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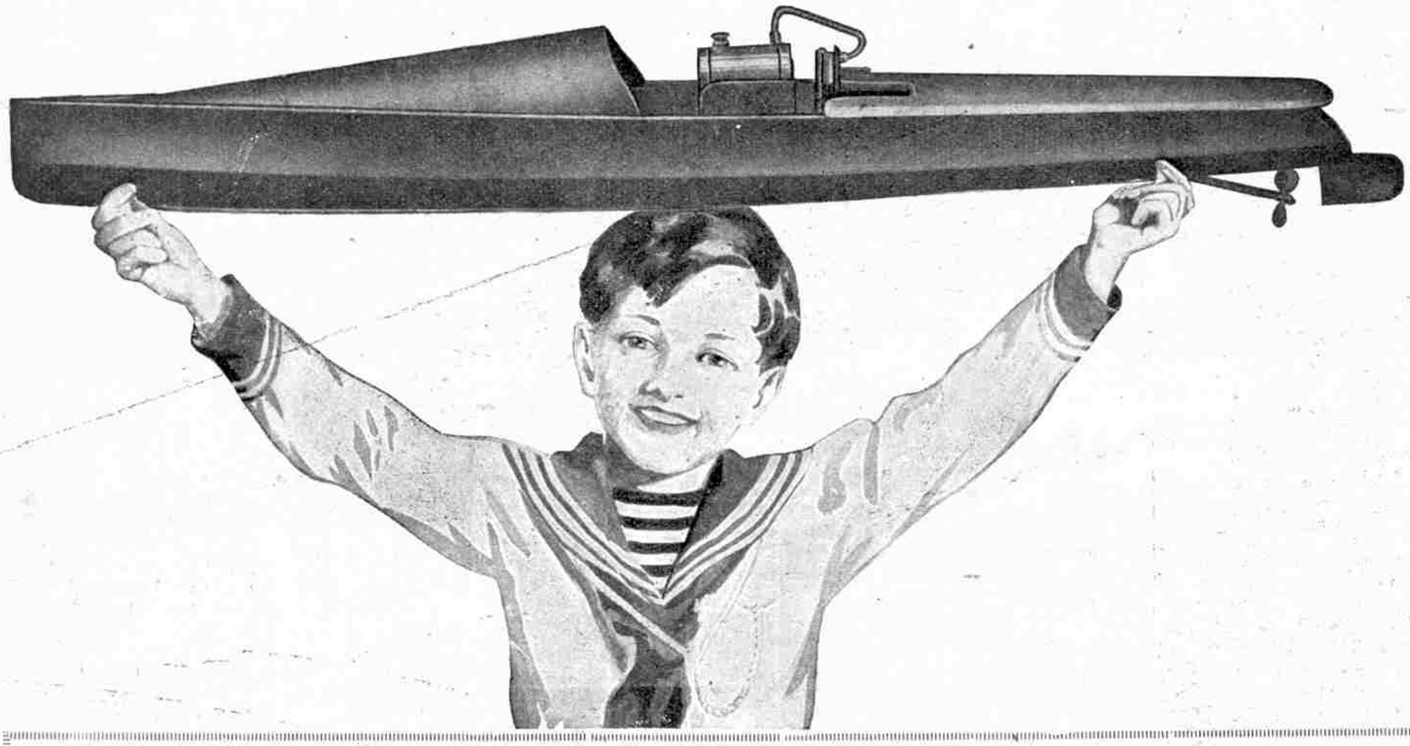

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MECCANO MAGAZINE

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IN THE INTERESTS
OF BOYS

Vol X, No. 8

August 1925

With the Editor

A Famous Author's Blunder

In dealing with the Centenary celebrations of R. M. Ballantyne, the famous author of boys' stories, I mentioned in the June Editorial that in his earlier books he laid some of his scenes in countries that he had never seen. The inevitable result was that in his third book, "*Coral Island*," he made at least one great blunder. I offered a guinea to the reader whose letter was first received, pointing out the blunder.

The winner is H. T. Bolus (of Cannon Hill, Birmingham) who points out that the great blunder occurs in the following extract (Chapter IV) dealing with cocoanuts :—

"Peterkin bounded up the tall stem like a squirrel and returned with three nuts, each as large as a man's fist. 'You had better keep them till we return,' said Jack. 'Let us finish our work before eating.' 'So be it, captain, go ahead,' cried Peterkin, *thrusting the nuts into his trouser's pocket*."

The winner's comment on this is: "Cocoanuts as they grow on the tree are enveloped in a husk four times the size of a man's fist, so that it would need a very large pocket to hold three cocoanuts." With this we must all agree!

More Mistakes in "Coral Island"

I was very pleased with the large number of replies, and the prompt response in this competition. The entries were more numerous than I had expected, and most of them came to hand on the 1st and 2nd June.

Several other mistakes that Ballantyne made were pointed out by other readers. These included Jack finding flints on the shore, "as it is unlikely that flints would be found on a coral island unless washed up by the sea." (C. MacDonald, Insch, N.B.) "There are no such things as the 'coral insects,' described in Chapter XVI" (M. Keidan, Bradford). "In one place it states in the book that "We saw . . . . . millions of little active sea creatures continuing the work of building up a living rampart." Coral is made only at a depth of from 15 to 30 fathoms, and at this depth diving apparatus would be required to see it." (W. R. Stevens, London, E.C.1). "The boys' reference to 'hills and dales' cannot be true because no Coral Island rises more than 10 ft. above the sea level." (H. Thompson, Glasgow and H. Weale, Keston, Kent). "The book says the South Sea Islanders are coal black, but really they are olive or red-brown in colour." (W. Harvey, Hastings). A curious printer's error is also pointed out (by G. Everest of Seven Oaks) "Jack remembered having *sword* once of a sword-fish attacking a ship." The word "sword," should, of course, have been "heard."

A large number of readers mentioned another error—that of the author describing penguins as inhabiting the small islands of the tropical seas. They point out that penguins are found in the Antarctic, and are not usually found in a climate so hot as that in which the legendary Coral Island was supposed to be situated.

I do not know how many of these mistakes were ever pointed out to Ballantyne, but I feel sure that, were he alive, he would agree with me that readers of the "*M.M.*" include boys with the sharpest eyes in the world—as has been proved time after time!

Next Month's "M.M."

As already announced, our September number will be a special and enlarged Railway Centenary issue. There will be a splendid coloured cover, and as many pages as possible will be devoted to railway matters. For instance, a special article will deal with postage stamps on which engines or railways appear; the Photographic Competition will be in connection with railway subjects; the Fireside Fun and Competition pages will also centre on railways.

The special Railway Centenary Celebrations that were held at Darlington will be fully described and illustrated. There will be articles dealing with the historical aspect and the early history of the locomotive, and a page of famous inventors associated with the discovery and perfection of the steam engine. Other special features include "How to Make a Model Railway Station," "New Series of Metropolitan Tank Locos;" "The Fastest Train in Britain;" "Novel Test for New Locomotives;" "Model Locomotive Trials on the Eskdale Railway;" "Steam Locos without Fires;" "The Story of Bradshaw's Railway Guide."

The number of this special issue to be printed is limited and every reader should order a copy at once, to avoid disappointment. The price is 3d. as usual.

Tell your Friends about the "M.M."

Although our circulation during the last year has increased to over 50,000 copies each month, I want to see it still further increased, and in this connection my readers can help me very considerably by obtaining new subscribers. There must be over a million Meccano boys in this country who would all enjoy the "*M.M.*" if only they knew of the existence of this Magazine. Although we do everything possible to make known the "*M.M.*" by advertising it and by including notices in every Meccano Outfit, Hornby Train Set, Manual and Catalogue that we issue, it is a surprising fact that there are tens of thousands of Meccano boys who do not know that such a Magazine is published. If our present readers will show their "*M.M.*" to their friends and mention it wherever possible, it will help me to make our Magazine more widely known. If every reader obtains only one new subscriber in this manner, we should double our circulation, and this would enable me to add even more literary pages to each issue. If you have a friend who is not a regular reader of the "*M.M.*" send me his name and address, and I will see that he has a specimen copy mailed to him free.

How to Obtain the "Meccano Magazine"

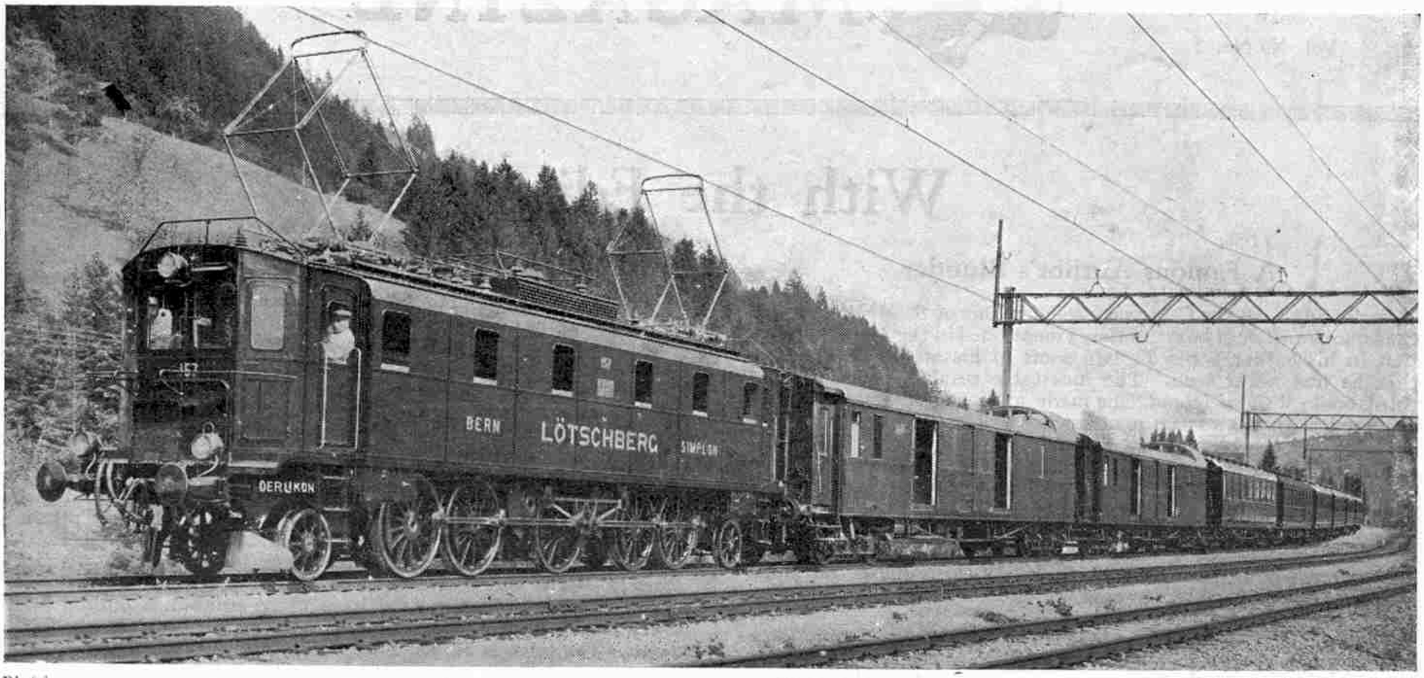
In reply to numerous recent enquiries, I should like to announce that there should be no difficulty whatever in obtaining the "*M.M.*" promptly on publication date—that is, the 1st of each month. The Magazine may be ordered from any Meccano dealer, and there is at least one Meccano dealer in practically every town in this country. If any of my readers do not know which firms are Meccano dealers I shall be glad to send a list of Meccano stockists in any town, on request.

The "*M.M.*" may also be ordered through any newsagent. If your newsagent cannot obtain it from his wholesaler, I will arrange that he receives supplies direct. If there is any difficulty in the matter ask him to write to me.

Finally, those who cannot obtain the Magazine from either a Meccano dealer or a newsagent—owing, perhaps, to living in some remote part of the country—may have it posted to them direct from this office. The subscription is 2/- for six issues and 4/- for twelve issues including postage.

SWISS, FRENCH AND ENGLISH RAILWAYS COMPARED

By H. E. Underwood



Photo] [*Machine Works, Oerlikon*

Express on the Loetschberg Railway

(*Concluded*)

LAST month the first instalment of this article dealt with Swiss, French and English railway organisation and we described also the famous Swiss tunnels of St. Gothard and Simplon. We now describe a famous French tunnel, the Mont Cenis, the best-known of all French tunnels, for it was the first tunnel through the Alps and connects France with Italy. The line here is worked (electrically) by the Italian railways as far as Modane on the French side.

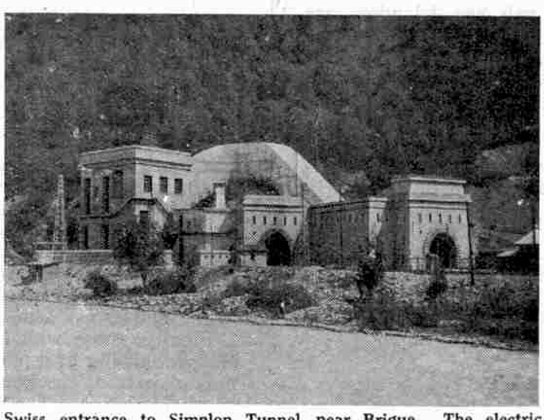
The Mont Cenis Tunnel

The construction of the Mont Cenis Tunnel was a remarkable engineering feat for its day. Work was commenced at both ends of the tunnel in 1857, the boring of the holes for the blasting charges being done by hand until the end of 1860 at the southern heading and until 1862 at the northern heading. Compressed air rock drills were then introduced and the average rate of progress was nearly trebled. It was speeded up even more during the last few years of the work.

The rock along the southern or Italian portion of the tunnel was on the whole easier to work than that on the French side, so that the two headings met at a point 2,107 yards nearer the French end than the Italian end. The wall between the two headings was cut through on Christmas Day 1870, 13 years and 1 month from the commencement of the work, and by the following day the aperture was sufficiently enlarged for the tunnel to be traversed from end to end.

The tunnel proved to be 15 yards longer than had been calculated, and the small error of 12 in. in level was probably due to this discrepancy in length. The direction of the two headings was perfectly correct, showing with what accuracy the alignment had been made from the two ends. Two short curved tunnels were subsequently made near each end to connect the railway in the tunnel with the approach railways on each side, with the result that the actual length of tunnel through which the trains run is very nearly eight miles.

