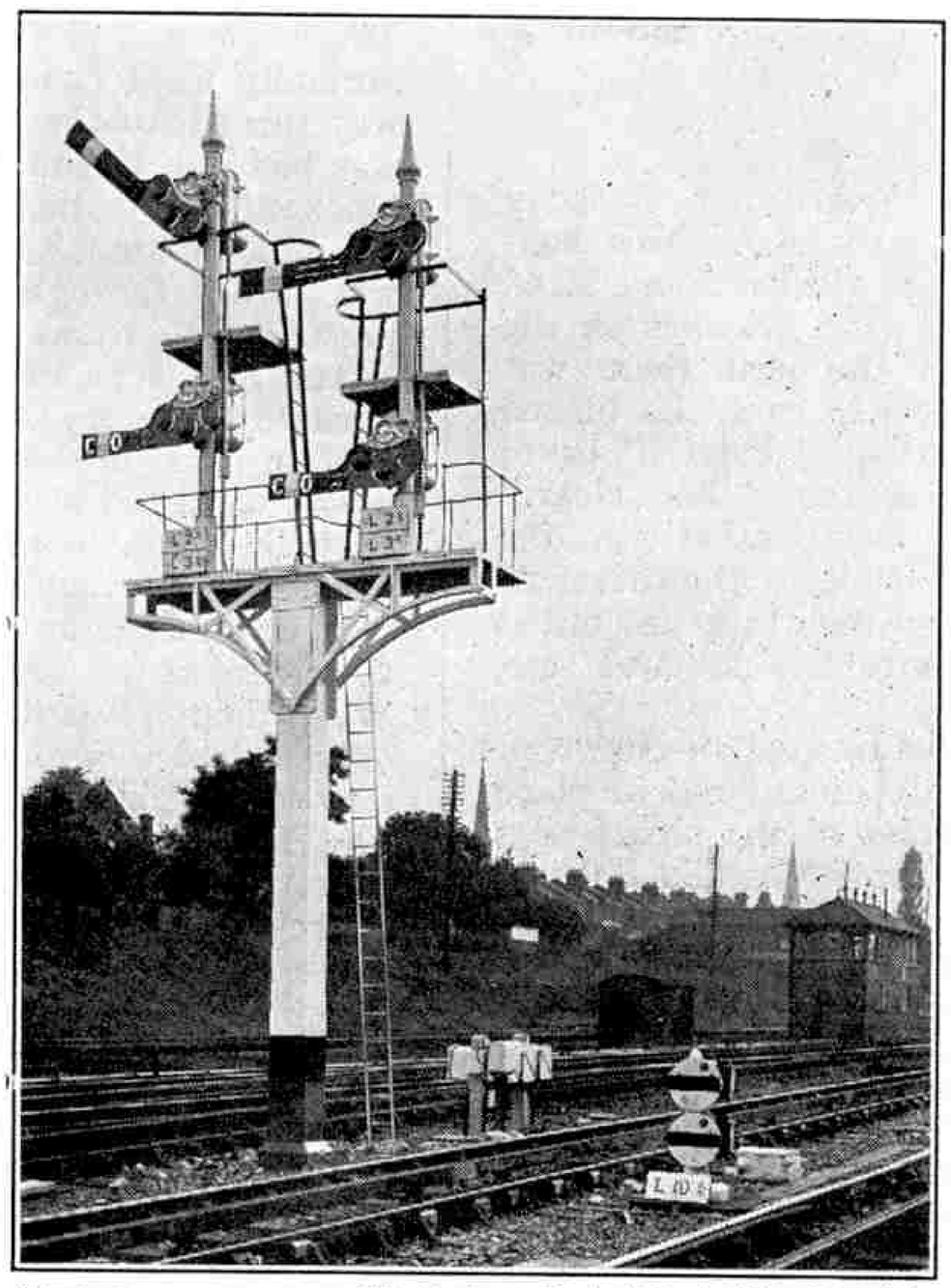
Sir C. H. Gregory followed up his invention of the semaphore signal by producing the first machine for operating several signals and points from one place. In 1843 he demonstrated the practical value of his invention by working the signals and points at the Bricklayers' Arms junction on the Croydon Railway from one frame of levers. The signals were connected to the levers in the frame by chains passing round pulleys. The levers were also provided with an attachment that made it impossible to lower two signals at the same time when these signals would be for trains crossing or otherwise fouling one another.

With the coming of Gregory's semaphore signal and operating frame, out of which has developed the whole signalling equipment of to-day, the requirements of railways appear to have been satisfied for a considerable time, for it is not until 1856 that we find any further attempts to make improvements.

Interlocking

Gregory's frame, while preventing conflicting signals from being lowered, did nothing to ensure the points being set before the signals were pulled to the "line clear" position. It soon became apparent that in order to ensure safety at junctions it was essential that the signals and points should be so interlocked as to make conflicting settings impossible.

The first attempt to provide a lever frame to supply this need was made in 1856 by J. Saxby, who connected the point and signal levers to work together. This method did not prove satisfactory however, and it was left to A. Chambers to produce in 1860 the first frame on the modern system, in which the levers moved independently but the movement of one point or signal lever locked all other conflicting levers. This frame also required that the points should be set before the corresponding signal could be lowered. Ten years later Messrs. J. J., J. J. F., and W. A. Stevens patented a locking mechanism employing tappets, a system that has remained in use until the present time and which has practically superseded all others.



Courtesy] [Westinghouse Brake & Saxby Signal Co. Ltd.

Three-Position Upper Quadrant Semaphore Signals

Tappet System

A detailed description of an interlocking frame is beyond the scope of this article, but it may be explained that the movement of a signal or point lever moves a tappet or sliding bar of metal to which it is attached. This in turn moves appropriate "dogs" that engage in notches in the tappets belonging to those point and signal levers that the movement of the first lever necessitates should be locked. The locked signals remain locked until the first lever is returned to its original position. This method of interlocking also makes it necessary for the levers to be set and returned in the proper order. For example, the points must be set before the signals are lowered and conversely the signals must be returned to "danger" before the point levers become unlocked.

The semaphore is now the most popular signal throughout the world and is used with

various modifications to adapt it for certain special purposes, for all types of signalling. There are "home" signal arms, "distant" arms with a v-shaped piece cut from the outer end, goods signals, dwarf signals, ground signals for shunting, and so on. In certain countries disc and other signals are still popular. The unusual types used in France and Switzerland were described and illustrated in the July *"M.M."*

The first semaphore signals had three positions, but after a time the two-position signal came into general use. It is interesting to note, however, that the three-position signal in an improved form has been reintroduced during recent years, but is not in general use. A detailed description of the modern semaphore signal and how it is operated was given in the *"M.M."* for December last.

Courtesy] [*Westinghouse Brake and Saxby Signal Co. Ltd.*

Three-Position Day Colour Light Signal

Modern Improvements

During the past 45 years considerable improvements have been made in the details of operating signals and points. At large stations the levers in the signal cabins are often merely electric switches controlling pneumatic apparatus near the individual signals and points. In this manner the work of the signalman is rendered much less arduous, and in addition considerable space is saved on the permanent way since there are no point rods or signal wires to provide for, electric wires being the only connection between the signal cabin and the apparatus.

Every signal cabin is in telegraphic and telephonic communication with the adjacent cabins. Communications between signalmen are chiefly made by means of a code of bell signals, which was explained in our January issue.

Automatic Signalling

The enormous growth of railway traffic during recent years has made it necessary to speed up the movement of trains while still keeping within safe limits. On certain sections of various lines the ordinary method of signalling by means of box-to-box communication does not allow a sufficient number of trains to be passed through during the rush hours of the day. In many cases on such sections of line steam traction has been superseded by electric traction and this change, together with the introduction of automatic signalling, has resulted in the necessary speeding-up.

For the purpose of automatic signalling the line is divided into sections, each of which is "track-circuited" and controls an automatic signal. The rails are insulated and are made electrically continuous by means of "bonding" wires, which join the end of one rail to the end of the next. At one end of the section the two running rails are connected up to a "track-circuit relay," which is really the signal controlling apparatus.

The necessary electric current is applied at the other end of the section and before reaching the rails it passes through an "impedance," which controls its flow. The current then flows along one running rail and through the relay, and returns by way of the other running rail. So long as the relay is energised by the current passing through it the signal is held at the "clear" position. When a train enters the section, however, its wheels and axles make a connection between the two running rails, and as this path offers less resistance than the relay, most of the current passes through it. Thus the relay no longer receives sufficient current to keep it energised and therefore its contacts open, thus moving the signal to "danger." As soon as the train passes out of the section the relay again receives its full amount of current and moves the signal to "clear," ready for the next train.

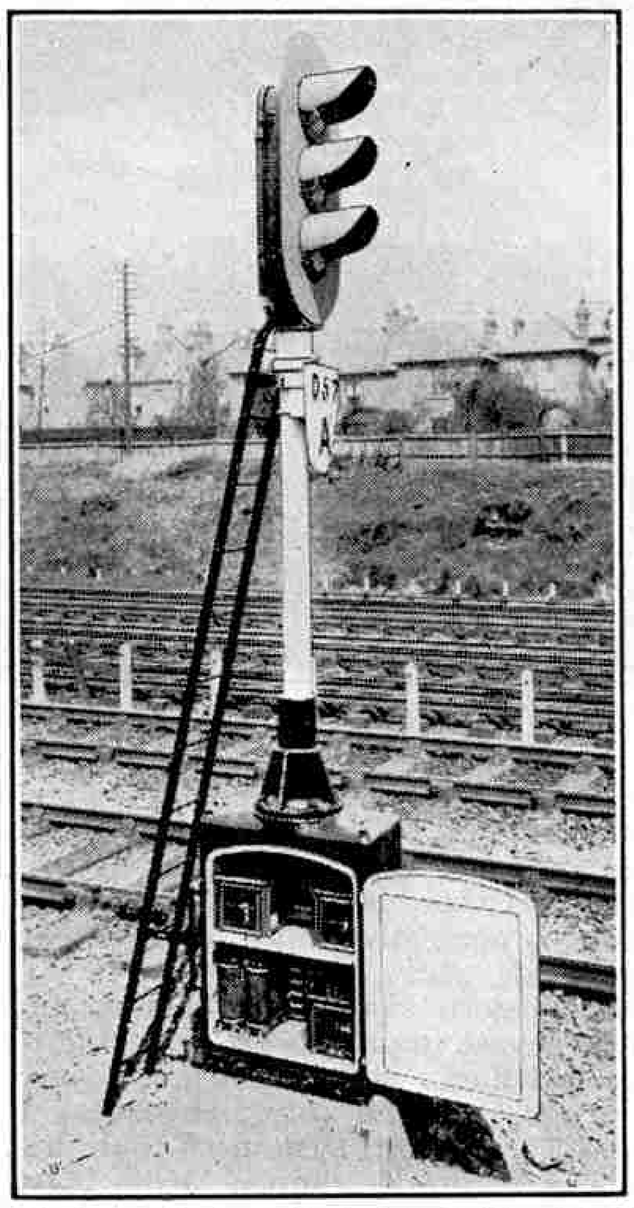
Semaphore and "Colour Light"

Two main types of automatic signals are now in use, the "semaphore" and the "colour light." The former type was introduced by the London and South Western Railway in 1902, and a section of the line at Grately was equipped with automatic signals of the "lower quadrant" type, in which the signal arms are horizontal for "danger" and drop 45 degrees to show "clear."

In 1909 the Metropolitan Railway introduced the "upper quadrant" type of signal, the first being installed at Aldgate. In this type the signal arm points upward at an angle of 45 degrees to indicate "clear," so that in the event of any failure of the apparatus the arm would immediately drop to a horizontal position, thus signifying "danger." Another advantage of the "upper quadrant" signal is that it gives a much clearer indication to the drivers than the "lower quadrant" type.

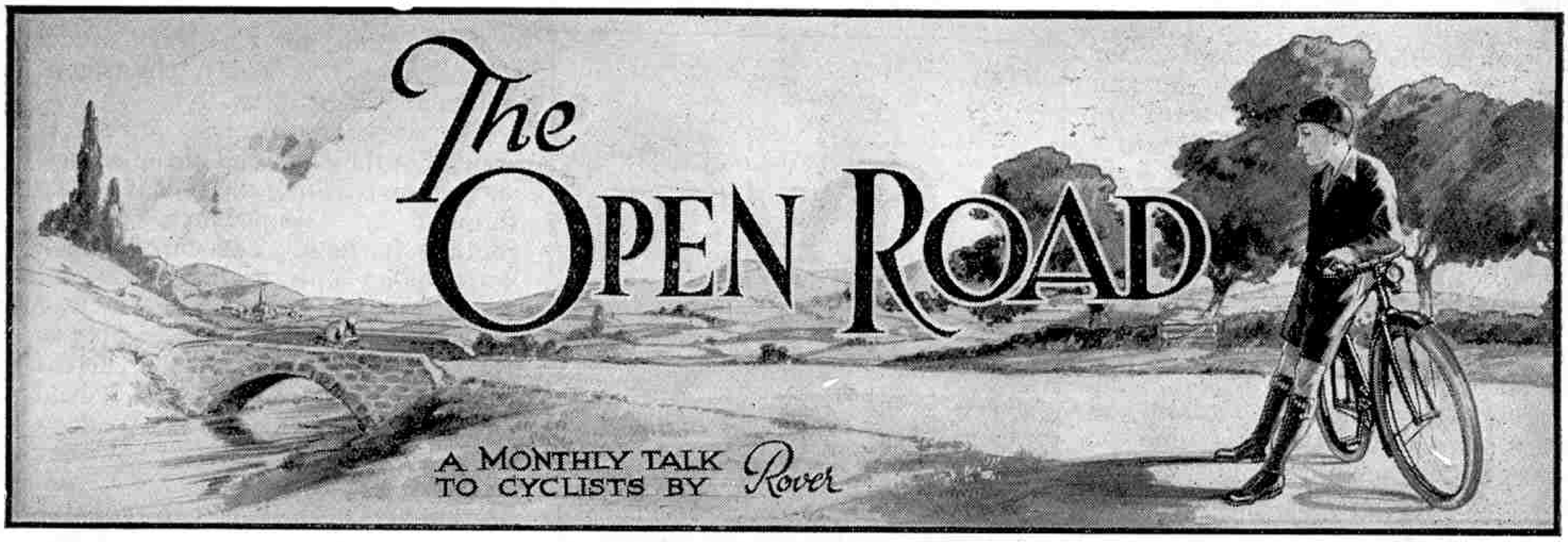
Colour-light signals are used principally in tunnels and other places where daylight does not penetrate, but they are rapidly coming into use for daylight signalling also. If the lamps are shaded they are visible at great distances, even in strong sunlight. The latest colour-light signals on the Metropolitan Railway are visible at 1,000 yards during daylight, and at a still greater distance at night. The lamp consists of an iron case with red and green lenses and sometimes also a yellow lens. Behind these lenses are the lamps proper. If a train were to attempt to pass a signal at "danger" it would be stopped by means of a trip

(*Continued on page* 666)



Courtesy] [*Westinghouse Brake & Saxby Signal Co. Ltd.*

Side View of above Signal showing Apparatus Box Open



VI. TOUR IN SOMERSET AND DEVON: TORQUAY

NOW we are past the danger point and can enjoy the remaining part in comfort, and this brings us, as you see, into Sidmouth. It is rather early for lunch so we will spend a little while on the beach. Just look at those cliffs with their deep red, splashed here and there with green foliage. They make a picture by themselves, to say nothing of the sea with its long line of surf breaking on those beautiful pebbles.

As usual there is a long pull out, in this instance a very gradual one. This road, although so close to the sea, has not the bare appearance of the village coast road, but takes us through luxuriant country, and incidentally close by the village of Hayes Barton, the birthplace of Sir Walter Raleigh.

Here, too, is Budleigh Salterton, a charming little place for a quiet holiday or for a "rest cure."

And now we arrive at the outskirts of Exmouth, and a little caution is required as cross roads seem to occur every few yards. We have to assume that someone is about to dash across our path, and shape our tactics accordingly. Entering a main road from a side road is comparatively easy when you wish to turn to the left. It is then merely a case of keeping to your own side when rounding the corner and watching your opportunity to take up a position in the stream of traffic. When you wish to turn to the right, however, it is a far more difficult matter. Always remember that traffic along a main road takes precedence over traffic along side roads. If there is a policeman, or if in the country an "A.A." scout on point duty, wait until he gives you the signal to cross over; if there is no one on duty slow down, or even stop until you are satisfied that all is clear. Do not in any circumstances "cut off" the corner but keep well over to the left, not forgetting to put out your hand to warn traffic behind you that you are about to turn.

Most accidents are the result of inexperience or carelessness. In order to provide every possible safeguard the authorities have placed various signs at most of the danger points and the cyclist no less than the motorist should treat them with respect. The familiar red triangle sign gives clear warning of danger of some kind and this warning should never be ignored. Other warning signs indicate double corners, steep hills, level crossings, cross roads, etc.

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

Torquay

The modern signpost indicating direction is a vast improvement upon the old-fashioned finger post which, not so many years ago, was the only signpost on the road. The modern system of route numbers is wonderfully simple. Knowing the number of his route the cyclist or motorist has no difficulty in finding his way through unfamiliar places by means of the road direction posts, each of which carries at the extremity of its arm its own particular route number. Places indicated on the signs may be quite unfamiliar, but so long as the traveller sees his route number there he knows he is on the right track.

Having had tea, the next thing is to have a look round Exmouth, which is admirably situated for the holiday maker. We are now looking over the estuary of the Exe, and no doubt you are wondering how we shall get across. According to the map Dawlish is immediately opposite. If you look carefully you will notice that a long stretch of sands comes towards us, nearly blocking up the mouth of the river. So when we have seen all we want here we will cross in a small boat to that sandbank, which is known as "The Warren," and then ride or walk by the waterside into Dawlish.

Our blue-jerseyed friends have brought us across in fine style and the sea breeze will make our walk quite invigorating. Here we have a splendid view looking back into Exmouth with the famous Powderham Woods at the back. Then there are splendid views up the Exe and again on the Dawlish side. We seem to be very favourably placed on this flat strip of sand, insignificant though it may look. Notice the celebrated "Parson and Clerk" rocks at Dawlish. They are like immense statues, rather crude, of course, but very impressive. Then look at the beautiful colouring. The deep red we admired in the soil as we came along looks even better here on these rocks with the sea in the foreground. This brings us to the G.W.R. station of Dawlish Warren. The railway runs for a considerable distance alongside the waterside and the passengers get a foretaste of this lovely part

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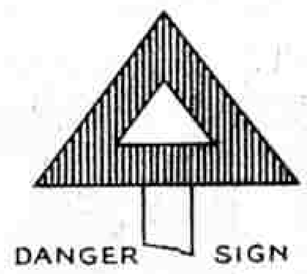
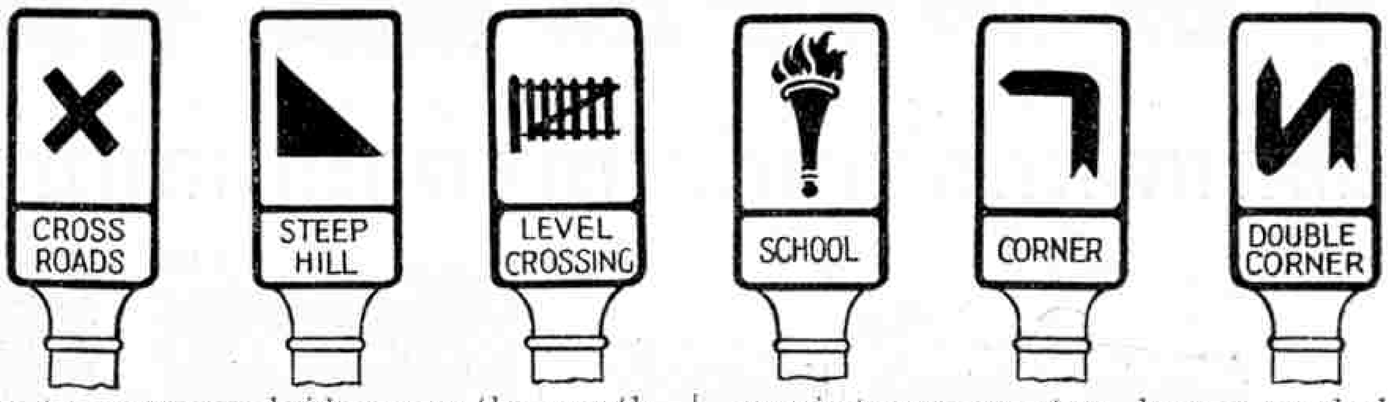
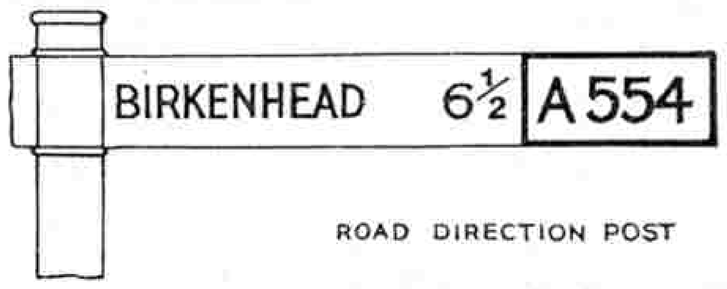
of our coast, to which they probably are coming for their holidays.

Here is Dawlish and quite a bright little town it is too. We will explore it for a little while and then proceed to Teignmouth. Only three miles separate these two towns and but for the great rock where the "Parson and Clerk" keep vigil unceasingly, they probably would be linked together.

Now we must tackle the remaining seven miles into Torquay. You will see that we have to go over a bridge over the mouth of the Teign. This is a toll bridge and formerly used to be a wooden structure nearly one-third of a mile long. I am told that the inhabitants of Newton Abbot, five or six miles further up the river, do not look very favourably upon this bridge, for it is not high enough to allow a big vessel to pass beneath it, and therefore shipping development is not possible.







ROAD DIRECTION POST

We have become quite used by now to having the sea on our left. It has been quite a long day "at the seaside," but what a difference from the meaning generally given to those words! Instead of one seaside place, where very often a single day is wearying, we have visited no less than six well-known holiday resorts, besides enjoying runs through admirable country in between. The only trouble has been that we couldn't stop long enough at each place.

This brings us to Torquay, the outward terminus of our ride and one of the most beautiful of British seaside towns. We have had a full day's ride and I expect you are feeling pretty tired, so we will repair to our quarters, have a good clean up, supper, a short stroll and then bed. To-morrow I shall turn you out early in the morning for a swim before breakfast from one of the most delightful beaches round the coast.

* * *

And here we will bid farewell to our cyclists, contenting ourselves with stating that, after spending a couple of days in exploring Torquay and the wonderful beauties of the neighbouring coast, they set out upon their return journey, covering almost the same ground as on the outward trip. In due course they arrived home, tired but happy, and firmly resolved to have another cycling tour next year.

Electricity—(*continued from page* 631)

inventor Thomas Alva Edison was experimenting on similar lines. Edison was born in 1847 at Milan, Ohio, U.S.A. From his earliest boyhood he longed to become an inventor, and whenever he saw any article or mechanism that he thought might be improved he promptly set about trying to devise something to do the work more efficiently.

When Edison was seven years old his parents moved to Port Huron, Michigan, and his first employment was that of newsboy on a local train. While engaged upon this work he set up a printing press and an experimental laboratory in a small compartment of the train. By the aid of his press he printed sheets giving the latest news, and these sheets he sold to passengers on the train at quite a good profit. His career in this direction came to an abrupt termination, however, owing to the fall of a bottle of phosphorus, which set his laboratory on fire. The conductor of the train had been worried for a long time by the uncanny smells that arose from Edison's den and he promptly took the opportunity to dump the boy and his belongings on a wayside platform!

Dodging the Regulations

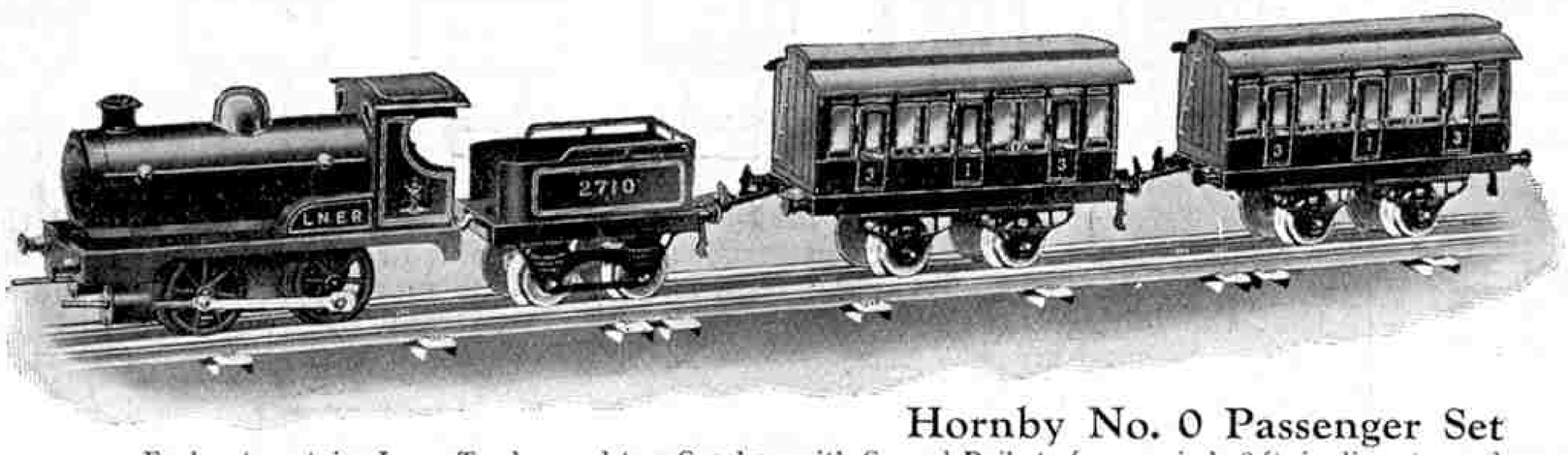
Edison next learned telegraphy and obtained a post as night operator. The local manager was a very keen disciplinarian, and with the object of ensuring that the operators did not fall asleep during the night he required them to report the word "six" every half-hour. This rule annoyed Edison, and it was not long before he found means of circumventing it by rigging up a clockwork apparatus that automatically transmitted the required word at regular half-hourly intervals.

Some years later, after his telegraphic and other inventions had brought him fame, Edison turned his attention to the invention of an improved telephone transmitter. Bell used the same instrument both as transmitter and receiver. As a receiver it was excellent, but the currents generated by it were so small that it was of little use as a transmitter. Edison produced a transmitter in which the vibrations of the voice actuated a mica diaphragm, thus causing it to press with greater or less force upon a disc of carbon in the circuit. These varying pressures caused the carbon disc to vary its resistance to a current accordingly, and this varying current set up corresponding vibrations in the diaphragm of a receiver of the Bell type. Without the microphone transmitter the telephone could not have reached its present wonderful development.

The term "microphone" was first used by Wheatstone in 1827 to describe an apparatus to increase the loudness of extremely feeble sounds.

Next month we shall describe the working of the telephonic apparatus of both Bell and Edison, and trace the growth of telephony to the present day.

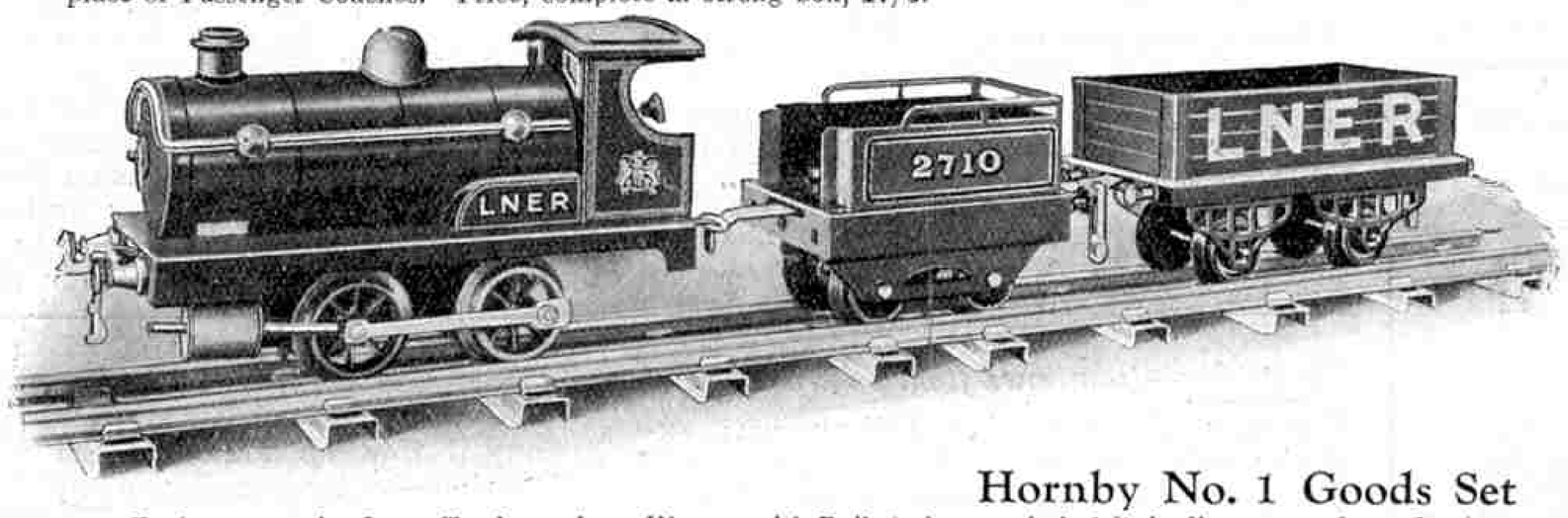
HORNBY TR



Hornby No. 0 Passenger Set

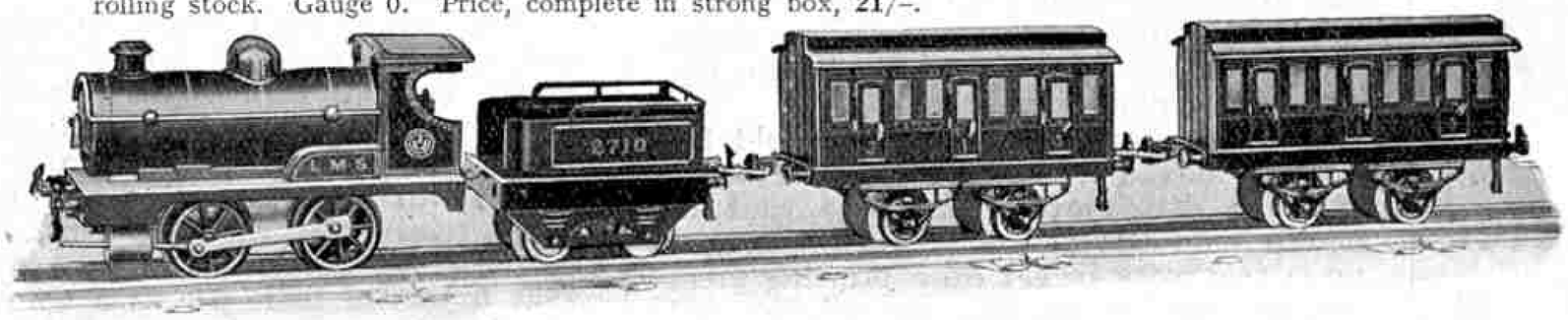
Each set contains Loco, Tender, and two Coaches, with Curved Rails to form a circle 2 ft. in diameter and two Straight Rails. One of the Curved Rails carries a brake by means of which the train may be stopped from the track. The Loco is fitted with brake and governor; non-reversing. Gauge 0, in colours to represent L.M.S. or L.N.E.R. rolling stock. Price, complete in strong box, **24/–**.

HORNBY No. 0 GOODS SET. This set is similar to the No. 0 Passenger Train but contains one Wagon in place of Passenger Coaches. Price, complete in strong box, **17/6**.



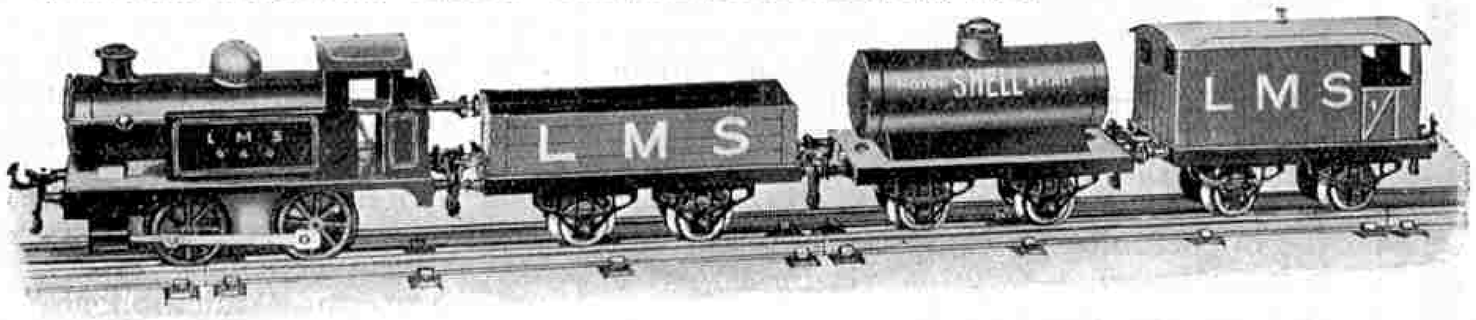
Hornby No. 1 Goods Set

Each set contains Loco, Tender and one Wagon, with Rails to form a circle 2 ft. in diameter and two Straight Rails. One of the Curved Rails is fitted with a brake by means of which the train may be stopped from the track. The Loco is equipped with reversing gear, brake and governor. In colours to represent L.M.S. or L.N.E.R. rolling stock. Gauge 0. Price, complete in strong box, **21/–**.



Hornby No. 1 Passenger Set

The set comprises Loco, Tender, two Passenger Coaches, and Rails to form a circle 2 ft. in diameter (including one Brake Rail by means of which the train may be stopped from the track) and two Straight Rails. The Loco is fitted with reversing gear, brake and governor: the doors of the coaches open. In colours to represent L.M.S. or L.N.E.R. rolling stock. Gauge 0. Price, complete in strong box, **27/6**.



Hornby No. 1 Tank Goods Set

This set contains a No. 1 Hornby Tank Loco, Hornby Wagon, Petrol Tank Wagon, Brake Van and set of Rails to form a circle 2 ft. in diameter, and two Straight Rails. The Loco is fitted with brake, which may be operated by a lever in the cab or from the track, reversing gear and governor. Gauge 0.

In colours to represent the L.M.S. or L.N.E. Railway rolling stock. Price, complete in strong box, **25/–**.

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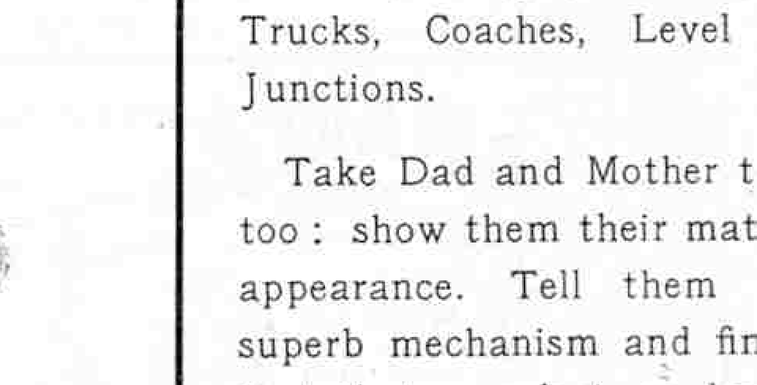

Each No. 00 Clockwork Train set is n... Rails to form a circle 2 ft. in diameter, a... commencing sets for the boy who wishes ... and those fortunate boys who already poss... admirably suitable for use as additional "... strongly built and fitted with reliable cloc...