The opening of the Mont Cenis railway for traffic took place in 1871, nearly a year after the tunnel headings had been joined. The tunnel cost about £3,000,000 or £225 per yard.



Swiss entrance to Simplon Tunnel, near Brigue. The electric ventilating plant is seen on the left

In passing we may note that all other French tunnels are less than three miles in length.

There are many important bridges and viaducts in France, notably the Morlaix viaduct on the Rennes-Brest line, 183 ft. in height. Generally speaking, these French structures have much in common with those on English lines and therefore do not require any special description.

Speeds and Non-Stop Runs

Before passing on to describe the locomotives and rolling stock it will be interesting to consider two points of great importance to all railways—the average speeds and the length of non-stop runs. Before the war comparatively long non-stop runs were a regular feature on the French railways. The Paris-Royon express, for instance, ran regularly from Chartres to Thouars, a distance of 149 miles, without stopping. This may not seem a very brilliant performance when compared with that of certain Great Western trains in England, but the absence of really long non-stop runs in France must be attributed to the lack of water troughs on most of the main lines. The world's record for speed was held for a short time by the Paris-Brussels express, which ran from Paris to St. Quentin in 93 minutes at an average speed of 62 miles an hour. The normal average speed of a French express train is between 50 and 56 miles per hour.

In Switzerland the latest type of

electric locomotive has a maximum speed of 56 miles per hour. The fact that there are no faster locomotives than this in Switzerland is due to the majority of the lines traversing hilly or mountainous country, and good climbing capacity is therefore the quality most looked for in a Swiss locomotive.

Owing also to the nature of the country, curves have had to be constructed of comparatively small radius, thus imposing a further obstacle in the way of high speeds. Long non-stop runs are very rare and what was once the longest of these—from Lucerne to Bellinzona, a distance of 106 miles—has now been discontinued.

Photo courtesy] [*Swiss Federal Railways*

Express Train at Fluelen Station, St. Gothard Railway

French trains are noted for keeping bad time and it is by no means unusual for a train to arrive at its destination an hour late or even more. We can scarcely imagine the remarks that a regular passenger on, say, the "Flying Scotsman" would make if he had to travel in France! In this country we are so accustomed to our trains—at any rate our main line expresses—arriving dead on time, that we scarcely appreciate what this means. After even a few day's travel on the Continent, however, we are in a better frame of mind to understand how efficient our railway science really is.

The bad running of the French trains has a serious effect upon the Swiss railways, as most of these are international. For instance, the Swiss railways take over through cars from Paris to Milan at the French frontier and hand them on to the Italian railways at the Italian frontier. Thus if the French trains are late, the Swiss trains are delayed in consequence. This applies not only to the main line expresses but also to the branch line trains, for the latter have to wait for the expresses and so the delay is handed on.

Switzerland, being surrounded by four countries, has to act in railway matters as an intermediary between them, and has rightly been called "The Turntable of the Railways of Europe."

Rolling Stock

Turning now to the rolling stock, we find at once that there are great differences between the systems of the three countries, especially for local trains.

Swiss coaches for local trains are planned on the lines of a tramcar, in that they have a door at each end opening on to a platform. Steps at both sides of these platforms assist travellers to climb into the car, and an opening at the end with a small folding metal floor allows the conductor to pass from one end of the train to the other.

These coaches are usually six-wheeled, while express coaches are eight-wheeled. The interior of the carriages is similar to that of English carriages for the first class, the second class is a little better than the British third, and in the third class, as on the Continent in general, there are no cushions, the seats being of wood like those in a tramcar.

In France the coaches on local trains, like our English coaches, are built on the side-door system.

All sleeping cars belong to the International Sleeping Car Company, which has its headquarters in Paris. This company owns sleeping and dining cars on all European railways except in Germany. In Switzerland the dining cars, except those in international service, are owned by the Swiss Dining Car Company. The various "trains de luxe," including the Simplon-Orient Express (Calais to Constantinople and Athens), are made up exclusively of sleeping, dining and luggage cars owned by the International Company.

Goods wagons are of the same type all over the Continent and are larger than English wagons. Most of them are fitted with the Westinghouse brake, so that brake vans are never seen.

Photo] *Jullien Frères, Geneva*

Southern Entrance of Loetschberg Tunnel, at Goppenstein

Locomotives

And now we come to the most interesting and distinctive feature of all railways—the locomotives.

In France, electrified lines are very few and therefore steam locomotives only will be considered in that country. The best express on the Nord system, the Paris-Brussels "flyer" to which we have already referred, was hauled by a "Baltic" compound loco capable of working a 400-ton train at 75 miles an hour. This company, as also the P.L.M., has a number of American engines brought over during the war, some of which still had "U.S.A." painted on the tender in 1921. On the P.L.M. the fastest trains are drawn by 4–6–2 locos, while many 4–6–0's are used and also a number of 4–6–4 tanks. A speciality of this line is the "Mastodon" 4–8–0 compound, while the Paris-Orleans has several 2–10–0 ("Decapod") locos. The last-named line uses 4–6–2 compounds for its expresses.

A new and powerful engine designed by M. H. Mestre, engineer of the Est Railway, has recently been tried, and 50 others of the same type have been ordered. This loco is of the 4–8–2 type and is over 80 ft. in length.

The above-mentioned locomotives represent some of the types in general use on French railways, and it will be noticed that the compound engine is greatly in favour.

Swiss steam locomotives on the Federal Railways are mostly 4–6–0 compounds for express trains, 2–10–0 and 2–8–0 for goods, and 2–6–0 or 2–6–2 tanks for local trains. The electric locomotives are principally of the 2–6–2, 2–6–4 or 2–4–4–2 types for express and local trains and 2–6–6–2 for goods traffic. The maximum speed is about 56 miles per hour for the express locos and about 40 miles per hour for goods engines.

Colour of Locos and Coaches

In France the colour of the rolling stock varies according to the owning company. The Paris-Orleans and Nord systems, for instance, have green coaches, while on the P.L.M. the coaches are dark red, yellow and green for first, second and third classes respectively.

The locomotives are usually coloured by their own smoke, but if by any chance some paint is visible it is green!

Swiss steam locos are black and the electric locos red. Coaches on the Federal railways, at present, are mostly black, but they are gradually being re-painted green, especially on the electrified lines. On the other Swiss railways the colour of the rolling stock varies, as in France.

Passenger trains on French lines are divided as follows:—The "train de luxe," to which we have already referred; the "rapide," which stops at very few stations; the "express," a fast train but which stops at all important stations, and the "omnibus," which stops everywhere.

In Switzerland there is the "train de luxe"; the "direct," which is the fastest train; the "omnibus," which stops at all stations; and in addition on some lines—Geneva-Lausanne, for instance—the "train-tramway," which stops at every station and also at a number of small

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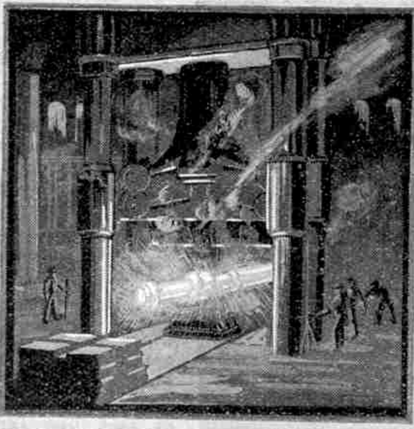


Lives of Famous Engineers

XIX
Joseph Bramah
Inventor of the
HYDRAULIC PRESS

INVENTORS, like poets, are born, not made. A man may be brought up in the midst of the most suitable surroundings, have the best possible training in every branch of science and engineering, and yet—unless he possesses certain natural qualities—he will never be an inventor in the real sense of the word. It is not easy to decide exactly what are the qualities that go to produce an inventor, but these certainly include quick and accurate observation; the power of immediately grasping the effect of a mechanical combination and what will take place if that combination is slightly altered; a considerable amount of imagination and, last but not least, sufficient perseverance to carry on, in spite of failure after failure, to ultimate success.

Bramah as an Inventor

Inventors may be divided roughly into two classes. First there are those whose inventive instincts are aroused whenever they come in contact with any mechanism that is not doing its work efficiently. Second, there are those who in their early days are filled with the ambition to produce a certain mechanism, and who confine themselves to the development and perfecting of that mechanism, practically to the exclusion of everything else.

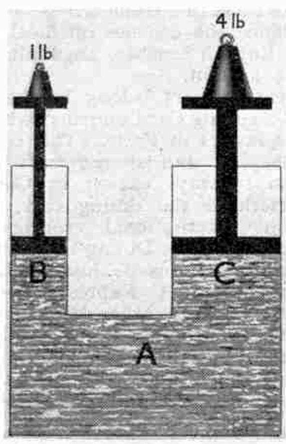


Fig. 1

Bramah, whose career we are briefly describing this month, was an inventor of the first type. He was not an inventor of the highest rank, but nevertheless much of his work was of permanent value. In addition, he brought about the foundation of a school of distinguished mechanics who devised the first really effective machine tools. From these tools have developed the marvellous mechanisms of the engineering shops of the present day.

Joseph Bramah was born in 1748 at the village of Stainborough, near Barnsley in Yorkshire, where his father rented a small farm. Joseph was the eldest of five children and he commenced work upon the farm at an early age. His favourite hobby at that time was making musical instruments. His only tools were very imperfect ones made for him out of old files and razor blades by his great friend the village blacksmith, but in spite of this handicap he turned out some excellent work, including a violin cut out of a solid block of wood.

Career Changed by an Accident

It is quite likely that Bramah would have remained a ploughman all his life but for an accident that occurred when he was about 16. This resulted in an injury to his right ankle that made him unfit for farm work. He was confined to the house for a considerable period, which he spent in carving various articles out of wood. His ability for this class of work was obvious to everybody and when he was able to to get about once more he was apprenticed to the village carpenter, under whose tuition he soon became an expert workman.

At the termination of his apprenticeship he realised that there was little prospect for him in his own locality and he therefore resolved to try his fortune in London, and he made the journey on foot. He soon found work with a cabinet maker and remained with him for some time, after which he set up in business on his own account.

Bramah's first invention was connected with household water apparatus and was sufficiently successful to place him on a sound footing. It is interesting to learn that at this time he sent for the blacksmith of his native village, who had made him his first tools, to take charge of the blacksmiths' department in his rapidly growing business.

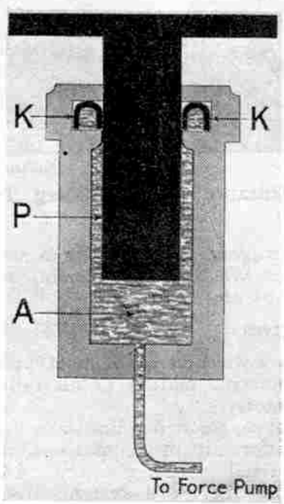


Fig. 2

The Bramah Lock

Shortly afterwards Bramah turned his attention to the invention of a satisfactory lock. The locks in use at that time were very imperfect and afforded little protection against expert thieves, but in 1784 Bramah took out a patent for a lock of a greatly improved type.

The security of this lock depended upon the principle of combinations. It consisted of a thin disc of metal placed inside a barrel and arranged so that when it was free to turn it operated the bolt of the lock by means of a pin on its under side. Normally the disc was prevented from turning by a number of steel strips called sliders, lying in slots around its circumference. The sliders were pressed upward by means of springs, but could be forced downward by the key.

In the end of the key barrel were cut notches to fit the sliders. These notches were cut to different depths and therefore some of the sliders were pushed downward more than others, thus giving rise to the different combinations. When all the sliders had been depressed to their correct distances they were free to pass round the barrel along with the central disc that carried them, and the turning of the key thus opened the lock.

For a long time this lock was regarded as impregnable and a notice was exhibited in Bramah's shop window in Piccadilly, offering £200 to anyone who succeeded in picking the lock. Ultimately an American named Hobbs succeeded in picking it after considerable difficulty.

Machine Tools Devised

The value of Bramah's lock was soon recognised by the public and a very considerable demand for it sprang up. The success of the lock depended very largely upon the precision with which its various parts were made and finished, and Bramah was faced with the necessity for devising machine tools capable of turning out these various parts in sufficient quantities, and at the same time of uniform accuracy.

In devising these various machines he was very greatly assisted by Henry Maudslay, his foreman. Maudslay had a remarkable capacity for the devising and construction of machine tools, and in a future issue we hope to give an account of his extremely interesting career. Bramah and his foreman between them overcame all preliminary difficulties and very soon the lock-making business became a source of considerable profit.

Hydraulic Press Patented

In 1795 Bramah patented the hydraulic press, by which invention he is best known.

The principle underlying the action of the hydraulic press was put forward by Pascal, the famous French mathematician (1623-62), as follows :—" If a vessel full of water, closed on all sides, has two openings, the one a hundred times as large as the other, and if each be supplied with a piston which fits it exactly, then a man pushing the small piston will exert a force which will equilibrate that of 100 men pushing the large piston, and will overcome that of 99."

This important principle may be illustrated simply by reference to Fig. 1. The water vessel A has two cylindrical necks each fitted with a piston. The bore of cylinder B is one inch and that of cylinder C two inches. The area of piston C is therefore four times that of piston B, and if a weight of 1 lb. be placed on piston B it will balance a weight of 4 lb. on piston C.

Bramah's hydraulic press consisted essentially of a large and massive cylinder (A, Fig. 2) in which worked a closely-fitting solid plunger P. A force pump of very small bore communicated with the bottom of the cylinder and by means of this pump small quantities of water were forced at high pressure beneath the plunger, thus gradually forcing it upward. In this apparatus the cylinder A represents the large cylinder C in Fig. 1, and the force pump takes the place of the small cylinder B.

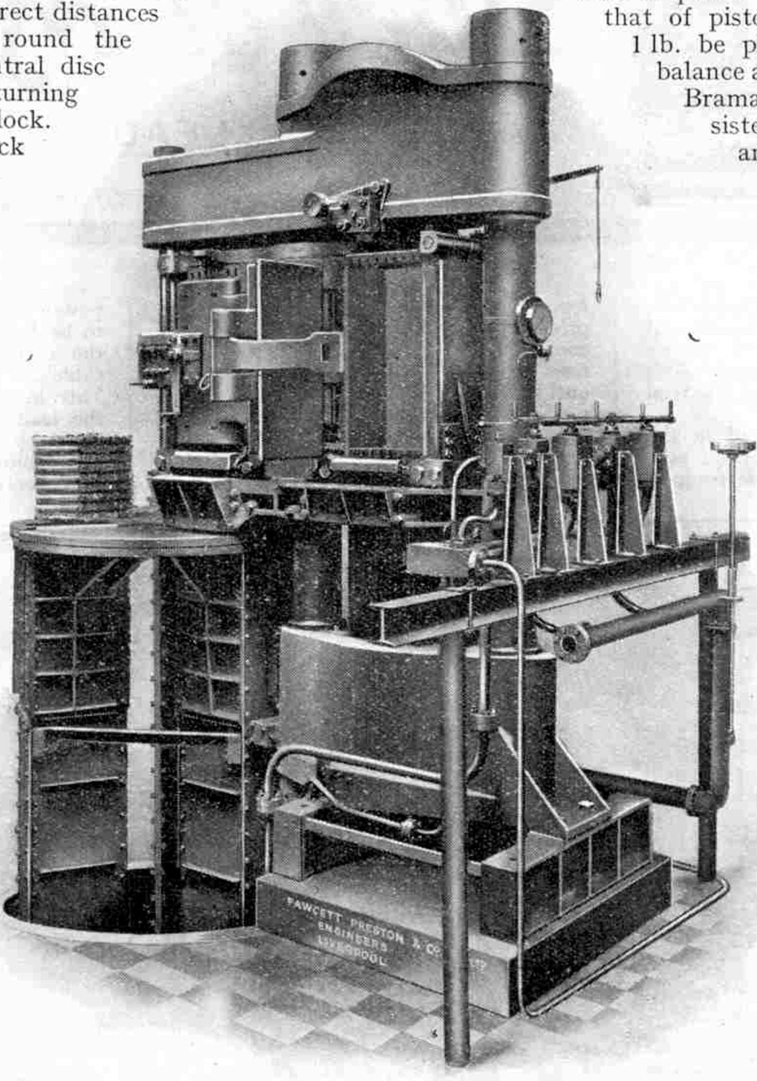


Photo courtesy] *[Messrs. Fawcett, Preston & Co. Ltd.*

A Modern Hydraulic Press for compressing Cotton or other Fibres into bales to reduce the cost of Freight

The Press compresses bales to a density of 56 lbs. per cubic foot and at the rate of 40 bales per hour, each bale weighing 500 lbs. The press weighs about 90 tons and exerts a pressure of about 2,000 tons.

Maudslay Solves a Problem

In constructing his hydraulic press Bramah was baffled for a long time by the difficulty of preventing the escape of water between the top of the cylinder and the plunger. The problem was that of securing a joint sufficiently free to allow the piston to slide up through it and yet at the same time sufficiently watertight to withstand the internal pressure exercised by the pump.

Bramah tried all kinds of devices but without success, and at one time it appeared that his invention was doomed to failure. In this dilemma the ever-ready Maudslay came to the rescue and solved the problem in a simple manner by the use of what might be called a self-tightening collar. A collar of sound leather of U-section (K, Fig. 2) was fitted, convex side upward, into a recess turned in the neck of the cylinder at the place formerly occupied by the stuffing-box. When the high-pressure water was turned on it forced apart the edges of the collar and thus caused the leather to apply itself to the surface of the rising plunger with a degree of tightness proportionate to the pressure of the water. As soon as the

(*Continued on page* 394)


POURING A BABBITT-METAL BEARING

The Story of Metals

1. LEAD.

In our June issue we described the mining of lead ore and the subsequent processes through which it passes before the pure metal is produced. This month we deal with the various practical applications of the metal.

We are all familiar with lead in the form of pipes in our houses. Lead pipe has probably been in use in one form or another for some 2,000 years. In our June issue we mentioned that lead pipes laid down in Rome, Herculaneum, and Pompeii some 1,800 years ago have lasted to the present day, the long life of these pipes being due to the fact that the coating of oxide that forms upon lead does not penetrate as deeply into the metal as does rust in iron pipes, but forms a protective coating which effectually prevents further corrosion.

The Latin word for lead is "*plumbum*" from which we get our English word plumber, which leads us to infer that the plumber's occupation is one of great antiquity.

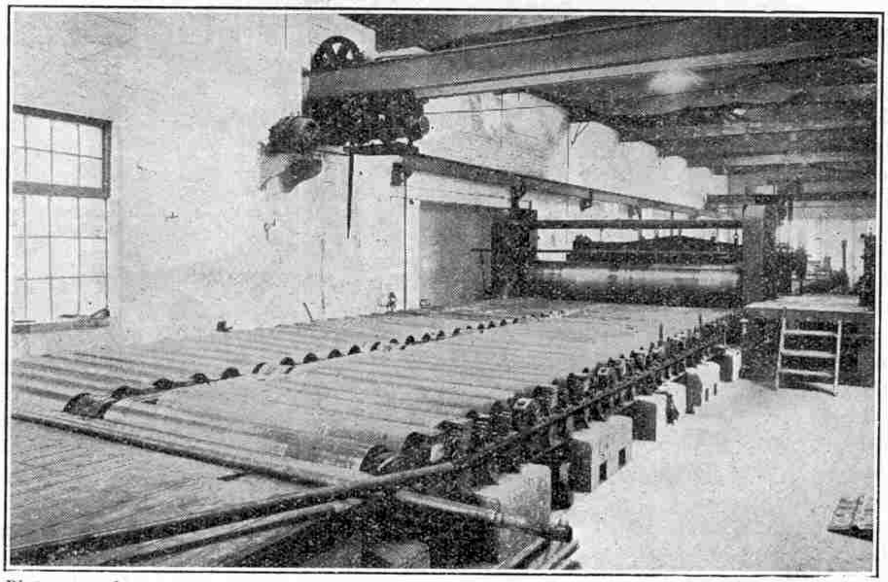


Photo courtesy] [*Mr. A. W. Wylie, London*

Electrically-driven Rolling Mill for Lead Sheet

Making Lead Pipe

The Romans made their lead pipe by bending over a piece of sheet lead until its edges touched and then burning these together.

This method of making lead pipe is only used to-day for pipe of very large diameter. The majority of modern lead pipe is made by a process known as "extruding," which consists of forcing molten lead through a die by means of hydraulic pressure.

The process is carried out in a large vertical cylinder at the top of which is a cylindrical plunger. In the centre of this plunger is a hole the diameter of which is the same as the outside diameter of the pipe to be made. A steel rod is fixed in the centre of the hole of the plunger. Molten lead is run into the cylinder and allowed to cool until it assumes a plastic condition. When all is ready for the process to commence hydraulic pressure is applied to force the cylinder containing the lead up to and round the fixed plunger. The lead is then forced out of the opening in the plunger and round the steel rod, thus forming itself into a pipe of exactly the required diameter.

If lead rod is required instead of lead pipe, the same method of extruding is adopted, the only difference being that the steel rod round which the pipe forms itself is not used, so that a solid rod is formed. Lead wire also is extruded, for lead cannot be drawn out like steel or copper. Solder, to which we shall refer later, is also often extruded in the form of wire.

Lead has many advantages over iron for domestic piping. It does not corrode, it is less likely to burst as the result of frost, and if a burst does occur a temporary repair may be effected by hammering the edges of the break together, which of course cannot be done with iron piping.

Lead-Sheathed Cable

We are all familiar with the gigantic reels of lead-sheathed cable that are seen in our streets when electric light and power cables are being laid. It appears to be a common idea that a lead pipe of the correct size is made and that the cable is then drawn through the pipe. This idea is quite wrong, however, for the lead sheathing is formed round the cable by a process of extruding.

A hollow core is made and this is set in a proper relationship to the die and pipe is made in the manner that has just been described. In this case, however, the core and die are so constructed that the pipe when made contracts down on the cable and pulls it through along with it. The sheathing can be put on tightly or loosely at will, according to the nature of the particular cable.

Mysteries of Solder

We have all at one time or another watched a plumber at work with his soldering iron, neatly joining together two pieces of lead or tin, and probably it has not struck us that there was anything very remarkable about the process. As a matter of fact, however, soldering is a process that presents many peculiar features.

Solder is made of tin and lead, and it is a curious fact that the alloy melts at a lower temperature than either metal separately. The result is that, by use of this lead-tin mixture, lead or tin may be soldered without being melted in the process. The so-called soldering iron used by the plumber to supply the necessary heat to melt the solder is usually made of copper, as this metal conducts the heat better and is more readily followed by the solder.

Frequently soldering is done by machinery, as in the case of the manufacture of tin cans and the sealing of them after they are filled.

The Use of a Flux

We all know that the plumber in his soldering operations uses what is known as a "flux." Without the flux the solder could not be made to "stick." When the heated soldering iron is applied to the surface of a metal the latter tends to oxidise immediately, and the oxide forms a thin coating that effectually prevents the junction of the solder with the metal.

The flux has two functions—it prevents the oxide from forming, or, in case any does form, it dissolves it immediately. Several fluxes of varying efficiency are in use, one of the commonest being a mixture of zinc chloride and sal ammoniac.

Lead Alloys for Sprinklers

We have already mentioned that an alloy of lead and tin melts at a lower temperature than either metal alone. By the addition of bismuth and cadmium, alloys with even lower melting points may be produced. Such alloys are employed in automatic sprinklers for large factories and works, where the danger of fire is always great. Under normal conditions the valves controlling the sprinklers are maintained in a closed position by means of a solder of the alloy. When a fire occurs the temperature quickly rises, and at a certain point the solder melts and the valves automatically open and release the water.

The melting points of the various metals to which we have just referred are as follows :—Lead 620°F, tin 450°F, bismuth 504°F and cadmium 610°F. An alloy of all these metals may be made, however, that has a melting point as low as 158°F.

Rolling Lead Sheet

The illustration on the previous page shows a large rolling mill for rolling lead into sheets. A slab of the metal is run backward and forward between the rollers, which are very gradually brought closer and closer together until the sheet reaches the required thickness. The mill in our illustration is electrically driven and is capable of applying enormous pressure. Lead sheet rolled out in this manner is used for covering and protecting large surfaces.

For some purposes, however, lead sheet is not so suitable as steel sheet coated with lead. This coating may be effected by placing the steel sheet —previously cleaned with acid and dipped into a flux—in a bath of molten lead, afterwards withdrawing it and draining off the excess lead.

Lining Iron Pipes

Sometimes a thicker coating of lead is required than can be secured by this dipping process. This is the case with iron pipes that require to be provided with a heavy acid-proof lining. Such a lining may be obtained by casting the lead.

Inside the iron pipe is placed a core of such diameter as to leave between it and the pipe a space equal to the thickness of the lining required, and molten lead is then poured into that space. As an alternative a lead pipe may be fitted closely inside the iron pipe and bonded to it by applying heat to the exterior of the latter. The lead pipe thus becomes "sweated" to the iron.

This sweating process is employed for lining large iron tanks with lead sheet in order to render them capable of holding corrosive liquids. Lead may be deposited also by means of an electroplating process.

Lead Wool

From very ancient times lead has been used for fixing iron bolts to masonry, the molten metal being poured into a hole around the bolt so that when it cooled it united the bolt firmly to the masonry.

A modern and interesting development of this process is the use of lead wool or shredded lead. A mass of what may be called lead threads is pressed round the bolt with a hammer and a caulking tool. During the process the lead fibres become squeezed and pressed together into a solid mass as compact as if molten lead had been used.

Lead wool is made by passing the molten metal through a sprinkler perforated with extremely tiny holes. The threads of metal thus produced quickly solidify and are twisted loosely into a rope. Shredded lead consists of very fine thread-like shavings planed off from the cold metal.

Lead in Ammunition

Lead plays an extremely important part in the making of ammunition. The smallest shot are made by an interesting process of dropping from a shot tower. Molten lead, to which a minute quantity of arsenic has been added, is poured into a pan the bottom of which is perforated with extremely small holes. The height up the tower at which this pan is placed is decided by the size of the shot to be made, the largest shot being dropped from the highest level.

The molten lead finds its way through the holes in the pan in the form of drops. These fall to the bottom of the tower into a tank of water, which breaks their fall and prevents them from flattening as they would if they fell upon a solid floor. From the tank of water the shot are dried and polished and are then carefully tested for uniformity in shape and size.

The dropping process can only be used for small shot and larger shot are therefore cast. At one time all such casting had to be done by hand, but of recent years mechanical moulding methods have been introduced.

Type Metal

In the early days of printing, each printer made his own types by cutting out the letters on small pieces of wood or soft metal. This process was very slow and gradually a method was evolved of casting separate types by means of moulds in sand or other convenient material. At first the casting was done entirely by hand but the growing need for speed resulted in the development of type-casting machines. Still later came machines that not only cast their own type but set it by the operation of a keyboard, the best-known of these machines being the Linotype, which is used in newspaper offices throughout the world. Lead has been a very important factor in this development of type-setting, for the casting metal that is used, and which is known as type metal, consists of an alloy of lead, antimony, tin and perhaps a little copper.

There are many other valuable applications of lead in the glass, pottery, rubber and other industries. We have not space here to deal adequately with these applications, and therefore we shall postpone them until we come to deal with these individual industries in a series of illustrated articles that we think will prove of great interest to our readers.

NEXT ARTICLE:—

ALUMINIUM

From Mine Prospector to Millionaire

The life stories of men who have risen from poverty to great wealth are nearly all similar in one respect, namely, that the rise has been gradual and spread over a long period of years of strenuous work. Sudden rises to wealth are rare and therefore all the more interesting. One of the most remarkable instances of such a sudden rise is that of an American mine prospector named George Carson, whose portrait we reproduce above.