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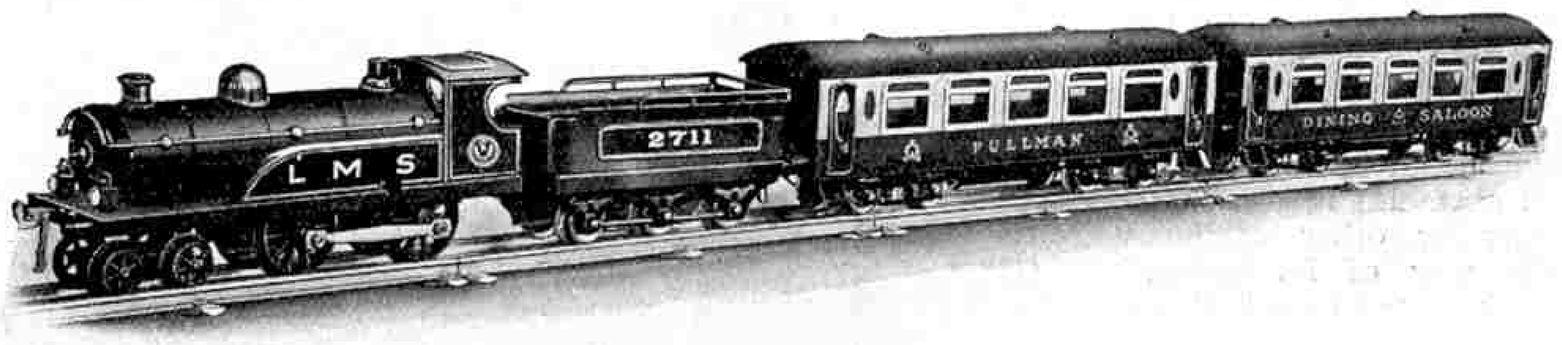
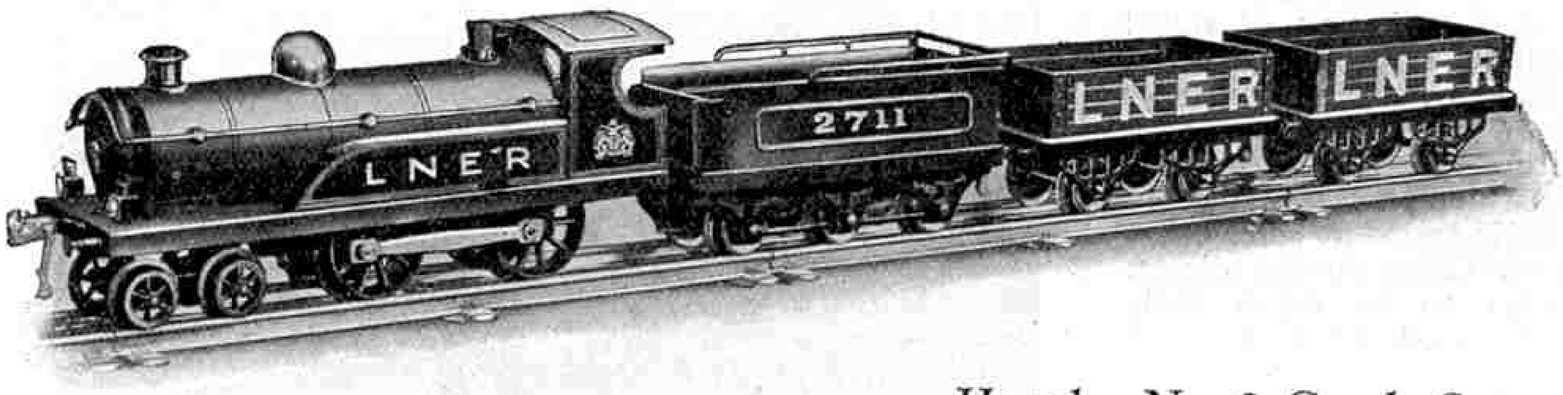


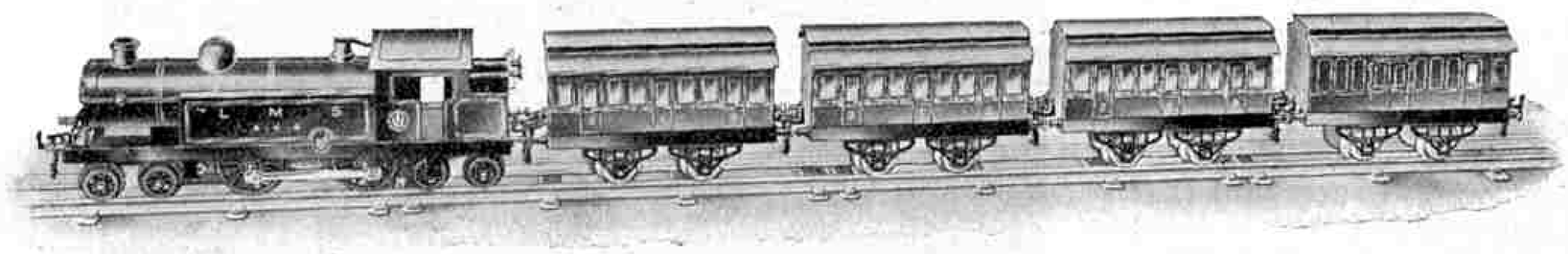
Hornby No. 2 Pullman Set

The Loco with Tender in this set measures 17 in. in length. A superior mechanism has been adopted, making it the most attractive and satisfactory clockwork train yet produced. The Coaches are beautiful both in colour and finish. Each Set includes Loco, Tender, and two Pullman Coaches, with Set of Rails to form a circle 4 ft. in diameter. The rails include one Brake Rail by means of which the train may be both braked and reversed from the track. In colours to represent the L.M.S. or L.N.E.R. Companies' rolling stock. The Loco is fitted with reversing gear, brake and governor. Gauge 0. Price, complete in strong box, **60/–**.



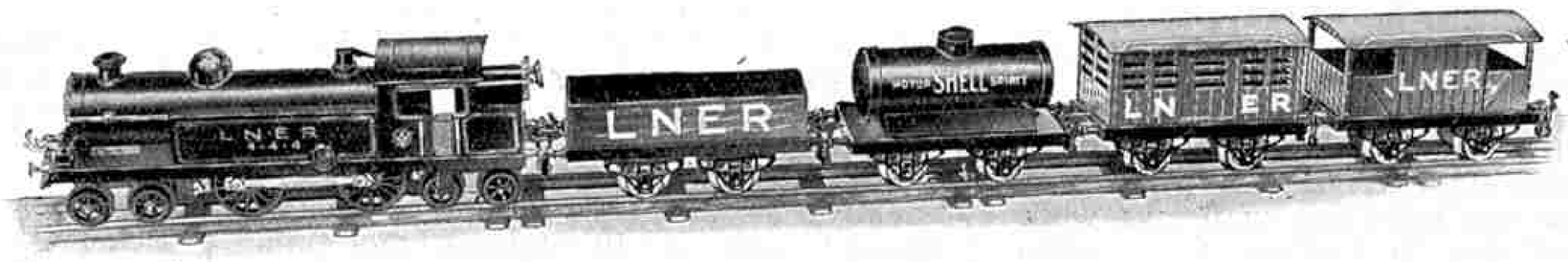
Hornby No. 2 Goods Set

The Loco, Tender and Rails of this set are similar to those in the No. 2 Pullman, but two Wagons take the place of the Coaches. As in all other No. 2 Hornby Trains, the Loco may be both braked or reversed from the track. The Loco and Tender are enamelled in black only, and lettered L.M.S. or L.N.E.R. Gauge 0. Price, complete in strong box, **37/6**.



Hornby No. 2 Tank Passenger Set

This set contains a No. 2 Hornby Tank Loco, three Passenger Coaches, Guard's Van, and set of Rails to form a circle 4 ft. in diameter. One of the Rails is fitted with levers by means of which the Loco may be both braked and reversed from the track. Gauge 0, in colours to represent the L.M.S. or L.N.E. Railway Companies' rolling stock. Price, complete in strong box, **45/–**.

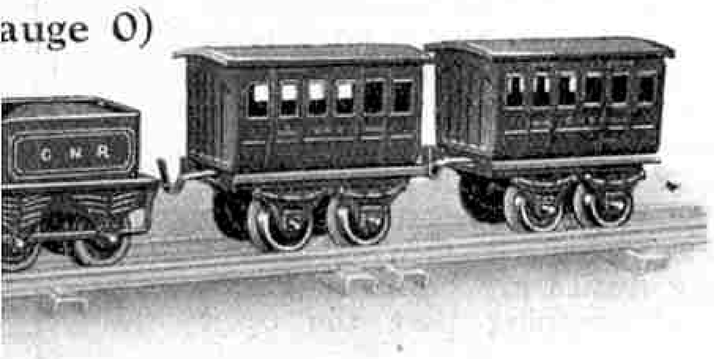


Hornby No. 2 Tank Goods Set

The rolling stock of this realistic goods train consists of a No. 2 Tank Loco, Hornby Wagon, Petrol Tank Wagon, No. 1 Cattle Truck, and Brake Van. The Loco may be braked and reversed from the track—which forms a circle 4 ft. in diameter—or from levers in the cab. The No. 2 Hornby Tank Loco is 11½ in. in length and is fitted with leading and trailing four-wheeled bogies. Gauge 0, in colours to represent the L.M.S. or L.N.E. Railway Companies' rolling stock. Price, complete in strong box, **45/–**.

WORK TRAINS

auge 0)



is now supplied complete with set of Curved r, and two Straight Rails. They form ideal shes to build up a model railway gradually, possess more elaborate railways will find them ial "suburban" rolling stock, etc. They are clockwork mechanism.

and two Passenger Coaches, with set of Rails ted with brake and regulator, non-reversing. d, or L.N.W. Railway rolling stock. Price, rice **6/6**. Coach, Price **1/–**. Tender, Price **9d.**

ED, BINNS ROAD, LIVERPOOL

The Travelling Post Office

How Mails are Handled by the Railway

THE conveyance of H.M. Mails by railway began with the opening of the first passenger services on the Liverpool and Manchester Railway on 14th September 1830. Mails were then carried four times daily in each direction.

As new railways were opened, the Post Office made use of them for this purpose, but in 1838 a Bill was introduced into Parliament proposing to give power to the Post Office to run its own trains on any line without payment of toll. This Bill laid down that the Post Office "shall have power to remove all obstacles in the shape of passenger or other carriages out of the way of its trains," and penalties were to be inflicted on any railway servants impeding the Post Office officials, while railway plant and staff were to be at all times at the absolute disposal of the Department. The companies were to receive scant recompense for all this disturbance, for the Bill proposed that they should be remunerated only for the wear and tear of rails!

The Bill aroused vigorous opposition and was subsequently modified to such an extent that the resulting Act merely ordered the railway companies to convey mails in their trains at such hours as the Post Office should direct, remuneration to be on a scale previously agreed upon between the parties.

First Travelling Post Office

The first Travelling Post Office ran on the Grand Junction Railway between Liverpool and Birmingham in 1838. On 6th January of that year a sorting-carriage, consisting of a horsebox temporarily fitted up, was run between the two cities, and the experiment was so successful that on 19th June 1838 it was decided to make the Travelling Post Office permanent. When through rail communication was made between London, Manchester and Liverpool, in September of the same year, a Travelling Post Office—or T.P.O. as these vehicles have always been called on the line—became a component part of the mail trains.

The first permanent sorting-carriage was built by the Grand Junction Railway Company. Its exterior was fitted with apparatus for collecting mail-bags while the train was in motion, this system having been devised by Mr. John Ramsey, an officer of the Missing Letter Branch of the G.P.O.

Improvements in Apparatus

Many postal reforms took place about 1840, and Mr. Hardwicke, the architect of Euston Station, demonstrated another apparatus for picking up the mail bags en route. At this period the mail-bags to be left by the train were simply dropped at the side of the line, presumably without much advantage to the contents! The T.P.O. was then a four-wheeled vehicle 16 ft. in length, 7½ ft. in breadth and 6 ft. in height, and was fitted up as a sorting room. Lancaster was the northern terminus of the mail train, the distance of 241 miles being covered in 9¼ hours, exclusive of stops. At ten stages en route the bags were taken up by the apparatus or dropped at the side of the track; at two points the interchange of small bags was done by hand at low speed; and at 19 stations the train stopped.

Fixing a Pouch in Position to be Picked up by Mail Train

In 1848 Mr. John Dicker, an inspector of mail coaches, further improved the rail-side apparatus, notably by installing a net, the counterpart of the one on the side of the T.P.O.

The next development was the provision of a double-arm apparatus by means of which two pouches of mails could be discharged through the carriage door. A further great improvement resulted from arranging matters so that the net caught the bags obliquely, with the result that the force of the collision caused them to rebound straight into the carriage without having to be pulled in from the net as before, a task entailing considerable risk, and requiring the strength of several men to overcome the draught of the train when travelling at high speed.

The "Limited Mail"

In 1859 the "Limited Mail" train was inaugurated. This was a train the running of which was under the supreme control of the Postmaster-General who, however, permitted a limited number of passenger carriages to be attached, subject to the condition that in every respect the conveyance of the mails was the first consideration. The companies invariably confined the accommodation to first-class passengers and not even directors' passes were available.

These trains have been largely superseded by ordinary expresses, but in Ireland they are still common although third-class passengers are carried over there by the "Limited Mails."

Mechanism on the Train

We must now turn to the mechanism of the collecting and delivery apparatus on the side of the carriage. The net is secured to a stout frame, the steel bars of which are hinged at the corners. It is thus collapsible, and when closed is folded closely to the side panels of the carriage. The operation of opening the net for the reception of incoming mails is performed by a stout spring lever inside, similar in shape to the levers in old manual-system signalboxes. In the "out" position the lever completes an electric circuit and thus sets a bell ringing to warn the staff that at any moment the incoming mail-pouches may crash into the van. This warning device is essential, as the clerks moving to and fro on sorting duties are liable to forget the danger of stepping past the open door.

Lower than the net lever is a smaller one which controls the hinged arm for swinging out loaded mail-pouches. The latter are suspended by heavy leather straps and a horizontal pin, which, when the folding arm is out at right-angles to drop the pouches, is in a free socket with the pouch to the rear (from the direction of the train). The railside net, on impact with the suspended pouch, causes the pin to withdraw from the

arm, and the pouch, thus freed, drops into the waiting net.

Railside Mechanism

In addition to the net, the railside apparatus usually includes a small hut or shelter for the postman in bad weather, and a wooden scaffold for him to mount in order to affix his pouch to the standards. The latter, generally two in number, are somewhat similar in appearance and working to the davits of a ship. When not in use, and in order that the mails may be slung up for an approaching train, they turn inwards. The pouches are affixed by stout metal fastenings as thick as a man's finger, the shock of impact with the net being considerable.

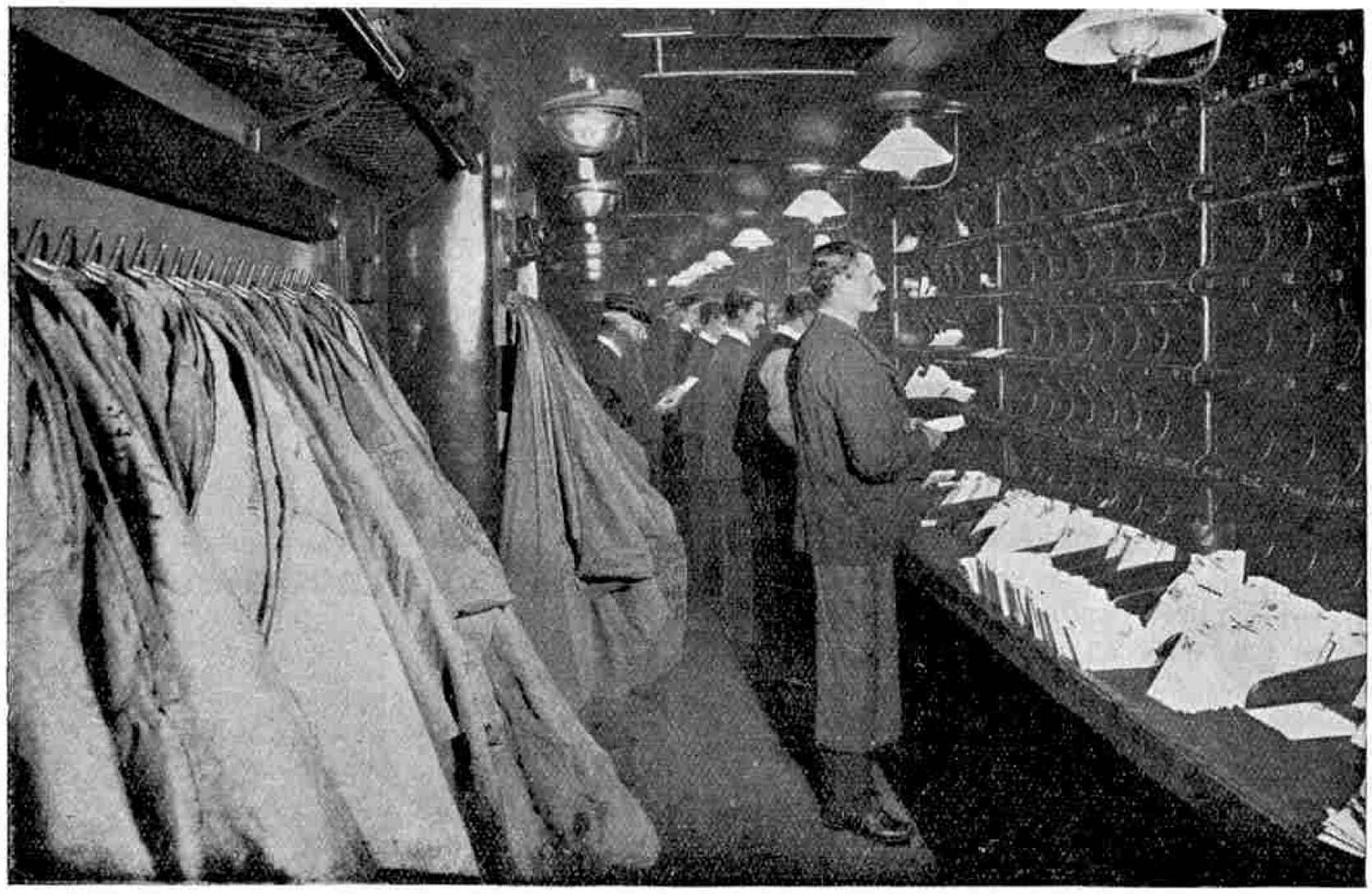
On some lines where the railside apparatus is out of sight of a signal box it is connected by electric bell to the last signal-box, so that the postman has ample warning of the approach of the mail train.

A Typical Mail Train

A typical mail train is drawn up at Euston every evening and is the means of letters posted in London at tea-time being opened at breakfast-tables in Edinburgh and Glasgow, and in remote Highland glens the next evening. The T.P.O.'s near the centre of the train can be picked out at once by the net fittings and folded brackets on the side of the long carriages, and the vermilion box where late-fee letters may be posted up to the moment of departure.

This train is known as the "Down Postal Express," and it leaves Euston at 8-30 p.m. It is composed entirely of sorting vans, parcel vans, and T.P.O.'s, and carries a staff of some 30 Post Office officials who go through to Carlisle, where their place is taken in the small hours of the morning by Scottish officers who, in their turn, are relieved by a staff taking over at Perth for the final stage over the old Highland section of the London, Midland and Scottish Railway to Inverness. One of the latest pattern express locos backs on from Camden Shed and, as the departure time draws near, the last of the familiar scarlet motor and horse-drawn vans transfer their bags of mails to the T.P.O. and the sorting staff roll their sleeves up preparatory to a night of strenuous work.

Exactly at 8-30 the "Down Postal" moves quietly out on its long run, and the long gleaming carriages that now gather speed through grimy North London will be saluted at daybreak by Scots farm-hands and shepherds. As the stiff bank out of Euston is surmounted and the outer maze of crossings and junctions negotiated, it will be of interest to look round the T.P.O. and from a comfortable corner among the mailbags watch the beginning of the night's activities.



Interior of a Travelling Post Office. Sorters at Work

The "T.P.O."

A pleasing green is the shade adopted for the roof and sides and the lighting of the vehicle is particularly good without being glaring. The partly-shaded table lights and the general atmosphere of orderliness give the impression of a comfortable city office, while the riding of the carriages is as smooth and quiet as it is possible to imagine. This is contrived by the inclusion of special springs and much indiarubber in the construction of the T.P.O.

On the platform side of the van are the wide doorways through which the mail pouches will be taken in or despatched en route. The other side of the carriage is fitted up as a sorting room, and the busy clerks stand before this cabinet of pigeon holes into which the letters are constantly being flashed with wonderful dexterity. Below the pigeon holes is a long table covered with plate-glass so that all letters are readily seen and none is likely to be missed.

After the letters have been sorted, they are grouped into smaller bags marked "Crewe forward" or "Carlisle forward," or "Aberdeen forward," and these are sealed ready for discharging at the respective bases or taken along the train to their own particular vehicle. Those for delivering en route are packed in strong leather pouches each measuring, when full, 22 in. by 22 in. by 18 in. thick, the usual weight when packed being about 56 lb. The full pouches are lifted across the T.P.O. and those for discharge first are fixed to the folding brackets.

Discharging the Bags

Now begins the most interesting part of the journey, from an onlooker's point of view. An official slides open the side-door, for without glancing at his watch or the sides of the line he knows by the sound of the train exactly where we are, and that a short distance ahead is Harrow where there is a roadside apparatus with its pouch uplifted in readiness for our passing at 60 miles an hour.

The pivoted arms, one at floor-level and the other about the height of the man standing in the doorway, and each bearing its pouch, are now pushed out to their maximum distance, while the strong hempen net is also opened and extends 2 ft. 7 in. from the carriage side, the warning bell meanwhile ringing furiously. Alongside the line a light rushes towards us, for dusk has now fallen, there is a slight shock of impact and a double thud.

A swift glance back shows the roadside arms with their pouches gone—these have even now been shot in from our net—and our discharged pouches quivering in the other net, now half-a-mile behind. The delivery arms and net having been prepared once again for the operation, we learn that the next pouches are going "outboard" some considerable distance further on. The official therefore has leisure to tell us something of the inner working of his job. He knows practically every mile of the route by sound, and through the night his operation of the apparatus depends largely on this knowledge. The passing of the canal bridge at Nuneaton, the hollow sound of the train running over water-troughs at Bushey, the distinctive roar of passing through certain stations—each of these gives him accurate information.

During the daytime landmarks by the side of the line used to be utilised in a similar way, and there is a legend that an old white horse grazed in a certain corner of a particular field so constantly for many years that she became a landmark for the T.P.O. man preparing his pouches. At last the old horse disappeared, presumably to other fields not of this earth, and it is said that for several days no mails were collected or delivered at that particular point!

Nowadays a white board at the side of the line indicates the proximity of a railside apparatus.

Driver's Startling Experience

The official tells us of an engine driver whose loco required unusual attention one night, so that he had to climb round the side of the cab with an oil can. At that moment the loco passed a roadside arm bearing its pouch and turned in readiness towards the on-coming train. Fortunately

(*Continued on page* 695)

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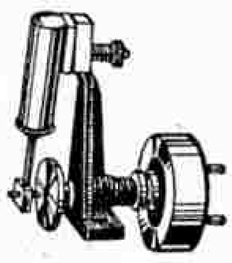

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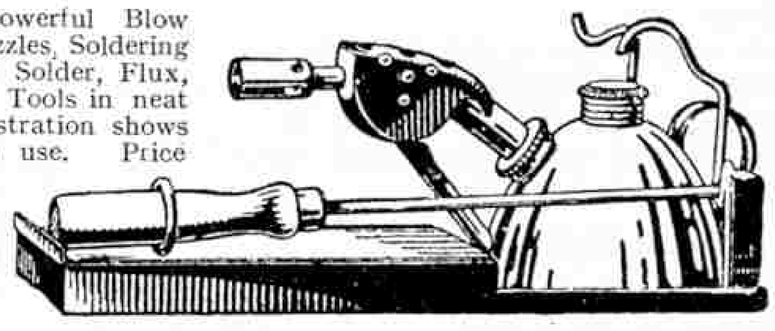

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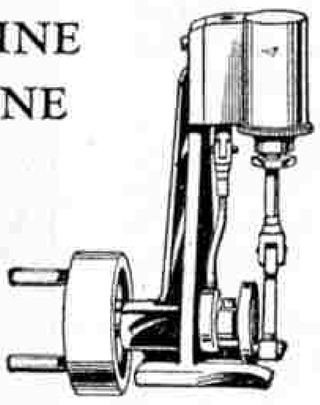

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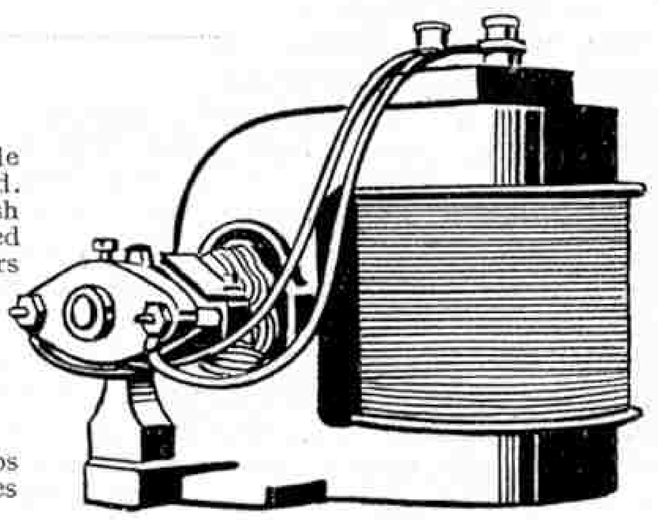

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The First Concrete House

One-Roomed Cottage Built 60 Years Ago

WE recently gave some account of an early Iron House, built over 100 years ago and standing to-day near Birmingham. With this matter in mind we were interested to read (in that well-known paper "*Engineering*") of a house at Newcastle-on-Tyne, which is believed to be the earliest example of reinforced concrete.

Mr. W. H. Thorpe, Civil Engineer, gave some particulars of this early concrete house and he has kindly given us permission to reproduce the accompanying photograph and plan.

Early Fire-Proof Construction

The house—more accurately described as a cottage perhaps, for it measures only 15 ft. × 14 ft. —stands in Northumberland Road. It was built in 1865 by W. B. Wilkinson, who was actively engaged in the building trade 100 years ago. He specialised in moulded blocks, which he used in place of stone, brick, or cast-iron, and he was one of the first to use Portland Cement.

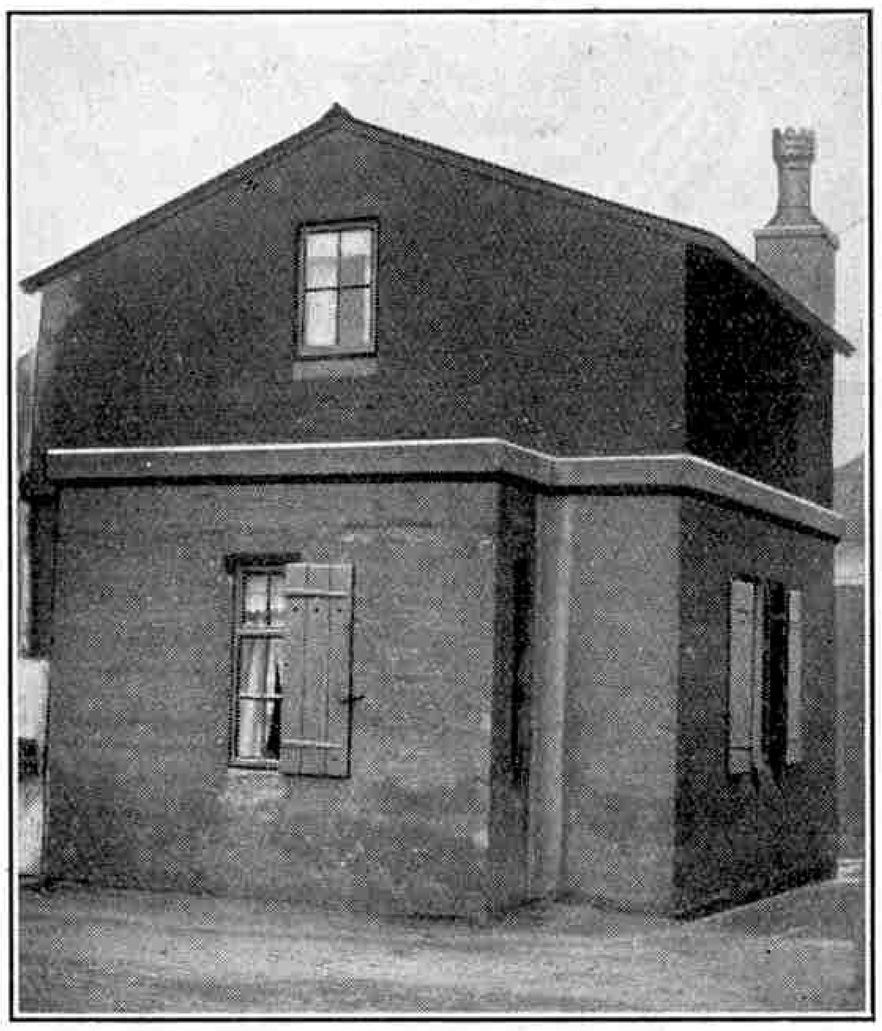
In 1854 Wilkinson was granted a patent (No. 2293) for a method of fire-proof construction, and on examination this proves to be the reinforced concrete principle of the present day. Wilkinson evidently appreciated the excellent qualities of Portland Cement, for with it he carried out many constructional works.

The concrete cottage in Newcastle is in good condition, even after 60 years. It has one large room on the ground floor with a panelled ceiling. From this room, and rising to the floor above, is a staircase of concrete. This and the concrete blocks that constitute the walls, were cast in position.

There seems to be only one defect in this interesting building and that is over the bay window. Here the reinforcement is too near the surface and the outer cover has come away.

Pioneer of Reinforced Concrete

The City Engineer for Newcastle, in describing the house writes:—"The work appears to be in fairly good condition and shows no sign of general disintegration such as would have occurred in the event of the embedded iron expanding due to oxidation." This statement is confirmed by Mr. W. Ferguson, who took over Wilkinson's business and who has had 60 years' experience of Portland Cement.



The Concrete House, built in 1865

It is interesting to learn that Wilkinson carried out a good deal of other work in the Newcastle district. At about the same date as the concrete cottage was built he constructed several concrete buildings, including a stable with a flat roof. He also laid a concrete floor of 14 ft. span to carry a baker's oven and constructed a reinforced concrete footway.

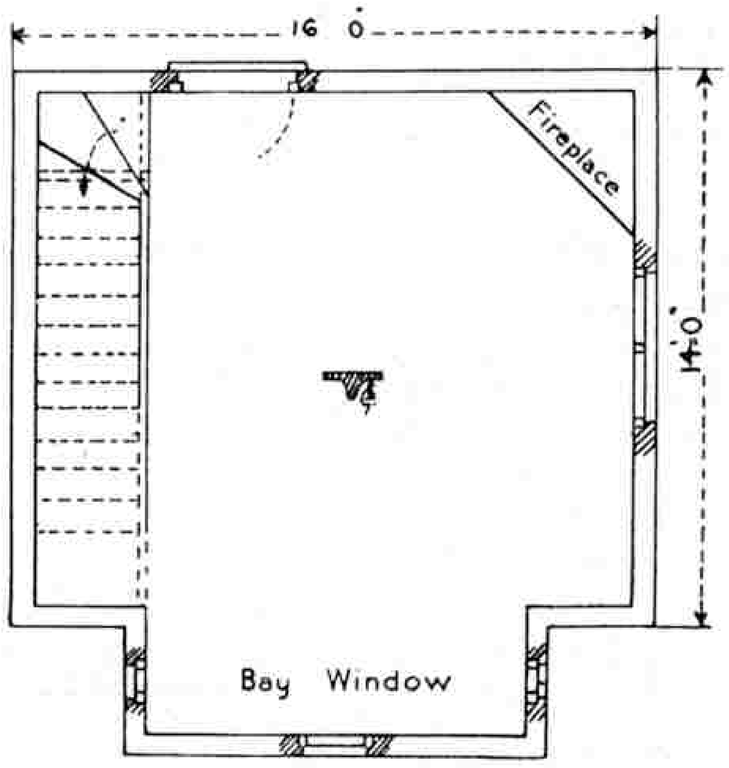
Having regard to the nature of Wilkinson's activity in this direction, it is not too much to claim that he was the inventor of reinforced concrete as applied to serious construction, as distinct from cement on wire mesh for light articles, as developed in France.

Some Curious Building Materials

A very interesting article could be written on the various materials used for building houses. Even to-day houses are not always built of bricks and mortar or concrete and iron. We have all read of the Esquimeaux houses built of ice—which would have been very acceptable in this country during the heat wave of July last!—and houses of mud, wattle, reeds and paper are being built every day in different parts of the world.

In this country in early times cottages were constructed with thick walls of turf and roofs of thatch, and remains of such early buildings were to be seen up to 40 or 50 years ago at Willesden, on the outskirts of London and at other places. In later times the half-timbered house was common; this was built up from a stout framework of timber, the spaces between the baulks being filled in with bricks and mortar. Some of these houses still stand in many parts of the country—as, for instance, at Chester, York, and in London within a stone's throw of the Surrey end of Blackfriars Bridge.

Most surprising of all, several old half-timbered houses may be found leaning over a row of quaint little shops right in the centre of Holborn—one of London's greatest thoroughfares! It is sad to think, however, that these relics of the past are doomed to vanish before long, for the stress and rattle of modern Holborn is proving too great for their ancient foundations.



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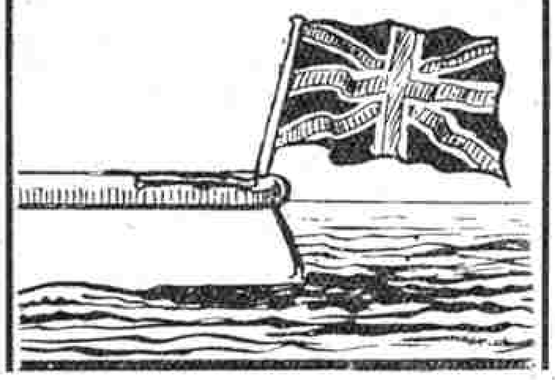

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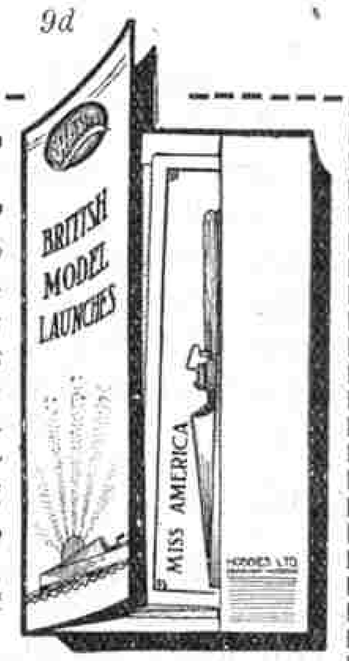

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The Adventure of Living

By Theodore Roosevelt

By the courtesy of the Roosevelt Memorial Association, and the Editor of "Boys Life," we are able to print Theodore Roosevelt's address to the students of Occidental College, Los Angeles, California.

We feel sure that our readers will be interested to read a message from this great man, who was President of the United States in 1904.

LIFE is a great adventure, and I want to say to you, accept it in such a spirit. I want to see you face it ready to do the best that lies in you to win out; and resolute, if you do not win out, to go down without complaining, doing the best that is in you, and abiding by the result. What is true of the boy is also true of the girl; what is true of the young man is true of the young woman, the fundamental facts are the same.

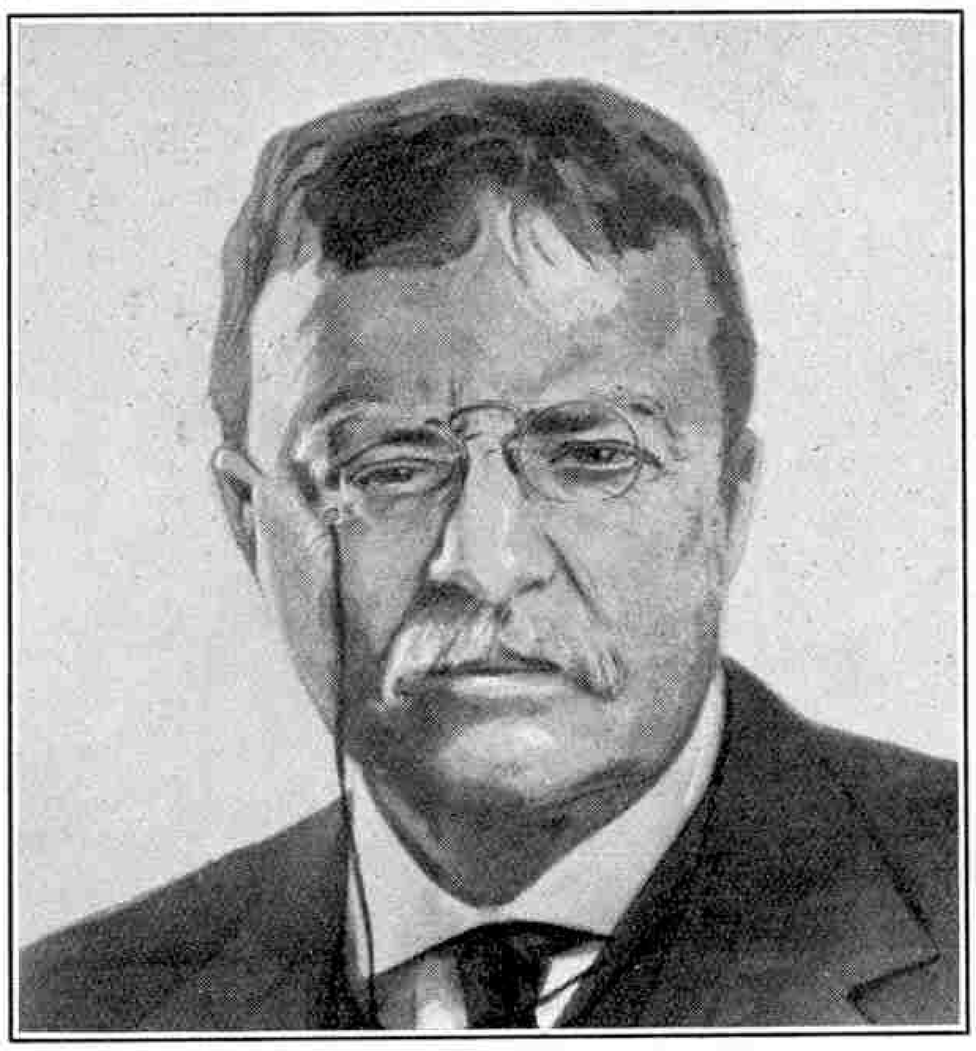
Nothing worth having normally comes unless there is willingness to pay for it. And perhaps the highest good that comes from training of the kind which you get in school or college is not merely training of the body, not merely training of the mind, but the training of what counts for more than body, more than mind—the training of character. Especially is this so in the two ways of giving you the proper perspective (so that you may see what are the important and what the unimportant things), and of giving you the type of soul that will make you willing to strive, and to pay the necessary penalty for achieving the things that are really worth while.