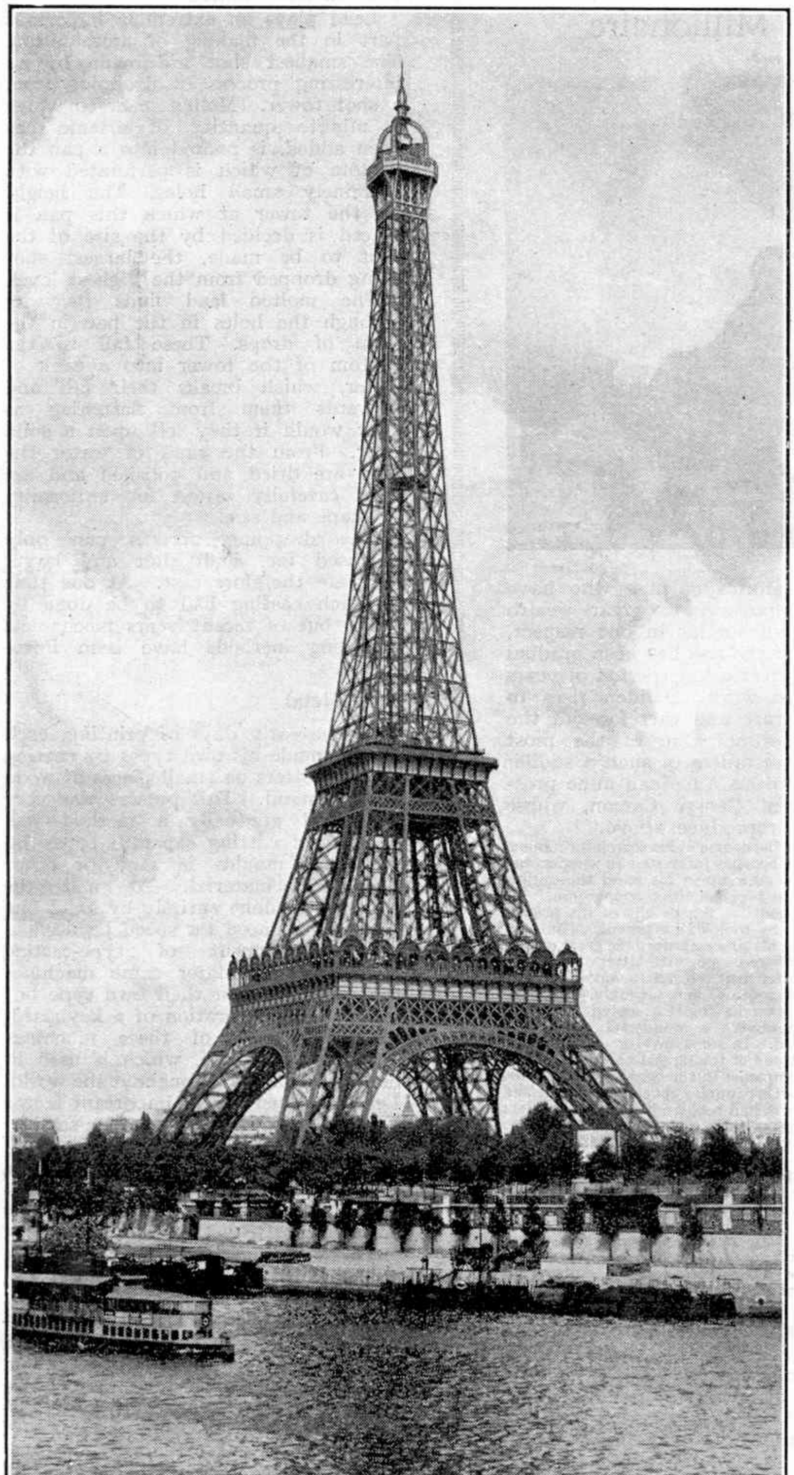
Years ago, in the course of his search for mineral wealth, Carson became interested in copper and gradually there grew up in his mind the outline of a new method of smelting copper ore. Bit by bit he worked out the details of his process and ultimately he took out a patent. His next step was to put his process before the great copper companies, but here he met with bitter disappointment. Firm after firm refused to have anything to do with his scheme, and ultimately he gave up all hope of ever having it accepted.

Recently, however, a wonderful change of fortune occurred. In some way or other Carson found out that one of the largest copper smelting and refining companies in the world was using his process, and further inquiry revealed the amazing fact that this firm had been employing the process for nearly 20 years! Carson at once took steps to enforce his rights. He succeeded in obtaining the assistance of a group of financiers, and commenced an action against the company to recover the money due to him. A prolonged legal struggle ensued, and a few weeks ago Carson finally won his case, the United States Court of Appeal upholding his claim against the company.

As the result of this decision, Carson, the penniless mine prospector, becomes entitled to the huge sum of £5,000,000.

The Highest Structure in the World

The Eiffel Tower and its 6,500 Tons of Iron



Eiffel's Masterpiece
The Eiffel Tower is the Highest Structure in the World

FROM the time of the Tower of Babel to the present day, very high buildings and objects have always exercised a great fascination. The Pyramids of Egypt, one of which is 484 ft. in height, and the Colossus of Rhodes, a bronze statue 105 ft. in height, are early examples of high structures, those of more recent origin including Cologne Cathedral, 528 ft. in height and the Washington Obelisk, 541 ft. in height.

In 1886 a French engineer, Gustave Eiffel, proposed to erect for the Paris Exhibition of 1889 a building that should dwarf every previous structure. His proposal met with strong criticism, and many prominent engineers ridiculed the idea and predicted the speedy collapse of such a towering structure. Eiffel had absolute confidence in the success of his scheme, however, and he commenced operations and persevered with his task. In two years, to the confusion of his critics and the astonishment of his friends, the great Tower was completed in the Champs de Mars, where it stands to this day with unimpaired strength.

A Great Engineering Triumph

Gustave Eiffel was born at Dijon on 15th December, 1832. From his early boyhood he was determined to become an engineer, and was so successful at school in all subjects connected with mechanical or engineering matters that he was placed as a student in the Paris School of Arts and Crafts. Here he qualified as an engineer, and while quite a young man was appointed to superintend the construction of an iron bridge over the river Garonne at Bordeaux. By 1868 he had succeeded so well as to be able to establish his own engineering works, and from that time onward his name became closely associated with striking engineering achievements all over the world. He built the famous Garabit Viaduct of Cantal, the great bridge over the River Douro at Oporto, and the movable dome at the observatory at Nice.

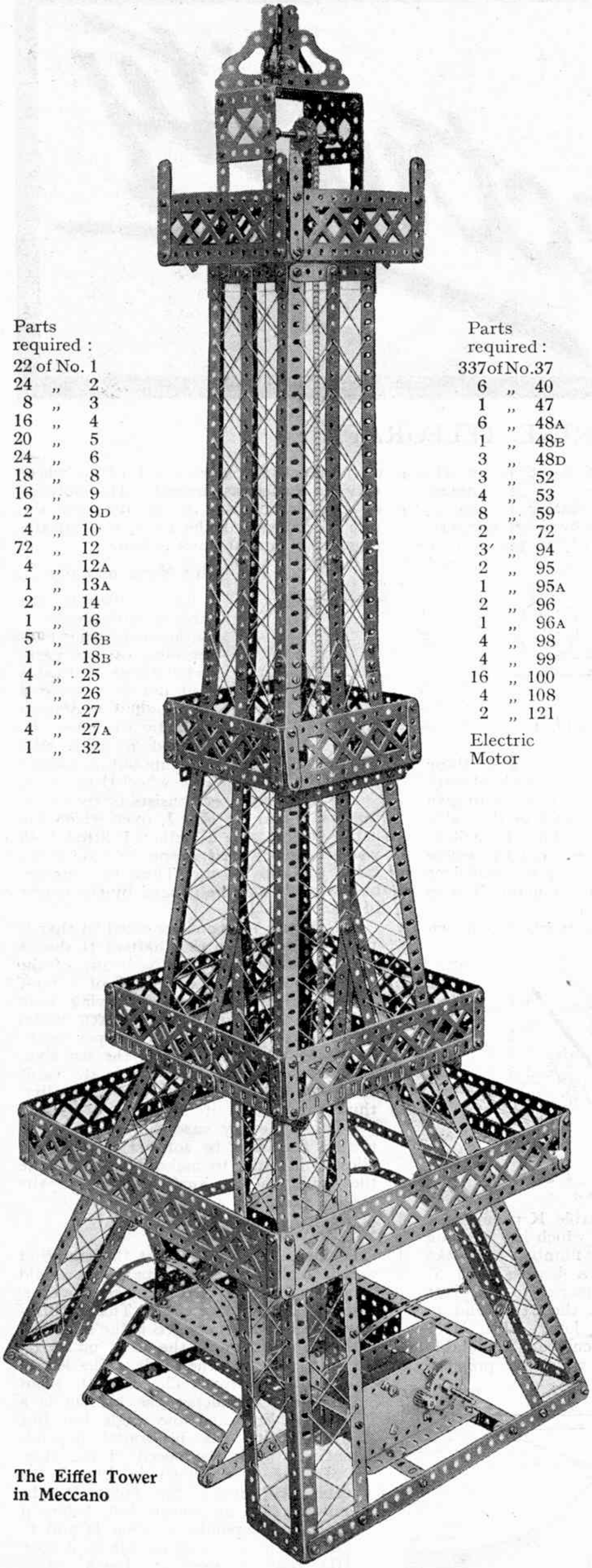
For many years Eiffel gave particularly careful study to the combined effects of iron columns and cross ties, and he was the first engineer to use the compressed air method in bridge construction. After several years of experience in connection with metal bridges, he undertook successfully the building of the framework of the huge Statue of Liberty in New York harbour in 1884, and five years later he became world-famous as the designer and constructor of the great Eiffel Tower—the highest building in existence.

The Massive Foundation

In erecting this huge structure Eiffel's first task was to secure foundations capable of supporting the enormous weight of the tower—6,500 tons. Four trellis-work piers were decided upon and work on the foundations for them was commenced early in 1887. The two piers furthest from the river Seine presented comparatively little difficulty, as a thick layer of gravel was found at a depth of 16½ ft., the ordinary water level of the river. The other two piers gave more trouble, however, as their foundations had to be taken down to twice this depth in order to reach the gravel.

The masonry foundations rested upon concrete, and the four uprights of each of the four pedestals were fixed to the masonry by anchor bolts. In order to counteract any possible displacement of the anchor bolts, a hydraulic press was inserted in each of the four feet of the structure.

The tower itself was built of a series of main ribs braced together by elaborate trellis work. As far as possible the various parts of the structure were finished in the workshops and hoisted to their final positions by cranes, leaving only the junctions to be completed. Two-and-a-half million rivets were used, and on the verticality of the tower being carefully tested, when



Parts required :

22 of No.	1
24 ,,	2
8 ,,	3
16 ,,	4
20 ,,	5
24 ,,	6
18 ,,	8
16 ,,	9
2 ,,	9D
4 ,,	10
72 ,,	12
4 ,,	12A
1 ,,	13A
2 ,,	14
1 ,,	16
5 ,,	16B
1 ,,	18B
4 ,,	25
1 ,,	26
1 ,,	27
4 ,,	27A
1 ,,	32

Parts required :

337 of No.	37
6 ,,	40
1 ,,	47
6 ,,	48A
1 ,,	48B
3 ,,	48D
3 ,,	52
4 ,,	53
8 ,,	59
2 ,,	72
3 ,,	94
2 ,,	95
1 ,,	95A
2 ,,	96
1 ,,	96A
4 ,,	98
4 ,,	99
16 ,,	100
4 ,,	108
2 ,,	121

Electric Motor

The Eiffel Tower in Meccano

the structure had reached the height of 720 ft. it was found to be absolutely correct. The total cost of the tower was £260,000, of which the State contributed £60,000.

Electric Lifts for Visitors

The total height of the tower is 984 ft. from the ground or 1094 ft. above sea level. The first platform is 189 ft. up—only 27 ft. lower than the towers of the Cathedral of Notre Dame, Paris. The second platform is 380 ft. up and the actual tower that rises from this second platform is 526 ft. in height, finishing at the third platform at a height of 906 ft.

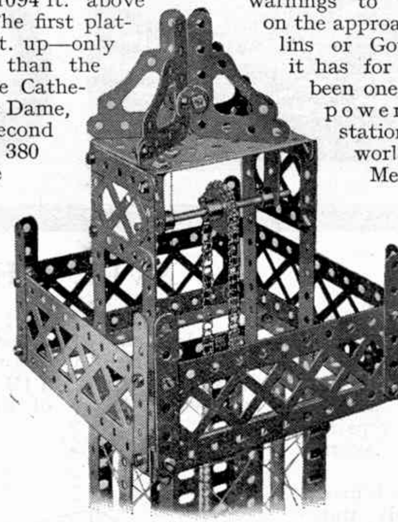


Fig. A

The campanile and lantern above the third platform bring the structure to its full height of 984 ft.—more than twice the height of the dome of St. Paul's Cathedral. A further comparison will no doubt interest the large numbers of our readers who have visited Blackpool. The Blackpool Tower, which seems to reach almost to the clouds, is only 500 ft. in height—scarcely more than half the height of the Eiffel Tower!

The Tower proved a great commercial success during the Exhibition of 1889, and tens of thousands of visitors took a trip to the top to enjoy the wonderful view. Afterwards it was found to be unprofitable, however, and was eventually taken over by the municipal authorities of Paris, partly with the idea of using it as a scientific observatory. The tower has always been very popular with sightseers on account of the marvellous view of Paris and its surroundings that can be obtained from the highest gallery, and for the use of these sightseers electric lifts are installed. Several spectacular feats, such as climbing to the top by means of a loose rope and cycling from the highest platform to the ground, have also been staged from the Tower.

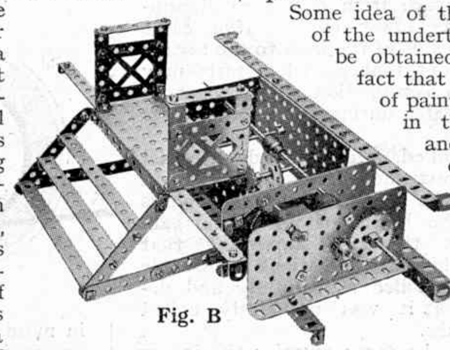


Fig. B

The Tower during the War

During the war the Eiffel Tower proved of the greatest value as an anti-aircraft observation post, enabling warnings to be sounded on the approach of Zeppelins or Gothas. Also it has for many years been one of the most powerful radio stations in the world. Many Meccano wireless amateurs, and especially those who possess valve sets, are familiar with the well-known call sign of the Eiffel Tower—FL. In this connection the Tower received what is perhaps its greatest vindication when General Ferrie, Inspector of French Military Telegraphs, said that "FL." served so many important scientific and military purposes that if such a tower had not already existed it would have been necessary to build one.