I do not at the moment remember any man or any woman whose life has been entirely easy, and who has at the same time led a life that under conceivable conditions I would have been willing to lead. That is true of the men; I think it is probably even more true of the women. The man or woman who has come to three-score years and ten without knowing sorrow, with no effort or risk, has, save in wholly exceptional cases, not known the highest joys. As I have said, life is a great adventure, and you cannot win the great prizes unless you are willing to run certain risks, unless you are willing to pay certain penalties.

It is the same in large things as in small. If you start to play football, and expect not to get bumped, you will be sadly disappointed. An individual who tries to rise to any position of prominence along any line in his school work and to surpass competitors, and expects to do so without struggle, is again in error. In the school world there is not any real prize in any field, the winning of which does not necessarily imply effort and self-denial, does not imply a certain amount of risk.

As on the football field, if you desire absolute safety, I do think you had better not play the game. And while it is the business of your elders and betters to shape conditions which shall minimize the risk, there will always be a certain amount of risk. On a larger scale it is just so in every day life. When you leave school or college and go into your life ,work you can purchase immunity from risk, the certainty of ease, the certainty of possessing a soul that will be unruffled by any pain, only on condition of living a life not worth living, only on condition of leading the life of a vegetable.

In looking back at my companions when they were your age, and when I was your age, it is half pathetic, and all too melancholy to realize how poor the lives have been of those young men and young women of that day who declined to get their enjoyment from worthy effort, and who have devoted themselves of set purpose to lives that should consist, at best, of active pleasure, and, at worst, of the avoidance of risk and responsibility.



THEODORE ROOSEVELT

I would not wish for any young man or young woman, or for any boy or girl of my own or of any one else for whom I care, a life of mere ease, a life which should consist merely of the absence of toil, of effort, of risk, or even of sorrow.

You cannot get the highest pleasure in life without toil and effort and risk, and yours is a poor soul if you fail to pay the price for them. No nation ever yet became great, unless it possessed within itself the power of effort and self-sacrifice in great crisis. The effort and self-sacrifice are demanded, and no individual ever became great, and no individual ever led a really worthy life, unless he or she possessed within himself or herself the power, if need be, for effort long sustained, at the cost of discomfort, of pain, and hardship; and the power to face risk, to face danger and difficulty and even disaster, rather than not achieve a worthy end.

It is impossible to prophesy for anyone an absolutely safe life. That cannot be done. No parents, no fathers and mothers can hope to bring up their children with the certainty that they will not meet with trials in after life. On the contrary, if their children are to lead full lives, if they are to know what is highest and best in life, it can be set down as certain that they will have to face trials, and will have to face suffering.

No great joy can be achieved save with the possibility that a great sorrow may come as an alternative. No great success can ever be won save by accepting the fact that normally, sacrifice of some kind must come in winning the success. No man or woman has ever known the extreme happiness of having and bringing up children without having to face the possibility of danger and of risk in connection with those children. And what is true of the family is true in every other expression of life. I was going to say in any other kind of life, but I mean in all the other ways in which life is led.

If you are to play any part in the world, if you are to have great happiness, you must make up your mind that you are not going to shrink from risks, that you are going to face the fact that effort, and painful effort, will often be necessary; and you must count for your happiness, not on avoiding everything that is unpleasant, but on possessing in you the power to overcome and trample it under foot.

If you have small, shallow souls, and shallow hearts, I will not say you will be unhappy; you can obtain the bridge club standards of happiness, and you can go through life without cares and without sorrows, and without conscious effort, in so far as your brains will enable you to do so; but you have richly deserved the contempt of everybody whose respect is worth having.

On the other hand, you can make up your minds to lead your lives well and nobly, doing first of all your duty to yourself and to those immediately dependent upon you, the duty of father to son, of husband to wife, of wife to husband, of parents to children—to do those duties first, and then to do the duties that lie beyond them, the duty of joining with your fellows in common work toward a common end, in

(*Continued on page* 695)

IX. TABLE TOP PHOTOGRAPHY

TABLE TOP work was first introduced as a photographic novelty many years ago but in its infancy it was undoubtedly very crude and earned the scorn of many people who, without testing its merits, condemned it as being a childish pastime. Gradually it has progressed, however, until to-day it is recognised as one of the most interesting and instructive branches of the hobby. It is practised on occasion by most of the more expert photographers of to-day, as a pastime lending itself freely to self-expression and originality of composition. That is the serious photographer's view, but, whilst on occasions we may be serious, we prefer to regard it as an amusing method of passing away a few hours during the long winter nights.

A Fascinating "Stunt"

Table top photography may be described as being the most interesting of all photographic "stunts." It employs models in such a manner that a photograph of the scene appears to have been taken from life. Some beautiful effects can be secured by ingenious arrangement of the materials to hand, and railway tracks, river scenes, interiors, doll portraits, landscapes, snow scenes, and innumerable other common everyday scenes may be introduced in an extremely natural manner. Table top photography is by no means restricted solely to lifelike imitations, however, and many scenes can be arranged that are obviously not from life, these being principally of the humorous type, and among the best of table top efforts.

Equipment Necessary

The necessary equipment is simple. For most scenes we shall require a board, about, say, 18″ × 12″, as a stage, and a background of the same size. For interiors the background may consist of a buff card bearing a rough sketch of the wall of a room. For outdoor scenes a background of some suitable picture, rather larger than the scenes to be photographed, serves splendidly. The stage should be tilted to give the rear a slightly higher elevation. Backgrounds are often very difficult to control in the sense that they stand out in competition with the principal figures. In addition to differential focussing, the use of which in dealing with a troublesome background will be described later, a light shadow cast over the whole of the offending area will subdue its boldness, but care must be exercised to prevent an abrupt change from light to shade in the scene. The principal light can be moved so that it is slightly behind instead of immediately overhead.

A matter of extreme importance, and one which, if neglected, will ruin the effect of even humorous studies, is the necessity for the dolls and "furniture" being in keeping with the general scale of the scene. For example, it is useless to expect a convincing result if a doll is seen to be knocking at a door rather less than half its own height! Attention to this point will carry the experimenter well along the road to success.

Before we pass on to suggest a few subjects and the improvised properties necessary to render them well, it is desirable to deal with general matters such as the position of the camera, the method of lighting and the exposure.

"Springtime." A typical outdoor scene. Negative on Imperial Plate

Focussing

At the outset, it is obvious that the possessor of a camera fitted with a focussing screen, has an advantage in this class of photography. Not only is he able to focus accurately but at the same time he is enabled to study the general arrangements with greater ease and certainty than is the case when using a non-focussing camera. For table photography it is essential that the camera be used close up to the subjects and, while cameras equipped with double extension will rack out sufficiently to allow "close up" work, box form and other non-focussing cameras will require a supplementary lens or "portrait attachment." The latter is a very reliable form of additional lens and the instructions given by the makers enable a beginner to use it without difficulty. The camera should be so placed that it is level with the middle of the scenery.

Lighting and Exposure

The lighting of the scene requires careful arrangement and only general rules can be laid down here. If the scene is to be photographed by daylight, the stage should be brought close to a window so that the light is at the side but slightly in front. If photographed by artificial light, the stage should be placed almost directly

underneath the light whether it is gas or electric. When employing artificial lighting it is desirable to have a second light, less powerful than that immediately overhead, to one side and slightly in front of the scene, so as to avoid "flat" lighting.

The same generality of instruction must apply to exposure, but once the correct exposure for an artificially lighted scene is discovered, the time is fixed and there is no further necessity for experiment in this direction, as long as the strength and position of the light remain unaltered. The daylight exposure is governed by the time of day and season of the year, and it is strongly recommended that an exposure meter be used with each attempted exposure. The following data will be of assistance as a rough guide, the plate in each case being speed 350 H & D.

Scene near Large Window
Stop F/16 Exposure 30 seconds
One Incandescent Gas Burner
Stop F/16 Exposure 20 minutes
One Electric Light Stop F/8 Exposure 2 minutes
Two Electric Lights " " " 1 minute

It should be remembered that the above are the figures of one individual experimenter and as personal circumstances vary so considerably it is imperative that the correct exposure be found by trial. Fortunately table top photography lends itself to our purpose, for a scene which has taken a long time to arrange can be laid aside for continuous experiment until a satisfactory result is obtained. It should be stated here that the difficulty of figures falling over can be removed by using seccotine to hold them steady.

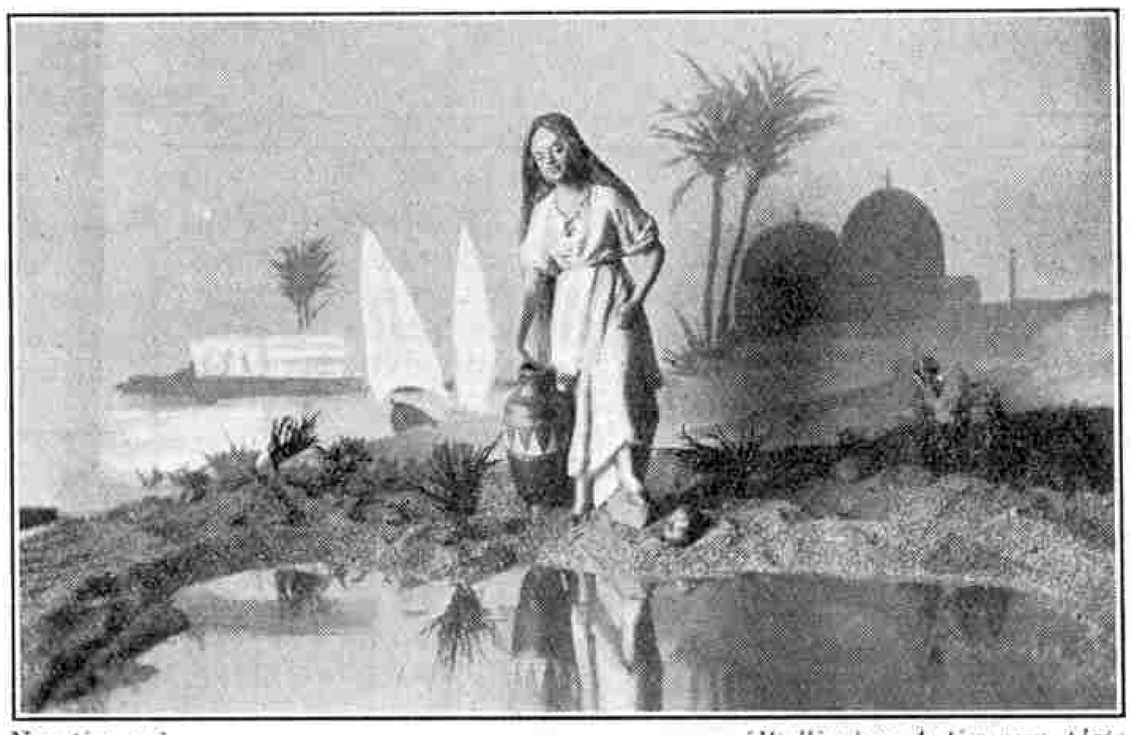
Use of Meccano and Plasticine

Much of the material required is already to hand and other details can be improvised very easily. It will be found very useful to have a supply of Meccano parts and Plasticine handy. These used in conjunction will often overcome difficulties. For example Plasticine by itself can be moulded to represent any desired object—flowers, chimney pots, door knockers, boats on lakes, animals, food on tables. Meccano can be used as the framework of houses, buildings, children's swings, bridges over lakes, railway signals, castle drawbridges and so on. In some cases it will be necessary to cover the framework with stiff paper, but the joy of achievement will make the extra labour well worth while.

It is important to remember that the most successful scenes are not necessarily the most elaborate. Indeed, rather is the reverse the case and we should strive to eliminate from our "make up" everything that is not absolutely essential. Experience is a splendid teacher and after the first two or three attempts the results will indicate far more than we could hope to teach in a complete volume. Let the scene be simple at first and work your way up. One more tip; keep the models at least 2" away from the background. As experience is gained, more elaborate scenes can be staged, the most effective grouping of the models being decided by experiment. The knowledge of lighting effects thus gained will be of great value when an ordinary portrait is to be attempted. One may learn more in half-an-hour on the table top than could be learned in a whole day outside.

Negative on [*Wellington Anti-screen plate*

A Winter's Scene



Negative on [*Wellington Anti-screen plate*

An Eastern Scene

Negative on [*Wellington Anti-screen plate*

The Mad Hatter Tea Party

An Interior Scene

Let us attempt to stage an interior scene. The necessary furniture may be obtained from a doll's house. The figure of a cook working at a kitchen table–perhaps a policeman sitting in a chair will help the scene—a clock upon the wall, one or two pictures, a doorway, a carpet, and perhaps a cat or dog. All of the suggested figures are small dolls, and a little draping gives a good representation of costume; dark cloth for the policeman, light for the cook. The pictures, clock and doorway can be drawn on the background—the drawings need not be elaborate if the principal lines are firm and straight—and the carpet may consist of brown paper on which a pattern may be roughly designed, if desired. A small strip of cloth could be used as a substitute.

It is almost impossible to lay down hard and fast rules for this type of subject but it would be sound practice to regard the room as being reduced to a scale of one inch to a foot and if all the objects are brought as nearly as possible into conformity, the result should be a fairly convincing study.

Doll's House as Background

A doll's house provides a very useful background and suggests many good set-pieces as, for example, a motoring party paying a call. The dolls may be in an open toy motor car and a figure at the door of the house welcoming the party will add a further touch of realism. This scene can be staged with the aid of Meccano parts if the ready made doll's house is not available. A framework should be constructed to represent the house and, for the outer walls, paper should be laid over and the windows and door-ways drawn on. The garden border, chimney pots, and door steps can be made with Plasticine. The path can be made or ordinary brown paper sprinkled with powdered cork (obtainable from any fruiterer for the asking) which will give a good suggestion of a gravel walk.

Snow Effects and Bathing Scenes

It may be desired to represent this same scene as in Winter, using salt to represent snow. If the salt is laid on white paper only a small quantity need be used, a slight sprinkling being laid on the roof, trees and figures in the open. We recommend salt in preference to flour because the latter has a slight yellow tinge which tends to photograph badly, and also because salt possesses that distinct sparkle which is present in clean crisp snow.

Perhaps we wish to try a bathing scene—say a girl diving into a river. The river is a piece of looking glass and the bank is built up from it. The diving girl is a doll

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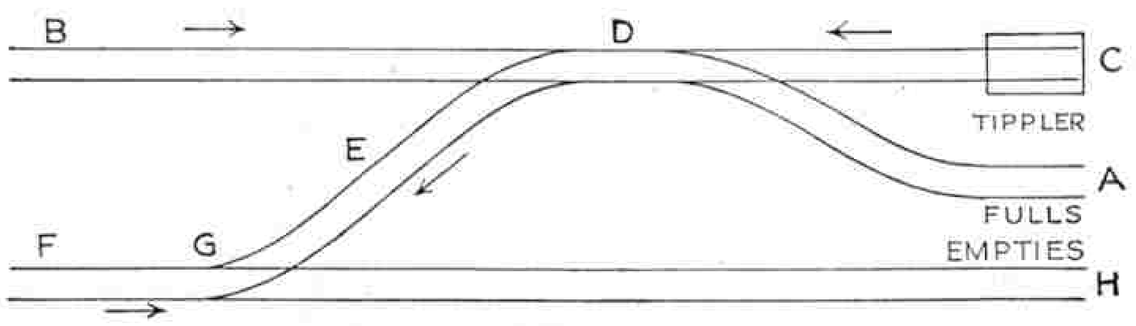
Suggestions Page

(4)—Gravity Shunting

By T. R. Barnard, Prestwich, Manchester.

I observed in a railway siding an ingenious shunting arrangement which should prove easily adaptable to Hornby model railways.

The accompanying sketch clearly shows the general layout of the rails. The arrows included in the drawing indicate gradients, the heads in every case pointing downhill. An engine hauls a train of full coal wagons from A up the incline B, where they are left braked. At C there is a tippler by which the coal is unloaded. The wagons, being released one by one, run by their own weight down B on to the tippler, the shunter controlling the speed by the wagon brake. After tipping, the brake is again released, and the wagon runs back, C being slightly inclined. The points at D have been changed meanwhile, and the wagon is diverted down the steep incline E and up F, a rising line. Its impetus carries it a fair way up F, and by the time it begins to run back the shunter has changed the points G and it runs on to the empty line H. The same procedure is repeated with each wagon, and finally the empties at H are coupled up and removed by the engine. Thus, apart from the initial bringing and final removing, the whole operation is carried out by gravity.



With Hornby rails, the necessary inclines may be obtained by "bolstering-up" the sleepers at the points B, D, C and F. D must, of course, be at a lower level than B or C, but higher than G.

[The tippler mentioned above provides an interesting subject for a Meccano model. We should like our readers to send in suggestions for its construction, the best idea received would be featured in this page and specially rewarded.—ED.]

(5)—Securing Wood-Screws

N. Creasy (Raynes Park) sends in an idea which may prove useful to many readers, although strictly it cannot be classified under ordinary Meccano practice. A screw inserted in a base of wood may be permanently secured, without fear of its working loose, by means of a small U-shaped staple. This is placed with its points at either extremity of the groove in the screw-head and driven into the wood until its centre rests in the groove, thus making it impossible for the screw to turn in either direction.

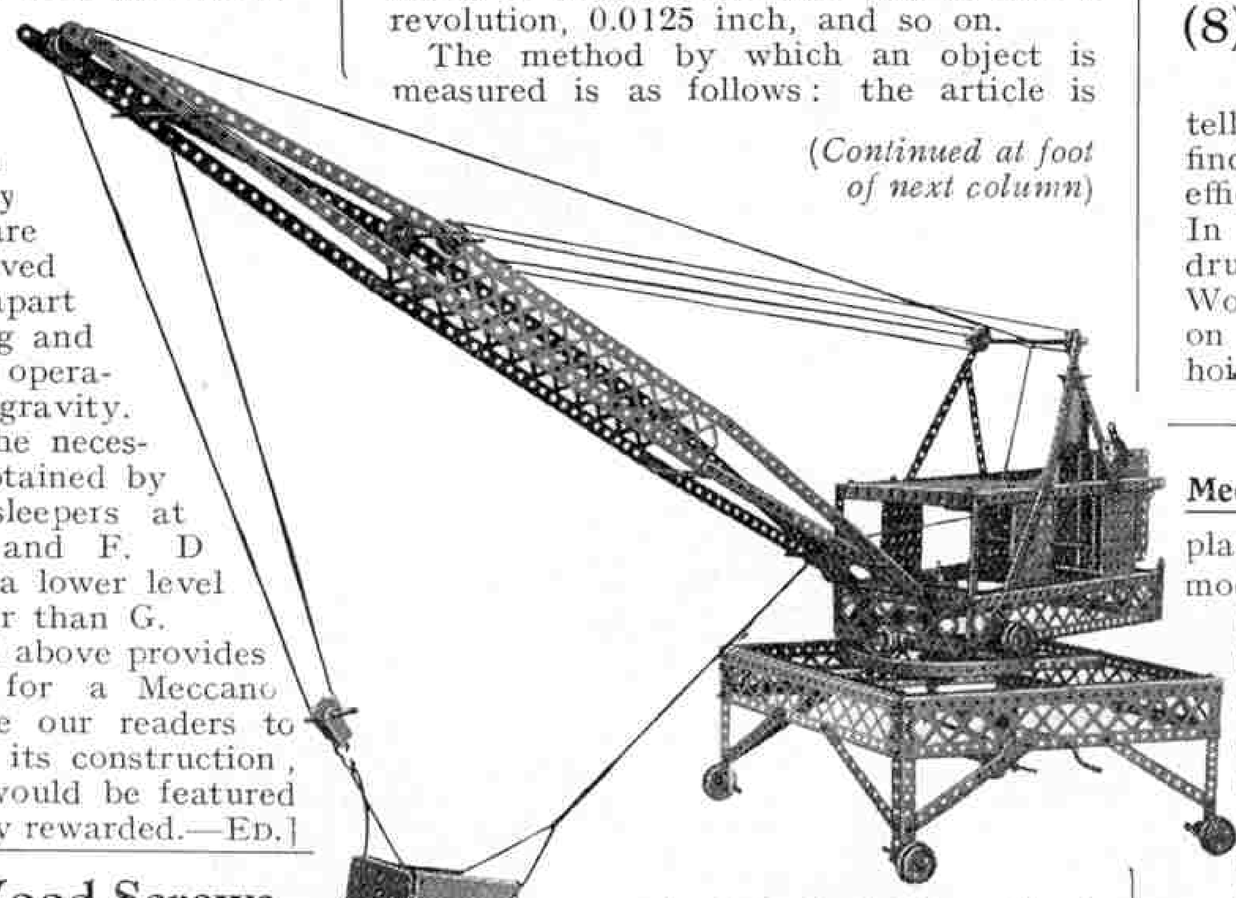
(6)—Meccano Micrometer

B. Happe (Redruth, Cornwall), sends us a suggestion for an interesting micrometer made from Meccano parts. A Threaded Rod is used to obtain the extremely accurate adjustment necessary, and our contributor tells us that he has obtained quite good results in measuring the size of small objects.

A 57-teeth Gear Wheel, having one tooth specially marked, is secured to the Threaded Rod, and the latter passes through the bore of a Threaded Crank. Master Happe calculates that in twenty revolutions of the Gear Wheel, the Threaded Rod traverses a distance of 0.5 inch; hence in one revolution it covers 0.025 inch and in half a revolution, 0.0125 inch, and so on.

The method by which an object is measured is as follows: the article is

(Continued at foot of next column)



A Model Dragline

The Model Dragline submitted by D. J. Ireland (of London, W.13) in our recent Competition. (Specially commended and awarded Certificate of Merit).

In an early issue we hope to publish an article on the work of giant Draglines in India. As described in the April, 1924, Magazine, several huge draglines of the type from which this model is designed were constructed in England and sent out to India in connection with the largest irrigation schemes ever projected.

(7)—Photographic Accessories

By David Richmond, Galashiels.

Meccano proves useful even in connection with photography, as is shown by the dark-room lamp and drying net which I have built almost entirely from Meccano parts. In constructing the drying net, I first built a frame consisting of four 12½" Strips and over these stretched a piece of netting, secured with nuts and bolts. To the two corners at one end of the frame I fixed Double Angle Strips, forming legs, to support the net at a suitable inclination.

The lamp was just as easily made. I used an ordinary small electric globe, around which I built a box-like frame formed from four 5½" Strips and four Double Angle Strips. Around the whole of this is secured some red transparent paper. When in use the lamp gives out a brilliant crimson radiance; a white light may be obtained simply by lifting the frame from the lamp.

(8)—Save Your Film Spools!

Philip Bailey (Golcar, Nr. Huddersfield) tells us that in models of cranes, etc., he finds that an empty film spool forms an efficient substitute for a hoisting drum. In larger models, of course, an excellent drum is obtained by using the Meccano Wood Roller, with a Bush Wheel mounted on the shaft at each end to retain the hoisting rope, or chain, in position.

Meccano Micrometer *(continued)*

placed against a stop suitably fixed in the model and the Threaded Rod rotated until its end just touches the object; the latter is then removed and the rotation of the Rod continued while the number of revolutions of the Gear Wheel are carefully counted, until the end of the Rod touches the stop. The dimensions of the object may then be found from the number of revolutions made by the Gear Wheel; for example, if 12 revolutions are necessary before the end of the Threaded Rod touches the stop, the width of the object must have been 0.3 inch (0.025 × 12).

We should like to see further experimental models built on these lines, for their construction is a most interesting and instructive pastime. Suggestions received showing particular merit would be rewarded, and published on this page.

ANOTHER RACING MOTOR-CAR MODEL

On page 287 of our June issue we were able to illustrate a model of the famous racing car Kim II. Through the courtesy of the designer of both models, Mr. D. M. Dent of Westgate-on-Sea, we are able this month to publish a photograph of a model of Capt. Frazer Nash's hill-climbing car.

This perfect model has a chassis constructed of Meccano parts, the body being built of zinc. The model is built to a scale of 1 : 4.5 and is complete in every detail. A small electric engine transmits the drive through a plate clutch and universal joint to the Frazer-Nash dog-clutch transmission. The brakes, shock absorbers, etc., are all correctly fitted and are built from Meccano parts.

Mr. Dent is indeed to be congratulated on the patience and ingenuity he has displayed in the construction of this wonderful model motor car.

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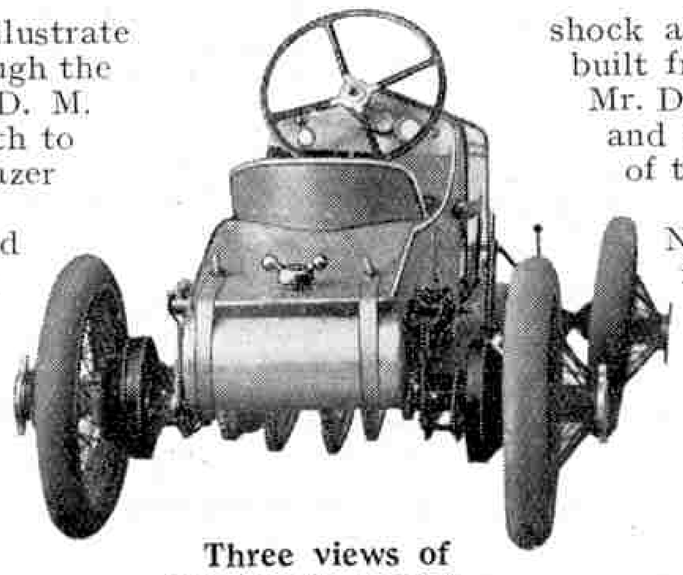
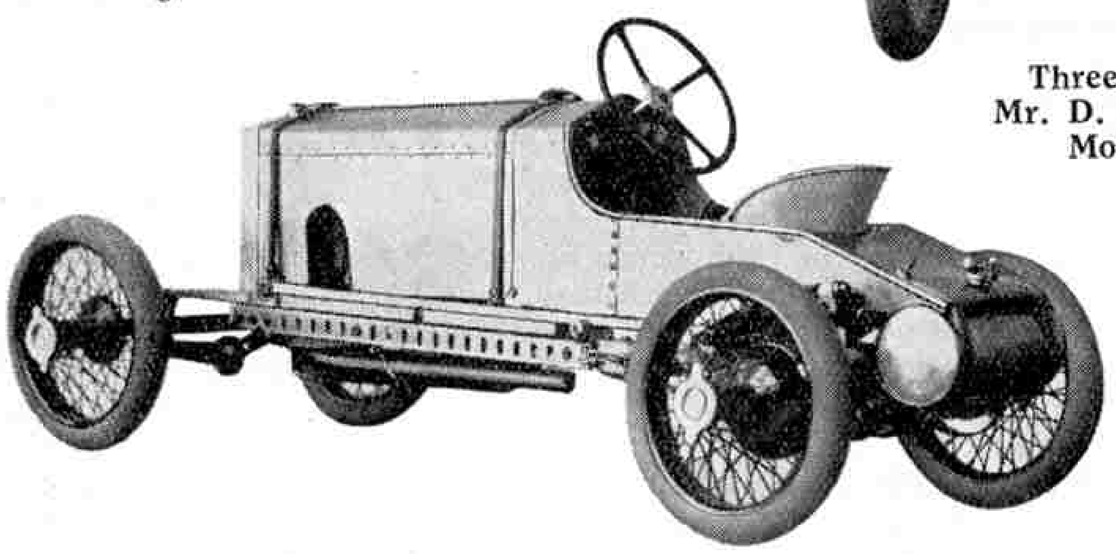
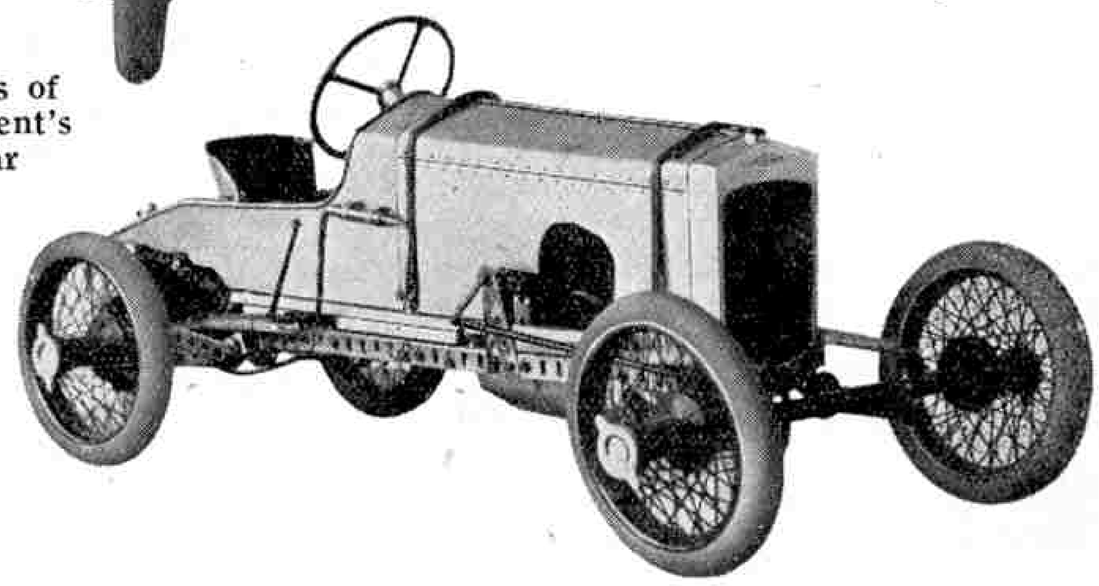
Next month we hope to publish full instructions for building a splendid model motor-cycle and side-car. This model is constructed entirely with Meccano parts, even to such items as the tyres, lamps, saddle, etc., and we believe all Meccano boys will agree that it is one of the best models of its kind yet built.







Three views of Mr. D. M. Dent's Model Car

In Reply

Suggested Meccano Improvements

DECIMAL SYSTEM FOR GEAR WHEELS.—There are several difficulties that prevent the adoption of the decimal system to the teeth of Meccano Gear Wheels. The wheels must be of certain dimensions in order to engage properly with each other when placed in the equidistant holes of the strips, and this makes the construction of gears with, say, 10, 20, or 40 teeth impossible. (*Reply to K. C. Whittaker, Manchester*).

" FORDSON " TRACTOR.—Your model " Fordson" Tractor is particularly interesting, and the possibility of a Meccano Model will be carefully gone into. With three speeds and reverse it would be attractive, as you say! (*Reply to A. R. Mabey, Isle of Wight*).

CLOCKWORK MOTOR.—We are contemplating re-designing our clockwork motor in the near future. Curved elements are under consideration. (*Reply to C. Deacon, Norwich*).

ENGINES FOR MOTOR BOATS.—Thank you for your sketch showing the Meccano Clockwork Motor coupled to the propeller of a small motor boat. Meccano Motors—both Clockwork and Electric—form excellent engines with which to equip model boats. Suitable propeller-shafts, complete with propellers, may be obtained at small cost, and are frequently advertised in this Magazine. (*Reply to E. Miles, Herne Bay*).

EXPLANATORY NOTES IN MANUAL.—Thank you for your suggestion that we should include in the Instruction Manuals brief explanatory notes concerning the more unusual machines of which models are shown. We shall give your idea further consideration when revising the Manuals next year. (*Reply to T. H. Markland, Widnes*).

Suggested New Meccano Parts

ROD AND STRIP CONNECTION.—Your suggested new part appears to duplicate one of the functions of the existing Coupling, which may be connected to Strips by a bolt passing through a hole in the Strip and inserted in one of the threaded borings of the Coupling. Washers may be placed behind the head of the bolt to prevent its shank penetrating too far into the Coupling. (*Reply to Herbert Holliss, Manchester*).

BALL BEARINGS.—Your suggestion for a journal-bearing assembly, in which a horizontal shaft may rotate in ball bearings, is very interesting. We shall give the matter further careful attention and hope to pronounce upon it later. (*Reply to L. Denis Milner, Pembury*).

FLANGED PLATE.—The part shown in your sketch may be constructed from a $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plate and two $2\frac{1}{2}"$ Angle Girders; therefore its addition to the Meccano system is not justified. (*Reply to Stewart Snell, Derby*).

NEW PINION.—We agree that your suggested elongated $\frac{1}{2}"$ Pinion would prove useful in the construction of gear changes, etc., and we are giving this idea further consideration. (*Reply to Eric Pedley, Willenhall*).

Suggested Hornby Improvements

0-4-4 LOCO AND YEAST VAN.—Thanks for your very clear sketch. Your proposal for a new Hornby Tank Loco of 0–4–4 type with outside cylinders would not be suitable. Besides being a departure from the usual British practice, it would make an unbalanced and unattractive model, and the Hornby No. 2 Tank Loco (4–4–4) type is much superior. The L.M.S. Yeast Van you also suggest for our adoption is old-fashioned and would leave us behind the times! (*Reply to W. Sharp, Paisley*).

NEW LOCOS.—A 4–6–0 engine would not be suitable, in view of the curves found in " 0 " gauge railways. The same objection applies to your suggestion for an 8-couple dgoods loco. (*Reply to A. T. Welford, Worthing*).

NEW COLOURING, LETTERING, ETC.—To enamel the smoke-boxes of the locos in a different colour to the boilers, an additional process in manufacture would be necessary, so increasing the cost of the locos. We were surprised to hear that you consider the lettering " Side-tipping Wagon," " No. 1 Luggage Van," etc., spoils the appearance of the rolling stock, and that the letters " L.M.S." and " L.N.E.R." should be smaller. The trucks are lettered in accordance with the general practice in this country; we should like to receive further opinions on this point. Thank you for your suggestion for using Girder Cranes and Gantries in model railways. (*Reply to A. T. Welford, Worthing*).

TRAIN INDICATOR.—We fear this would prove a little difficult and costly to manufacture. Why not make a model Indicator with your Meccano? This should not prove impossible to keen Meccano boys, although, of course, it would necessarily be on a very small scale in order to stand on the station platform. (*Reply to H. C. Whittaker Manchester*).

SHACKLE-COUPLINGS.—The addition of shackle couplings to the passenger coaches and locos and coupling chains to the goods rolling-stock would hardly warrant the increased cost of production. (*Reply to K. C. Whittaker, Manchester*).

" COWCATCHERS " FOR LOCOS.—The idea of fitting Hornby Locos with " cowcatchers " is distinctly novel; the lettering " L.M.S." and " L.N.E.R." would, however, spoil the effect. It should not be too much for Colonial enthusiasts to contrive a cow-catcher of their own to hook on. I am glad you find the "*M.M.*" brightens things up when the rain is scarce! (*Reply to I. Stevenson, Karachi, India*).

NUMBERING LOCOS.—In the matter of the individual numbers you suggest for Hornby Locos, this would involve immense confusion, and before long the locos would be like the Welsh Station with such a long name that the platform is too short for the name-basrd (*Reply to A. R. Mabey, Isle of Wight*).

SIDING POINT.—It is our intention to introduce a siding point sometime in the near future. (*Reply to Stanley Maden, Bury*).

RAIL JUNCTION.—We are not quite clear in regard to the type of junction to which you allude. We assume, however, that you refer to a junction between two parallel rails; if so, we would draw your attention to the new Hornby " Crossover," which is now available (Price 6/6, 1 ft. radius). (*Reply to R. Sanford, Colchester*).

Queries & Replies

SLOW MOTION.