It is interesting to know that last year the Tower received the fifth coat of paint since it was built. Some idea of the vastness of the undertaking may be obtained from the fact that thirty tons of paint were used in the process and the job occupied 100 men a total of 4,000 hours! Eiffel was always extremely proud of his achievement, and the success of his original plans must have been a source of great satisfaction to him. Until the time of his death, in December 1923, he maintained a flat on the third floor of the Tower. There, 906 ft. above the ground, the great engineer would retire to his comfortable room to think in quietness of the past and plan out new schemes for the future.

The Eiffel Tower in Meccano

The Meccano model of the Eiffel Tower is well known.

(*Continued on page 389*)

XVIII. THE SUBMARINE TELEGRAPH

LAST month we briefly described the history of submarine telegraphy from the days of the brothers Brett to the present time. We now come to the methods employed in laying the cable and in repairing it when it becomes damaged.

After a cable is manufactured it is transferred to a ship containing equipment for storing and laying it, and also for grappling for it and bringing it to the surface if a break should occur. The paying-out apparatus is shown diagramatically in Fig. 1.

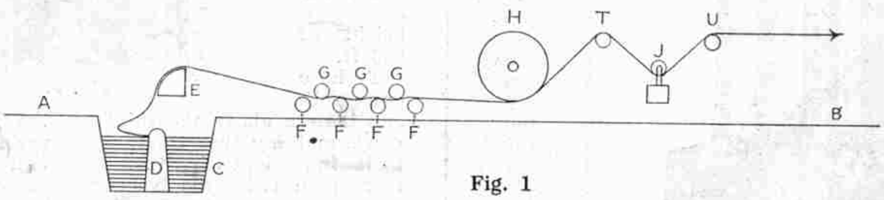


Fig. 1

In this figure the line AB represents the deck of the cable ship. The cable is coiled in a tank C, slightly broader at the top than at the bottom, and having at its centre a cone D. The cable is coiled round the cone, each layer or " flake " being laid flatly and precisely filling the space from centre to circumference. The lower end of the cable is led up the side of the tank to the testing cabin in order that electrical tests may be made in conjunction with the shore end of the cable during the whole process of laying.

Once uncoiled, a cable tends to twist itself into intricate curves and knots on account of the various twists and spirals in which the layers of its interior are laid. It is therefore important that during paying-out operations the cable should be uncoiled as carefully and deliberately as it was previously coiled into the tanks.

Owing to the tarry exterior the layers of cable would be apt to stick to one another, but this is prevented by giving the cable a coat of whitewash before it is stowed away, and during the whole period of its stay in tanks, either in the factory or on the cable ship, it is kept under water to prevent it from drying-out and losing its flexibility.

Fig. 1 shows only one tank, but actually a cable ship has three or four different tanks each containing a section of the cable.

Paying Out

Now let us suppose a section of the cable has to be laid. It is first led over a guiding quadrant E; then alternately over and under the series of pulleys FG; under the paying-out drum H, round which it passes several times, and through the dynamometer mechanism TJU to a pulley (not shown) at the stern of the ship, from which it passes into the water. Of the pulleys FG, those lettered G may be raised or lowered with reference to those lettered F, so as to give any desired amount of bend to the cable passing through them. The F pulleys are provided with brakes, and the whole system is designed to give sufficient back-pull to the cable to make it grip the paying-out wheel H.

In Fig. 2 the paying-out wheel is shown

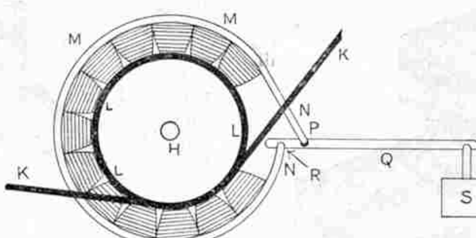


Fig. 2

in more detail. The cable K passes in a groove in the wheel H which has pressing against its rim L a number of brake blocks M attached to a flexible band N, one end of which is attached to the pivot P of the lever Q and the other end to the point R on this lever. The lever carries on its outer end an adjustable weight S, by means of which the pressure of the blocks M on the rim L of the wheel may be varied as desired. The purpose of this mechanism is to regulate the rate of paying-out the cable so that the correct amount of slack is laid.

Mile Marks on Cable

Each mile of the cable is indicated by a marker consisting of a wrapping of jute yarn, and the length of cable paid out is calculated from the number of turns made by the wheel H, checked by these mile marks. The rate of paying-out is gauged by the rate at which the wheel H revolves.

The dynamometer consists of two fixed pulleys T and U, Fig. I, over which the cable passes, and a pulley J fitted to a weighted block that is free to slide vertically up and down. Thus the tension on the cable may be gauged by the height of the block J.

An electric motor is arranged so that it may be coupled to the shaft of H should it be necessary to haul back any of the cable owing to the discovery of a fault or to an excess of slack having been paid out. The amount of slack varies from three per cent. to ten per cent., according to the contour of the sea floor. It must be sufficient to enable the cable to adapt itself easily to any inequality, thus preventing it spanning across a hollow. In every case, however smooth the sea floor may be, some slack is always allowed in order to make it easy to raise the cable to the surface when repairs become necessary.

The Danger of Spans

It might be thought that the fact that sufficient slack had been paid out would be a guarantee that no spans could occur, but that is not the case. This is illustrated in Fig. 3, where AB is the sea level, CDE the sea floor, F the stern pulley on the ship, and GH the cable. The length of cable GH from pulley F to the point H where it touches the bottom is a straight line, and the angle this line makes with the horizontal depends entirely upon the speed of the ship.

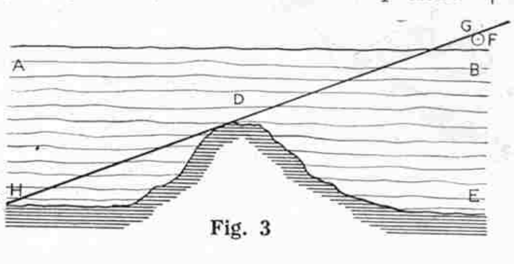
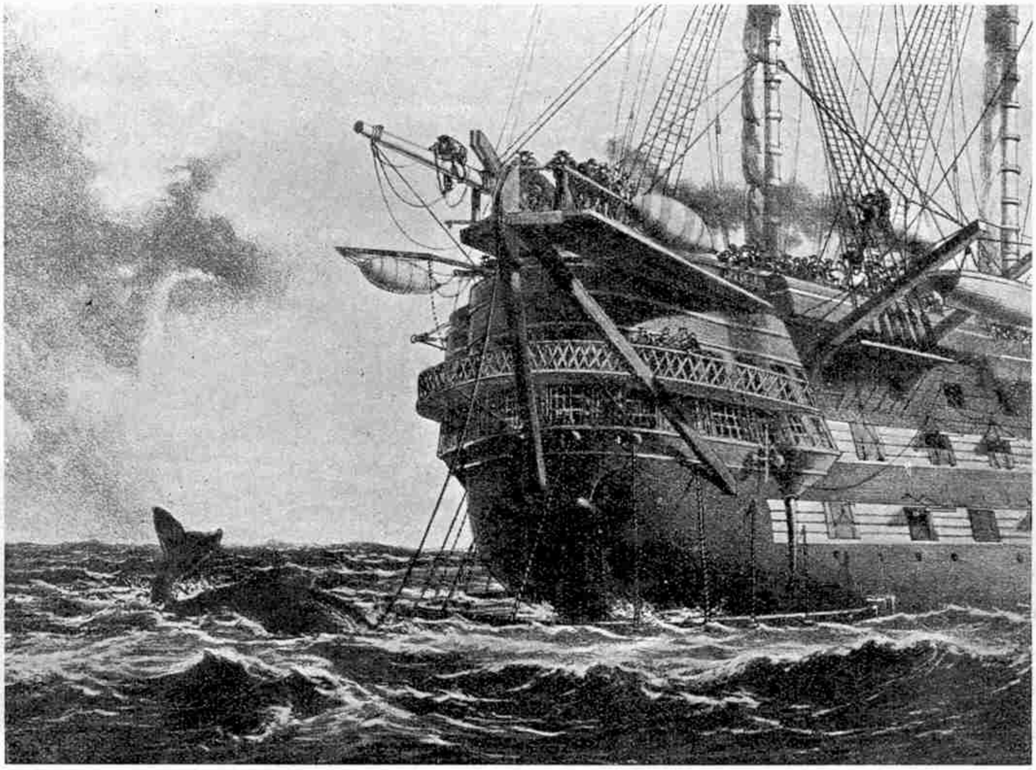


Fig. 3

In the case shown in Fig. 3 the cable will touch the point D, the summit of a submarine hill, before it touches the points between D and C. Consequently it will be left in a span HD that is sure to break either immediately or at some future time. If considerable slack is paid out, the cable, provided it is sufficiently heavy, will slip across point D towards C until most of the section HD is resting on the ground CD. During this sliding, however, the outer covering of the cable is almost certain to be damaged so that a breakdown will result sooner or later.

Thus it will be seen that, in order to ensure success, not only must the necessary amount of slack be laid, but also the ship must be running slowly, the actual speed being determined by the nature of the sea floor. It is interesting to note that at a depth of 3,000 fathoms, with the ship steaming at her normal cable-laying rate of rather less than eight knots, there is more than 25 miles of cable still in suspension between the ship and the bottom of the sea.



Courtesy] [White Star Magazine

H.M.S. " Agamemnon " laying the Atlantic Cable of 1858. A Whale threatens danger

An Ingenious Slack Indicator

Messrs. Siemens Bros. and Co. Ltd., have produced a very ingenious and simple slack indicator, a portion of which is shown in Fig 4. A threaded rod A carries a thin disc B fixed to a threaded boss C. In contact with B is a cone D fixed to the rod E and arranged so that its line of contact is parallel to A. The rod A is driven by gearing from the axle of the paying-out drum and therefore its speed depends upon the rate at which the cable is being paid out. The rod E with the cone D is driven by a steel wire that is continuously paid out from the stern of the ship without any slack. The disc B is driven by friction from the cone D, and on account of the thread on rod A will always take up such a position that it rotates at the same speed as A. Thus if E rotates faster than A, B will move to the left, and if slower it will move to the right. To a certain extent the indicator may be likened to a continuously variable friction gear, the position of the disc B along the rod A indicating the amount of slack actually paid out.

By the use of this mechanism the brakeman's task is considerably simplified, and elaborate calculations from data obtained from the dynamometer and varying with the weather conditions are rendered unnecessary.

International Cable Signal

While a ship is actually engaged in laying a cable she flies the international cable signal, consisting of two red canvas globes with a white canvas diamond between them, hung vertically in the rigging. The globes are about 2 ft. in diameter and are hung 6 ft. apart. At night the cable sign consists of lanterns arranged vertically, the top and bottom ones red and the middle one white. All other ships on seeing this signal give the cable ship a wide berth in order that she may continue her straight course uninterrupted. A detour of a mile or so might mean two or three miles of cable unnecessarily paid out, and such a length of cable represents a good deal of money. Another reason for all other ships getting out of the way of a cable ship is that the latter, being attached to the cable, is greatly hampered in her movements.

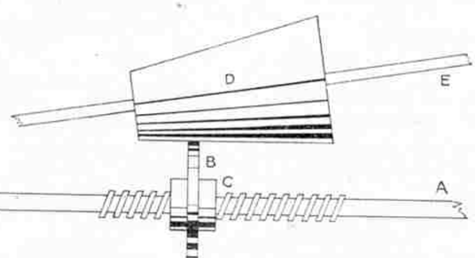


Fig. 4

During the whole time that paying-out is taking place the electrical continuity of the cable is under constant observation. From the moment when the testing instruments have been attached to the first shore end landed, electrical experts are on watch at both ends of the cable and signals are exchanged at stated intervals until the cable has been completely laid. In the testing room on board the ship there is always an electrician on duty watching the reflection of a spot of light from a mirror galvanometer. This light is in constant motion owing to induced electric currents of various origins. Every fifth minute, however, an impulse is sent through from the shore end which gives the little mirror a decided swing in one direction, and indicates that so far there is no break, electrical or mechanical, in the cable. When the cable ship first leaves shore there is a great deal of irregularity in the movements of the galvanometer, but the operation of the instruments tends to become steadier with every successive mile of cable laid. The combination of cold and pressure on the bed of the sea improves the insulating qualities of the gutta - percha covering of the copper conductor.

Cable Casualties

However well a cable may be manufactured and laid it is always liable to injury and breakdown. The danger of injury is, of course, much greater near the shore than it is at great depths, for below a depth of a very few fathoms there is no movement of the water, even when the severest storms are raging on the surface. Close to shore, however, a sandy sea floor is often moved considerably by the force of a storm and whatever is lying upon this sand is moved also. Consequently, when a severe storm occurs, the portion of a cable close to land is very likely to be damaged. On rocky coasts also the cable is liable to constant chafing which eventually wears through the insulation.

Even in the deepest water, however, the cable is exposed to danger. For instance, a great storm may send a fine ship down to find its last resting place across a cable. Off the west coast of Ireland, where many trans-Atlantic cables converge and where during the war the activities of German submarines were considerable, repair ships when grappling for cables that have failed have on various occasions pulled up funnels and other parts of wrecked ships. One cable belonging to the Western Union Telegraph Co., was put out of action recently by what is believed to be the wreck of a large ship sunk by a submarine so that its keel lay across the cable. In the course of a few years the weight of this ship, together with a slight shift of its position, wore through the insulation. Several miles of cable had to be abandoned and a new section spliced in to pass round this obstruction.

(*Continued on page* 425)

New "King Arthur" Locomotives

4-6-0 Super-heated Express Locos for Southern Railway

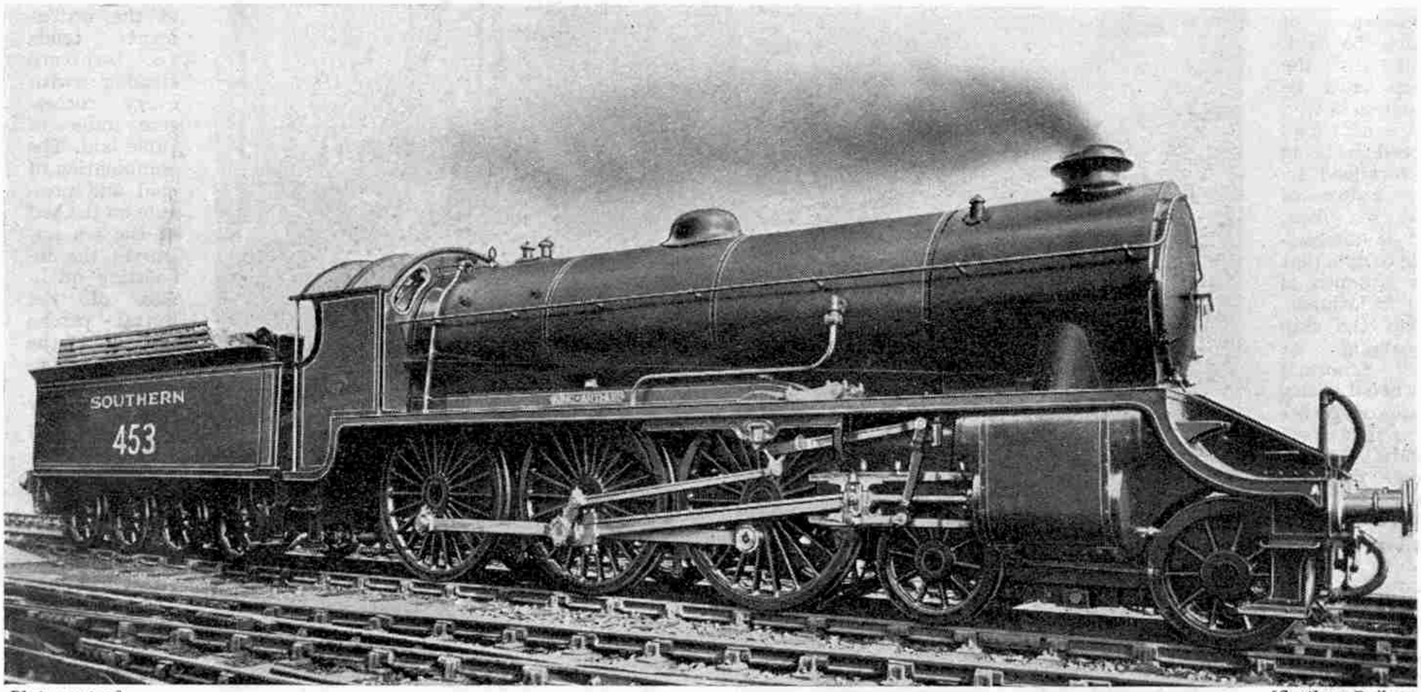


Photo courtesy] [*Southern Railway*

No. 453 " King Arthur," the original of the 4-6-0 type of express passenger locos of the Southern Railway

A BATCH of ten 4–6–0 rebuilt superheater express locomotives numbered 448–452 and 453–457, are now being constructed at the Eastleigh works of the Southern Railway. The first two locos of this class, Nos. 453 and 454, are named "*King Arthur*" and "*Queen Guinevere*" respectively. Both are now in service and the remainder will be completed and put into service shortly.

Alterations in Design

Before rebuilding, the locos had wheels of 6 ft. diameter and four cylinders, 15 in. diameter by 26 in. stroke, driving on two axles. As rebuilt they are similar to the latest London and South Western express locos, however, and have 6 ft. 7 in. wheels. Various modifications have been introduced by Mr. R. E. L. Maunsell, C.B.E., the chief Mechanical Engineer of the Southern Railway.

There are now two cylinders, $20\frac{1}{2}$ in. in diameter by 28 in. stroke, and a working steam pressure of 200 lb. per sq. in. The valve gear has been altered to give a longer travel of about $6\frac{3}{8}$ in. to the piston valves in full gear.

The boiler is standard for the class, but it is fitted with the Maunsell superheater, having Header vacuum relief valves, Ross safety valves, and a larger chimney. The Ashford sight feed lubricator is arranged to feed into the steam pipes that join the cylinders outside the smoke box.

Loco Details

The overall dimensions of the locos have been reduced in height and width to enable them to be worked on any section of the Southern Railway. Pumps are fitted to maintain the vacuum for the brake. The tenders are of the original design, but the wells and the Drummond feed water heater have been removed.

The leading dimensions and particulars of weights, etc., are as follows :—

Cylinders (two)	$20\frac{1}{2}$ in. dia. by 28 in. stroke
piston valves	19 in. dia.
Wheels—driving (six)	6 ft. 7 in. dia.
bogie (four)	3 ft. 7 in. dia.
Heating surface, firebox	162 sq. ft.
tubes 2 in. dia.	1,252 sq. ft.
$5\frac{1}{4}$ in. dia.	464 sq. ft.
Total	1,878 sq. ft.
Superheater	337 sq. ft.
Grate area	30 sq. ft.
Working Steam pressure	200 lb. per sq. in.
Tractive effort at 85% h.p.	25,320 lb. or 11.3 tons
Tender—water capacity	4,300 galls.
coal capacity	5 tons
Weight on coupled wheels	59 tons 3 cwt.
in working order, engine	79 tons 18 cwt.
tender	49 tons 3 cwt.
Total weight in working order, engine and tender	129 tons 1 cwt.

Successful Trials

Locomotive No. 453 ("*King Arthur*") has already been put into main line service with quite satisfactory results. It was attached to the 1 p.m. express, Charing Cross to Folkestone (Central), the load of which was specially strengthened to consist of eight double-bogie

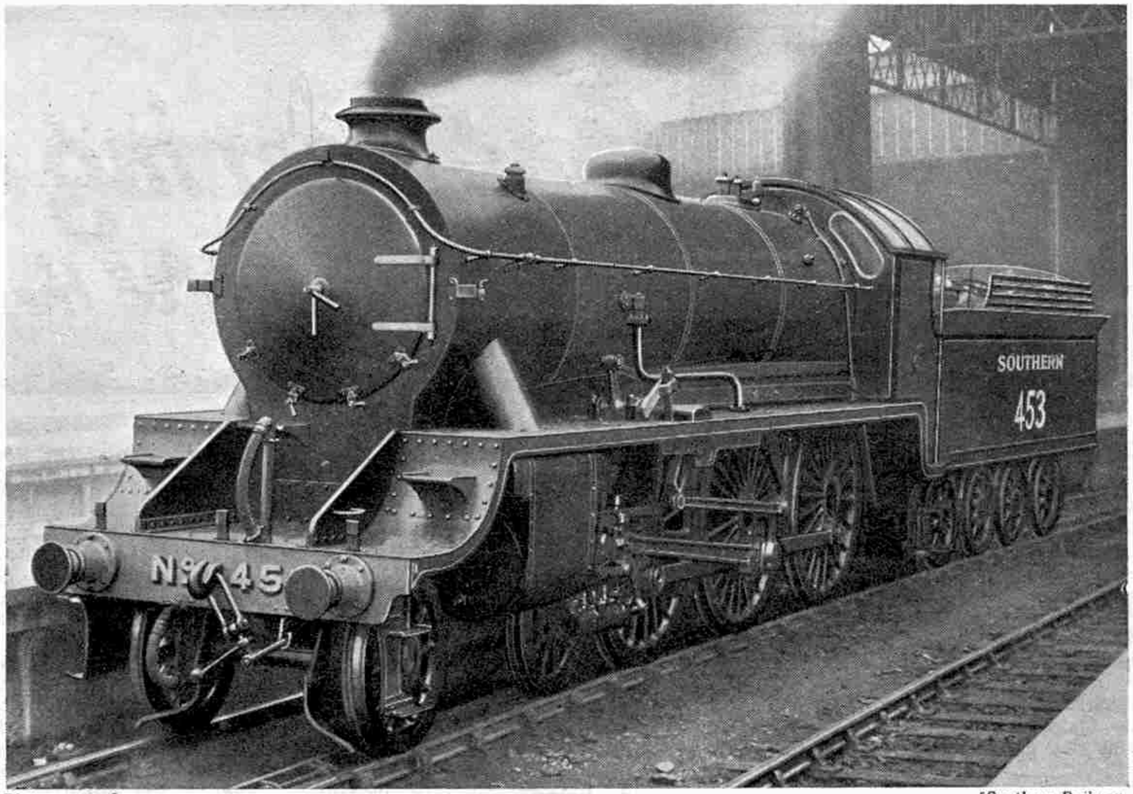


Photo courtesy] [Southern Railway

The "King Arthur" outside Victoria

coaches and five Pullman cars, a total weight behind the tender of 413 tons, exclusive of passengers and luggage.

Although the locomotive was restricted to a maximum speed of 60 miles per hour, the journey was accomplished over this unusually difficult section of railway several minutes within the regular booked timing.

Naming the Engines

The policy has been adopted of giving names to the new and rebuilt engines, bearing some relation to the districts in which they are destined to serve.

The 4–6–0 giant express locomotives of the King Arthur class will each be named after one of the Knights of the Round Table.

Thousands of holiday-makers in days gone by have clambered over the rocky old fortress known as King Arthur's Castle, perched high up on Tintagel cliffs in North Cornwall. Equally as many have visited the little town of Camelford, which is the Camelot of King Arthur's Legends, and Slaughter Bridge where King Arthur is supposed to have fought his last battle.

It is therefore very appropriate that the new engines should be named after the Knights of the Round Table, as many of them will be in the holiday traffic to the romantic district known as "King Arthur's Land." Ten will also be put into traffic this summer on the boat train services from London to Folkestone and Dover.

Hitherto the working of these important trains has been confined to locos of the 4–4–0 type (various S.E. and C.R. classes) owing to weight restrictions on certain bridges, etc., which as the result of various strengthening operations have recently been removed. Apart from the 2–6–0 mixed traffic locos, designed by Mr. Maunsell for the late S.E. & C.R., the new type will be the first six-coupled passenger locos to work on this section.

The following is the list of names of the "King Arthur" class locomotives :—

Drummond Type 4-6-0 Locos Rebuilt at Eastleigh

No.		No.	
448	Sir Tristram	453	King Arthur
449	Sir Torre	454	Queen Guinevere
450	Sir Kay	455	Sir Launcelot
451	Sir Lamorak	456	Sir Galahad
452	Sir Meliagrance	457	Sir Bedivere

Urie 4-6-0 Express Passenger Locos

No.		No.	
736	Excalibur	742	Camelot
737	King Uther	743	Lyonnesse
738	King Pellinore	744	Maid of Astolat
739	King Leodegrance	745	Tintagel
740	Merlin	746	Pendragon
741	Joyous Gard	477	Elaine

Urie 4-6-0 Express Passenger Locos *(continued)*

748	Vivien	752	Linette
749	Iseult	753	Melisande
750	Morgan le Fay	754	The Green Knight
751	Etarre	755	The Red Knight

The "*Red Knight,*" No. 755, is painted in the standard olive-green livery, but its nameplates have a scarlet background.

New Locos Ordered

No.		No.	
763	Sir Bors de Ganis	778	Sir Pelleas
764	Sir Gawain	779	Sir Colgrevance
765	Sir Gareth	780	Sir Persant
766	Sir Geraint	781	Sir Aglovale
767	Sir Valence	782	Sir Brian
768	Sir Balin	783	Sir Gillemere
769	Sir Balan	784	Sir Nerovens
770	Sir Prianius	785	Sir Mador de la Porte
771	Sir Sagramore	786	Sir Lionel
772	Sir Percivale	787	Sir Menadeuke
773	Sir Lavaine	788	Sir Beaumains
774	Sir Gaheris	789	Sir Guy
775	Sir Agravaine	790	Sir Villiars
776	Sir Galagars	791	Sir Uwaine
777	Sir Lamiel	792	Sir Hervis de Revel

These fine locos will carry brass name-plates as shown in our first illustration of No. 453, with the words "King Arthur Class" in small letters beneath the name of the engine.

The names to be given to the eleven "Atlantic" 4–4–2 type express passenger locos of the Brighton Section are as follows :—

No.		No.	
421	South Foreland	37	Selsey Bill
422	North Foreland	38	Portland Bill
423	The Needles	39	Hartland Point
424	Beachy Head	40	St. Catherine's Point
425	Trevose Head	41	Peveril Point
426	St. Alban's Head		

The new express passenger tank loco 2–6–4 type, No. 790, will be named the "*River Avon,*" and the nine other new locos of this class ordered will also bear names of rivers (as shown below), and will probably be used on the London-Eastbourne fast expresses.

No.		No.	
790	River Avon	795	River Medway
791	River Adur	796	River Stour
792	River Arun	797	River Mole
793	River Ouse	798	River Wey
794	River Rother	799	River Test

Engineering News of the Month

Electric Power Breakdown at Warwick

Owing to a fault in the cable near Warwick, Rugby was recently without electric light or power for nearly 10 hours. As it was found on investigation that the usual supplies of current could not be restored for some time, arrangements were made with the British Thomson-Houston Co. to receive power from their generating plant. The B.T.H. Co. immediately carried out the work entailed, which included laying a cable through the factory, and by 9.50 p.m. on the same day current was supplied as usual.

* * * *

Swiss Hydro-Electric Power

During 1924, hydro-electric development in Switzerland increased by 80,000 h.p. Other new hydro-electric plant, with a capacity of 320,000 h.p. is also either being built or under consideration, and fear was at first entertained that the sites were being developed too quickly. It has now been found that this is not the case, however, as there is already a demand for the power to be developed by the stations still awaiting construction.

* * * *

"Beam" Station for Winthorpe

The Spilsby Rural Council recently decided not to oppose the Government's scheme for the erection of a "Beam" radio-telegraph station at Winthorpe, near Skegness. The station will be used for communication with India and Australia and will be distantly controlled from London. The masts will be 300 ft. in height and the site has already been inspected by the Marconi Company's engineers.

* * * *

Dover Station Improvements

A sum of £325,500 is to be spent by the Southern Railway Company on improvements at two of the three Dover Stations. Of this amount £190,000 will cover the cost of a new locomotive depot on the site of the old Town station and the demolition of the existing depot. A further £135,000 will be spent on enlarging the passenger and goods accommodation at Priory Station, which wi.l then possess two platforms, each 700 ft. in length by 22 ft. in width. The two platforms will be joined by a subway 18 ft. in width and on the town side new station buildings will be erected. A new goods shed will be built on the site of the existing locomotive depot, while on the same site there will be three groups of sidings capable of accommodating 114 wagons.