Q. " I wish to build a working model for window display purposes. Having no motive power but a steam engine (lasting 20 mins. per filling) and a Meccano Clockwork Motor, I have difficulty in making a model to work for several hours. Is there any balance motion, or a way of checking tremendously the Clockwork Motor, to solve my difficulty? "

A. The speed of the Clockwork Motor may be checked, of course, to almost any extent by means of a pallet wheel and pendulum, as in the Meccano Clock, but this means a very great loss of power, and the motion so obtained is a jerky one. This drive could be used, however, to operate a very simple model such as a Windmill, and even a neat model of this description would prove of no little attraction in a window display. The essential mechanism in such an arrangement would consist of a big reduction gear between the Motor and the pallet wheel. Another method by which the speed of the Clockwork Motor may be reduced effectively consists in the employment of a " fan-wheel " (suitably shaped from a piece of cardboard). When rotated rapidly, the resistance of the atmosphere on the wheel prevents the Motor from exceeding a certain speed.

If desired, the gravity attraction in a heavy weight may be employed as the motive power in place of the Clockwork Motor. The jerky movement may be lessened by transmitting the drive to the model—which should be capable of turning very easily—through a fairly slack Sprocket Chain. We do not know of any means which would enable you to run your steam engine for longer than 20 minutes without refilling (*Reply to G. E. Owen, Henleaze, Bristol*).

Suggested Hornby Improvements—(*continued*)

MINIATURE CATTLE.—The manufacture of miniature horses, cattle and sheep, etc. for use in connection with Hornby Cattle Trucks, would be too great a divergence from our usual practice. We believe suitable model animals for your purpose can be obtained from most toyshops. (*Reply to D. E. Shidmore and J. Coates, Stockport*).

Contributions for the " Suggestions Page " are invited. Articles should be accompanied by drawings or photographs if possible. Do not hesitate to send rough sketches, for if the idea is suitable for publication, we will have new drawings made by our artists. Special awards of five shillings each will be paid for any suggestions published showing special merit, whilst the senders of all other contributions used (not including, of course, those mentioned under " Replies ") will be presented with complimentary copies of " Meccano Standard Mechanisms."

The Meccano Guild

A Great Fellowship of Boys

President: Mr. Frank Hornby, Inventor of Meccano.

What the Guild Means The Meccano Guild is an organisation for boys, started at the request of boys, and conducted as far as possible by boys. In joining the Guild a Meccano boy becomes a member of a great brotherhood of world-wide extent, every member of which has promised to observe its three great objects ; wherever he happens to be—even in strange countries—he will know he has met a friend whenever he sees the little triangular badge. The Meccano Guild is bringing together Meccano boys all over the world, and is helping them to get the very best out of life.

How it Commenced More than a million boys in Great Britain derive their greatest indoor pleasure from Meccano. Before the Guild was formed, hundreds of these Meccano boys wrote to us every week. They told us how they wished they could be put into communication with other Meccano boys and how they longed to be able to meet them. They asked if arrangements could be made so that their wishes might become an accomplished fact. We responded to their repeated and increasingly numerous appeals, and as a result the Meccano Guild came into being.

Why You Should Join Every Meccano boy should be a member of the Meccano Guild. All who have studied its objects must agree that the Guild cannot fail to have a profound effect for good on the lives of its members. It is ready to be of service to each individual member—to help or give advice whenever requested. At the head—guiding and controlling, and taking a personal interest in this great movement—is the President, Mr. Frank Hornby, Inventor of Meccano and Managing Director of Meccano Limited.

The Headquarters of the Meccano Guild are at the Head Offices of Meccano Ltd., Binns Road, Liverpool.

THE GUILD RECRUITING CAMPAIGN

Every Meccano boy should become a member of the Guild and do his utmost to help to make the objects of the Guild widely known. With this end in view, a special medallion is presented to each member of the Guild who obtains three new recruits. As a mark of further merit the medallion is engraved with the name of the recipient and with the words "Special Award" when six more members are recruited. Full particulars of the Recruiting Campaign, together with a supply of application forms, will be sent on request.

HOW TO BECOME A MEMBER

Membership of the Guild is open to every boy possessing a Meccano Outfit, or Hornby Train Set, who satisfactorily fills in the prescribed application form. The only conditions are that members promise to observe the objects of the Guild and to wear their badges on all possible occasions.

The price of the Guild membership badge is 7d. post free in the United Kingdom, but members abroad will be required to pay 5d. extra for registered postage. A remittance for the necessary amount should be sent along with the form of application. The Guild badge is beautifully enamelled in blue and white and is made for wearing in the lapel of the coat. Any boy wearing the Guild Badge is at once recognised by other Meccano boys as being a member of the Guild and one who has undertaken to live a clean, truthful and upright life.

In addition to the badge, each member receives a membership certificate, measuring 7" × 9½". This certificate is printed in orange and sepia and is a smaller edition of the large club certificate.

Write to the Secretary of the Meccano Guild, Binns Road, Liverpool, asking for an application form and full particulars. Then fill in the form and return it to Headquarters, when you will be enrolled and your badge and certificate will be sent to you. Write to-day, and put M.N. after your name for reference.

The Secretary receives hundreds of letters every week from members all over the world and he hopes that new members will also write to him as often as possible.

BADGE OF THE MECCANO GUILD MEMBERSHIP.

THE THREE GREAT OBJECTS OF THE GUILD

(1) **To make every boy's life brighter and happier.**

(2) **To foster clean-mindedness, truthfulness, ambition, and initiative in boys.**

(3) **To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.**

MECCANO CLUBS

Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters At the present time there are over 100 affiliated clubs in various towns and villages in this country and abroad, together with a much larger number not yet affiliated. Each club has its Leader, Secretary, Treasurer and other Officials, all of whom, with the exception of the Leader, are boys. If the nearest club to you is too far away for you to join, or if you are unable to join for any other reason, consider the possibility of forming a new club in your own district. A special booklet explaining "How to run a Meccano Club" is now ready, and will be sent to any reader (post free) on receipt of 2d. in stamps.

AFFILIATION WITH THE GUILD

When a Meccano Club has been successfully launched and good progress is being made, affiliation with the Guild is granted. A beautiful club certificate, suitable for framing and hanging in the club-room, is presented, and the club becomes entitled to such privileges as the loan of interesting lectures and club membership cards. All members of the Guild are eligible for the Merit Medallion, which is awarded to members who display special ability in connection with club work, or in helping the Guild.

THE CORRESPONDENCE CLUB

Members of the Guild are able to join the Correspondence Club, by which they are placed in communication with other Guild members in some other part of the country or abroad. To those boys who are interested in foreign languages the Correspondence Club presents a splendid opportunity of obtaining a correspondent in the particular country in the language of which they are interested. They are able to write to a Meccano boy in his native language, and as he would probably reply in English, the correspondence will be of mutual benefit. Stamp collectors also find the Club of value, as they are enabled to exchange stamps with their correspondents. Full particulars and enrolment form will be sent on application.

The Secretary's Notes

All clubs that have adopted the plan of holding "Visiting Nights" for parents and friends have quickly found out the great value of such nights. The good results obtained in this way may be further extended by the adoption of a scheme of Associate Membership. The lines on which a scheme of this kind is worked must depend very largely upon local conditions, but in almost every locality there are people who, once they have been convinced of the great value of the work of a Meccano club, are very willing to contribute towards its funds. I have just received the annual report of a large and enterprising club in South Africa, from which I note with pleasure that the club is enrolling "Associate Members" with a minimum subscription of 2/6 per annum. The report goes on to say:—"This is an innovation of the English clubs." I hope that club Leaders will give this idea their careful consideration.

Associate Members

In reading through the monthly reports I receive from club secretaries I am often greatly disappointed by the absence of details. Frequently a certain interesting event is mentioned, only to be dismissed in a few words, and thus I am unable to extract from the report a description of this event for inclusion in "Club Notes." I should like secretaries to realise that their reports are practically the only source of material from which to compile the "Club Notes" page. I am quite aware that after one or two uneventful meetings there appears to be very little to write about, but my experience is that there is some feature of interest in practically every club meeting. Secretaries would find the task of writing their monthly reports greatly simplified if they would adopt the practice of keeping a club record book and filling this in as soon as possible after each meeting, before anything is forgotten. It certainly is a fact that the reports I receive from secretaries who keep such a book are the most interesting and the most valuable to me.

Secretaries' Reports

I find from inquiry that many clubs have not yet adopted what are known as "Contractors' Nights." These are nights on which the members of the club are divided into sections, each under the direction of one of the older boys who is called a "contractor." The Leader then puts forward some engineering problem to be solved. This may consist of the building of a bridge across a "ravine," the latter being represented by, perhaps, the gap between two boxes placed on the table. The Leader asks for tenders from the various "contractors" for constructing a bridge across this ravine. Each contractor then consults with his gang and puts forward his tender and specifications, describing the type of bridge he proposes to erect and giving estimates of the amount of material he will require and the length of time it will take to complete the structure. The Leader then decides which tender to accept and the "contractor" at once gets to work. As an alternative, several "ravines" may be provided, each "contractor" tackling the problem of bridging one of them, and the relative merits of the completed bridges being assessed by the Leader.

"Contractors' Nights"

The great value of such competitions lies in the fact that the "contractors" and their gangs are left to their own resources and have to act on their own initiative. In short, the scheme provides excellent training in the methods actually employed by civil engineers. I should like those Leaders and secretaries who have not already done so to try the experiment of "Contractors' Nights" and to let me know how they succeed. In particular I should be glad to receive descriptions, or better still photographs, of any of the Meccano structures thus produced.

Training in Engineering Methods

A new Guild Map is now being prepared and is expected to be ready during the next week or two. This map shows the position of all the affiliated clubs in the British Isles and also of the larger unaffiliated clubs. I hope to make a further announcement regarding this map in the January issue.

The Guild Map

This is the best time of the year for obtaining recruits to the Meccano Guild and I strongly urge every Guild member to try to enrol at least one recruit, so that by the end of the Winter Session the Guild membership may be doubled. If you know of a Meccano enthusiast who is unaware of the existence of your club, introduce yourself to him and invite him to accompany you to the next meeting. You will then be doing active work for your club and for the Guild, besides enabling another Meccano follower to meet boys of his own age and of similar interests. Undoubtedly he will appreciate your introduction and become 'a friend for life," In this manner many new friendships have been formed.

New Members

In almost every case where the plan has been put into operation it has resulted in the two sections working away merrily on their own separate lines with growing enthusiasm. At regular intervals and on various special occasions the two sections combine, and these combined meetings are looked forward to with keen interest, especially by the juniors. The secret of the whole idea lies, of course, in preventing any feeling of boredom on the part of the younger members, and in giving them the feeling that they have their own particular position in the club, into which the seniors do not intrude. As time goes on, the juniors pass into the senior section and thus the progress of the club is steady and unbroken. I hope that where it is at all feasible, Leaders will try the experiment of arranging their clubs on this sectional plan. Special meetings might be called to discuss the question, and in such cases I should like to hear the results. An age limit to the junior section should be fixed by agreement, and the sub-leader might be selected from the seniors. It might be advisable to allow the junior section to appoint a secretary chosen from among its members.

Sectional Enthusiasm

A Berkshire Meccano Club Group

Courtesy "Reading Standard"] [*Photo C. E. May*

Our photograph is of Mr. H. G. Rogers, Leader of the Reading Meccano Club, and a group of some of the members. The Reading Meccano Club was formed at the beginning of the present year and has made splendid progress. Affiliation was granted in August, and the membership is about 50. The Club's headquarters is at the Oddfellows' Hall, Friar Street, and as there is considerable enthusiasm, a successful career is assured.

CLUB NOTES

King Edward VI. School (Aston) M.C.—Opened the winter session with a record attendance of 42 members following upon an active recruiting campaign. Mr. W. B. Chivers, the Leader, is giving a series of lectures on "Swiss Railways." A competition to determine by vote the ten most popular models in the Meccano Manual is being held. A committee of six has been elected to take charge of minor affairs. Club roll: 46. *Secretary*: H. Mapp, 31, Thornhill, Handsworth, Birmingham.

United Schools (Melton Mowbray) M.C.—An Invitation Concert is fixed for the end of the year and a good general programme has been arranged. Club roll: 24. *Secretary*: H. White, 25, Bayswater Road, Melton Mowbray.

Richmond M.C.—Mr. Hosking, the first Leader, has resumed that position. The present clubroom has been outgrown and new headquarters are being sought. The experiment of holding a "Visitors' Night" has been tried successfully. Club roll 32. *Secretary*: A. R. White, 15, Albert Road, Richmond, Surrey.

Royal Grammar School (High Wycombe) M.C.—Has very active, Meccano, Fretwork, Photographic and other sections. The programme includes Lectures and Papers, Model-building and Cinema show (with Baby Cine outfit), closing with an Exhibition of Models and work from all sections of the club. Prizes are offered for the best Model from the Manual and for the best Design cut in wood or linoleum for a Club Crest. *Secretary*: H. R. Foden, Royal Grammar School, High Wycombe, Bucks.

South Park (Ilford) Hobbies & M.C.—Great interest has been shown in Model-building and Wireless. An Exhibition of members' work is being arranged to wind up the year. Club roll: 35. Average attendance: 28. *Secretary*: S. R. Steele, 20, Ripley Road, Seven Kings, Essex.

St. James' Choristers (Exeter) M.C.—Has a Hornby lay-out called the "Universal Railway," which is shortly to be electrified. There are now over 25 feet of double track. A large Model of a Tramcar has been built by members working in shifts. It is proposed to publish a history of the club and a magazine is likely to be inaugurated. Recently a Lantern Lecture was given with a series of slides illustrating the club's progress. Club roll: 115. *Secretary*: L. Mathews, 44, Rosebery Road, Exeter.

Harwich M.C.—Had a splendid exhibit of Meccano and Hornby Trains at the autumn show of the local Horticultural Society. Special prizes were awarded to the builders of Meccano models. The club has been divided up on the "House" system, and now comprises "Stephenson House" and "Marconi House." Mr. Hogg, the Leader, gave an illustrated lecture on "Tanks." In addition to Model-building there are sections for Fretwork, Raffia-work, Toy Soldier making, Drawing and Art Classes. An Exhibition is to be held at Christmas. Club roll: 60. Average attendance: 50. *Secretary*: A. E. W. Ward, Osborne House. Pepys Street, Harwich.

Boston (Lincs.) M.C.—Has purchased a Billiard Table and this is proving a very popular feature. The usual winter activities are being enthusiastically carried on. Club roll 30. *Secretary*: R. Robinson, 30, Woodville Road, Boston, Lincs.

West View (Nottingham) M.C.—Has resumed activities since last winter. The ground to be covered this session includes Model-building, Wireless, Lectures, etc. Lectures have already been given on "A Home-made Loud-speaker," "Types of Engines" and "Coils, and how made." *Leader*: Mr. H. W. R. Cousens, 494, Mansfield Road, Sherwood, Nottingham.

Queen Elizabeth's School (Crediton) M.C.—Was affiliated with the Guild in October. Mr. T. H. Thompson is Leader and the club meets one night weekly. Club roll: 14. *Secretary*: A. Sprague, Queen Elizabeth's School, Crediton, Devon.

Blackpool Sports M.C.—Mr. W. Slingsby is Leader again, and J. Fraser, formerly secretary, has been elected Chairman. A football team is run by the club and is doing well. Lectures have been arranged on Wireless and Woodwork. *Secretary*: Maurice Naylor, "Dalesford," St. Annes Road, Blackpool.

Cheltenham Grammar School M.C.—Members are showing steadily increasing interest and an attractive programme is being carried out. At the end of the term there will be an Exhibition of members' Models. *Secretary*: E. W. Griffiths, The Grammar School, Cheltenham.

Meads M.C.—The club-room has proved to be too small and the committee have decided to hold meetings in a larger hall. Preparations for a concert are in progress and it is proposed to purchase a number of games for the use of members. All activities are now in full swing. Club roll: 20. Average attendance: 10. *Secretary*: A. A. Moore, 7, Rodmill Road, Eastbourne.

Davenport M.C.—Has rapidly got into its stride and members are now fully occupied with preparations for an Exhibition and a Play entitled "Uncle Ben." A large model is to be lent from Headquarters for this Exhibition, a full report of which will be given next month.

St. Marks M.C.—This month has been particularly successful. The first meeting was devoted to games and the second and third were occupied in model-building in view of the approaching Exhibition, which is expected to be a great success. Mr. Clarke filled in the fourth meeting with a very interesting Lecture on the different kinds of wood and at the fifth meeting a Fretwork Section was commenced through the generosity of the Church, who gave a large donation in order that a good start might be made. Club roll: 20. Average attendance: 15 *Secretary*: Geo. C. Green, 21, Hafton Road, Catford, London, S.E.6.

Diss (Norfolk) M.C.—Has recently been affiliated and promises to become very successful under the Leadership of Mrs D. M. Maling. At present model-building is the chief activity but further developments are now under consideration. Club roll: 9. *Secretary*: J. Maling, 15, Heywood Road, Diss, Norfolk.

Meccano Club Presidents

No. 4

Sir R. N. Mookerjee, K.C.I.E., K.C.V.O.

Sir Rajendra N. Mookerjee, President of the Calcutta Meccano Club, takes a keen interest in its progress. A civil engineer by profession, Sir Rajendra was Sheriff of Calcutta in 1911 and was knighted in that year. In 1921 he was elected first President of the Institution of Engineers (India), and served as a member of the India Railways Committee. He is also a Governor of the Imperial Bank of Bengal.

The Calcutta Meccano Club was founded in the Summer of 1922, and was affiliated with the Guild in October, 1922, under the leadership of Mr. M. N. Gan.

The club has been characterized by the extensive nature of its activities, and takes a prominent place among the young people's organisations of the great Indian City.

Skelmanthorpe Wesleyan M.C.—Has introduced a novelty in the shape of Physical Training for ten minutes at each meeting, and this venture is exceedingly popular. It is hoped to be able to organise a football club shortly. The club Library now numbers more than eighty books, which are lent to members at the charge of a half-penny per fortnight. The membership is increasing satisfactorily. Club roll: 19. Average attendance: 17. *Secretary*: R. G. Field, Pilling House, Skelmanthorpe, nr. Huddersfield.

South Africa

Simonstown M.C.—The members spent a pleasant evening at the house of Mr. Holiyer and were keenly interested in an excellent four-valve wireless set operating two loud-speakers. Cape Town, Johannesburg, and Durban were heard. The working of a Crystal Set was also explained in detail. Another interesting feature has been an address by the President on Meccano, its uses and possibilities. A large railway lay-out with five Hornby locos running provided a pleasant evening and aroused great enthusiasm.

Australia

Adelaide M.C.—Meets for a long session every month as many members have to travel considerable distances. Meccano model-building and Hornby Trains provide the chief activities and impromptu four-minute speeches, draughts tournaments and Radio are also included in the programme. Annual subscriptions have been raised and are now 2/- for members over 15, 1/6 for members from 12 to 15 and 1/- for those under 12. Club roll: 22. *Secretary*: R. E. W. Cornish, Walkerville Terrace, Walkerville, Adelaide.

Glenelg M.C.—The Leader, Mr. Patrick, has given interesting lectures on "Famous Engineers," "Famous Expresses of different Countries" and "Aeroplanes." Members are very enthusiastic in regard to Model-building and there is keen competition for the various prizes offered in the monthly contests. Recent models have included Aeroplanes and Locomotives. Club roll: 92. *Secretary*: Keith Holmesby, 22 Partridge Street, Glenelg.

India

Calcutta M.C.—Six-a-side Football has been a popular pastime, and a recent tournament took place for the silver cup presented by Mr. A. Chatterjea. During the autumn session the members enjoyed several excursions, notably to a Calcutta Fire Brigade Display, and also had a cruise in a motor launch. An afternoon party and display of models was held on September 19th, in honour of Sir R. N. Mookerjee, President of the Club. Club roll: 40. *Secretary*: Mr. A. N. Roy Chowdhry, Calcutta Meccano Club, 35-2 Beadon Street, Calcutta.

Clubs Not Yet Affiliated

Pinewood M.C.—More than 20 members have now joined and Mr. C. C. Cooke, O.B.E., has become Leader. *Secretary*: E. Batchelor, Pinewood, Farnborough, Hants.

Westgate-on-Sea M.C.—Is now well established and has been fortunate to obtain Mr. Pitfield as Leader. Good headquarters have been secured. *Secretary*: Alexander Robb, 13, St. Benets Road, Westgate-on-Sea, Kent.

Pitsea and District M.C.—A church hall is now the headquarters and meetings are held every Tuesday at 8.15 p.m. Model building evenings are popular. Club roll: 10. *Secretary*: F. E. King, High Street, Pitsea, Essex.

Perranwell and District M.C.—Is increasing its membership steadily. Arrangements for an Exhibition of Models are being put in hand. *Secretary*: F. R. Evans, Penhenver, Perranwell Station, Cornwall.

Hougham M.C.—Continues its activities although the membership has fallen off somewhat. An adult Leader is urgently required. *Secretary*: J. Scotney, 2, Hougham Station, nr. Grantham, Lincs.

Haslingden (Manchester) M.C.—Is connected with Haslingden Secondary School, and meets weekly in the Physics Laboratory. Mr. Barton, Science Master, is Leader. A practical demonstration of Wireless has been arranged. Club roll: 10. *Secretary*: Kenneth J. Tupling, 16, Alexandra Terrace, Haslingden, nr. Manchester.

Sandwich M.C.—With Mr. Jezzard as Leader, the Club is doing well. New members are cordially invited. *Secretary*: W. Barbour, 9, Paradise Row, Sandwich, Kent.

Leicester M.C.—Is engaged in building a Model Motor-Bus. Meetings are held on Wednesday and Saturday evenings, and members pay a small weekly subscription towards copies of the "*M.M.*" and the purchase of Meccano parts. A recent lecture, entitled "A Stamp Tour Round the World," was based on the series of articles upon this subject in the "*M.M.*" Club roll: 10. *Secretary*: Kenneth Green, 87, Winchester Avenue, Leicester.

St. Lawrence (Jersey) M.C.—Is now successfully established. Mr. Whistler Headmaster of the boys' School, has been appionted President. Weekly meetings are held in the school, and the President has given interesting talks on various subjects. Radio is included among the various activities. *Secretary*: F. Brown, Le Brocage, St. Peters, Jersey, Channel Islands.

St. Anne's (Bristol) M.C.—Meets every Saturday evening at St. Anne's Vicarage under the Leadership of the Vicar. The Secretary will be glad to hear from Meccano boys in the district desirous of joining. Club roll: 10. *Secretary*: J. Davies, 45, Arlington Road, St. Anne's Park, Bristol.

Selby St. James' M.C.—A Railway Centenary Exhibition was held in October with a large Hornby lay-out on a billiard table. The Exhibition proved very attractive and admission receipts covering the two days amounted to £5 8s. 8d. *Secretary*: G. S. Froggatt, St. James' Vicarage, Selby, Yorkshire.

Bellahouston (Glasgow) M.C.—Has secured a good club room and expects to have a Leader appointed shortly. Activities include Meccano Nights, Hornby Train Nights, Lecture Nights, etc. Club roll: 12. *Secretary*: J. Malcolm, 16, Golfview Terrace, Cardonald, Glasgow.

Walsall M.C.—Requires additional members now that excellent headquarters have been obtained. Mr. D. Schumacher is Chairman, and a new secretary has been elected. Club roll: 11. *Secretary*: J. Whiston, 37, Thorpe Road, Walsall.

The Origin of Guilds

The Splendid Ideals and Traditions of the Ancient Companies

MAN has always been a sociable being, even from the very earliest times. In far-distant ages men formed themselves into tribes for mutual protection against their enemies and against the fierce wild animals that roamed the countryside. As civilisation dawned and gradually spread, the tribes drew together into larger and still larger bands, and so in time nations came into existence. But during all this banding together there remained in the larger bodies small groups of men drawn together by some strong common interest, and in these little groups we find the origin of Guilds.

We have been asked repeatedly why we chose the name "Guild" for the great Meccano organisation. The answer is that we wished our movement to be based upon the splendid ideals and traditions of the old Guilds—good fellowship and comradeship and unselfish working for mutual benefit. The old Guilds are dead, but the spirit that animated them is as much alive to-day as ever, and we believe that spirit animates the members of the Meccano Guild. As long as its members remain true to its ideals, the Meccano Guild will live and prosper and become an ever-widening influence in the world of modern boyhood.

Craftsmen from Flanders

A Guild may be described briefly as a union of men formed for mutual benefit, responsibility and protection. It cannot be claimed that Guilds originated in England, but it was in England that they reached their highest development.

After the conquest of England by William I., traders and skilled artisans began to come from Flanders and northern France to settle in what was then a comparatively thinly populated country. These men were masters of their respective crafts and were also very industrious, and consequently in time they became very prosperous. Those were lawless times, and the wealth of these merchants soon attracted the attention of the robber bands that infested the country. The merchants therefore found it necessary to band themselves together for mutual protection of their lives and property, and so a number of Guilds came into being.

Formation of Merchant Guilds

As time went on and the state of the country became more peaceful, the need for combining against robbers gradually disappeared. By this time, however, the merchants had realised that there were many other advantages in such combinations, and so the Guilds already in existence were kept going, and from time to time others were formed. In the twelfth century Merchant Guilds received Royal authorisation, and thus were placed upon a sound basis.

The Merchant Guilds were formed primarily for trading purposes, and the members passed many stringent rules regulating trade in various towns and villages. For instance, only members of the Guild were allowed to sell goods to the inhabitants of a town. A stranger might bring in goods, but he could only sell them to members of the Guild, and anyone found breaking this rule was very severely punished. It might be thought that the merchants, protected by Royal authority and strongly organised in this manner, would make exorbitant charges, as there was no competition and no restraint. This was not the case, however, for wise rules were drawn up by all the merchants assembled together, and any member disregarding these for his own profit had his privilege of membership taken away and was thus deprived of the means of livelihood.

Gradually the scope of the Merchant Guilds widened, and when the liberties of the townsmen were threatened there were large assemblages at the Guild Hall to consider ways and means of defending their rights. Thus the Guild's affairs became more and more the town's affairs, and later on we find that the Guild-Halls became Town Halls and the Merchant Guilds became Town Councils.

Craft Guilds and Apprentices

As the Merchant Guilds gradually changed in character, the Craft Guilds sprang up and replaced them as far as trading interests were concerned. The Craft Guilds, as was the case with the Merchant Guilds, were governed by very strict rules. Each member held himself directly responsible for the actions of his fellow members and this naturally led each one to consider his conduct very carefully.

The rules and regulations were drawn up on the vote of the majority, and were framed for the welfare of the community as a whole, and for the religious and moral good of the individual. They demanded that each member should lead an upright, honest life, giving succour to anyone in distress (particularly a fellow member of his Craft) and doing his utmost to live up to the high ideals of the Craft. Should a member find his business failing through the markets going against him, it was the duty of his fellow members to help him and save him from going to moneylenders, who charged exorbitant interest.

The Reward of Merit

A determined effort to break down class distinctions was made through the introduction of the apprenticeship system. No matter how rich and influential a man was, he could not buy the right of entry to the Guild for his son, who must serve his apprenticeship, live, sleep, have his meals and his games with his fellow apprentices. Promotion to the various offices in the Guild was given on merit alone, and it was possible for the son of the poorest parent to gain the highest honours the Guild had to bestow.

As in the case of the Merchant Guilds, the interests of the Craft Guilds widened, and in addition to the ordinary commercial and social obligations they took a deep interest in religious and educational matters. Not only did they strive to make the Church services beautiful, but they spent endless time, energy, and wealth in beautifying the buildings in which the services were held, and many churches and chapels bear evidences of their efforts to this day. In some old churches there are wonderful examples of wrought-iron work, marvellous wood carvings and tapestries and priceless specimens presented by the old Goldsmiths and Silversmiths. In educational affairs they spent huge sums in founding and endowing schools and colleges, and they usually engaged the very finest masters it was possible to get.

This religious tendency is still reflected in the Church, for to-day there is scarcely a church or chapel in the Kingdom without a Guild of some sort or other.

The Dissolution

The Guilds, in the oldest and best sense, received their deathblow in the reign of Henry VIII. A Bill was introduced in Parliament authorising the King to acquire all the property and lands belonging to churches and the Guilds. The Guild members banded themselves together and used all their great influence and power to resist the Bill, but although they managed to retain a great many of their rights and privileges from a commercial and social point of view, their colleges, churches and chapels were seized and confiscated.

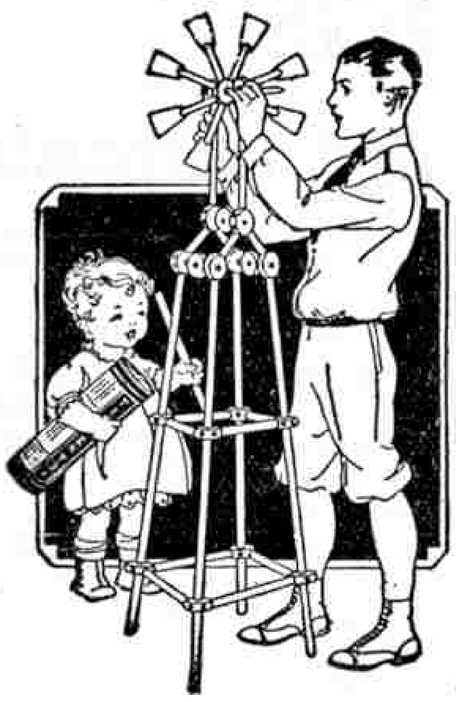
The Guilds never recovered from this blow. The former strict rules were gradually relaxed, and little by little unscrupulous men won their way to power. They altered everything completely, and soon the Guilds became leagues or companies of employers and capitalists, who used them for grinding down the poor workmen and townspeople for their own profit. Efforts were made in Elizabeth's reign to restore the Guilds to their former purity of purpose, but without success, and it is doubtful if they can ever exist again as they did hundreds of years ago.

A Souvenir of the Railway Centenary

One of the most interesting records of the railway centenary was "*The Railway Centenary Supplement*" published by "The Northern Echo," Darlington. The wide scope covered by this publication, and particularly the remarkably large number of interesting illustrations, brought about a large demand for it in its original form.

Since then the unique character of this supplement has led to widespread requests for an edition printed on better paper. We are glad to be able to announce that a new edition printed on art paper is now available and copies will be sent for 3/6 each, post free, to any part of the world. Applications should be made to "The Northern Echo," Darlington, and those of our readers who intend to purchase a copy should not delay as the edition is strictly limited.

TINKER TOY

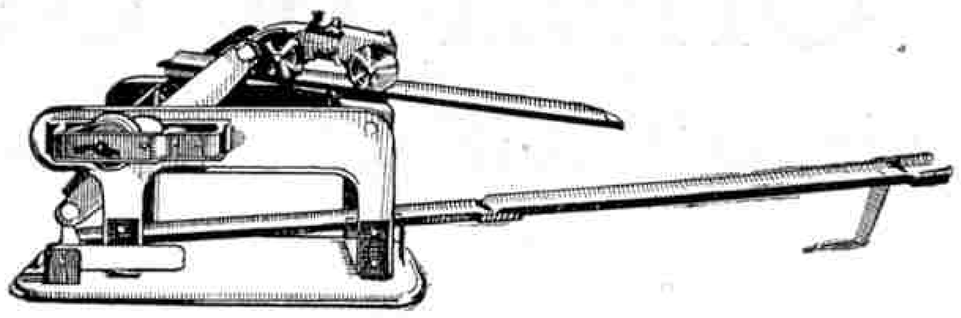


TINKERTOY is composed of smooth round sticks and thick spools, with eight holes each around the edge, and one hole in the centre. Each set is packed in a strong laminated tube three inches in diameter and twelve inches in height.

Tinkertoy is made in only one size, and is complete in itself. With **TINKERTOY** a great variety of models can be built. A book of simple instructions comes with each set.

Price **4/3**

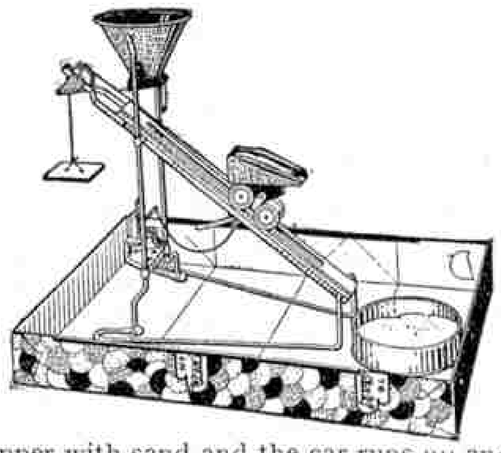
OVER and UNDER



No. 28. 25 inches long, 6 inches high.

The driver in the race car runs down the upper incline, drops to the lower track and continues to the end; then reverses to the opposite end, where the motor raises the car to the upper incline for the next trip. This is repeated many times on one winding. Price **7/6**

SANDY ANDY



Fill the hopper with sand and the car runs up and down the incline, dumping sand as long as there is any in the hopper. Tin of clean white sand furnished with each toy. The carton opens flat and forms a tray to catch and hold the sand. Toy is 13½ inches high when set up. No. 76, Price **7/6.** No. 60, Price **4/11**

"SCARY ANN"

Most Amusing Novelty of the Season.

Pressing a spring at the back raises the hair—causing much fun and laughter—hand decorated—six different colours.

Price **2/6**

Obtainable from ALL GOOD TOY SHOPS AND STORES—Wholesale: H. A. MOORE & CO. LTD., 150, Southampton Row, W.C. 1.

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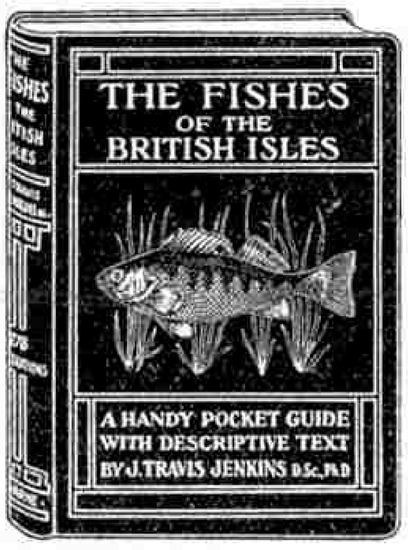
The New Volume in our Well-Known
WAYSIDE AND WOODLAND SERIES IS :—



THE FISHES OF THE BRITISH ISLES

By J. TRAVIS JENKINS, D.Sc., Ph.D.

A Complete Pocket Guide dealing with the characteristics and habits of British Fish, both Fresh Water and Salt. With 278 Illustrations, of which 128 are in full colour, all thoroughly reliable for identification, &c. Complete List of Common and Scientific Names, Appendices, Bibliography of Books on the subject and Full Index. In pocket size (6½ × 4½ ins.), cloth gilt, round corners, **12/6** net.

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Separate issues illustrated by L. Leslie-Brooke

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Of All Booksellers. **Catalogue free on application.**

Chandos House, 1, 2, 3 & 4, Bedford Court, London, W.C. 2

This boy built a Peep-Show

A Splendid Christmas Gift THE "TOBY" BOOK 6/-

HE found the coloured cut-out model in the Christmas "Toby" and very soon erected it. Next he read the thrilling adventure stories, the jolly school tale, and the humorous verses. Then he sharpened his pencil and tried the competitions. "Toby" will give *you* hours of amusement, too. Don't miss this wonderful number.

TOBY *A Children's Monthly Magazine* XMAS NUMBER

ONE SHILLING.