Another P. & O. Liner

The "*Comorin*," a new vessel of 15,000 gross tons, built by Messrs. Barclay Curle & Co. Ltd., for the Australian Service of the Peninsular and Oriental Steam Navigation Co. recently underwent successful trials on the Clyde, attaining a mean speed of 17¼ knots. The "*Comorin*" has a length of 545 ft., a breadth of 70 ft. and a depth of 46 ft. Of the 600,000 cubic ft. of cargo space available, half is cooled by refrigerating machinery and insulated for the carriage of perishable materials and produce. Passenger accommodation is provided for 200 first-class and 100 second-class passengers, the cabins being of the single and two-berth types only.

The vessel is driven by balanced twin-screw quadruple-expansion engines, steam being supplied by seven boilers working at a pressure of 220 lb. per sq. inch, burning oil fuel under forced draught. Other features of the ship are the mechanical operation of watertight doors and ventilation, and the large number of lifeboats provided.

* * * *

Record Cargo Handling

What is believed to be a record in loading grain at the port of New York was recently achieved by the Atlantic Transport Line, when four elevators with a combined capacity of 8,000 bushels per hour were worked at the same time alongside the steamship "*Minnetonka.*"

This ship and her sister ship the "*Minnewaska*" are the only vessels entering the port of New York with hatches sufficiently far apart to take four elevators alongside at once. The length of each elevator is 140 ft., and the four, lying end to end, occupy 560 ft. of the ship's side. Each elevator handled 214 tons of grain per hour, making 856 tons an hour for all four.

As a full cargo of grain for either of these ships is 60 loads, a load corresponding to 8,000 bushels, the total capacity of each ship is 480,000 bushels, weighing 12,840 tons.

* * * *

New Motor Ships

Messrs. Furness Withy & Co. have recently invited tenders from British shipbuilders for the construction of four new motor ships. The vessels have been under consideration for some time, and it is hoped that on this occasion the orders will go to British yards, particularly as the recent order for five fifteen-knot ships was obtained by Germany. The new ships are to be slightly slower than the five already ordered.

The New Zambesi Bridge

A note on the proposed new Zambesi Bridge, appeared in the February number of the "*M.M.*," and it is interesting to learn that the Government propose to sanction the necessary expenditure for the construction of the bridge. The total cost will be nearly £1,000,000. The site for the bridge will be Sena, 150 miles from the mouth of the Zambesi, and the necessary plans and specifications have already been prepared.

The main bridge is to be three-quarters-of-a-mile in length, but owing to the fact that in the flood season the river covers the low-lying land, a quarter-of-a-mile concrete gantry and a mile stone embankment will be erected between the bridge and the left bank of the swollen river. Work on the bridge will be commenced as soon as the expenditure has actually been authorised.

* * * *

A New Aqueduct

A new aqueduct to carry the Leeds and Liverpool Canal over Yorkshire Street, Burnley, is to be constructed by Messrs. Wellerman Bros., of Sheffield. The structure will be of steel and reinforced concrete with a 70 ft. span, which will allow double-deck cars to pass instead of only single ones as is now the case. As the aqueduct has to be built without interfering with the working of the canal, a temporary trough will be constructed outside the present aqueduct.

* * * *

The Majestic's Record

On a recent voyage, the White Star liner "*Majestic*" landed 2,570 passengers at Southampton. This is stated to be the largest number of passengers to be carried from New York by any one steamer since 1914. A special army of porters had to grapple with the enormous number (over 7,000) packages of baggage, which the passengers brought with them. Within two hours three special boat trains had left the ship's side for London.

* * * *

Meccano Motor-Cycles

The "thinning down" of their machines to bring them to within the 150 lb. limit was a feature among the entrants for the recent Tourist Trophy Races in the Isle of Man (Douglas).

J. A. Porter weighed-in by drilling the mudguard stays, gear-lever and brake drums, so that his machine looked as if it were made up of Meccano parts.—"*Daily Mail.*"

New Liners

Several new liners for use on the Atlantic passenger routes have been and are being completed. On 22nd May the new Cunarder "*Ascania*" left Southampton on her maiden voyage to Quebec and Montreal. The "*Ascania*," which was built by Sir W. G. Armstrong Whitworth & Co. Ltd., at their works on the Tyne, has a gross tonnage of 14,000. The vessel burns oil fuel and has twin screws driven by double-reduction geared turbines. She is a two-class ship, with accommodation for 520 first-class and 928 third-class passengers, the third-class quarters having received special attention with a view to attracting tourists.

Two more Cunard liners, the "*Alaunia*" and the "*Carinthia*," the latter a vessel of some 20,000 tons, will shortly be completed.

The Anchor liner "*Caledonia*," of 17,000 tons, is also nearing completion. She will run on the Glasgow–New York service and will also be used for cruises.

Another new Atlantic Liner is that reported to have been ordered from Messrs. Harland and Wolff Ltd., by the White Star Line for their Canadian trade. The new vessel will be of the same class as the "*Regina*," carrying cabin and third-class passengers only. With a gross tonnage of 18,000, or 1,500 tons larger than the "*Regina*," she will be the same length, 575.3 ft., but slightly larger in breadth. She will be constructed to carry a large number of passengers and a big cargo, and will be driven by twin screws at a speed of 16 knots.

* * * *

Canal from Baltic to Black Sea

The scheme has now been revived for the construction of a canal from the Baltic to the Black Sea. The first scheme proposed is to make a canal connecting Lodz, Warsaw, Poznau and Danzig, for the transport of coal. Side canals will branch off to the mining districts. If the canal is constructed, coal from Poland will have a better prospect of reaching the Baltic market, as at present the miners can only send by water approximately one-twentieth of their production. Approximately one-fifth of the coal from the Westphalian district is sent by water.

Another proposed canal for coal transport will be from the Danube, via the Pruth, Dniester, and Sau, to the Weichsel. Rumania is also interested in the project, and the total cost, estimated at 1,000,000,000 gold lei, would be divided between Poland and Rumania, Poland bearing about two-thirds of the cost and Rumania the remainder.

* * * *

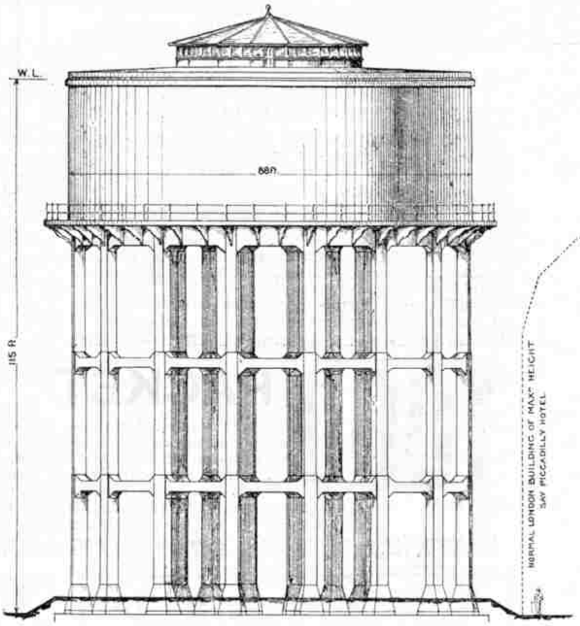
New Staffs. Road

A new road is to be made between Burton and Branstone, the total cost of which will be £50,000. Representatives of the Burton-on-Trent Corporation and the Staffordshire County Council recently decided to adjourn further consideration of the matter until it is seen what financial assistance the Ministry of Transport are prepared to give to the project.

Ropeway to be Dismantled

A large part of the Khyber ropeway, which, since its erection in 1919 has handled a maximum of 200 tons of goods per day, is to be dismantled owing to difficulties with the Afghans. The total length of the ropeway is 19 miles.

Largest Water-Tower



The above illustration—kindly sent to us by Mr. W. H. Thorpe, Civil Engineer—shows a huge reinforced concrete water tower of one million gallons capacity, believed to be the largest tank of its type in existence.

This tower was designed and detailed by Mr. Thorpe for the late Hon. R. C. Parsons, M.I.C.E., Engineer to the Water Company at Rosario, S. America. It has 30 ft. depth of water, the height from the ground to the finial being 131 ft. The total load at the base of the columns is about 8,600 tons, of which the water weighs 4,470 tons.

The surrounding country is flat and the Tower, which has now been in service about twelve months, is visible from all directions for many miles.

New Seismograph Station

A new seismograph station, established at St. Anne de la Pocatiere, Quebec, is situated close to the centre of the area affected by the earthquake of 28th February. It will assist in the work of those maintained by the Dominion Observatory at Saskatoon, Halifax and Ottawa, and by the Meteorological Service at Victoria and Toronto.

* * * *

Loch Katrine Waterworks Alterations

Members of the Glasgow Corporation recently visited the Loch Katrine Waterworks on their annual inspection tour. They were given an opportunity of seeing the new road which, built along the north shore of the loch, is being continued to Strone. Owing to the water level in the loch being raised it became necessary to make extensive alterations in the aqueducts, sluices, and inlet basins, and these are now nearly completed. A new pier has been made at Stronachlacher and lighting and heating for the residential buildings and works is provided by the recently-built power station.

New Motor Ships for Italy

A report from Italy states that two new twin-screw motor passenger liners, each having a gross tonnage of about 23,500, are being built by the Cantieri Nava'e Triestino, Malfroncone, for the Consulich Navigation Company of Trieste. The new vessels will carry 3,000 persons (including crew) and 9,000 tons of cargo, will be 691 ft. 3 in. in overall length and have a beam of 79 ft. 6 in. and a depth of 45 ft. 6 in. They will be propelled at a speed of 20 knots by two sets of Burmeister and Wain oil engines, developing 24,000 shaft h.p. at 105 r.p.m. The vessels will carry sufficient lifeboat accommodation for all on board, some of the boats being fitted with wireless and motors.

Large as these motor vessels are, a still larger one is to be built for the Italian General Navigation Company of Genoa. The vessel will be 706 ft. in length, 82 ft. 6 in. in breadth and 51 ft. 3 in. in depth, while the propelling machinery will consist of four sets of double-acting two-cycle four cylinder engines driving quadruple screws. The total output of the engines will be 28,000 shaft h.p. at 125 r.p.m. The auxiliary machinery will consist of eight Diesel electric generating sets, developing 4,825 brake h.p. The ship will be built at the Ansaldo Yard, near Genoa.

* * * *

100-Ton Shipyard Fitting-out Crane

What is said to be the most powerful crane on the Pacific coast of America is a 100-ton shipyard fitting-out crane recently built by Messrs. Cowans, Sheldon & Company, of Carlisle, and commissioned by the Burrard Dry Dock Company of North Vancouver. The jib of the crane has an outreach of 80 feet.

* * * *

Floating Dry Dock for Mediterranean Fleet

Leaving Sheerness on 1st June in charge of six naval tugs and a destroyer escort, the 700 ft. ex-German floating dock, which it is understood will be used for docking the Mediterranean Fleet capital ships, arrived safely at Malta on 27th June.

* * * *

Emergency Arrangements at 2LO

The broadcast transmitting apparatus at the old 2LO station at Marconi House has been re-established, and will be kept ready for instant use in case of any breakdown at the Oxford Street Station. There have only been three breakdowns in 18 months, which period represents 75,000 hours of transmission.

* * * *

Power Plant for Buenos Ayres

The Electricity Supply Company of Buenos Ayres has under consideration the construction of a new power plant with a total capacity of 500,000 kilowatts, of which the normal output will be 400,000 kilowatts. The plant will really consist of five stations of 100,000 kilowatts each, and these will be able to work either in conjunction or separately.

Stamps for Sale

FREE.— 50 Different German Postage, 1½d.— Howell, 20, Trilby Road, Forest Hill, London.

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

FREE. 50 DIFFERENT STAMPS. Ask for ½d. approvals. Stamp Collector's Outfit 1/2, post free.—Butterworth, Upper Mulgrave Rd., Cheam, Surrey.

STAMP APPROVALS. Fine selections at lowest prices. About 1,000 foreign at ¼d., Colonials from ½d.—Wyk, Bolehill, Flixton, Manchester.

Six Revolutionary Crete, 1905 (Cat. 1/8) Free to "Big Discount" approval applicants.—H. Scott Johnson, C.P.A. Room, C. 49, Felden St., S.W.6.

1000 Foreign Stamps 6d., Postage 2d. 500 Stamps all diff., 6d., Postage 2d.—Phil, 20, Castle St., Dover.

BRITISH COLONIALS, 200 different, 3/9; 500, 15/-; 1000, 55/-; or a selection sent on approval at ½d. each. Colonial Mixture including high values, 3/- per 1000.—Theobald, 54, Antill Road, London, N.15.

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

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The FALCON Packet Costs You only 2d. (for Postage) and contains: The new **Ruanda-Urundi Unused** (a beautiful stamp), Cuba, **Obsolete East Africa and Uganda,** Roumania (unused), **Jamaica** (native woman grinding cassava), scarce **Cochin** (Raja), Sweden (lion), **Unused Paraguay,** New Caledonia, Dutch Indies, **Pictorial Cameroons** (just out), and a set of **4 Martinique** (1c., 5c., 10c., and 15c.) **Also,** for responsible approval applicants only, **A Set of 4 different Uruguay Free.**

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ST. HELENA, Script, 3d. dull blue ... ... 4½d.

SOUTH AFRICA, Air Mail, 1d. red ... ... 2d.

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£5 WORTH OF STAMPS FOR 5/-

This Sale parcel contains over 750 different. Containing fine lot Mint Colonials:—From Antigua, Bahamas, British Honduras, Guiana 1890 1c. on 2 Dols, Cayman, Dominica, Gibraltar, Gilbert and Ellice, Gold Coast, Jamaica, Kenya, Malta, Montserrat, Palestine, St. Kitts-Nevis, Trinidad, Turks and other used and unused stamps. Lot catalogued over £5 for 5/- post free. Abroad 6d. extra.

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Send Postcard Only Requesting Approvals.

LISBURN & TOWNSEND, London Road, LIVERPOOL

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"Many thanks for packet which I think is splendid quality." 23/5/25.

"The 'New Issue Packet' you sent me gave every satisfaction." 14/6/25.

"Stamps received, for which many thanks. I have got a good few more added to my collection out of them."

The **NEW ISSUE PACKET** containing 30 diff. stamps **all issued during 1925 and all mint,** exactly as advertised in the May "*M.M.*" can still be supplied at 1/3, post 1½d. extra. Excellent value.