FROM OUR READERS

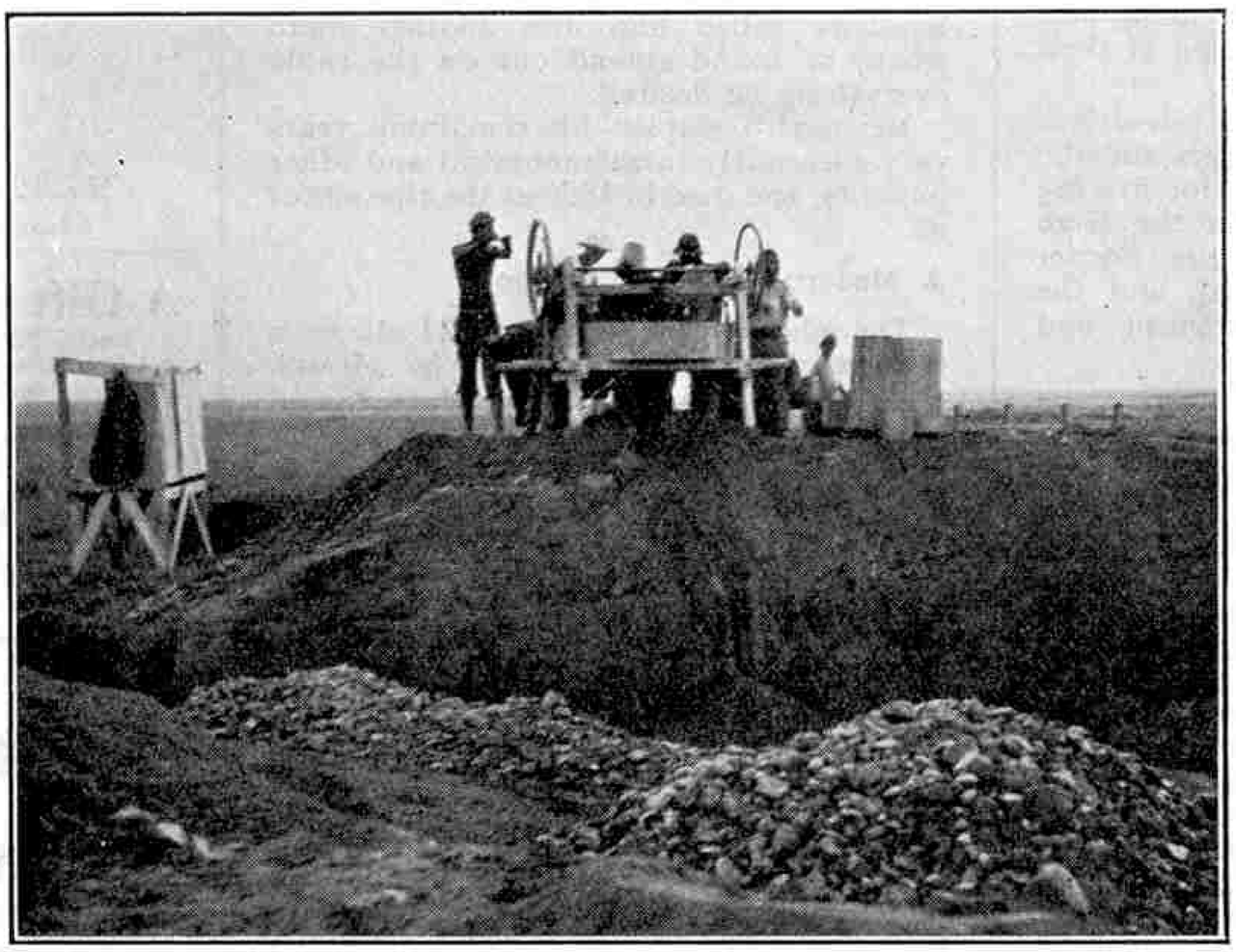
This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles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

Diamond Mining in the Transvaal

I lived in a town in the middle of the South African diamond fields all my life until I came to England a couple of years ago and I thought that perhaps a short account of diamond mining might be of interest to readers of the "*M.M.*"

In South Africa there are two classes of diamond mines, those that—like gold mines—are worked hundreds of feet underground, and the alluvial mines, usually called the "Diamond diggings." It is the working of the latter type of mine that I propose to explain.

When a certain area is discovered to contain diamond-bearing gravel it is "proclaimed" by the Government, and on an appointed day crowds of "diggers" assemble. They are all armed with pegs and when the word is given they run and peg out their claims, the fastest runners securing the best claims. These are dug out, and after the "overburden," that is the earth and grass, has been done away with, the diamond-bearing gravel is encountered.



Photo] [*E. C. R. Hadfield*

Scene on the diggings. Natives working a washing machine

When a sufficient quantity of this has been dug out it is put through a sieve mounted on a frame commonly called a "baby," which separates the larger stones that could not possibly be diamonds. The remainder is then placed in a "washing machine" in which any particles of earth are washed away and only the gravel is left. Then a native, filling a hand-sieve with gravel, again washes it in a tub of water, swirling the gravel round and round the sieve so that the diamonds, being heavier than the gravel, sink to the bottom. The sieve is now quickly inverted over a table covered with sacking and the diamonds, if any, are on the top.

The prices of diamonds vary very much, from £9 to about £40 a carat, according to the value of the stone. Stones less than ¼ carat are regarded as more or less worthless, fetching 2/6 to 10/– if a buyer can be found.

The "diggings" are worked by native labour, supervised by white men, who are always on the watch against a native secreting a diamond to sell for his own profit.

Many of the "poor whites" from the slums of Johannesburg and other towns go to the diamond diggings to attempt to make their fortunes. Only a few make large profits however, and most of them lose the little they have.

The "diggers" live in tents or houses made of old tins beaten out, or sacking, squalid and filthy, and when the price of diamonds falls, many starve and die. The "diggers" life is a great gamble—a gamble which he seldom wins.

E. C. R. HADFIELD
(Tiverton, Devon).

The Dams on the River Elan

I was interested to see in the September Meccano Magazine a picture of one of the dams on the River Elan. I went there myself in August, and I think that possibly some readers might like to have a little information about the reservoirs that serve Birmingham with water. The reservoirs were opened on 21st July 1904 by King Edward and Queen Alexandra.

The River Elan is a tributary of the Wye, which it joins about 3½ miles beyond Caban-Coch, the lowest of the reservoirs. The lakes are about 5 miles south of Rhayader and the water is taken to Birmingham by an aqueduct 73 miles in length. The whole scheme cost nearly £6,000,000. Nearly all the stone for the dams was obtained from quarries near Caban-Coch.

There are four lakes with three great dams and one submerged dam with a viaduct crossing it. Caban-Coch is the largest of the reservoirs, holding 8,000,000,000 gallons of water, and is fed by the river Claerwen. The other three reservoirs, of which the top one, Craig-Goch, holds most —2,000,000,000 gallons—have the River Elan as their source of supply. On each of the dams there is a tablet giving statistics as to their capacity, etc.

When the reservoirs were being made two interesting houses had to be submerged. The poet Shelley stayed with some cousins at one of these houses and, when he was married, lived for a short time at the other, Nantgwyllt. He received many of his most beautiful inspirations in this magnificent valley. The reservoirs have not spoilt the scenery in the least and but for the dams the lakes might almost be thought to be natural. P. N. BARNARD (Prestwich).

Lives of Famous Engineers—

(*Continued from page* 627)

applied the elastic force of steam to raise a ram or driving-block a distance of only three or four feet, after which the block was disengaged and fell with its weight of three tons upon the head of the pile, the process being repeated as rapidly as 80 times per minute.

This steam pile-driver was first used in the construction of an extension to the great docks at Devonport, and when the machine arrived it excited great interest and curiosity in the dockyard. The pile-driving machine men threw out a good natured challenge to Nasmyth, who promptly accepted it. Two huge piles, 70 ft. long and 18 in. square, were obtained and at a given signal the old and the new machines started together. The result sealed the fate of the old method. In 4½ minutes Nasmyth's pile was driven down to the required depth, whereas the men working the ordinary machine took over 12 hours to complete the driving of their pile!

The success of the steam pile-driver was followed by numerous orders and the machine was afterwards used for driving the immense piles required for the High Level Bridge at Newcastle, the Border Bridge at Berwick-upon-Tweed, and the docks at Birkenhead, Tynemouth and Grimsby.

The Bridgewater Foundry became more and more successful as years went on, and in 1856 Nasmyth, at the early age of 48, decided to retire. "I have now enough of this world's goods," he said, "let younger men have their chance."

During his active work at Patricroft Nasmyth's chief hobby had been astronomy, and after his retirement it became his serious study. He settled down at Penshurst in Kent and devoted himself to the minute study and drawing of the various features of the moon's surface. His work in this direction won for him the praise of Sir John Herschel and other eminent astronomers. Nasmyth's drawings of the moon attracted the special notice of Queen Victoria and the Prince Consort and in 1851 he had the honour of showing Her Majesty some of his drawings and explaining them in detail.

A Ghost Story

In his autobiography Nasmyth tells an amusing story of his telescopic observations while still at Patricroft, where he used to proceed to his garden at all hours of the night to gaze through his telescope at some interesting feature of the skies. "It became bruited about," he writes, "that a ghost was seen at Patricroft! A barge was silently gliding along the canal near midnight, when the boatman suddenly saw a figure in white. It moved among the trees with a coffin in its arms! The apparition was so sudden and strange that he immediately concluded that it was a ghost. The weird sight was reported at the stations along the canal, and also at Wolverhampton, which was the boatman's headquarters. He told the people at Patricroft on his return journey what he had seen, and great was the excitement produced. The place was haunted; there was no doubt about it! After all, the rumour was founded on fact, for the ghost was merely myself in my night-shirt, and the coffin was my telescope, which I was quietly shifting from one place to another in order to get a clearer sight of the heavens at midnight!"

Drawing a Meal

Another of Nasmyth's great hobbies was drawing. From his earliest days he had been in the habit of expressing his ideas by means of his pencil and throughout his life his sketch book was always at hand. On one occasion, while on a visit to Sweden, he found himself at a lonely country inn. He was very hungry and thirsty, but as he knew no Swedish and the landlady knew no English he found it difficult to express his desires. In this dilemma he resorted to his sketch book and in a few seconds produced a clever sketch of a table with a dish of meat upon it, a bottle and a glass, knife and fork, loaf, salt cellar, etc. The landlady looked at the drawing, laughed and nodded and ran into the back garden to show it to her husband, who inspected it with delight. Shortly afterwards the landlady called him into another room where he found spread out on the table everything he desired.

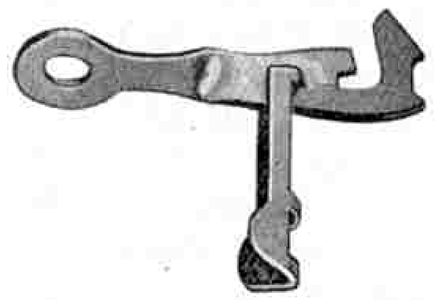
Nasmyth occupied his remaining years very pleasantly in astronomical and other pursuits, and died in 1890 at the ripe age of 82.

A Modern Two-Ton Hammer

The photograph on page 627 shows a modern steam hammer built by Messrs. B. & S. Massey Ltd., of Manchester, and it will be noticed how closely this resembles in general form the hammer shown in Nasmyth's sketch. This arch form type of hammer is used for general forge work where the nature of the work or the material to be dealt with demands a maximum of strength and rigidity.

Both the front and the back of the hammer are open to receive work and cranes can swing close up to the hammer. Perfect control is obtained by means of a patent hand-worked expansion valve gear which not only reduces the consumption of steam but also increases the safety of working. It is so arranged that the hammer can be made to strike lightly or heavily, quickly or slowly, with long or short strokes as desired. There is no jar or shock to the operator's hand. Steam is used expansively on both up and down strokes.

New Meccano Parts

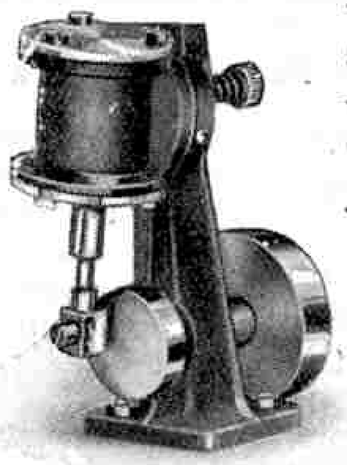


No. 121 Train Coupling, each 2d.
(*Available in the United Kingdom only*).

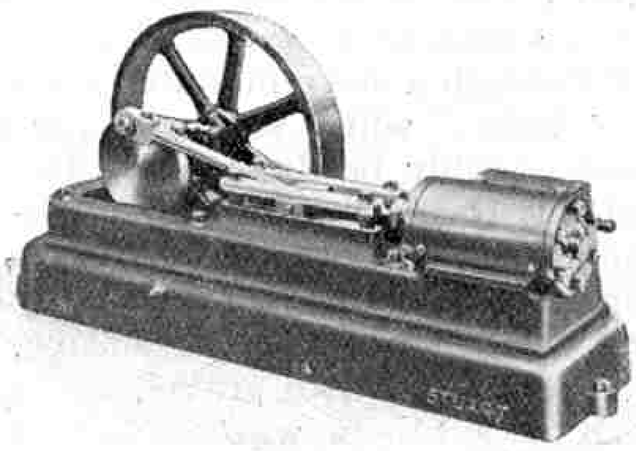
A Gift for your Young Sister

"Sunny Jim" as a rag-doll strikes quite a new note and it is no wonder that he is so popular. He is the quaintest, funniest little fellow who ever boasted a cloth exterior and a stuffed interior! Just like the pictures you see of "Sunny Jim" in a hurry, with his coat-tails and his pigtail flying behind him, he easily bends into the most comical attitudes without damaging himself. Readers with young sisters will find him a fine present to give for Christmas. Full particulars in the "Force" advertisement (page 702).

The Most Fascinating Hobby is to Build Your Own Engine



STUART ENGINES are utterly different to the ordinary toy engines. They are made by Engineers for young Engineers.



THE POWERFUL S.T. ENGINE will drive your Meccano easily.

We **guarantee** it will work when you have built it. You only need a small screwdriver.

Complete set of parts with full instructions 5/-

Brazed Copper Boiler for same. **Perfectly safe** 8/-

For 13/- you have the finest small plant it is possible to obtain.

THE FAMOUS "S 50"

8½ inches long.

Can be built with screwdriver and spanner.

Complete set of parts and full instructions 30/-

Send a stamp at once for List 12M which gives full details of these and several engines, boilers, the Stuart Dynamo and the new Steam Launch "Henley."

Better still send 6d. for the 80 pages "Engine" Catalogue.

STUART TURNER LTD., HENLEY-ON-THAMES

SECOND SERIES:

Meccano Model-Building Contests

TWENTY-SEVEN PRIZES TO BE WON

THE competitions announced below are the second pair of a series which we are running throughout the winter months. Every contest is complete in itself and separate prizes are offered for the best entries received in each. Subsequent competitions appearing in the Magazine will be arranged on similar lines, but the size of the Outfit involved in the "Outfit" contests, and the type of model required in the "Model" contests, will continually change. In this way we hope to extend the opportunity of competing to all our readers, whether they possess a No. 0 or a No. 7 Outfit. The results of the competitions will be announced in the "*Meccano Magazine*" two or three months from the date of the issue in which they appear.

In the October issue of the "*M.M.*" we announced the first two competitions of the series; in one of these, prizes were offered for the best models built with a No. 0 Outfit, whilst the other carried splendid awards for the best models of Meccano Locomotives. The responses in both cases were excellent, and the difficult task of judging hundreds of very interesting models is now in progress. The results and names of prize-winners will be published in next month's "*M.M.*"

We should like to remind competitors that it is most important that entries should be marked with the name of the competition for which they are intended, and that the age of the competitor should be clearly indicated.

Le Rhone-engined Sopwith "Gnu"

"AEROPLANE" COMPETITION

£25 IN PRIZES

Entries in this competition will be divided into the following sections:
SECTION A, for competitors residing in the British Isles;
SECTION B, for competitors residing outside the British Isles.
Competitors' ages will be taken into consideration when judging the entries.
Prizes will be awarded for the best entries FROM EACH SECTION as follows:—
FIRST PRIZE, £5-5s.; SECOND PRIZE, £3-3s.; THIRD PRIZE, £1-1s.; SIX consolation prizes of 10/6 each.

HOW TO ENTER. This competition is opened with a view to testing the ingenuity of Meccano boys in devising realistic model aeroplanes—a type of Meccano model that has hitherto received comparatively little attention. You may construct your model on the lines of any existing machine that comes under the general classification of "aeroplane"—monoplanes, biplanes, triplanes, gliders, helicopters, etc.—and you may use any Outfit or number of parts.

The first prize in each section will be awarded to the competitor who builds the aeroplane that the judges decide to be the best model entered in that section, and the second and third prizes will be awarded to the second and third best models. It is wise to remember that very often the simplest and most straightforward models are better than the more complicated structures.

When you have built your model, you should send in a photograph or a good drawing, together with any explanations you may think necessary, although the latter should be made as brief as possible. Write your name and address on the back of each sheet used, and state your age, and section in which your model is entered.

Closing date for Section A, 30th January, 1926. Overseas Section, 30th April, 1926.

Mark envelopes "Aeroplane Competition."

Do not send models. A clear photograph or good drawing is all that is necessary.

"No. 1 OUTFIT" COMPETITION

In this competition prizes are offered for the best models made entirely from a No. 1 Meccano Outfit. Models comprising parts that do not appear in this outfit will be disqualified. It is not necessary to use all the parts contained in the outfit.

We hope to receive some very interesting entries in connection with this contest, and we shall endeavour to publish as many of the prize-winning models as possible in future issues of the "*Meccano Magazine.*" An interesting feature of the contest is the fact that all competitors will be using a similar number and variety of parts.

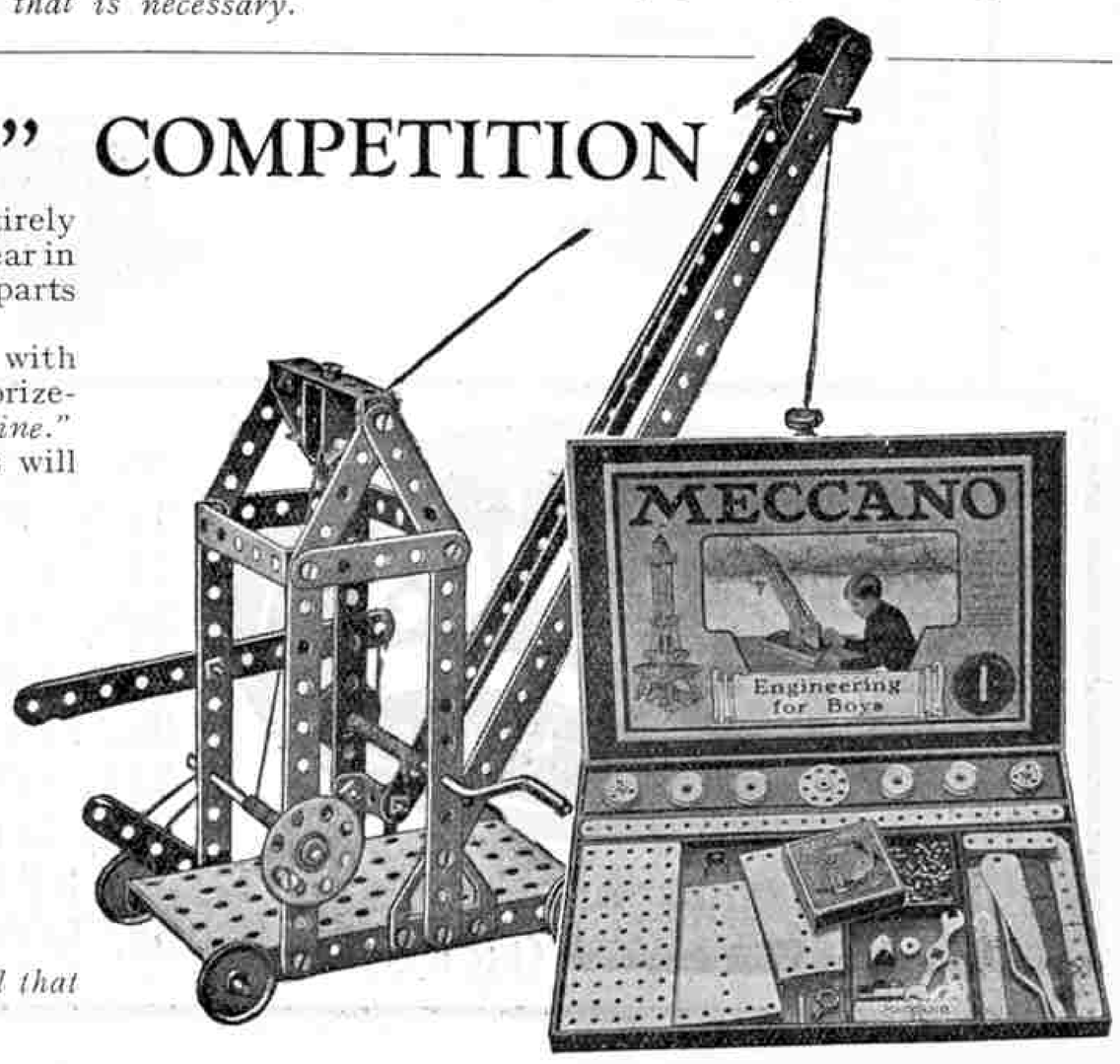
Entries will be divided into the following sections:—
SECTION A, for boys under 12.
SECTION B, for boys over 12 and under 16.
SECTION C, for boys residing overseas, and not exceeding 16 years of age.

Prizes will be awarded for the three best entries from each section as follows:
FIRST PRIZE: Meccano Goods to the value of £2-2s.
SECOND PRIZE: Meccano Goods to the value of £1-1s.
THIRD PRIZE: Meccano Goods to the value of 10/6.

Closing dates for Section A and B: 30th January, 1926. Overseas Section, 30th April, 1926.

Mark envelopes "No. 1 Outfit Competition."

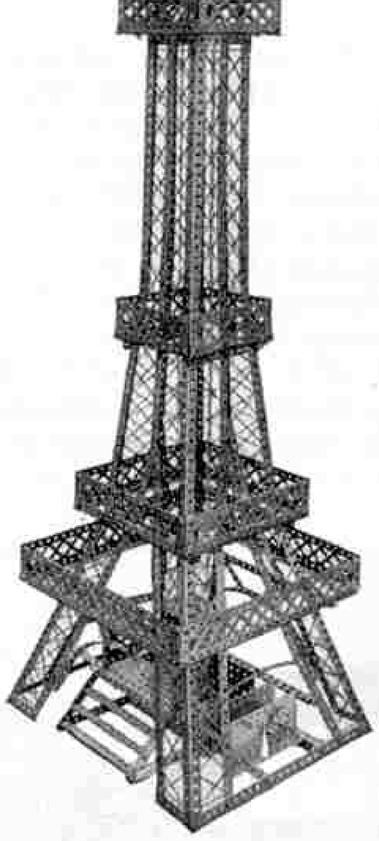
Models should not be sent. A clear photograph or good drawing is all that is necessary.



Buy them all at Hobbies!

MECCANO

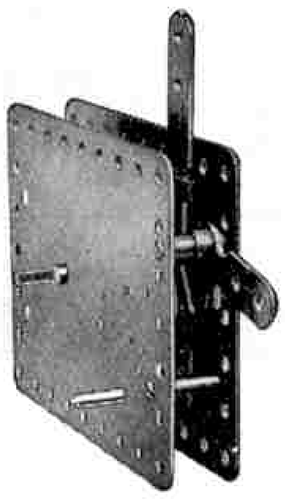
Whether it is a new Outfit or some tiny accessories, you should go to one of Hobbies Branches for them. They keep a large stock of everything or will obtain it for you by return.



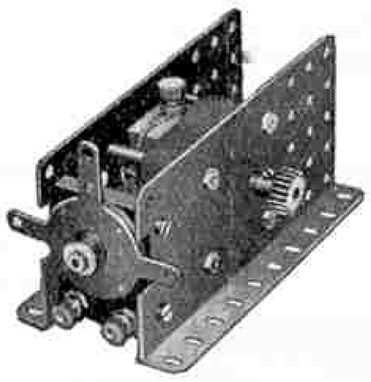
MECCANO PRICES

No. 00 Outfit ...	3/6	No. 4 Outfit ...	40/–
No. 0 ,, ...	5/–	No. 5 ,, (Carton)	55/–
No. 1 ,, ...	8/6	No. 5 ,, (Wood)	85/–
No. 2 ,, ...	15/–	No. 6 ,, (Carton)	105/–
No. 3 ,, ...	22/6	No. 6 ,, (Wood)	140/–

No. 7 Outfit (Wood) ... 370/–



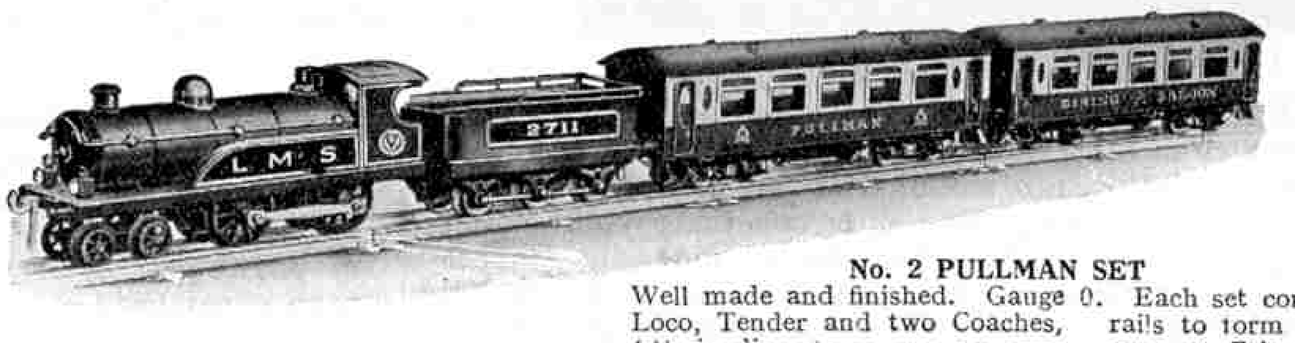
CLOCKWORK MOTOR
Price 7/6



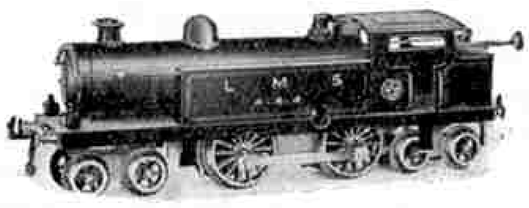
4-VOLT ELECTRIC MOTOR
Price 15/6

Outfits, Accessories and all Latest Parts are always obtainable at Hobbies Branches

HORNBY CLOCK WORK TRAINS



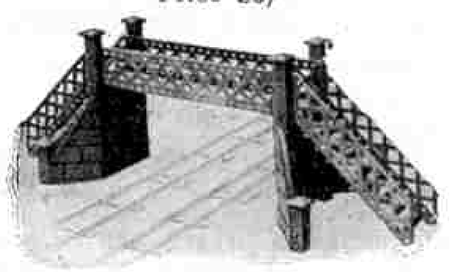
No. 2 PULLMAN SET
Well made and finished. Gauge 0. Each set contains Loco, Tender and two Coaches, rails to form circle 4 ft. in diameter. Price **60/–**



No. 2 TANK LOCO
A powerful locomotive, 11½ in. long, fitted with two four-wheel bogies, reversing gear, brake and governor. Price **30/–**

SIGNAL CABIN
Finished in colour and lettered "Windsor." Is 6¼ in. high and 6½ in. long. Signal levers can be fitted if desired. Price **6/6**

GUNPOWDER VAN
Finished in Red and fitted with opening doors. Price **4/–**



LATTICE GIRDER BRIDGE
This bridge is of the constructional type, strong and well proportioned. Price **10/6**

Hobbies LIMITED

HEAD OFFICE AND WORKS :
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65, NEW OXFORD STREET - - LONDON, W.C.
147, BISHOPSGATE - - - LONDON, E.C.
79, WALWORTH ROAD - - LONDON, W.C.
326, ARGYLE STREET - - - GLASGOW.
10a, PICCADILLY - - - - MANCHESTER.
9a, HIGH STREET - - - BIRMINGHAM.
214, WEST STREET - - - SHEFFIELD.
89a, WOODHOUSE LANE - - - LEEDS.
25, BERNARD STREET - SOUTHAMPTON.
68, LONDON ROAD - - - BRIGHTON.

Electric Trains—(*continued from page* 647)

Continental routes, and it seems that the day is not far distant when the American steam loco will be finally superseded. As the latter appear to have reached the limit of their size and weight the transition will be in the ordinary run of progress.

The electric locomotive came into its own in Canada when a long tunnel between Sarnia, Ontario, and Port Huron, Michigan, gave through communication with the United States. This tunnel, which is known as the St. Clair, was operated by a private company until it was taken over by the Grand Trunk Railway in November, 1908. Traffic is worked by electric locos taking direct current from an overhead wire.

Electric Railways Overseas

In New Zealand is the Otira Tunnel, the longest in the British Empire (5 miles 554 yards). It was opened in 1923, and is worked by British-built electric locos constructed for the 3 ft. 6 in. gauge. Current is collected from an overhead catenary wire, this being a live wire suspended from a higher cable by means of short lengths of vertical wire. The locos weigh 50 tons each and can attain 18 m.p.h. on a rising gradient of 1 in 33 with a standard train. Altogether some 13 miles of line are electrically operated.

A very up-to-date system is now in operation on the Melbourne suburban lines of the Victorian Government Railway, Australia. The first train ran on 29th May, 1919, and the motors are driven by current collected from an overhead wire at 1,500 volts and suitably transformed.

Developments in South Africa are upon a very ambitious scale. No less than 171 miles between Glencoe and Pietermaritzburg are being electrified, and for working this long section 78 locos have been supplied by the Metropolitan-Vickers Electrical Company. Three of these locos coupled together and worked in multiple unit by one driver are designed to haul trains weighing 1,400 tons from Ladysmith to Pietermaritzburg (129 miles) in 7 hours, and in the reverse or "up" direction, 625 tons in 7½ hours. The gradients to be negotiated include stretches of 1 in 50-65.

These fine locos are of the eight-wheels pattern, with single-reduction gearing and two motors mounted on each bogie. Their maximum tractive effort is 43,000 lbs. They weigh 65 tons each and are built for the standard gauge of 3 ft. 6 in. Current is taken at 3,000 volts d.c. from an overhead wire.

Japan and Argentine

Japan has an overhead electric and a suburban electric railway, while there is a specially interesting 7-mile section of mountain railway for which the Abt Rack System is used. This is the Usui Pass line of the Imperial Government Railways, and as there are no less than 26 tunnels in under 5 miles of line, the advantages of electric traction are obvious. At places the gradient is as steep as 1 in 15.

The Argentine boasts a model electric suburban system at Buenos Ayres which is jointly owned by several of the great trunk railways of that country. The first train ran in 1922, and the full service was inaugurated in May 1923. Power is produced at the generating station as three-phase current at 20,000 volts, with a periodicity of 25 cycles, transmitted to sub-stations and converted into direct current at 800 volts. The trains collect the current from the underside of a specially-protected third rail, but near stations and in sidings, etc., there is overhead equipment for which the motor coaches are also fitted.

South American Electrification

An interesting Brazilian conversion to electricity was described in the "*M.M.*" for October, and another South American advancement was the introduction of electric working of the Mexican Railway last year. The line climbs from sea level at Vera Cruz to a height of 9,000 ft. Ten electric locos displaced twenty-three articulated "Fairlie" steam engines, and it is most interesting to note that the weight of both types of iron horse is exactly the same, they are both of a "double-ender" nature, and in each case all the weight was borne by the driving-wheels.

The electric locos are revolutionising the operation of the line and are successful in every way. They work with D.C. at 3,000 volts taken from an overhead cable, and were built in the United States.

The Longest Electric Railway

The world's longest electrified railway is the Chicago, Milwaukee, and St. Paul Railroad which is the chief link between the great cities of the American Central Lakes region and the North Pacific coast. The electrified portion is 650 miles in length, and crosses the Belt Mountains at an altitude of 5,788 ft., the main Rockies at 6,322 ft. at Donald, and the Bitter Root Range at 4,163 ft. at East Portal. At some points the line climbs 53 feet per mile.

Powerful electric locos of 3,440 h.p. are employed to haul the heavy all-steel expresses and long freight trains. They are divided in the centre for greater flexibility in running, but the two portions form a single engine unit with four motors at each end. The length of one of these mammoth locos is 112 ft. and the weight 284 tons, more than six tons heavier than the giant steam locos of articulated type used on other parts of the same railroad.

The run of 440 miles through the mountainous scenery of the Great Continental Divide, in a comfortable express hauled by one of the largest and most powerful electric locos ever built is an experience never to be forgotten.

CHOOSE YOUR OWN CHRISTMAS PRESENT

An opportunity for *M.M.* readers

It is a wonderful sensation to sit down and study illustrations and descriptions, and select your own Christmas present. Try it! In our pages this month there are advertisers' announcements of all kinds of splendid toys, books, and all manner of articles for giving pleasure to boys at Christmas. We are going to make at least one boy happy by giving him the very thing he wants from amongst the articles advertised in our columns.

Let us know what you want—on a Postcard

Look carefully at *all* the advertisements and decide which article you would like the postman to hand to you on Christmas morning. Write the name of it on the top of your postcard, marking it No. 1. Then write the name of the article that you would like second best and mark it No. 2. Do this with six articles altogether, write your own name and address at the bottom in very plain letters, and send the postcard to "Christmas Presents, *Meccano Magazine*, Binns Road, Liverpool."

To the sender of the list that corresponds most nearly in order of merit with the total voting we will post the article that heads his list, to reach him on Christmas morning.

"Christmas Presents" postcards must reach us not later than 18th December.

Table Top Photography—(*continued from page* 681)

sold by most toy dealers, or perhaps some motorist might be persuaded to lend you his "Diving Girl" mascot. If the latter, it would be desirable to drape the model in a bathing dress and to whiten the face and the exposed portion of the arms and legs with chalk—otherwise they will photograph black. The feet should be buried slightly in the bank to cover any trace of a stand. The bank can be of earth or powdered cork and a few twigs and pieces of moss scattered here and there give a more realistic appearance. The background should consist of a clump of trees and undergrowth, placed well back from the main figure with the object of throwing it out of focus. This will have the effect of rendering the trees as a blurred mass and in consequence we need not be so particular as to their make-up, so that different kinds of grasses with small leafy twigs will serve very well. Before the exposure is made, the effect may be tested by standing well away from the scene and viewing it through half-closed eyes. This, by the way, is an illustration of the help afforded by the focussing screen which shows at a glance the softness of the definition of the background. In using a mirror for any purpose, it is necessary to prevent, as far as possible, any reflection other than from our scene, and particular care must be taken to avoid a direct reflection of the lighting source into the lens of the camera.

Utilising Hornby Trains

Those who possess Hornby Train Sets are well placed for securing railway scenes and these are worth attempting. For instance, suppose we wish to depict a train emerging from a tunnel through a hill into a cutting. The background will not be a vital part of the scene, since the camera is required to include only that part of the picture below the top of the cutting. The tunnel may be made by bending a sheet of cardboard into a semi-circular shape; the hill is obtained by scattering sand or earth over the top of the tunnel, the effect of darkness in the tunnel being obtained by covering up the other end, and a cardboard framework covered by rough green paper will represent the cutting. The permanent way is laid on powdered cork, which has all the appearance of ballast. The best position for the engine is at the opening of the tunnel, the smoke and steam being suggested by cotton wool, held in position and secured to the tunnel wall by wire. Match sticks for fencing and pencils as telegraph poles—with black cotton to represent the wires—will also add to the effect.

Jungle Scenes

Those readers who possess models or ornaments in the shape of stuffed lizards, ebony elephants, tigers, lions or any other of the larger wild animals are well able to stage jungle scenes. These are among the easiest of all for it is only necessary to represent luxuriant undergrowth and trees, with the animals placed in natural positions. Clods of the tougher kinds of grasses, freely planted with hay and rushes, will give a very passable imitation of forest undergrowth and in scenes of this type the photographer will find that he has ample scope to attempt stunts that in more ordinary surroundings would be out of the question.

The development of the plate and the making of the print do not require any special instructions for our present purpose, but special attention must be paid to the finishing of the print. It is probable that the table top scene has not occupied the whole of the plate or film and to secure the best effect the unwanted portions must be trimmed away from the print. The Meccano penknife described on page 577 of our last issue, with a straight-edge, will do the job neatly, but care must be taken that the sides of the prints are parallel with the known vertical lines in the picture. This question of trimming is too often overlooked by inexperienced photographers, but the improvement in appearance is such that one experiment is sufficient to ensure trimming becoming a regular practice.

We are indebted to Messrs. Wellington & Ward Ltd., Elstree, Herts., and The Imperial Dry Plate Co. Ltd., Cricklewood, London, N.W.2, for their courtesy in granting facilities for the reproduction of the table top photographs used with this article.

22nd Photographic Contest

Our photographic article this month is designed to indicate the possibilities of table top photography as a winter pastime. The suggestions given do not by any means cover the only schemes possible and we are quite sure that the fertile imaginations of our readers can evolve some wonderfully ingenious results. Accordingly we have chosen as the subject of our December competition "A Table Top Photograph." We anticipate a very keen contest for the prizes as the idea of the subject has been explained very fully in our article. Heaps of fun may be had in preparing the layout and we hope that all our photographic readers will attempt this subject.

Each print submitted must bear the name, address and age of the competitor, together with a statement as to whether the developing and printing is his own work.

There will be the usual classes—"A" for those aged 16 and over, and "B" for those under 16. First and second prizes, consisting of Photographic Goods or Meccano Products to be chosen by the successful competitors, to the value of one guinea and 10/6 respectively, will be awarded in each class.

No print can be returned unless it is accompanied by a stamped addressed wrapping.

Closing date 31st January, 1926 (Overseas 30th April, 1926).

Goods advertised in the "Meccano Magazine" and made by Lott's (Stone Building Bricks), Lines Bros. (Fairy Cycles) or H. A. Moore Ltd. (Pedal Kiddie Kars) are always in stock and will be sent to any address in Great Britain.

Send Your Orders for Hornby Clockwork Trains and Meccano Sets or Parts by Post

Please send money order or cheque with order and post direct to

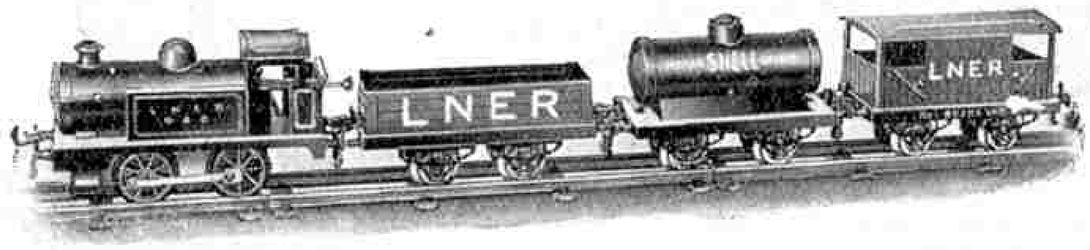
Rushworths LTD.

The Meccano House of the North

WESTGATE, HUDDERSFIELD

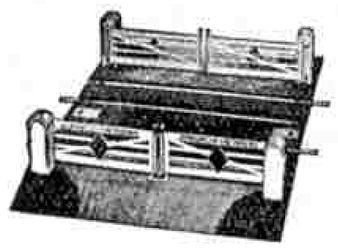
Established 1875.

HORNBY CLOCKWORK TRAINS



No. 1 TANK GOODS SET. This set contains a No. 1 Hornby Tank Loco, Wagon, Petrol Tank Wagon, Brake Van and set of rails. Gauge 0, in colours to represent the L.M.S. or L.N.E. Railway Companies' rolling stock. The loco is fitted with reversing gear, brake and governor. Price **25/-**

No. 2 TANK LOCO
The Hornby No. 2 Tank Loco is a powerful model embodying all the characteristics of the Hornby Train. Beautifully finished in colours, and fitted with reversing gear, brake and governor. Price **30/-**



LEVEL CROSSING
Beautifully designed in colour. Measures 11½ × 7¼ in. with Gauge 0 rails in position. Price **6/6**

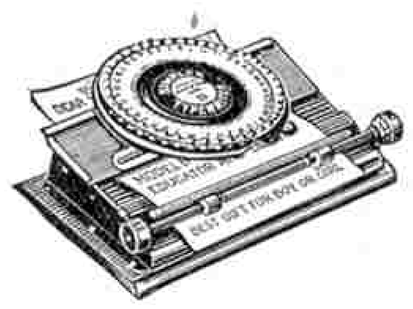
Simplex Typewriter

Takes any length of paper. Inked, tested and ready for use.

Model A. Prints 30 characters, is 5 ins. wide, Price **5/-**.

Model B. Prints 42 characters, is 6 ins. wide, Price **10/-**.

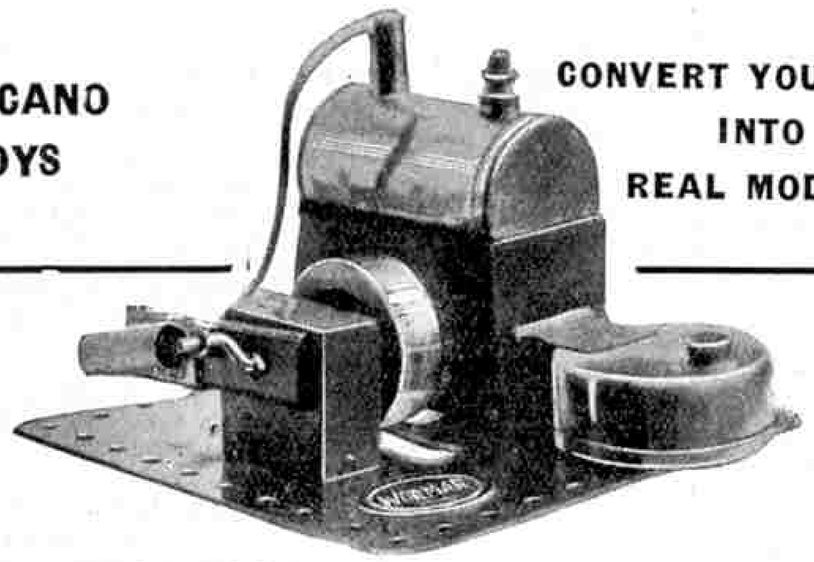
Model C. Prints 68 characters, is 6 ins. wide, Price **20/-**.



Visit Rushworth's Christmas Exhibition of Model Railways and Toys

MECCANO BOYS

CONVERT YOUR TOYS INTO REAL MODELS



THE "WOR-MAR" MODEL STEAM ENGINE

for driving all models, but specially adapted for building into Meccano Units, by kind permission of Messrs. Meccano Ltd.

Price 5/11

Post free **6/6**. Guaranteed or money returned.

TERRIFIC SPEED—COLOSSAL POWER

Don't confuse this engine with the cheap German articles. It is British made throughout of solid brass and steel, and carries the guarantee of our 40 years' reputation. It is only many years' experience with model making and latest mass production methods that have made its production possible. For power and durability we have no hesitation in saying that it is

EQUAL TO MANY ENGINES AT £1 1 0

Brief Specification:—Brass oscillating cylinder with accurately fitting piston. Heavy brass flywheel, ⅜" thick. Solid drawn brass boiler, safety valve, new safety type lamp giving great heat and absolute safety. Filler and instructions. Height 4". Each engine tested and guaranteed to attain 3,000 to 5,000 revs. Will hum round driving 6 models at once, such is the marvellous power obtained.

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Obtainable from Messrs. Gamages, Hamleys, Halfords, Wildes, etc., and of all large Meccano stockists, or if any difficulty in obtaining, send P.O. 6/6 (mentioning your retailer's name) direct to

WORBOYS & SMART, 141, King St., LUTON

Established 1885. Bankers—Barclays.

A real *fixed* Condenser

The "IGRANIC-FRESHMAN" is a fixed Condenser in the truest sense of the word. Because of the special form of construction, dust or moisture cannot enter, and, therefore, its capacity, which is guaranteed to be accurate within the unusually small limit of 5 per cent. remains absolutely unalterable over long periods of use. For the same reason IGRANIC FRESHMAN FIXED CONDENSERS may be relied upon to give consistently excellent performance under all climatic conditions. For whatever purpose you require a thoroughly reliable fixed condenser, be sure to specify "IGRANIC-FRESHMAN."

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Write for the new Igranic Catalogue Z.843, and particulars of the new Igranic Super-Heterodyne Receiver Outfit.

IGRANIC RADIO DEVICES include:

Honeycomb Duolateral Coils, Variable Condensers, Fixed Condensers, Filament Rheostats, Intervalve Transformers, Variable Grid-leaks, Variometers, Variocouplers, Coil Holders, Potentiometers, Combined Instruments, Vernier Tuning Devices, Valve Holders, Switches, etc., etc.

All carry the IGRANIC guarantee.

Branches: BIRMINGHAM, BRISTOL, CARDIFF, GLASGOW, LEEDS, MANCHESTER, NEWCASTLE

IGRANIC ELECTRIC COMPANY LIMITED

149, Queen Victoria St., LONDON.

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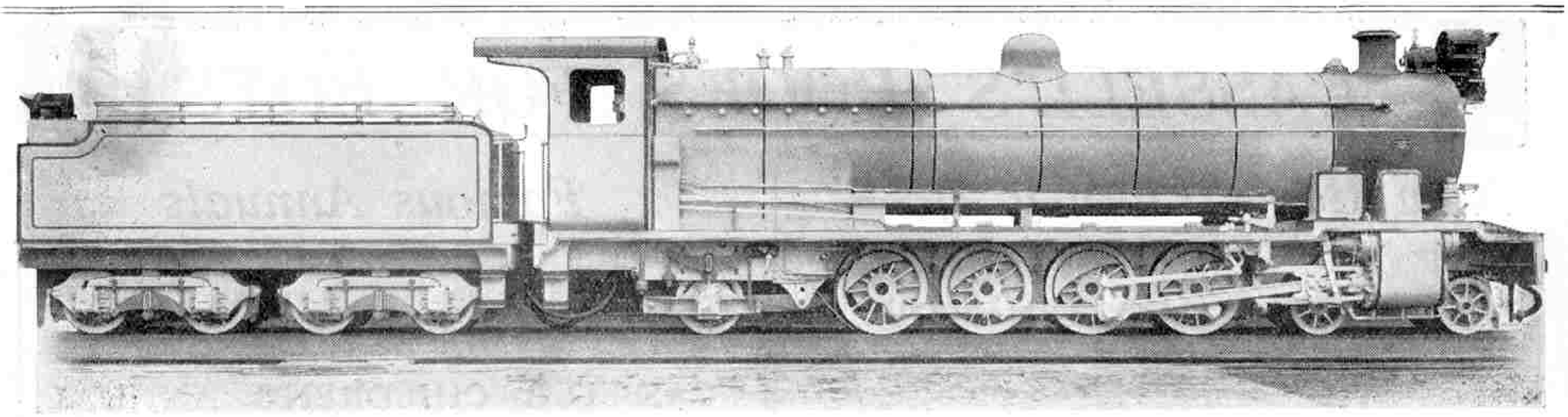

British-built Locomotives for Gold Coast

Our illustration shows one of four 4–8–2 goods locomotives that have been built recently by the Vulcan Foundry Limited, of Newton-le-Willows, Lancs., for goods service on the 3 ft. 6 in. gauge lines of the Gold Coast Government Railway.

These locomotives have coupled wheels 3 ft. 9 in., leading bogie wheels 2 ft. 4 in., and pony truck wheels 2 ft. 9½ in. diameter respectively. The rigid wheelbase is 12 ft. 9 in., and the engine wheelbase is 30 ft. 9 in. The cylinders are 19¼ in. diameter with a piston stroke of 24 in. The boiler, the length of the barrel of which is 19 ft. 9½ in., has a working pressure of 180 lb. per sq. in. The heating surface is 1,973 sq. ft., to which the firebox contributes 198 sq. ft. and the tubes 1,775 sq. ft.

Each of these four engines is fitted with a Robinson superheater giving 347 sq. ft. heating surface; the grate area is 32.14 sq. ft. The engine fittings include Gresham and Craven's No. 9 injectors and a Detroit sight feed lubricator. The loco is fitted with steam brake and the tender with the vacuum brake. In working order, the engine weighs 73.65 tons, 52 tons of which are distributed on the driving wheels, 10.4 tons on the bogie wheels, and 11.25 tons on the pony truck.

The tender is carried upon two four-wheeled bogie trucks the wheels of which are 2 ft. 9½ in. diameter. There is a tank capacity for 2,500 gallons of water and 305 cu. ft. of space for fuel. The tender in working order weighs 32.75 tons, making the total weight of engine and tender, 106.4 tons.

Travelling Post Office—(*cont. from page* 675)

the train's speed was not great as the up-gradient was steep, but the driver was caught up by the standard and a moment later was shot into the T.P.O. via the net, much to the amazement of the staff who certainly did not anticipate the arrival of this particular "male." The driver soon recovered and the greatest damage done was the nervous shock to the fireman when he missed his mate!

During our chat at least one more exchange of pouches has been effected and now the "Down Postal," having stopped for a minute at Rugby, slows for Tamworth, which is probably as important an exchange point for mails as any in the country. The old Midland main line to the west of England crosses our way to the north, and there is a general transference of mailbags in and out, from and for the West Country, the South Midlands, etc.

Soon we are off again, with quite a short interval between the preceding Irish Boat Train (Euston-Holyhead) and ourselves. The "Irishman" will await our arrival at Crewe in order to take over our letters for Ireland and North Wales, so that it is possible that four letters posted at the same time to Ireland, Scotland, Plymouth and Yorkshire from a village in, say, Northamptonshire, and picked up by our T.P.O., will shortly each be speeding in an express in opposite directions. Another interesting point is that in coming North we have been picking up mails for London and the South, and these will be transferred at Crewe to a later "up" train.

The lights of the huge goods marshalling yards at Crewe now gleam ahead, and in that great station, which never is quiet, we leave the "Down Postal" to the care of a fresh loco, which in turn will give place to a Scottish steed at Carlisle in the early morning hours.

Each night, while England sleeps, the skill of the engineers and the keen efficiency of the Post Office officials are ensuring the punctual arrival of that cheery person—the morning postman.

The Adventure of Living—

(*Continued from page* 679)

the effort to achieve in common something worth achieving for the sake of all. You can lead that kind of life—and it is the only kind of life worth leading, and the only kind of life worth living—and you can lead it only on condition of making up your mind that you will not expect always to have an easy time, to escape care, to escape responsibility, to escape the burdens that inevitably must be carried by every man and every woman whose shoulders are broad enough to enable him or her to play a part in the world.

You have two duties to perform. In the first place, be able to pull your own weight; and then when you have done that, remember that that is only the beginning. We have a right to expect that; in addition to having worked for yourself so that you will not be a burden to anyone else, in addition to your being able to take care of all those whom it is your duty to care for, your education has counted for little if you cannot, furthermore, do your part in helping the world move on.

We are now advanced over a quarter of a century big with the fate of mankind. Many great problems confront us all over the civilized world. Ours is not an easy task but our business is to make the best use of what we have received from our fathers, and leave it in better shape to our sons.

Do not flatter yourselves that you can stand still, or that the Nation can stand still. If you think you can stand still, you may be perfectly certain that you are going back. We as a Nation will either go forward or backward; and whether we succeed or fail will depend more than anything else upon the kind of training that you and those like you receive in your own home and in institutions such as this, and upon the use that you make of that training.

Veterans of the War—(*cont. from page* 655)

candles and lamps in the crowded trucks. Lucky was the man who could ensconce himself with a blanket in the brakesman's little cabin to be found at the end of many Continental trucks! The officers were little better off, and generally had to travel Third Class, which in France means narrow wooden seats, with uncomfortable straight-up backs, no heat and a hanging oil lamp with an evil smell.

In addition to the immediate risks of travelling under war conditions, with primitive signalling and worn-out track, there was also the chance of being shelled from twenty miles' range, or being involved in the worst railway menace—an air raid. Many a loco driver worked frantically to damp down his fire and stop the safety valves as his train, jammed between others, stood in a shallow cutting with enemy planes bombing all round them. The valour of the railmen has not been thoroughly appreciated and often theirs was a thankless task.

War Memorial Locos

Certain of our lines each have a modern express loco specially named and dedicated to the memory of the railwaymen who gave their lives. On the L.M.S., for instance, a Crewe-built 4–6–0 is named "*Patriot*" (No. 1914). As is the case with other similar locos she carries an explanatory plate.

The Great Central memorial loco is named "*Valour,*" and that on the Southern Railway "*Remembrance.*" The latter is a magnificent "Baltic" type tanker.

A new express loco built in this country for India is similarly dedicated and bears the proud title "*Hero.*" On every line where locos bear names there are to be seen some particular locos, named after heroic members of the company's staff and in other ways commemorating the Great War. One of the most interesting sights of the Centenary procession at Darlington was that of a North Eastern war veteran proudly carrying her service chevrons past the Grand Stand.

CASSELL'S BOOKS FOR BOYS

New Boy's Library 2/6 each net.

Large, beautifully illustrated volumes, cloth, with coloured jackets.

THE ISLE OF FORGOTTEN PEOPLE
By THOMPSON CROSS

A thrilling tale of mystery and adventure, and of the rivalry between two parties which set out to wrest from an uncharted island a vast store of radium.

SOMETHING LIKE A HERO
By JOHN MOWBRAY

A fine school story with a gripping plot and strong sporting interest that will enthral the reader.

A LOYAL YOUNG REBEL
By D. H. PARRY

Torn between love for his family and sympathy for the cause of Prince Charlie, Dick Ormerod eventually runs away from home, and his subsequent adventures make a story of surpassing interest.

RIVALS OF THE FOURTH
By TOM BEVAN

This enthralling story concerns the rivalry in work and sport between a somewhat clannish section and the "home" boys of a West Country school.

SMUGGLERS ALL! By W. BOURNE COOKE

The people of Baytown are smugglers to a man. The reader will revel in the stirring adventures the hero goes through while in the hands of the "enemy."

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A vivid story of adventure at sea on a modern wind-jammer. The battle of wits between the skipper and an unscrupulous rival will be followed with keen interest.

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Splendid school and adventure stories, handsomely bound in cloth, with a half-tone frontispiece.

BARKWORTH'S LAST YEAR
By JOHN MOWBRAY

Boys, young and old, will revel in this fine school story, and follow "Juggie" Barkworth with keen interest through the surprising happenings of his last year at Northborough.

THE MYSTERY OF NAMELESS ISLAND
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Three boys, contemplating an uneventful cruise in a fast motor-boat, suddenly find themselves embroiled in a mystery, with surprising and unexpectedly exciting results.

THE SECRET OF THE SNOWS
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Mr. Judd takes his heroes over the great ice fields and glaciers of the Antarctic, and through perils and adventures which will thrill every reader of this fine story.

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Picture Boards, 5/- net.

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The exquisite colour plates, and the many black-and-white illustrations make this volume particularly attractive. Picture Boards, 5/- net.

BRITISH BOY'S ANNUAL

With four colour plates and a profusion of other illustrations. Cloth gilt, with fine all-over three-colour jacket. 5/- net.

The Modern Boy's Library

HOBBIES 5/- each net.

This volume covers a wide field: Collecting—Elementary Science and Simple Experiments—Pets—Outdoor Hobbies (from Cycling to Cliff Climbing, Woodcraft and Geology), and other miscellaneous hobbies; in fact, everything from Conchology to Kite-flying.

SOMETHING TO MAKE

Contains instructions and clear working diagrams for making a great variety of models and other apparatus, such as a Model Railway, Gramophone, Magnetic Compass, Telescope, X-Ray Apparatus, Cinematograph Camera, Water Motor, etc.

THE BOY'S WORKSHOP

Treats of the use of tools and materials under these suggestive headings: The Carpenter's Shop—the Laboratory—the Engineering Shop—the Electrician's Shop—the Metal Worker.

THE BOY'S BOOK OF WIRELESS
By ERNEST H. ROBINSON

By the aid of this splendid book you can gain a thorough knowledge of what Wireless is and how it works. It shows you how to construct sets ranging from the simple Crystal Receiver costing only a few shillings, to the most powerful Valve sets.

ALL ABOUT OUR WONDERFUL SHIPS
By ARCHIBALD WILLIAMS

This fascinating book deals with every type of vessel from the "fussy" tug to the leviathan battleship, and contains a wealth of information acceptable to any boy. Beautifully illustrated in colour and black and white. 7/6 net.

Cassell's
Publishers
London

Competition Corner

Which were the Most Popular Covers in 1925?

THE question as to which of the splendid art covers that adorn the "*M.M.*" each month is the most popular with readers is continually being asked by correspondents. With the publication of the last issue for 1925 a suitable opportunity has arisen for our readers to settle this question for themselves.

We reproduce above reduced half-tone facsimiles of the twelve coloured covers of the "*M.M.*" during 1925. These reproductions are intended for reference purposes only, and will be of assistance to readers who have joined us since January and to any others who may have mislaid one or two of their "*M.M.'s.*" The effectiveness of our covers of course owes a great deal to the richness of the colouring and therefore it is advisable, as far as possible, to make use of the originals for purposes of comparison.

Write on a postcard your idea of the order of popularity of the 1925 covers, describing each by its month of issue. Add your name and address, and post the card to "Cover Voting Contest," Meccano Magazine, Binns Road, Liverpool.

The covers are arranged in correct order, January to June in the top row and July to December below.

Each entrant may send in more than one list, provided each one is on a separate card. Every list must cover the whole year.

Four prizes of Meccano Goods to the value of £1/1/–, 15/–, 10/6 and 5/– will be awarded to the competitors whose lists most accurately state the order of popularity of the twelve covers as decided by a careful census of all entries.

Closing date 31st December (Overseas, 30th April, 1926).

Christmas Painting Competition

Recently we have been greatly interested in seeing a number of splendidly executed Christmas Cards prepared by members of certain Meccano clubs for sale among their friends with the object of raising club funds.

Knowing the artistic ability of large numbers of our readers, as shown in previous painting competitions, we decided to announce a competition for "THE BEST DESIGN FOR A CHRISTMAS CARD." We make no restrictions of any kind in regard to the shape, size or style of the card, and competitors therefore have full scope for their imagination.

The contest will be divided into two classes—A for those of 16 and over and B for those under 16. Drawing or Painting Materials (or Meccano Products), to be selected by the winners, to the value of 10/6 and 5/– respectively, will be awarded to the entries placed first and second in each class.

Closing date 31st December (Overseas, 30th April, 1926).

Christmas Essay Contest

'IF I HAD £10 TO SPEND.'

Our Essay Competition this month presents a glorious opportunity to indulge in day dreams of what we would do if we had £10 to spend exactly as we liked! Of course every reader of the "*M.M.*" would prefer to spend part at least on Meccano or Hornby Trains, but for the purpose of this competition that is not permitted. The object of this restriction is to widen the scope of the contest. Essays must not exceed 500 words, but in this space competitors should be able to set forth their individual ideas upon the subject of spending this sum.

The contest is divided into two classes, "A" for those aged 16 and over and "B" for those under 16, and prizes of £1/1/– and 10/6 will be awarded to the competitors whose essays are judged first and second respectively in each class.

Closing date 31st December (Overseas, 30th April, 1926).

Results

Seven Engineering Wonders

The popularity of our voting contests was amply demonstrated by the swarm of entries received for this competition. The judging was not a simple task, for the leading entries were extraordinarily alike, but although the seven most popular engineering works were clearly defined by an overwhelming majority of votes, no competitor succeeded in giving a completely accurate forecast.

The chosen seven were as follows, the order given being that of voting:—Forth Bridge, Assouan Dam, Panama Canal, Canadian Pacific Railway, Eiffel Tower, Wembley and London Tube Railways.

We do not wish to make any further comment as the Overseas Section of the contest is still open, and we anticipate that our Overseas readers will possess distinct favourites of their own. We propose to give a detailed note of the combined voting of both competitions when the Overseas results are available.

Awards:—

First Prize, A. R. PICTON (Woodbridge, Suffolk); Second Prize, G. P. LAMB (Stratton-on-the-Fosse, nr. Bath); Third Prize, L. R. ROGERS (Rathmines, Dublin); Fourth Prize, JAS. ORR (Haddington, Scotland); Consolation Prize, R. S. KIMBER (Harrow).

9th Drawing Competition

The judging of this competition has presented no little difficulty, the wonderfully high standard of most of the entries leaving very little to choose between the winners and a number of other excellent entries. We were particularly impressed by the careful attention to technical detail shown by the majority of competitors. In contrast to this, the young gentleman who depicted the "Caerphilly Castle" as possessing only four wheels, no tender, belonging to the L.M.S. and on its way to London Bridge Station certainly deserves special mention!

Awards:—

First Prizes—Section A, L. OSGOOD (Southsea, Portsmouth); Section B, R. ENIM (Paddington, W.2). Second Prizes—Section A, G. F. ROBERTS (Newlands, Hull); Section B, M. C. HART (Hounslow, Middlesex).

Puzzles Page Suggestions

The object of this competition was to obtain our readers' ideas for increasing the interest of the "Puzzles Page," more particularly during the winter months when indoor pastimes have the greatest vogue. Many of the suggestions submitted were very ingenious and, if possible, will be acted upon. When the Overseas Section closes we hope to deal with one or two of the more interesting ideas put forward.

The special prize of £1/1/ has been divided between two competitors whose suggestions were of equal merit:—J. P. SIMPSON (Ulverston) and A. HUNTER (Gatehouse, Kirkcudbrightshire).

(Several results are held over until next month. In the meantime prizes are being sent to successful competitors.)

BRITISH MADE

BRITISH MADE

The STANDARD FAIRYCYCLE

SPECIFICATION

Ball-Bearing Free Wheel
Ball-Bearing Rubber Pedals
Machine-cut Chain Wheels
½ in. by ⅛ in. Cycle Chain
Adjustable Plated Handlebars with Cycle Grips
⅝ in. Wired-on Tyred 12 in. Wheels, Steel Bearings
Solid-drawn Cycle Tube Frame
Mudguards Forged Steel Cranks
Adjustable Cycle Saddle
Best Cycle Finish with Lines on Frame
Brake and Free Wheel Bell Extra
Lamps Extra Stays to Seat Pillar

Price as Illustrated

49′6

The Fairycycle

(REGD. TRADE MARK)

in three superb models

As advertised in all the leading Daily Papers throughout the Country

As Illustrated

49′6

The SUPER FAIRYCYCLE

SPECIFICATION

Ball-Bearing Tangent Spoke Cycle Wheels
Ball-Bearing Steering Head
Ball-Bearing Bottom Bracket
Ball-Bearing Rubber Pedals
Machine-cut Chain Wheels ½″ × ½″ Cycle Chain
Adjustable Raised Plated Handlebars with Cycle Grips
⅞″ Wired-on Ribbed Cushion Tyres
Curved upturned Handlebars
Cycle Chain Adjusters
Best Malleable Lugs throughout
Solid-drawn Cycle Tube Frame throughout
Forged Steel Cranks
Adjustable Cycle Saddle, specially sprung
Best Cycle Finish with Lines on Frame
Cycle Rim Brake Ball-Bearing Free Wheel
Toolbag and Spanner Lamp Bracket

Price

75′-

With Pneumatic Tyres, 102/9

THE SIGN TO LOOK FOR WHEN BUYING TOYS

See that the word "FAIRYCYCLE" is on the frame

The DE-LUXE FAIRYCYCLE

SPECIFICATION

⅞ in. White Rubber Cushion wired-on Tyres
Ball-Bearing Tangent Spoke 12 in. Wheels
Ball-Bearing Rubber Pedals
Machine-cut Chain Wheels
½ in. by ⅛ in. Cycle Chain
Adjustable Plated Handlebars with Cycle Grips
Solid-drawn Cycle Tube Frame
Forged Steel Cranks
Adjustable Cycle Saddle
Best Cycle Finish with Lines on Frame
Rim Brake and Free Wheel Spanner
Lamps Extra

Price

61′6

With Pneumatic Tyres, 89/3

OBTAINABLE AT ALL GOOD TOY SHOPS

Sole Manufacturers:—
LINES BROS. LIMITED
London

Standard Mechanisms—(*continued from page* 637)

raised with an applied force of 100 lbs.

A few trials with our Meccano model, however, will show that the real efficiency is not so great. Although in actual practice the contrivance would enable a man to lift a load of over a quarter of a ton, more than 50 per cent. of the power is lost in friction. This leads to a very interesting result, for the load when hoisted remains suspended, and it will not descend unless we actually haul on the chain at B.

If a weight of 450 grammes is placed on the load hook, we know that, theoretically, 25 grammes attached by means of a hook to the chain at A should raise it. Actually, it will be found that no less than 70 grammes are necessary (this weight may be arrived at by using one 50 gramme weight and four 3 in. Strips, for the latter equal approximately 20 grammes). Friction therefore absorbs 45 grammes, or about 64 per cent. of the power. Since we must use 70 grammes to raise 450 grammes, the real mechanical advantage is only about 6½, instead of 18.

Load Remains Suspended

To explain the reason why the load does not descend of its own accord, let us suppose for a moment that our grammes are lbs. and that the load has been lifted through 1 ft. To raise the load C (450 lbs.) through 1 ft. requires 450 foot-lbs., but we have used 1,260 foot-lbs. for this is the product of the power load of 70 lbs. moving through a distance of 18 ft.; therefore 810 foot-lbs. have been absorbed by friction. The total load depending from the upper pulley block is 520 lbs. (450+70), and practically the entire amount of friction present in the model is produced by the pressure of this load upon the axle F. Of this total (520 lbs.), the power load of 70 lbs. contributes only 7/52, which for convenience we will call 1/7th of the total.

Now let us remove the power load. By so doing we diminish the pressure on F by 1/7th, and consequently reduce friction by 1/7th, so that friction now equals 694 lbs. It will be seen that the load is unable to descend unless we aid it by hauling on the chain at B, for the energy it exerts in falling (namely, 450 foot-lbs.) cannot overcome the friction. 810 foot-lbs. were required to overcome the friction in raising the load, and because 6/7ths of the friction is still present, 694 foot-lbs. (6/7ths of 810) would be necessary to overcome friction in the descent.

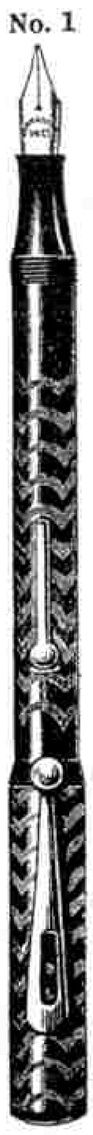
The principle set out above may be applied to other mechanical powers. Whenever more than half of the applied energy is uselessly absorbed by friction, the load will remain suspended without overhauling.

The concluding article on "Pulleys and Pulley Blocks" will appear in next month's Magazine. This will contain a description of moveable pulleys, blocks, and guide pulleys adapted to Meccano models.

"BETA" PENS

BRITISH THROUGHOUT

THE PENS OF REAL VALUE



No. 1

EACH PEN IS A LEVER SELF-FILLER & FITTED WITH 14 Ct. GOLD NIB, IRIDIUM TIPPED.

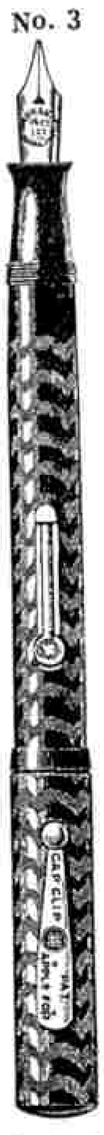
EACH PEN IS GUARANTEED FOR 2 YEARS.

THE 5/- MODEL. "IS THE PEN FOR CONSTANT HARD WEAR."

MAKERS:

THE "BETA" PEN CO.

181, Lisburn Lane, LIVERPOOL.



No. 3

2/6 Model with patent Fixed Clip.

7/6 Model Boxed Lever

Shooting with Rubber Rings

One of the most interesting among this winter's novelties is the "Peltic" pistol sold by Messrs. Radior Co. Ltd. (Old Quebec Street, London, W.1.) This pistol fires rubber rings and it will send them across a room with considerable force and accuracy. Needless to say the rings cannot do any damage. The pistol is strongly made and is supplied, together with six rings, for 2/6, post free. (Page 717).

For Model Makers

The latest list of models and model-making materials issued by Messrs. Bonds (254, Euston Road, London, N.1) is crammed throughout the whole of its 64 pages with details of goods that will be of interest to all our readers. The section dealing with model railways is of particular interest and the various items are very fully illustrated. In addition the catalogue includes all kinds of fittings for stationary engines and indeed everything for the model maker. This interesting list will be sent, post free for 4d. to any reader mentioning the "*M.M.*"

A Beautiful Catalogue

Printed on art paper in five colours the Mead new season's gramophone catalogue is in keeping with the high quality of the instruments which that famous mail-order firm manufacture. Seventeen gramophones ranging from massive horn instruments to solid oak and mahogany cabinet gramophones, all displayed in their natural colours, give a comprehensive range of choice.

A postcard to Dept. G186, The Mead Company, Sparkbrook, Birmingham, will bring full particulars.

A Fine Picture

A fine picture of the now world-famous L.N.E.R. Pacific Locomotive No. 4472, "*The Flying Scotsman*," has been published by the L.N.E.R. Advertising Dept. (26, Pancras Road, London, N.1.,) and is available for 1/6 post free. Every boy should have one of these pictures which shows the engine in her natural colours, and measures 24"×10".

Meccanoland in Pantomime

As announced in our issue last month there is to be a splendid Meccanoland scene in "The Sleeping Beauty" pantomime at the Empire Theatre, Liverpool this Christmas. In this scene the stage will be filled with huge Meccano models, and real Meccano boys, wearing the regular Meccano jersey, will play with them. At their head will be Marie Blanche who, as the handsome and dashing Prince Charming, will be the principal "boy."

The above photograph shows Geo. Robey (who also takes part in the pantomime) in one of his famous character studies.

We have no doubt that all Meccano boys who live within a radius of many miles of Liverpool will take advantage of the Christmas holidays to come to see this wonderful Meccanoland scene. They will be well advised to book their seats early.

OUR MAIL BAG

In this column 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.

L. J. Cross (Llandrindod Wells).—The account of your Meccano career from the age of six interested us greatly and we can quite understand your joy when the longed for No. 4 Outfit came. It is a great compliment to the "*M.M.*" that your Dad risked being late for work in order to read it! It really looks as though you will have to keep the paper out of his way until he returns at night!

L. P. Storey (Clifton, Bristol).—Judging from your letter you are a keen aeroplane enthusiast and in this connection we have some exceptionally interesting articles in preparation. We are not surprised to hear that the pilot of the "Bloodhound" thinks a tremendous lot of the "Bristol" engines. You appear to have some very interesting experiences, and we hope you will write and tell us about them from time to time.

S. Watson (Huddersfield).—We are glad that our aquarium articles have convinced you that there is nothing very difficult about the successful running of a small aquarium. Failure is almost always due to neglect. Many people start off with a big burst of enthusiasm but after a while they lose interest and neglect their tanks, and consequently the poor fishes suffer and frequently die. An aquarium is one of the most interesting things in the world, and all that is required is a few minutes attention every day. We wish you every success with your new tank and if you get into difficulties, let us know.

W. L. Holcroft (East London, S.A.)—We are glad you have been so successful in regard to your correspondent. In selecting correspondents for members of the Correspondence Club we do our utmost to ensure that there exists a similarity in age and interests, and as a rule our choice turns out well. It is quite cheering to hear that you will stick to Meccano until you have reached the highest age, which you say is 72. Secretly we may whisper to you that there are Meccano "boys" even older still!

E. Holder (Trinidad).—We hope you will never be cured of your attack of Meccanoitis, because it seems to have improved both your health and your spirits! Thanks for your drawing, which is good. We may be able to use it later.

J. E. T. Read (Bexhill-on-Sea).—We have by us a certain number of back issues of the "*M.M.*" and we are always glad to let readers have these to make up their volumes. Unfortunately some of the earlier issues are now quite out of print. Thanks for your promise to write us more frequently.

R. Waite (Retford).—We do not think we shall be able to publish the Magazine oftener for some little time to come, but it will certainly grow bigger and bigger. We note your suggestion for a special book of prize-winning models and we will bear this in mind.

J. A. Webster (Hartlepool).—We hope your damaged hand is quite alright again by now. It was certainly a very unfortunate accident. We note you are persuading your friends to give up "blood and thunders" and read the "*M.M.*"

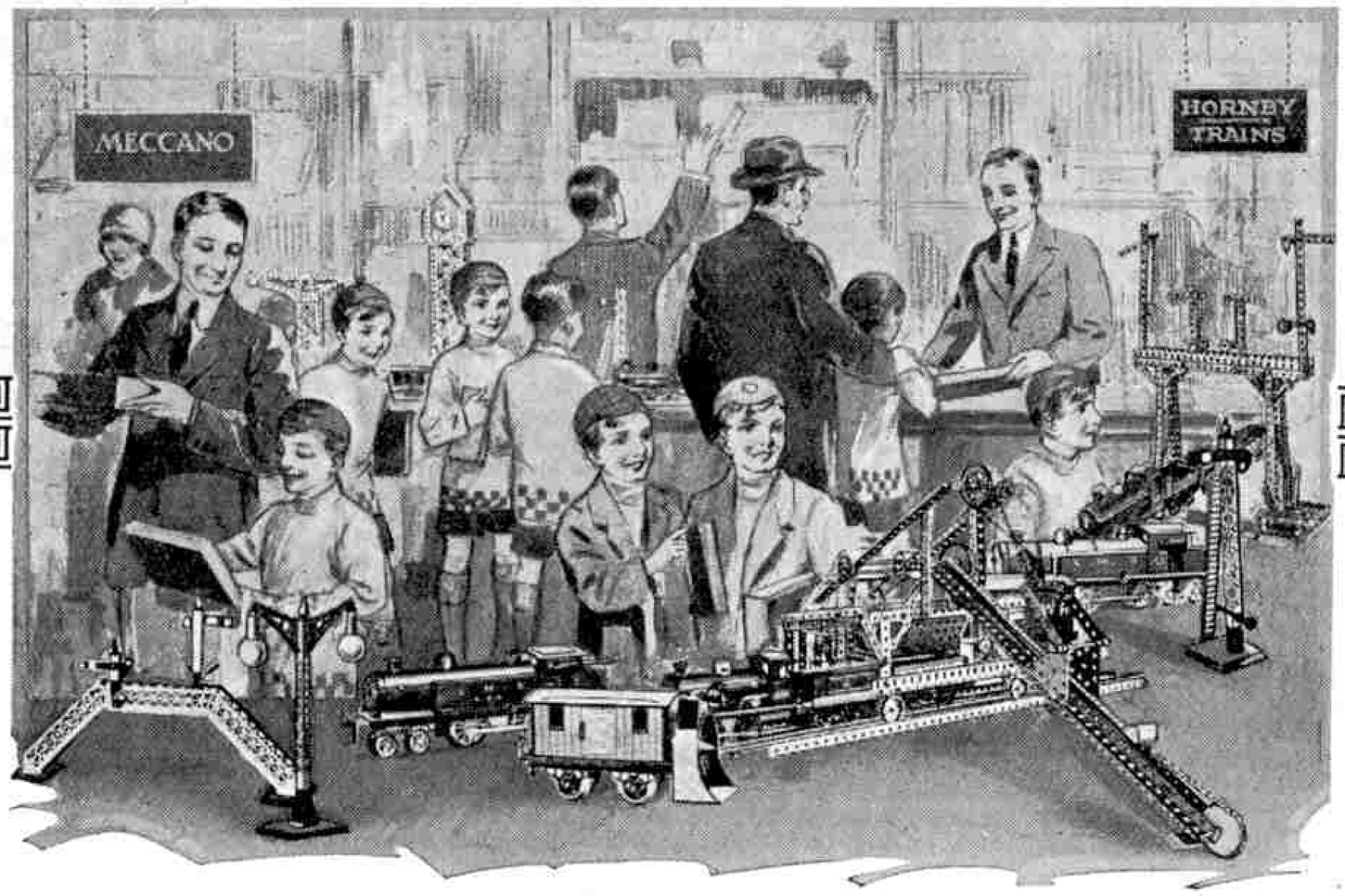
G. Campbell (Buenos Ayres).—We find your letters very interesting. You appear to have given the Prince of Wales a wonderful reception and we in Great Britain have followed his tour with keen interest. Your letters are always welcome.