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BOUNTIFUL PACKET No. 5

contains **2 triangular Austrian** express; set 3 **Kenya and Uganda; 4 Carinthia plebiscite; India, 1 rup.; Kedah; Japan,** Coronation; **Madagascar 25c.** pictor.; large **Malta** (mint); **Somaliland** (Protect.); **15 Germany; 15** diff. **Norway** and **5 Malay** (tiger). Price **8d.** post free. **Bargain No. 8.**—50 diff. **Sweden 6d.,** or 25 diff. **3d.**

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1,111 H. HARDY, 285, Archway Road, London, N.6. 1,111

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ASK FOR 3 CORNER PACKET

Send a postcard to-day. *Only 1 lot allowed each applicant.*

This packet contains high value **Greek pictorial catalogued 3/-,** Gwalior official, Hungarian revolution (eagle), set of 3 China ships, **Bolivia** arms, Bulgaria pictorial, Norway, **Wallis and Fortuna Island, set 5** Switzerland, Sweden, Denmark, **Venezuela high value catalogued 1/-,** Germany 50 million Marks, Pair large Ukraine pictorials, Ireland, and an obsolete 3-cornered stamp in fine condition.

R. Wilkinson, Provincial Bldgs., Colwyn Bay

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Those who wish to complete their sets of "*M.M's*" will be interested to hear that we have in stock a few copies of recent issues.

All Magazines up to and including December, 1921, are out of print. A few dozen copies remain of each number from January to December, 1922, with the exception of the issues of March and April. Copies of each of the 1923 issues are also available, with the exception of February, June, September, October and November, which are sold out. Copies of back issues will be sent post free, price 3d. each, but early application should be made, as the number available is very small. The price of the December 1924 issue is 5d. post free.

Bind your "*M.Ms.*"

In the advertisement columns of the "*M.M.*" a reader recently offered 2/6 per copy for certain early numbers of the "*M.M.*" in order to complete his file. This offer indicates the value placed upon the "*M.M.*" by some readers, and we suggest that you should see that your file of copies is complete. Keep the Magazines in the special spring-back binder illustrated here. This binder has a strong stiff back, holds a large number of copies, and keeps them neat and clean. Covered in black imitation leather, tastefully tooled, lettered gold, its price is 3/- (post free).

MECCANO LTD.

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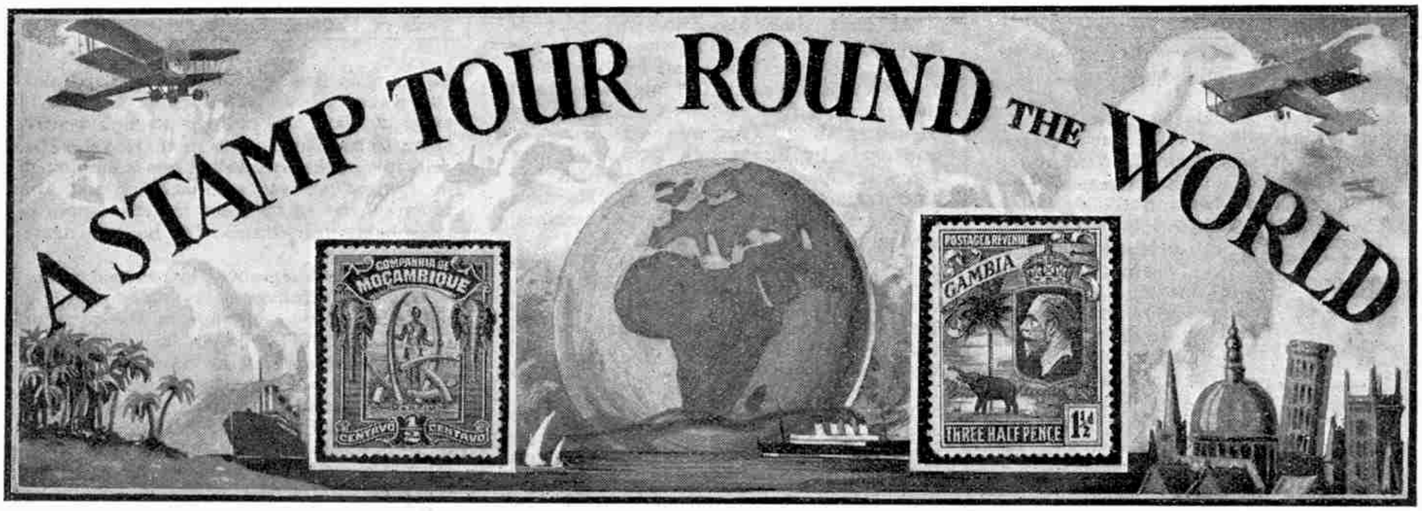

XII. EGYPT, ERITREA AND DJIBOUTI

LEAVING our aeroplanes at the Pyramids, we take the electric tram for the journey of eight miles to Cairo, the Arabic name for which is "*Misr-al-Kahira*," often abbreviated to "*Misr.*" Cairo, the largest city in Africa, is the capital of modern Egypt and when the last census was taken in 1917, had a population of nearly 800,000. The city occupies a length of five miles along the eastern bank of the Nile, beginning at the old Roman fortress of Babylon.

The Citadel or El-Kala illustrated on the 50 mils. 1914 issue, occupies the south-eastern corner of the modern city. It is built on a spur of the Mokattem Hills, which rise 550 ft. above the town on the east. The building was erected about 1166 by Saladin (1138-1193), Sultan of Egypt, about whom we read in connection with the Crusades and King Richard I. of England. Since the time of Saladin the Citadel has undergone considerable alteration, however, and now contains a palace, built by Mehemet Ali, and a mosque of Oriental alabaster, the minarets and dome of which form one of the finest sights of the city.

A magnificent view of Cairo is obtained from the ramparts of the Citadel. Far below we see the city with the delicately carved domes and minarets of the mosques; the palaces and lofty towers; the gardens and squares; and the ancient walls surrounding all. We see also the gardens and palace of Shubra; the port of Bulak, and the broad river studded with islands. Away into the distance stretches the valley of the Nile, dotted with groups of trees. In the south-west we see the Pyramids and on the east are barren cliffs, backed by a waste of desert sand.

The Colossi of Thebes and Karnak Temple

From here we return by tram to our aeroplanes and resume our flight up the Nile valley until we reach the district of Thebes and Luxor, about 300 miles south of Cairo. Thebes was the ancient capital of Upper Egypt and here are the great colossi of "Memnon," attached to the temple of Amenophis III. (1914, 10 mils.) These are surpassed in size, however, by the stupendous black granite colossus of Rameses II., the builder of the Ramesseum in which it stands. This colossus was about 57 ft. in height and is estimated to have weighed about 1,000 tons.

At Karnak, a few miles from Thebes, is the Temple of Ammon, the greatest of all known temples and the work of many successive monarchs. Here is a series of ten pylons, one of which was shown on the 20 mils. value of the 1914 issue (illustrated here). Luxor, the neighbouring village, has recently been made prominent by the discovery of the tomb of Tutankhamen in the famous Valley of the Tombs of the Kings. Unfortunately, however, no views of this valley have yet formed the subject of the design of a postage stamp.

The Assuan Dam

Continuing, we next come to Assuan, about 150 miles south of Luxor, and three-and-a-half miles beyond which is the Assuan Dam (200 mils., illustrated) stretching across the Nile at the commencement of the First Cataract. At this point in the course of the river a natural dyke of granite stretches across the valley. By making use of this for the foundation it was possible to construct the dam entirely above the old river level so that no expensive under-water work was required. The dam is nearly a mile-and-a-quarter in length and is pierced by 180 sluices, some of which may be seen in the illustration.

The reservoir thus formed by the partial stoppage of the flow of the river forms a huge placid lake stretching upstream for 200 miles, with a capacity of nearly nine-

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A Stamp Tour Round the World—

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and-a-half million millions of cubic feet of water!

As originally built, the dam held up only 3¾ million million cubic feet of water, but in 1907 it was decided to raise the top 26 ft. higher, thus increasing the storage capacity two-and-a-half times. This work was completed in 1912. The original structure was completed on 10th December 1902, to the design of Sir W. Willcocks, the contractors being the well-known firm Messrs. John Aird and Co., and the cost two million pounds sterling.

More Temples and Colossi

By March each year the winter floods have filled the reservoir and then the sluices are gradually opened until, by July, all are open and the river flows freely past. This magnificent triumph of modern engineering has already increased the fruitfulness of Egyptian land enormously, and a further increase will take place when the Khartum dam in the Sudan, now under construction, is completed. This dam is to hold up a reservoir of water of double the capacity of the Assuan dam.

Our final stop in Egypt is at Abu Simbel or Ipsambul, a group of temples built by Rameses II. about 1250 B.C. on the left bank of the Nile, some 200 miles direct from Assuan. These temples are hewn out of the solid rock forming the cliffs of the riverside (1914, 100 mils.) There are three temples, the chief of which was discovered by Burckhardt in 1812. Although the sand has been cleared from in front of them several times, it is continually drifting back, so that considerable expense is required to prevent the temples from becoming submerged again. The colossi shown on the stamp are 65 ft. in height and are accompanied by figures of the queen and children of Rameses, while over them is a cornice and a long row of apes worshipping the rising sun above.

The Ports of Abyssinia—Massawa and Djibouti

Having thus completed our visit to Egypt, we now fly due south-east for about 700 miles until we arrive at Massawa or Massouah, the chief port of the Italian colony of Eritrea. This colony is situated on the west coast of the Red Sea, and is bounded on the north-west by the Sudan, on the west by Abyssinia and on the south by French Somaliland. Massawa has a population of about 10,000 and is built partly on the mainland and partly on the islands of Massawa, Tautlub and Sheik Said. These islands are of coral, and most of the important buildings of the town, including the Government Palace (1910 issue of Eritrea, values above 5c., illustrated here), are built of this substance.

Here Christopher da Gama, brother of the famous explorer Vasco da Gama, landed in July 1541, with 450 musqueteers, to go to the relief of the Abyssinians who were being over-run by invading Moslems. They marched into the interior and receiving reinforcements of native troops, were at first successful, but a year later da Gama was defeated, taken prisoner and put to death.

At that time Massawa was part of Abyssinia, but in 1557 the island was captured by the Turks and held by them for over 200 years. It has since been held in turn by the Sherif of Mecca, by Mehemet Ali of Egypt, by the Turks again, and again by Egypt. In 1885 an Italian force occupied the territory, which has since remained an Italian colony. Massawa is the natural port of northern Abyssinia, although communications are poor.

From here we fly southward to visit the neighbouring French Somali Coast, the capital and chief port of which is Djibouti (often spelled Jibouti). This town issued its own stamps until 1902 when they were superseded by stamps issued for the whole of the district.

Between the years 1894 and 1902 the public were supplied with a series of huge stamps showing views of the town and district. The 2c. value is illustrated here. The apparent perforations round the stamp are part of the engraving, the whole series being issued imperforate. The town was founded by the French in 1888 and has been the capital of the colony since 1896. Its trade consists mainly in coaling ships and in acting as a port for southern Abyssinia, as there are no local industries.

NEXT MONTH:—

WESTERN ASIA.

Recent Issues: Cyprus

After having used stamps with the same border design during three reigns, Cyprus has now issued a new series showing the head of King George V. on a shield with the words "Postage" and "& Revenue" at the sides, the object being to combine the postage and revenue stamps in one series, instead of having two separate issues as previously. The old design has always been considered to have very little artistic merit but the new series does not appear to be a great improvement.

The first King George stamps of Cyprus appeared in 1912 and had a life of nearly ten years. Between 1921 and 1923 they appeared on paper watermarked multiple script CA and in 1922-3 various values were printed in new colours and additional values were added. All these however were withdrawn from sale and the remainders destroyed on 30th July 1924, the new type being on sale on 1st August.

Air-Mail Stamps

During the Lympne light aeroplane meeting of 1923, Mr. J. H. James carried about 125 letters in his machine from Lympne to Hastingleigh, dropping them in a bag near the post-office. These envelopes are now priced at £4.

The envelopes of letters carried on the return flight of R34 from New York are listed at £38.

Lives of Famous Engineers—

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As soon as the pressure was relaxed and the water released, the collar collapsed, thus allowing the plunger to sink gently down to be ready for the next stroke. The principle of the hydraulic press is employed in a great variety of machines and appliances, one of its most familiar applications being in hydraulic lifts for passengers or goods.

Bramah subsequently introduced many valuable improvements in pumping machinery. By a change in the form of the piston and cylinder he obtained a rotary motion which he applied to many purposes, notably in a fire engine that was very successful. Another of his inventions, patented in 1797, was the beer pump, by means of which a publican could raise beer from the casks in his cellar to the level of the bar where it was to be served.

Introduction of Machine Tools

In 1802 Bramah introduced tools "for producing straight, smooth, and parallel surfaces on wood and other materials requiring truth, in a manner much more expeditious and perfect than could be performed by the use of axes, saws, planes and other cutting instruments used by hand in the ordinary way."

The tools were fixed on frames driven by machinery, some moving in a rotary direction round an upright shaft, some with the shaft horizontal like an ordinary wood-turning lathe and some on frames sliding in stationary grooves. In his own shops at Pimlico, Bramah used a machine with revolving cutters to plane metallic surfaces for his locks and other articles. He also introduced a method of turning spherical surfaces by a tool moveable on an axis perpendicular to that of the lathe, and of cutting concentric shells by fixing in a similar manner a curved tool of nearly the same shape as that employed by ordinary turners for making bowls.

Banknote Printing Machine

The Bank of England applied to Bramah in 1806 to construct a machine for more accurately and speedily printing the numbers and date lines on banknotes and he invented the necessary mechanism in a month. The employment of this machine in the Bank of England alone saved the labour of one hundred clerks, but its value lay principally in its greater accuracy, the legibility of the figures it printed, and the greatly improved check afforded by it.

Bramah also carried out a certain amount of civil engineering, including waterworks at Norwich, but his mechanical pursuits left him little time for work of this nature. He also contemplated various improvements in the methods of building bridges and canal locks but he did not live to bring any of these ideas to completion. While superintending the uprooting of trees at Holt Forest in Hampshire by means of his hydraulic press he caught a severe chill from which he never recovered, and he died on 9th December, 1814, in his 66th year.

Bramah was a man of admirable character and of such a cheerful temperament that he was welcome in any company. As a manufacturer he attained a great reputation for perfect workmanship and prompt attention and honest dealing. He was certainly the greatest mechanical genius of his time, and may be regarded as the real founder of the art of tool-making.