W. L. Holcroft (East London, S. Africa).—We note that you intend to read the "*M.M.*" until you are 72. There are lots of young men of 72 who read the "*M.M.*" regularly, William, and they tell us they intend to go on until they are 100!

Kenechi Yoshida (Tokio).—We are always interested to receive your letters and we are glad to know of your photographic experiences. Japan is a long way from here but we may come out to see you some day!

Olaf Jacobsen (Norway).—Many thanks for your account of your experiences on the "Calypso." We can quite understand your surprise at seeing snow in the engine-room—we should not have expected to find it there ourselves.

J. K. Stuart (Sheffield).—Your letter is very nicely typed and there are very few mistakes. Thanks for your article on Rolling Mills, which we may be able to use. You certainly might have done better in your exams., but at all events you appear to have done a little above the average. We expect a better report from you after the next exam.



FIVE GOOD REASONS

Why Meccano Boys Buy from W. H. Hull & Son

AN increasing number of Meccano boys are becoming regular visitors to our establishment in North Western Arcade. We are glad to know that we are pleasing so many enthusiastic customers.

We have made a careful study of Meccano boys' requirements and have spared no effort to meet them. We give below five reasons why many "*M.M.*" readers send us their orders for execution by post.

(1) A comprehensive stock is always carried of Meccano and Hornby Trains and all accessories. Our customers may be reasonably sure of getting just what they want for their particular hobbies—especially if their requirements are connected with miniature engineering or model railways.

(2) Our assistants have special knowledge of Meccano products, and helpful advice is gladly given on model engineering and railway matters. The same careful attention is given to every order received—whether by mail or over the counter.

(3) Readers of the "*M.M.*" are cordially invited to call and inspect our stocks; a visit, of course, places you under no obligation to purchase. If you are unable to call personally, write for our Christmas List of Toys and Model Railways, which will be sent post free.

(4) All goods sold by us carry our special guarantee, in addition to the manufacturer's guarantee. Our customers, therefore, know that they will obtain the fullest possible satisfaction from their purchases.

(5) Post orders are executed by return, no matter from which distant part of the country they originate. The utmost care is expended on packing and despatch, with the result that this method of shopping proves as satisfactory as buying over the counter.

W. H. HULL & SON

NORTH WESTERN ARCADE, BIRMINGHAM

Established over 40 years.

December Puzzle Competition

FOR the Puzzle Page this month I have selected a varied assortment of puzzles which, I hope, will appeal to the great majority of my readers, and I confidently expect to receive a deluge of solutions.

I have emphasised over and over again the necessity for competitors to write their names and address on the back of each sheet of paper they send in. Even yet, however, I receive each month numbers of entries written on three or four separate pieces of paper, not fastened together in any way, and with the sender's name and address on the first sheet only. In other cases competitors write their addresses at the top of the first sheet and afterwards apparently become so absorbed in their solutions that they quite forget to sign their names at the end! I hope that this month all competitors will remember this very important matter.

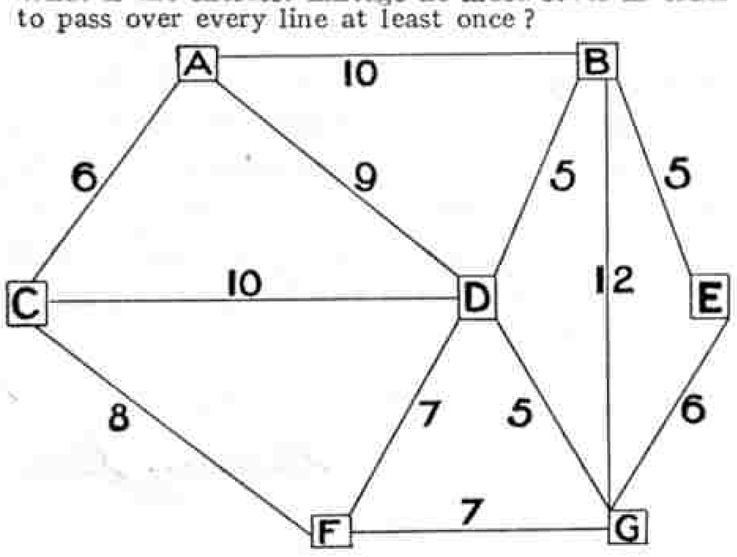
I often wonder which kind of puzzles my readers find the most troublesome to solve, and this month I am announcing a special competition to enable me to ascertain this. Each competitor who wishes to enter for this special competition must write on a postcard the numbers of the various puzzles placed in what he considers order of difficulty, the most difficult one coming first and the easiest one last. I am offering prizes of £1/1/–, 10/6 and 5/– respectively to the three competitors whose placing of the puzzles is closest to that of the majority of entries. Entries must reach this office on or before 30th December (Overseas, 30th April).

I am offering also the usual three prizes of Meccano or Hornby Train goods to the value of £1/1/–, 10/6 and 5/– respectively for the three best solutions of 8 of the puzzles on this page.

The closing date is 30th December and there is no Overseas section.

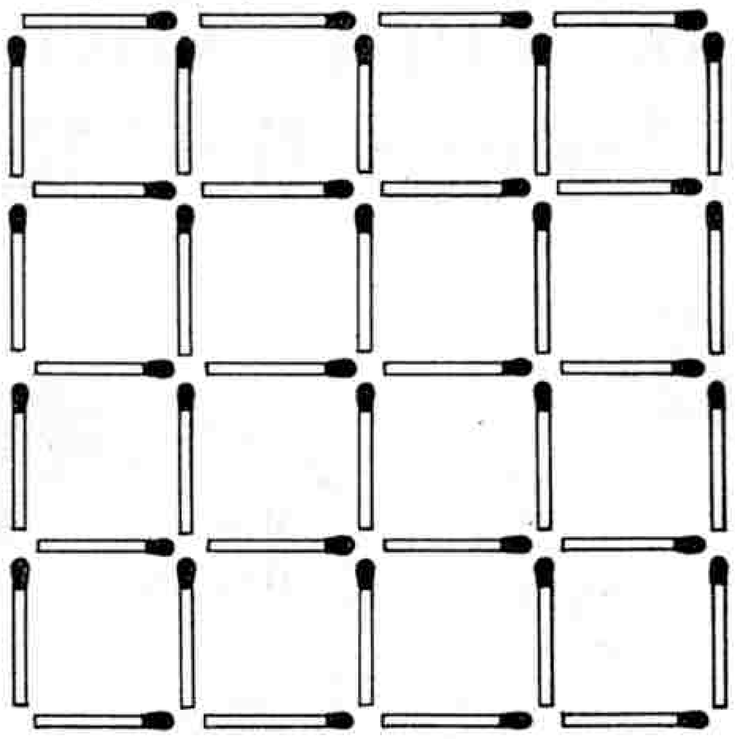
Puzzle No. 150.

The seven chief towns in a certain county are connected by railway. The diagram below shows the routes and distances in miles, the initial letter of each town being shown in the small squares. The railway official superintending this section of railway decided to make an observation tour of all the various lines. What is the shortest mileage he must cover in order to pass over every line at least once?



Puzzle No. 151.

40 matches are arranged so as to form 16 equal squares as shown in the diagram below. The problem is to remove 16 matches in such a manner as to leave two squares of equal size.



Puzzle No. 152.

A carrier charges 3d. each for all parcels not exceeding a certain weight and on heavier parcels he makes an additional charge for every pound above that weight. The charge for 14 lb. is 1/–, and the charge for 12 lb. is twice that for 7 lb. What is the carrier's scale of charges?

* * * *

Puzzle No. 153.

It is a portable climate, it carries the heat of the tropics to Labrador and the Polar Circle. It is needed in places thousands of miles apart and it is obtained wherever required with little difficulty because it is the means of transporting itself. What is it?

* * * *

Puzzle No. 154.

A man bought a certain number of bicycles for £180. He kept one for his own use and sold the rest for £1 each more than he gave for them. As a result of this transaction he made a profit of £10, in addition to obtaining his own bicycle for nothing. How many bicycles did he buy?

* * * *

Puzzle No. 155.

A large square is divided into nine smaller squares and in these squares are placed numbers such that when multiplied together either horizontally, vertically and diagonally the result is 4096. What is the arrangement of figures?

* * * *

Puzzle No. 156.

Each of the following definitions indicates a well-known make or maker of a motor car :—

(1) A crossing over a stream; (2) An English river; (3) A Boy Scout aged over 18; (4) Up-rising ground and a human being; (5) To elude relations; (6) A vocalist; (7) An inhabitant of an ancient city; (8) A leguminous vegetable; (9) A satellite; (10) A mighty iron worker; (11) The route of a railway track; (12) A great English writer; (13) A regimental rallying point; (14) The inventor of logarithms.

* * * *

Puzzle No. 157.

I'm but a little letter, still
I've various duties to fulfil;
But if you take
My tail you make
An alteration in my lot.
You'll say I'm shorter, but I'm not.

* * * *

Puzzle No. 158.

In the following collection of letters and dots replace each dot by a vowel so as to form a sentence that reads the same both backward and forward :—

R.DR.,TP.T.PT.,RD.R.

Answers to Last Month's Puzzles

No. 136. The man was 78 years old.

* * * *

No. 137.

A	slee	P
R	efe	R
C	ant	O
H	in	T
I	neu	R
T	hali	A
R	omanti	C
A	sser	T
V	et	O
E	rro	R

* * * *

No. 138. There were 5 teachers and 99 children at first, and 7 teachers and 132 children afterwards.

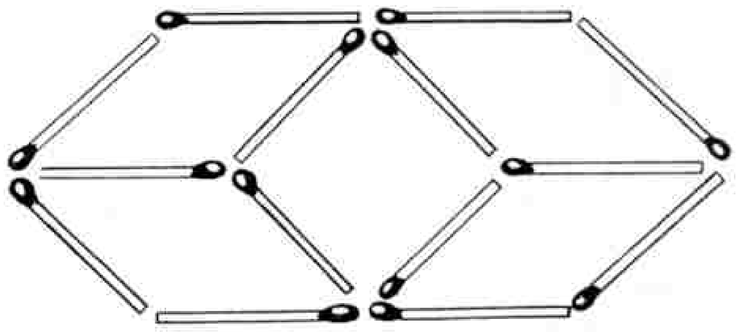
* * * *

No. 139. The sentence should have been punctuated as follows :—

"Jones, where Smith in an examination had had 'had,' had had 'had had;' 'had had' had had more weight with the examiners."

* * * *

No. 140. The Matches are arranged as shown below.



No. 141. Place five birds into each of three cages and then place the three cages in one large cage.

* * * *

No. 142. The number of letters in the numerals.

* * * *

No. 143. Ten cyclists.

* * * *

No. 144. Cigars 5/2. Tobacco 2/5. Change 2/5.

* * * *

No. 145. The letter L.

* * * *

No. 146. Dairymaid, Remove aid; Myriad.

* * * *

No. 147. Chaucer. The Canterbury Tales.

* * * *

No. 148. There were three persons only, a grandfather, his son, and his grandson.

* * * *

No. 149. The number is 20.

Puzzle No. 159.

My first denotes a Company
My second shuns a Company
My third calls a Company
My whole amuses a Company.

* * * *

Puzzle No. 160.

The words in italics in the following letter indicate the names of certain geographical features and these names when found complete the sentences :—

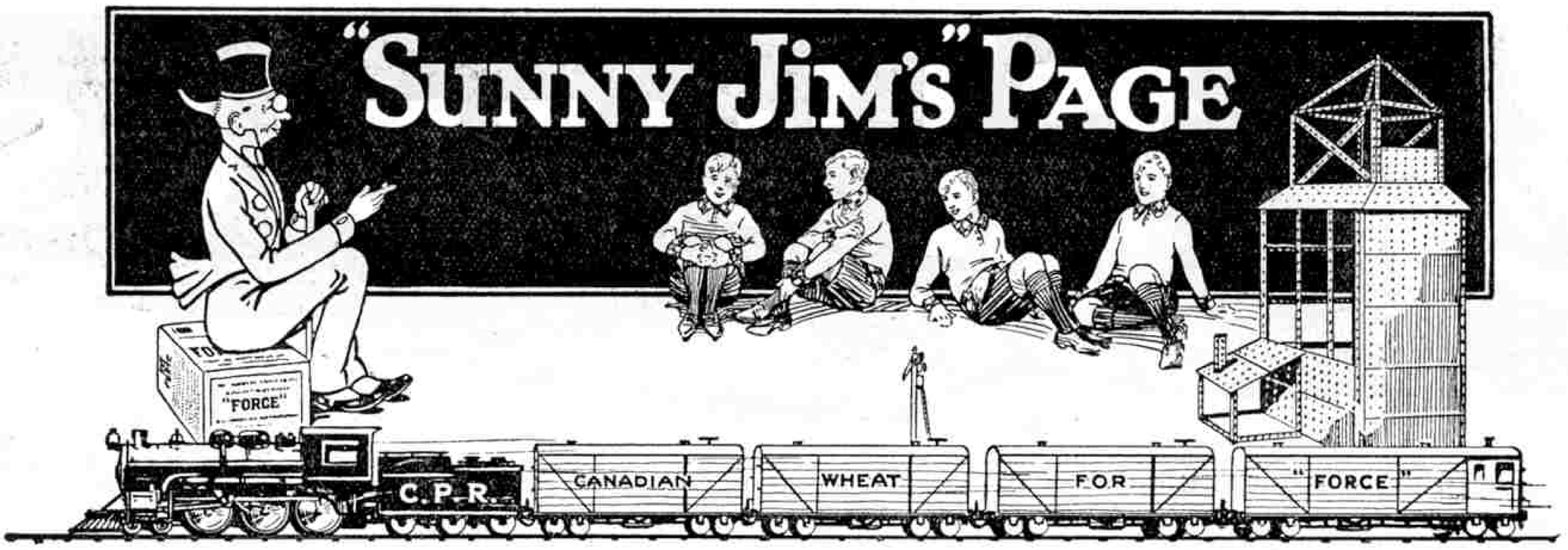
Dear *mountain near Ancient Troy*—The weather here is *lake in Minnesota* and sometimes *river in Victoria*. We are however in *cape in South Africa* of its becoming more *most southerly cape of Ireland*. Our food here consists largely of *French town on the Somme*, which is rather *lake in Utah*, and cakes of *part of the West African Coast*. We seldom get *bay in Cape Colony*, *island in Hudson Bay* or *cape in Co. Cork*, which have to be brought from town by *lake in Turkey*. All the same we have everything to our *town in Avalon peninsula*. *Cape in Greenland*, *town in New South Wales*, *river in Canada*.

* * * *

Puzzle No. 161.

A gentleman sent the following message to a friend. What does it mean?

Rebellion Rebellion
stand
Sir,—you will
that in the year 1877
F-R-A-N-C-E
Laws Laws
Religion
Rebellion Rebellion



Now for *Your* 'Good Turn'—Give Your Little Sister or Baby Brother a 'Sunny Jim' Rag Doll for Xmas

Everybody gives everybody else a present at Christmas time. Sometimes it is hard to decide just what is the right thing to give to our little brothers and sisters. That's where the Sunny Jim Rag Doll comes in so handy. Little Sister or Baby Brother would be as delighted to get a jolly Sunny Jim Rag Doll as you would be to have a new Meccano set. And it is easy to get a Sunny Jim Rag Doll.

Save two of the lids from the packets of " FORCE " mother buys (if mother has not started buying " FORCE " yet, ask her to let you buy two packets, 9½d. each, from her grocer). *Send the two lids, with two penny stamps to—*

" SUNNY JIM,"
197, Gt. Portland St.,
LONDON, W.1.

marking your envelope " DOLL " in top left-hand corner. In return you will receive the RAG PATTERN. Ask mother, or big sister, to make it up into the Sunny Jim Rag Doll, for you to stuff with soft kapok. The furniture shop will sell you, for a few pence, enough kapok to stuff the doll.

If you do not want the trouble of making the doll yourself, go to the Post Office and purchase a 1/– postal order. *When a 1/– postal order is pinned to two " FORCE " packet tops and posted to the address given above you receive in return the Complete Doll, ready stuffed* and ready for baby to play with.

How big is the Sunny Jim Rag Doll? The Sunny Jim Rag Doll is 16 ins. high. Is it coloured? It is, in Sunny Jim's correct colours, red, yellow, black and white. How long will it last? A very long time indeed; it is practically indestructible. Is it value for money? Because Sunny Jim advertises " FORCE " the Sunny Jim Rag Doll is sold cheaper than it would be possible to buy a similar kind of toy in a toyshop. It is therefore exceptionally good value for money. Can I have more than one? You can have as many as you like provided that each application is accompanied by *two " FORCE " packet tops and 2d. in stamps, if you want the RAG PATTERN, or two " FORCE " packet tops and 1/– postal order if you want the COMPLETE DOLL.*

Look for this Tableau in your Grocer's window

Thousands and thousands of happy little boys and girls are owners of Sunny Jim Rag Dolls. See to it that your little sister or brother becomes a happy owner of a Sunny Jim Doll too.

If you see a grocer's shop with the Tableau, illustrated on this page, displayed in the window, walk right in and buy your two packets of " FORCE " there. In the window will be a REAL Doll for you to see exactly what you are going to get.

If you don't happen to see a grocer's shop showing this tableau, it will, of course, be just as good to buy your " FORCE " from mother's usual shop.

If mother is not in the habit of giving you "FORCE" you will be doing *yourself* a " good turn " when you buy your two packets. Mother will find that "FORCE" is easy to serve with hot milk, and she will be so pleased to know it needs no cooking that she will give you " FORCE " every day.

You will then be sure of getting regularly a plateful of those delicious " FORCE " flakes that other boys like so much. " FORCE " is WHEAT. Wheat is STRENGTH. " FORCE " is WHOLE wheat made so that you can get all the nourishment in the best way possible. Eat " FORCE " and you'll be on the road to health and strength—and you'll find it a jolly pleasant road to follow.

Yours forcefully,

Sunny Jim

Fireside Fun

SOME HEN!

Boastful traveller (in village inn): "My father had a hen that would hatch anything from a tennis ball to a lemon. One day she sat on a chunk of ice and hatched out a pint of hot water."

Jinks (after prolonged silence): "My mother had a better hen than that. One day they fed her on sawdust by mistake. She laid ten eggs, and when they were hatched nine had wooden legs and the tenth was a woodpecker!"

* * * *

Q. Why does the monkey look so unhappy?

A. He's just found out that his scientific name is "Anthropoid Trogolytis."

* * * *

Professor: "Where do insects go in winter?"

Absent-minded student: "Search me!"

* * * *

Small Boy; "Dad, will you buy me a pair of skates if I can prove that a dog has ten tails?"

Father: "Yes, my boy."

Small boy: "Well, one dog has one more tail than no dog."

Father: "Right."

Small Boy: "Then if no dog has nine tails, and one dog has one more tail than no dog, then one dog must have ten tails."

Father (faintly): "You shall have the skates!"

* * * *

Moggs (reading from a book): "And in the bright moonlight we could plainly see the dark muzzles of the wolves."

Boggs: "What an awfully lucky thing the wolves had their muzzles on!"

* * * *

NOT PAINLESS!

Bill: "That dentist you sent me to, that was advertised as painless, wasn't."

Father: "What do you mean?"

Bill: "I bit his finger and he yelled just like any other dentist!"

* * * *

Jack: "You say Jimmy Jones got hurt?"

Bob: "Yes, but not seriously. He got jammed in the pantry and his father gave him first aid treatment."

* * * *

Teacher: "You must stay in after school and work on your geography lesson. You didn't know anything about a single one of those cities."

Willie: "Well, perhaps not, but I can tune in the whole lot with my radio set!"

This Month's Short Story

Willie drank a pint of yeast
In spite of friendly warning.
"I hope," said he, "this will make me
Rise early in the morning."

* * * *

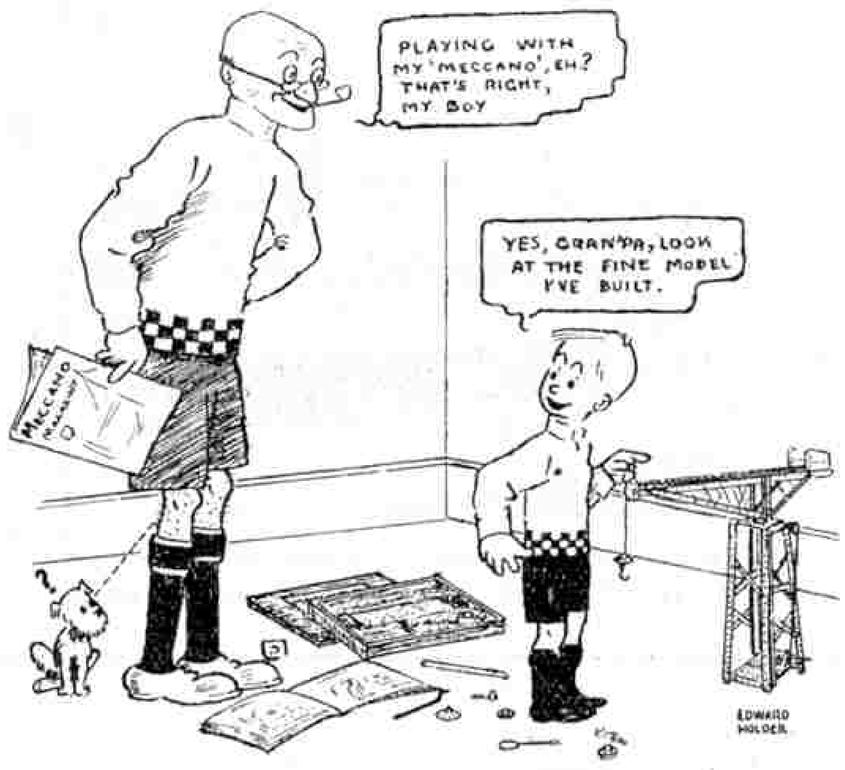
Boxer (to opponent): "I'm sorry for you. I was born with boxing gloves on."

Opponent: "That may be, and I reckon you're going to die the same way."

* * * *

Tramp: "Madam, I was not always like this."

Madam: "No, it was the other arm you had in a sling yesterday!"



Drawn by] [*E. Holder, Trinidad*

The Best Age to Start Meccano is anywhere between 5 and 70.

Infuriated Neighbour: "Sir, that miserable dog of yours has just bitten me."

Dog owner: "Don't worry, my dear sir, he has a good constitution and will probably recover."

* * * *

First Camper: "How many chops did we leave for this morning's breakfast?"

Second Camper: "Two, of course."

First Camper: "Well, the dog has got away with yours."

* * * *

NO IDEA!

Tommy: "Do you know what I should do if it were not for the Meccano Magazine?"

Johnnie: "No, what would you do?"

Tommy: "That's just what I should like to know!"

* * * *

Recruit: "The Captain says I'm to draw my uniform."

Sergeant: "Sure. How will you take it, too large or too small?"

WHY HE WALKED!

"The Doctor said he'd have me walking again in three weeks."

"Well, did he do it?"

"He did, I had to sell my motor car to pay his bill."

* * * *

The old man entered the village shop. "Good morning," he said heartily. "I've just looked in to buy an average. Let me look at some, young man."

"An average did you say, sir?" asked the assistant, blankly.

"Yes, the same as Mr. Megson bought."

"What is it like sir?" asked the young man, looking hot and bothered.

"All I know," said the old man, "is that Mr. Megson says he's got a hen that lays 20 eggs on an average, and I want an average too!"

* * * *

Teacher: "What minerals exist in England beside coal and iron?"

Bobby: "Ginger beer and lemonade!"

* * * *

Bill: "I'm an exporter now."

Bob: "How on earth did you become an exporter?"

Bill: "Well, the railway company fired me, so now I'm an ex-porter!"

* * * *

Two men were standing on the pier looking out to sea and discussing the various steamers that were passing.

"Look," said one of them, "there comes an Aberdeen boat."

"Rubbish," said the other, "you can't recognise a boat at that distance."

"Oh yes, I can," said the first man. "You look again carefully and you will see that there are no seagulls following the steamer."

* * * *

Student: "The more I read about this subject the less I seem to understand it."

Professor: "Obviously you have been reading a great deal!"

* * * *

STUNG!

Tim: "What's the difference between a bank and a bee-hive?"

Tom: "Give it up."

Tim: "A bank takes in notes and a piano gives out notes."

Tom: "But you said a bee-hive."

Tim: "That's where you get stung!"

* * * *

Big One: "Sorry I trod on your feet."

Small One: "Don't mention it, I frequently walk on them myself!"

* * * *

Percy: "Did you take a bath last night, Bertie?"

Bertie: "No Percy. Is one missing?"

BRITISH MADE

LOTT'S BRICKS

BRITISH MADE

OF ARTIFICIAL STONE

DESIGNED THROUGHOUT BY AN EMINENT ARCHITECT

FOUR-GABLED HOUSE
TUDOR 2

Box O Complete with Plans, Bricks and Roofs 6 Models 2/–

,,	OA	,,	,,	,, 12 ,,	3/3
,,	A	,,	also Fences and Trees	30 ,,	5/–
,,	B	,,	,,	,, 12 ,,	5/6
,,	1	,,	,,	,, 48 ,,	10/–
,,	2	,,	,,	,, 18 ,,	10/6
,,	3	,,	Plans, Bricks and Roofs	72 ,,	17/6
,,	4	,,	,,	,, 6 ,,	7/6
,,	5	,,	,,	,, 6 ,,	7/6
,,	6	,,	,,	,, 101 ,,	42/–

The boxes are progressive yet self contained. No tools or accessories required.

COUNTRY COTTAGE
BOX A

Lott's Bricks. The most captivating and joyous gift for playtime. A hundred toys and games in one. Every Box is packed full of variety and fun. Be sure and get yours.

There is nothing complicated about Lott's Bricks. The plans are easy to understand and perfectly straightforward. There is no limit to the number of different models that can be built from even one box.

GARDEN SETS

Box 1 ... ... 4/–
Box 2 ... ... 6/–

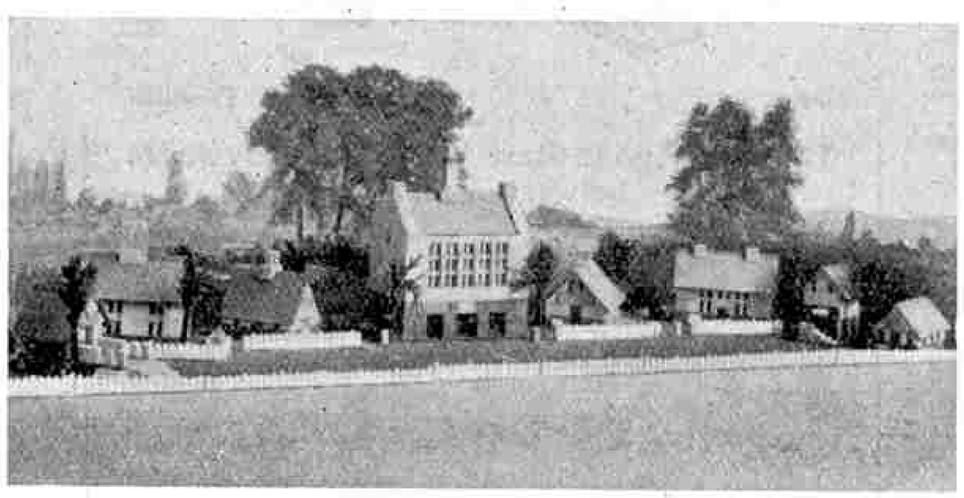
Containing Fences, Trees, Shrubs, Shells, etc.

MARKET HALL. BOXES 1 and 2 or 3

TUDOR BLOCKS

Box 1 (builds 6 Models) ... 3/6
Box 2 ,, 12 ,, ... 7/6
Box 3 ,, 18 ,, ... 21/–

Would not this Display of Models and Scenery add to the Fun and Pleasure you get out of your Railway ?



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You may Win it.
Write for Full Particulars enclosing Stamp for Postage.

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WRITE FOR ILLUSTRATED LIST AND NAME OF NEAREST AGENT

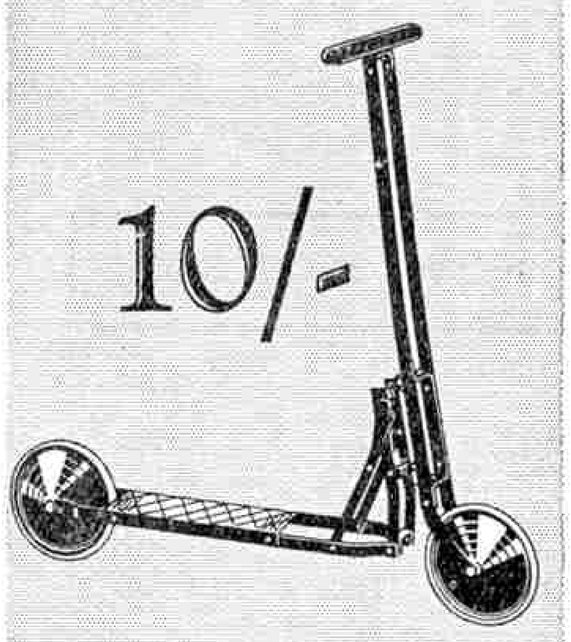
LOTT'S BRICKS LTD., WATFORD, England

TAN-SAD WHEEL TOYS

THE type of Pedal Car shown below has been a recognised favourite for generations, and is just as popular with boys to-day. Actually it is far more popular than ever before because, now, for the first time it is possible to obtain this type of car greatly improved and fitted with Tan-Sad Springs. There is nothing of its kind to compare with the Nip-on The seat is so arranged that though you enjoy the full comfort there is no lateral sway. Also the springs makes manipulation more certain, and adds to the ease of pedalling. See this and other British-Made Tan-Sad Wheel Toys at the nearest Dealers, or send to Tan-Sad Ltd., Drake Works, 1, Albert Street, Birmingham, for folders which describe in full the complete range.

The TAN-SAD "RACER"

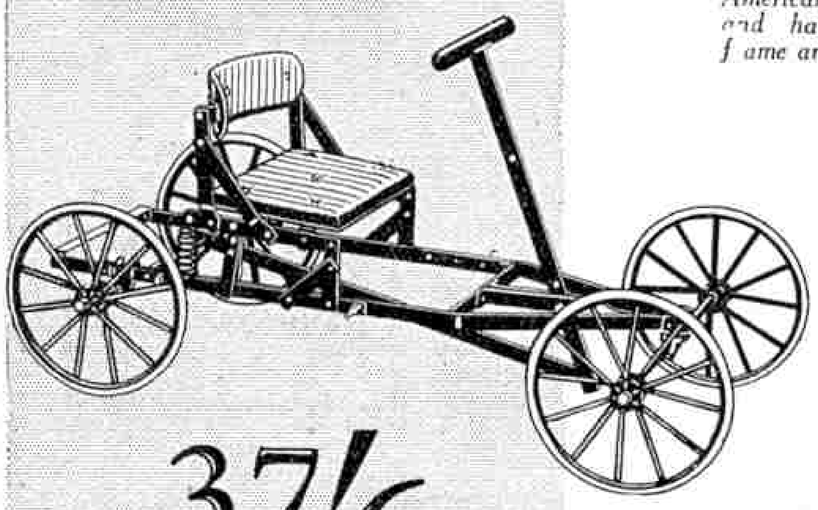
An ideal model for younger children. It is strongly constructed, and fitted with 6in. disc wheels with ½in. wired-on tyres. Folds when not in use. At its price it is by far the best scooter on the market.



10/-

The TAN-SAD 'ADJUSTACAR'

The "Adjustacar" is constructed from best mild steel. Fitted with Tan-Sad Patent unbreakable 10in. wheels, with ½in. wired-on tyres. It is simple to operate, easy to control. Seat padded and upholstered in American cloth.



37/6

The TAN-SAD 'NIP-ON'

The "Nip-on" is constructed from best mild steel. Fitted with 10 in. front and 6 in. back wheels, with ½ in. wired-on tyres. The seat is well padded and upholstered in American cloth. Rubber pedals and handle grips. Handlebars, frame and cranks finished in red.

19/6

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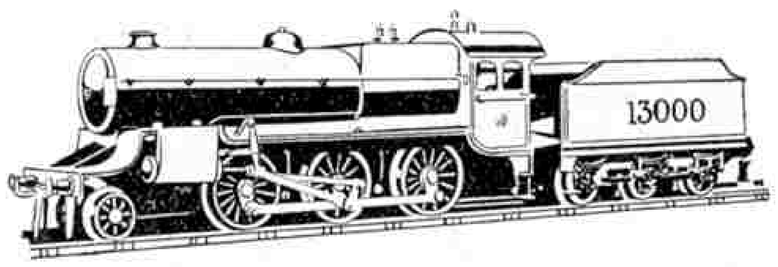
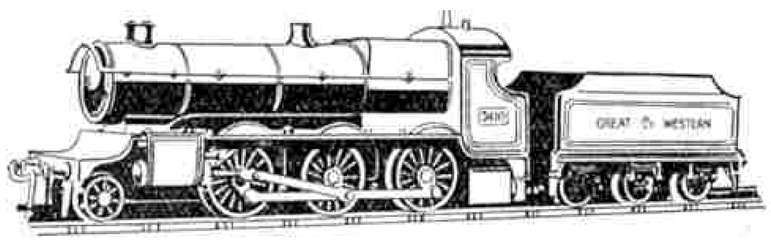
Tan-Sad Toys and Prams are fitted with North Pole Tyres.

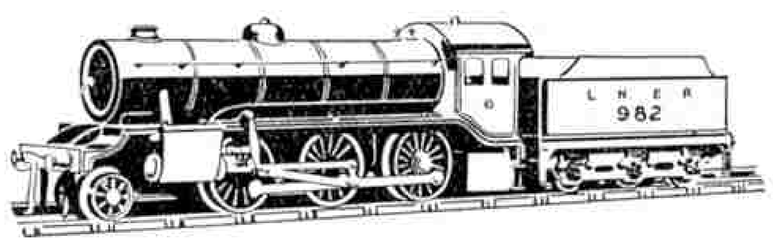
WT. 11



YOUR CHOICE OF THE WORLD'S FINEST RAILWAY MODELS

BASSETT-LOWKE SCALE MODELS have set the fashion for the past 25 years, and the new models introduced this season surpass everything previously made in realism and mechanical perfection.





Of all indoor pastimes for the winter evenings, what can be more fascinating—or more interesting—than a well laid-out model railway ? Equip your railway with Bassett-Lowke scale models and it will look like the **real thing**—in fact, it **will** be the **real thing** in miniature ; which, after all, is the true function of a model of any description.

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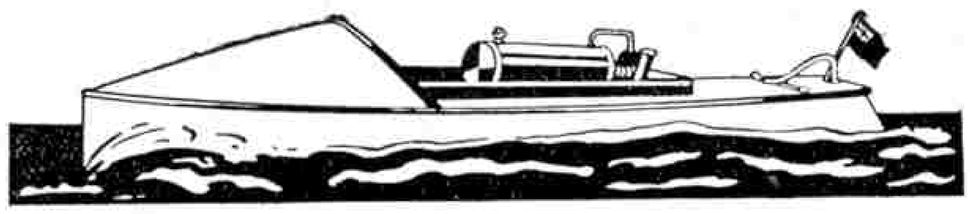

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LOCOMOTIVES. Clockwork, Steam and Electric. Over 70 different types to choose from, in $1\frac{1}{4}$" Gauge upwards.

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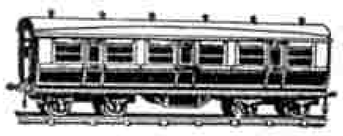

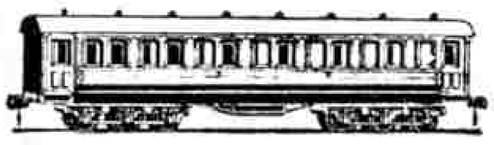

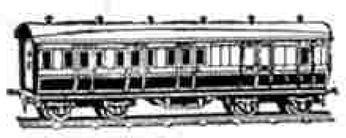

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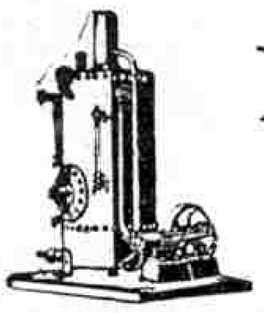

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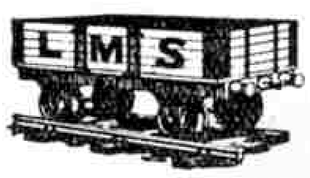
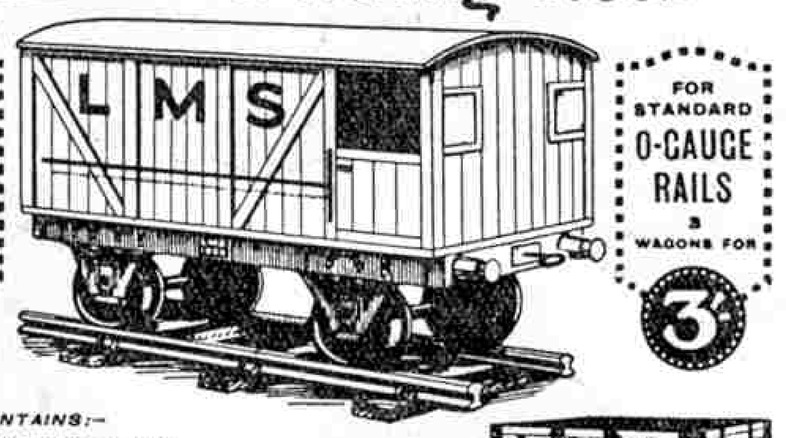
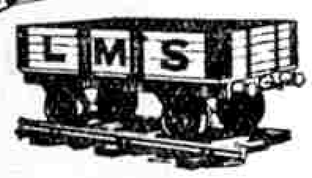


Simplex CONSTRUCTIONAL MODELS of Rolling Stock



CONTAINS:—
MATERIAL FOR CONSTRUCTING
2 OPEN O-G TRUCKS, 1 BRAKE VAN
INCLUDING
12 WHEELS, 6 AXLES, 6 DRAWHOOKS
PRINTED COLOURED SHEETS FOR MOUNTING. FULL INSTRUCTIONS.



Simplex Constructional Models of Rolling Stock, for 0 Gauge Rails. For boys to build their own Rolling Stock. The box contains materials for constructing: 2 Open O.G. Trucks and 1 closed O.G. Brake Van. Including 12 wheels, 6 axles and 6 drawhooks with complete printed coloured sheets for mounting and full instructions.

Price, 3/- per set of three. Postage 6d.

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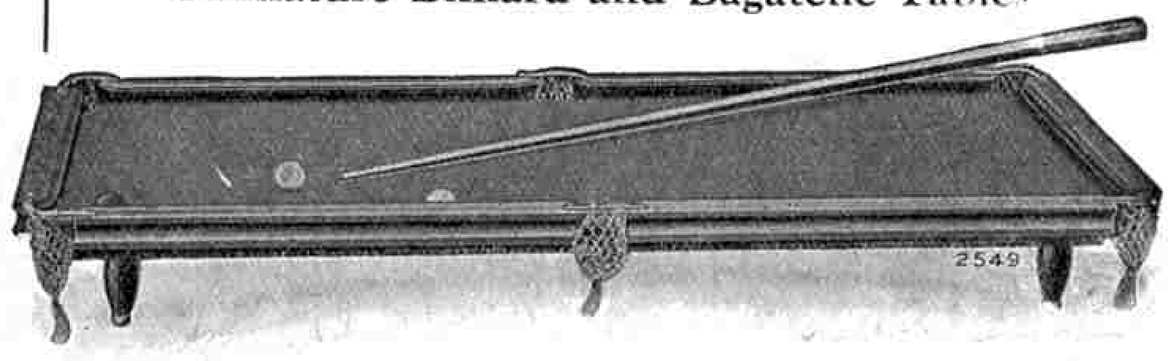


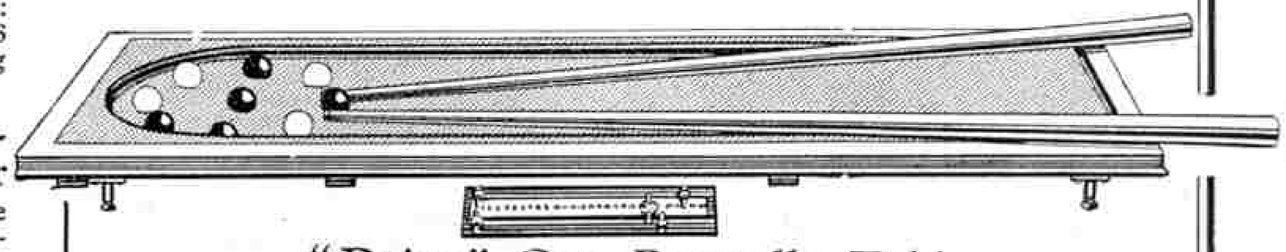
The Finest Value Ever Offered.

'DAISY' Miniature Billiard Tables are not toys—they are scientific reproductions of full-sized tables and afford continuous enjoyment to young and old, in the most skilful game ever invented.

'DAISY' Tables are fitted with adjustable feet to ensure a perfect level, and are complete with two cues, marking board, chalk, rules and three composition balls—*not* wooden, as is frequently supplied with inferior makes.

Size	Ball	Cue	Price
3 ft. 6 in. ...	1¼ in.	3 ft.	30/-
4 ft. 6 in. ...	1⅜ in. ...	3 ft. 6 in....	60/-

Carriage & Packing 2/- extra



"Daisy" Cup Bagatelle Table

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These tables are fitted with adjustable feet and a perfectly level surface can thus be obtained. Size 4′×18″. Price **37/6** Carriage Paid.

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No. 12. Standard Single Shot Air Rifle of the World. Lever action single shot, blued finish. Shooting Barrel removable and shoots either air rifle shot or 17-100 Darts. Length, 31½″.
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A Very Special Line

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Prices **5/- 10/- 15/-** Postage 6d. 9d. 9d.
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Railway Station Staff for Model Railway Stations

This set of figures is made throughout in white metal and consist of :—

No. 1.—Small Set consisting of 1 Station Master, 1 Ticket Collector, 4 Porters, 4 pieces of Luggage, 2 Porter's Barrows.
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All working parts are interchangeable. Made entirely of Fine Steel, including Trigger, Sear, Barrel, Plunger, Breech Plug and Muzzle Nug. Fitted with best Chrome Springs. The Pistol is shaped and designed on the very latest principle for easy handling and correct aiming. Price **10/6** each. Postage 9d.

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The illustration shows the now famous "Dragon-fly" AMPLION, a real Baby loud speaker embodying the latest improvements and exclusive AMPLION features.

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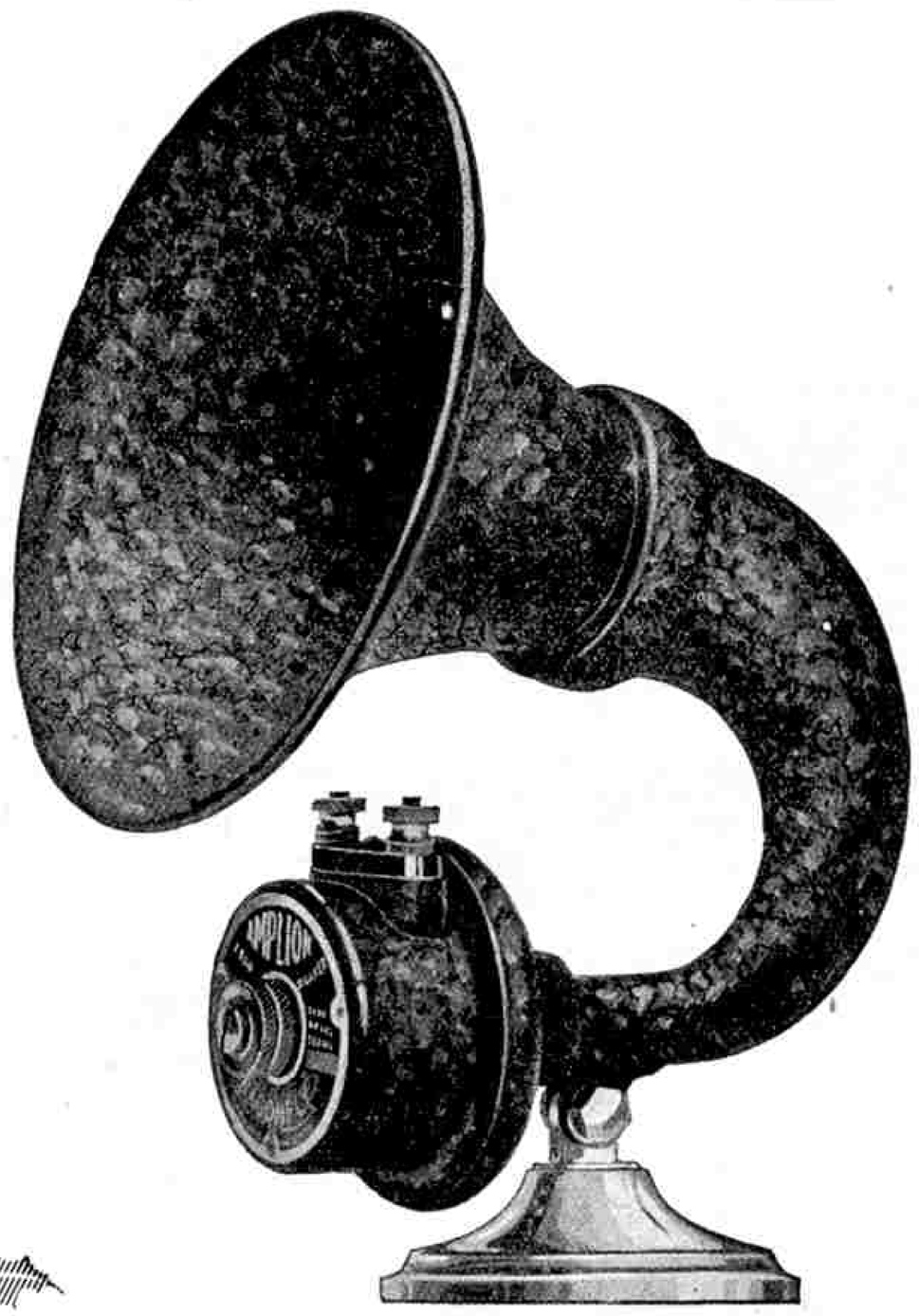

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No gift could possibly prove more acceptable to any boy who is keen on wireless. The AMPLION is recognised throughout the World as the *Loud Speaker Supreme*, by virtue of unique constructional features such as the non-resonating sound conduit and super electro-magnetic unit with "floating" diaphragm which enable the AMPLION user to enjoy "*BETTER RADIO REPRODUCTION.*"

The AMPLION "Dragonfly" is small and attractive in appearance . . . a standard AMPLION in miniature . . . although costing only 25/- the "Dragonfly" reproduces with wonderful clarity and tonal quality when associated with a receiving set of suitable power and efficiency. Considering the size of the instrument the volume of sound is remarkable.

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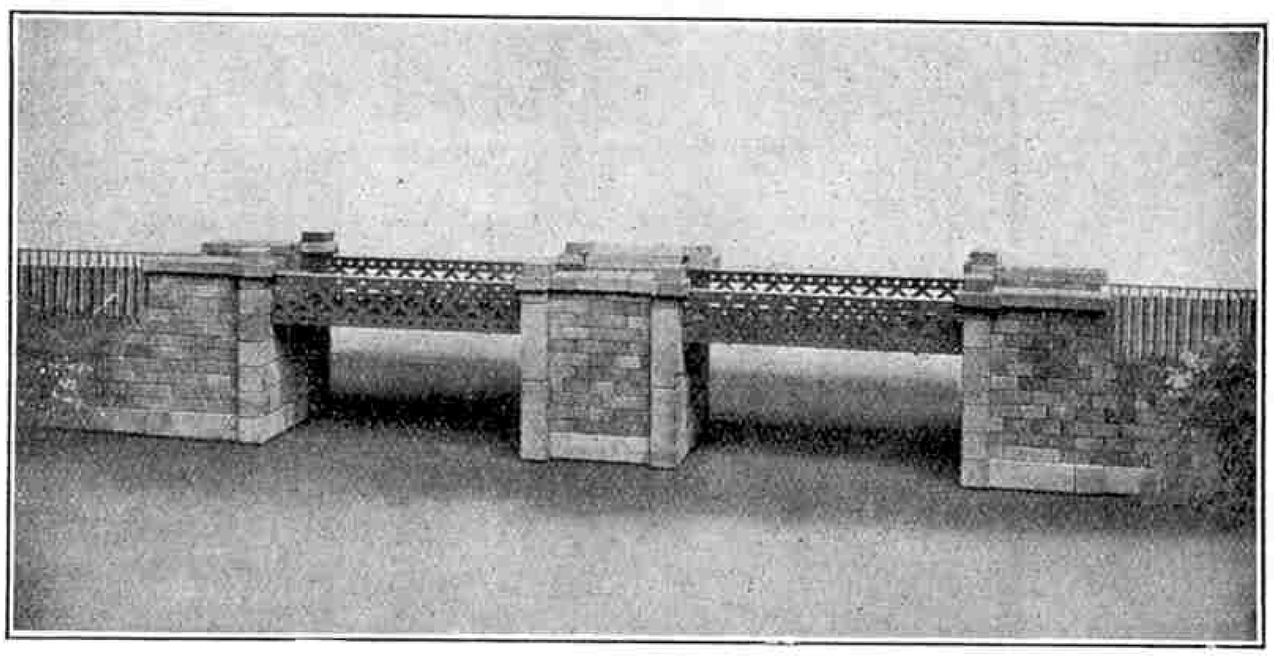
LOTT'S BRICKS

OF STONE

FOR MODEL RAILWAYS



For particulars of Bridge Competition see advertisement on other page

No Railway is Complete without some

Stone Buildings

dotted around.

You can test this statement by the purchase of one box. If you are not satisfied with the Results

LOTT'S BRICKS LTD.

will refund your money together with postage.

START NOW WITH ONE BOX!

YOU WILL BE PLEASED

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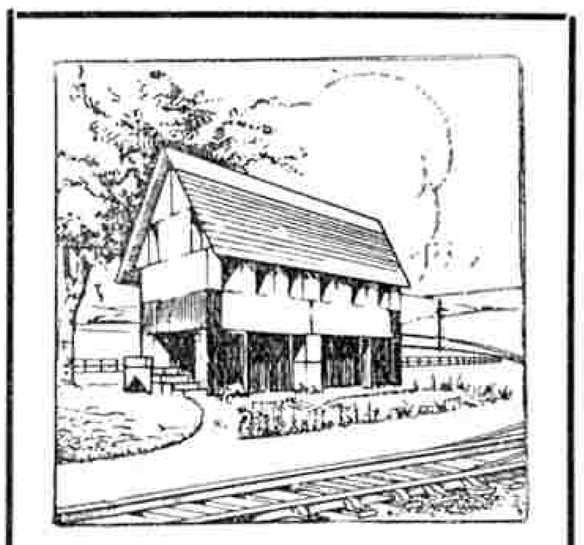

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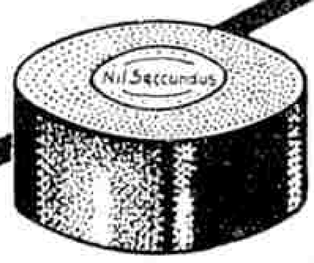

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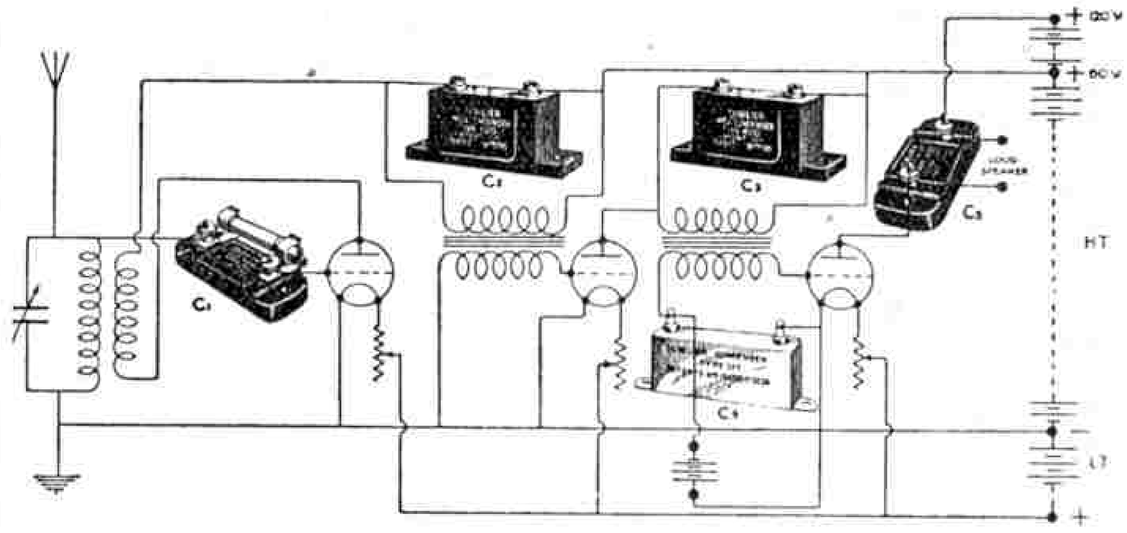

THE RIGHT THING in THE RIGHT PLACE

ALTHOUGH the experience of the average man with wireless matters has been comparatively short, it has certainly been intensive. In the summer of 1922 an aerial outside a house was a rarity. In 1925, on the other hand, it is the house without one that is the exception. Literally millions of people nowadays know quite a lot about the theoretical and practical sides of wireless. Above all they now realise that a successful set must be fitted with good condensers, and in every case the name Dubilier is generally recognised as the hall mark of condensers both fixed and variable, Anode Resistances, and Grid Leaks, and other similar products.

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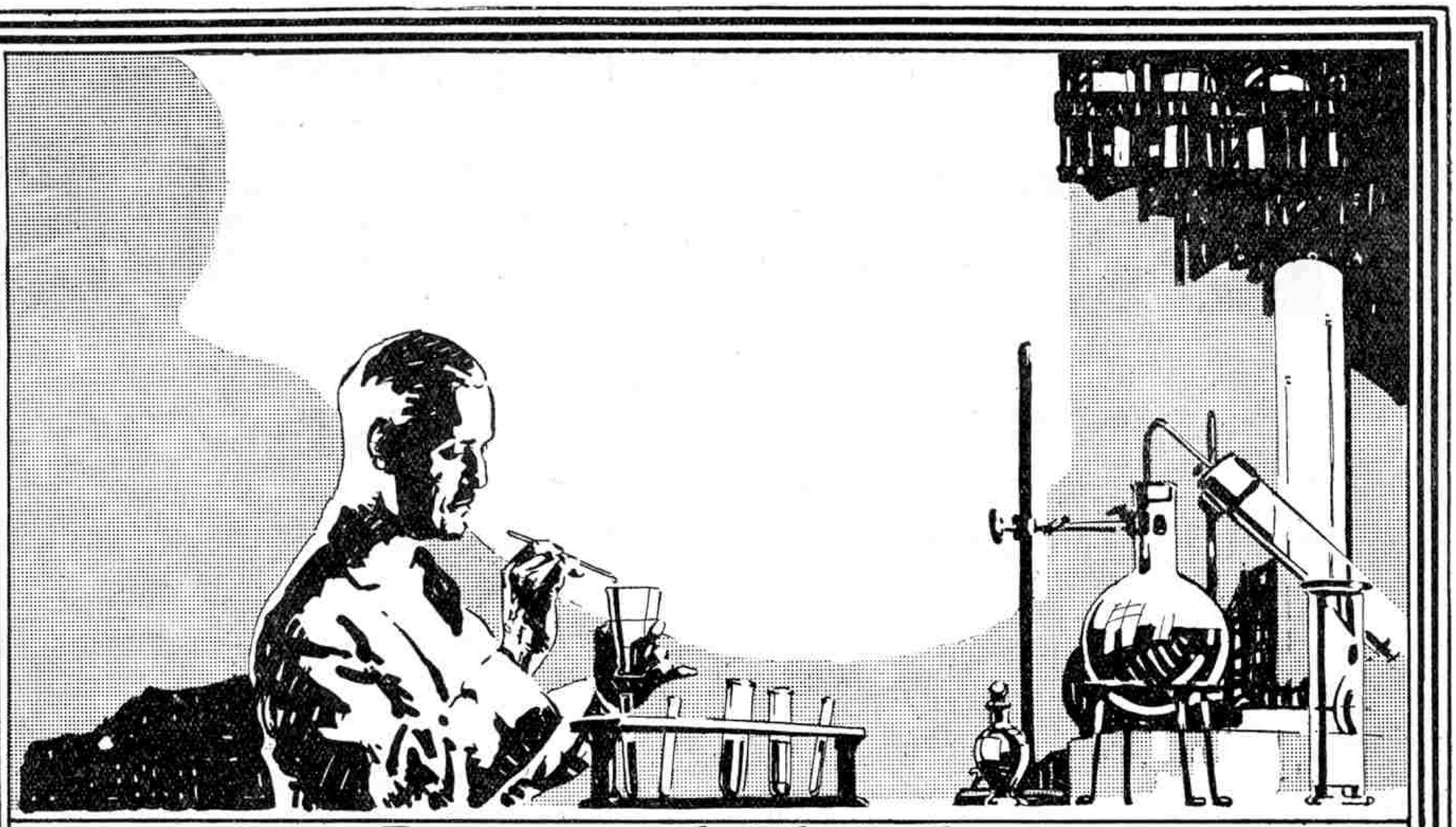

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ALWAYS AT HAND

ITS USES ARE INNUMERABLE

A few of these uses are noted in the column at left. But new and strange uses are continually recorded. One of these just to hand is worth printing—

Mending shoes.
Patching clothes.
Making screens.
Affixing book leaves.
Mending photos.
Making ash trays.
Mending shirt studs.
Fixing clasps to belts.
Mounting microscopic slides.
Mounting enamelled letters on glass.
Making kindergarten models.
Repairing telescope lenses.
"Fixing" drawings (to prevent rubbing).
Repairing china ornaments.
Making letters on a ground with pieces of china.
Mending broken glass stoppers.
Making putty to fill up cracks in ornaments.
Affixing india-rubber heel pads.
Making fretwork articles.
Making lantern slides.
Bookbinding.
Mending knife handles.
Making models of all kinds.
Repairing Bicycles.
Repairing Motor Cars.
Repairing violins.
Making wall plaques.
Repairing handle-bar grips of bicycles.
Decorating trays.
Making articles of egg shell.
Making dolls' furniture from matches.

Dear Sirs,

Have just bought another tube of Seccotine, and am interested in your long list of usefulness, but there is one thing you don't know about, and that is for the renewal or preservation of hard felt hats (men's). The effect is marvellous, for my felt hat was about done when I first treated it over two years ago, and though I wear it three or four days per week, it is going yet, and still smart. I am not stretching when I say it has worn three times more than my hats usually do, and has been really smart all the time, and is yet.—Half a teaspoonful in half a cupful of boiling water, and washed round and round the hat, including ribbon, and then let it dry. Wonderful indeed!

Another thing I did was to stick the house numbers in embossed figures on the fanlight window over my front door. I was having great difficulty as the figures would keep sliding down the glass. I then got the idea of letting the Seccotine set until it got sticky as when using solution to put a patch on a punctured tube, and it worked the oracle. No more trouble to get the figures stuck on the glass.

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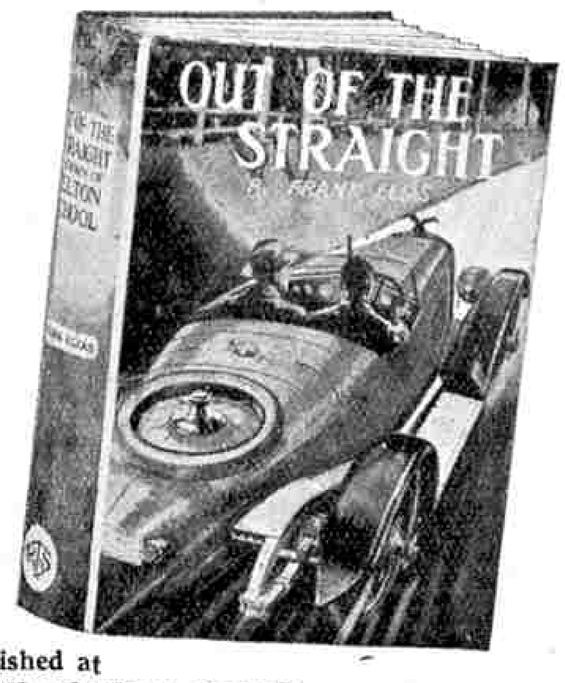

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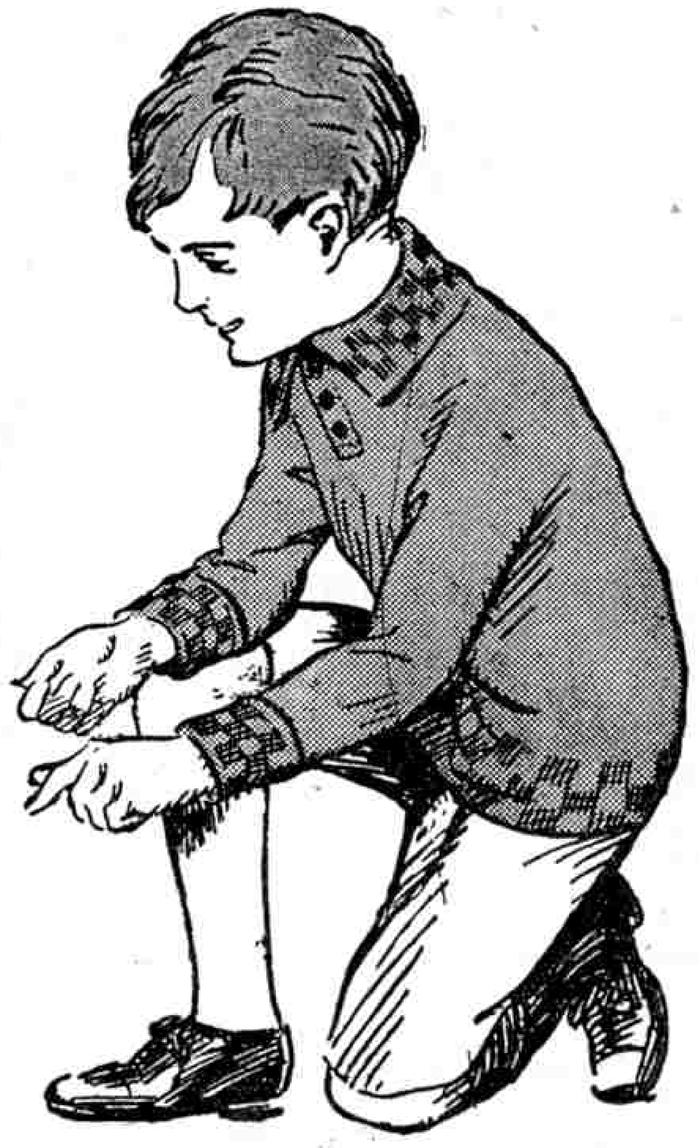

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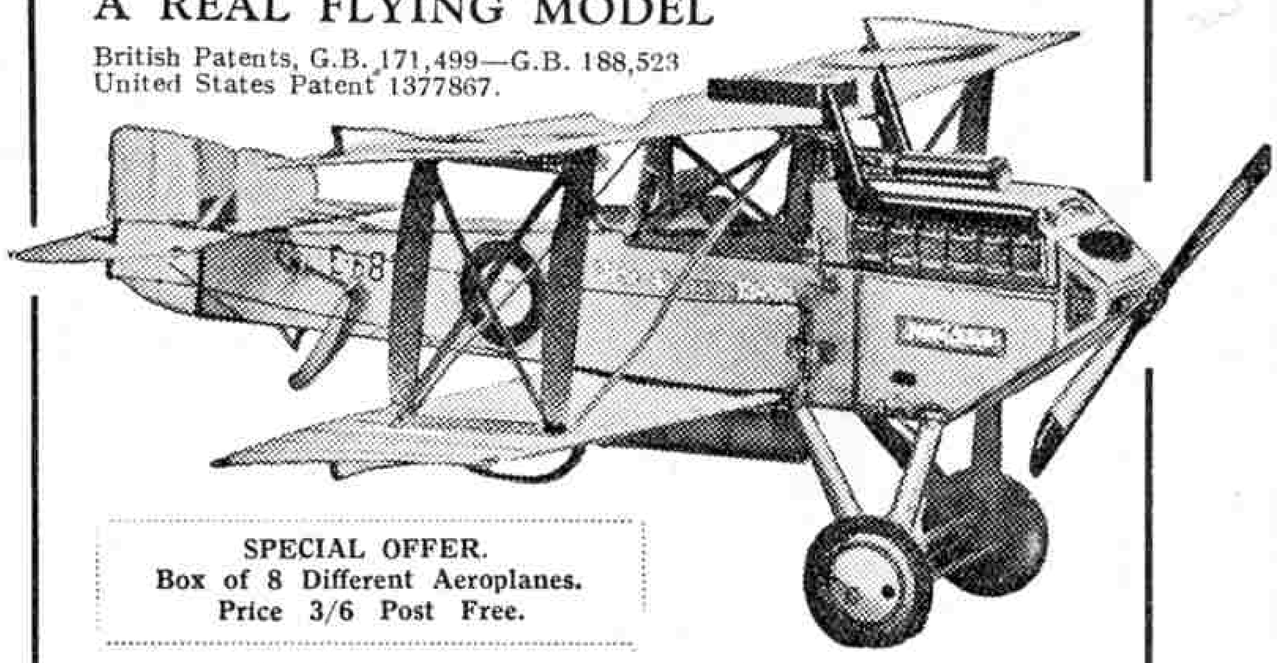

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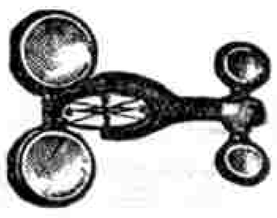

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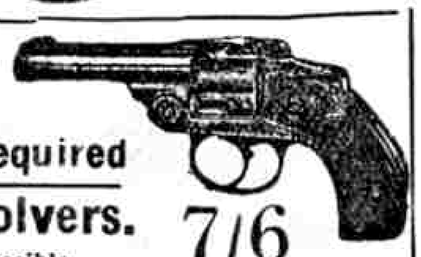

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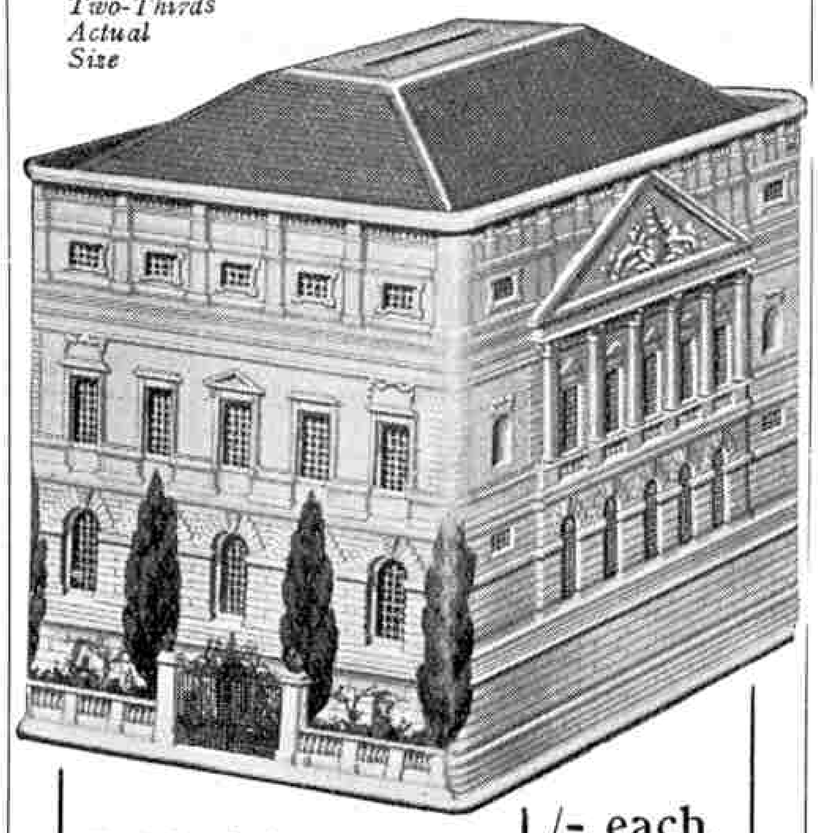

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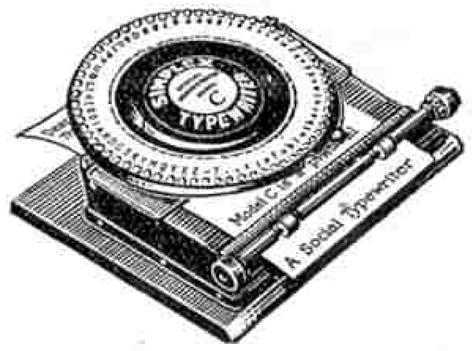

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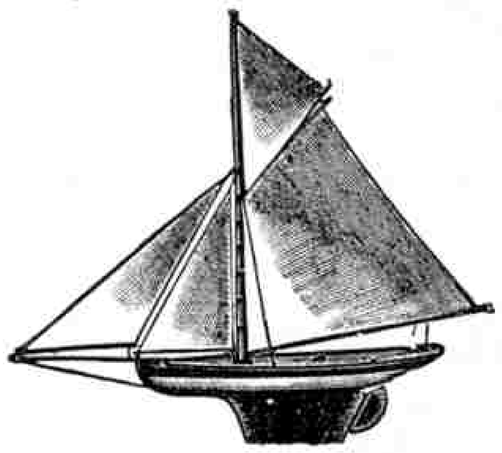

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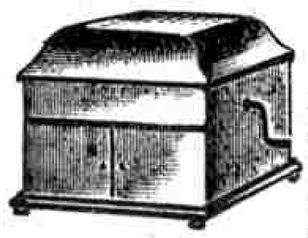

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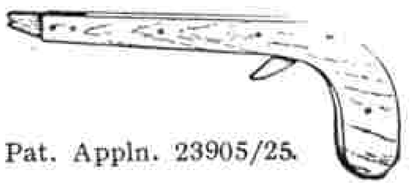

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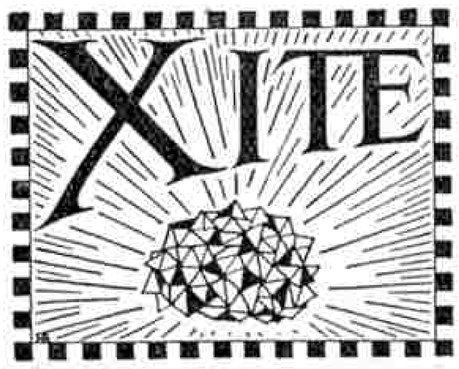

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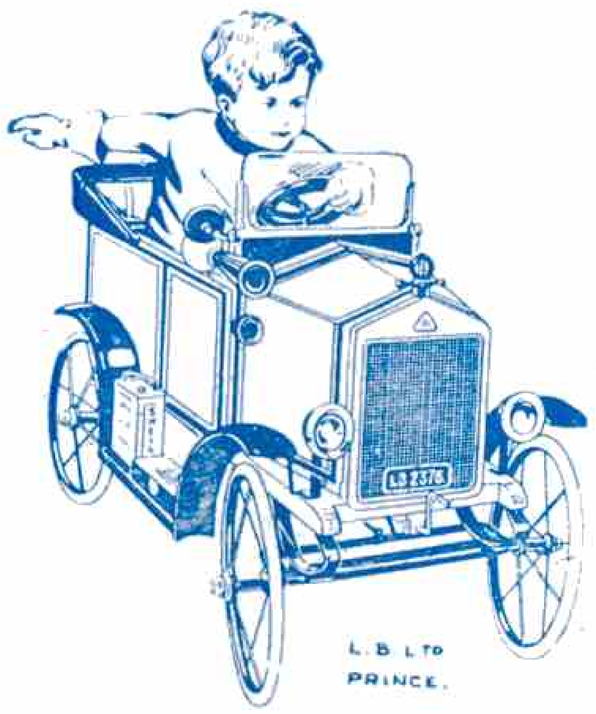

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