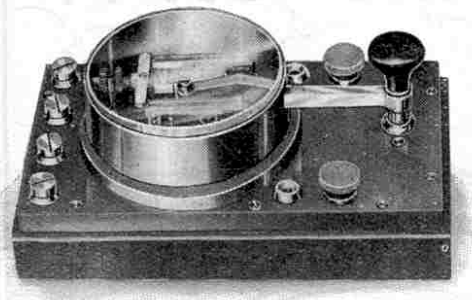
usually of 10,000 ohms each, are connected as shown in Fig. 2. At G is a galvanometer, an electrical instrument for measuring weak currents by means of a moving pointer.*

The type of galvanometer used for testing telegraph lines has two coils wound in opposite directions. The wire A from one resistance passes around one coil and then goes to the accumulator as shown. The wire B from the other resistance goes to the other coil and is then connected to earth and also to the other terminal of the accumulator through the switch S.



Photos courtesy]

Reversing Key

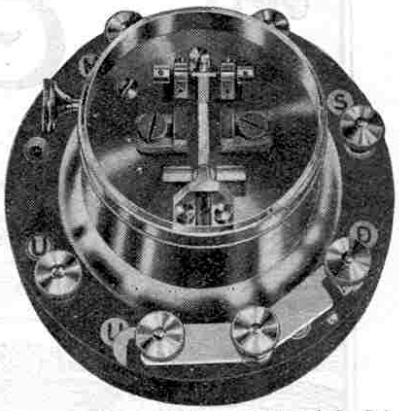
When the current is switched on it passes first through one coil of the galvanometer and tries to deflect the needle in a certain direction. It then passes on to the distant station and back to the testing station through the second wire, and so to the other coil of the galvanometer where it tries to deflect the needle in the opposite direction. Thus there are two forces acting on the needle each trying to move it in a different direction, and if as much current returns to the station as is sent out there will be no movement of the needle at all. If one of the wires is faulty, however, some of the current will leak away to earth. The needle will then be deflected, the amount of deflection varying according to the magnitude of the fault. A bad line thus indicated is at once cut out of service and steps are taken to have the leak discovered and rectified, for only in this way can an efficient telegraph service be maintained.

Modern Telegraph Circuits

As we saw last month, the early telegraphs required a large number of wires, and even the first commercial apparatus erected in this country required six connecting wires. To-day there is only one wire, technically known as the "line," connecting the sending instruments with the receiving instruments, and at each end there is an earth connection so that the earth acts as a return for the electric currents.

The object of the complex modern telegraph instruments is to economise in the number of lines required for a certain amount of traffic, for although the lines are perhaps the simplest item of the equipment, yet they are sufficiently costly to make it more economical to provide elaborate apparatus than extra lines. The simplest circuit would be one consisting merely of a sounder, a battery and a key in series, as shown in Fig. 3. When the key is pressed in accordance with the Morse signals to indicate a particular letter, the sounder will make corresponding clicks as described last month.

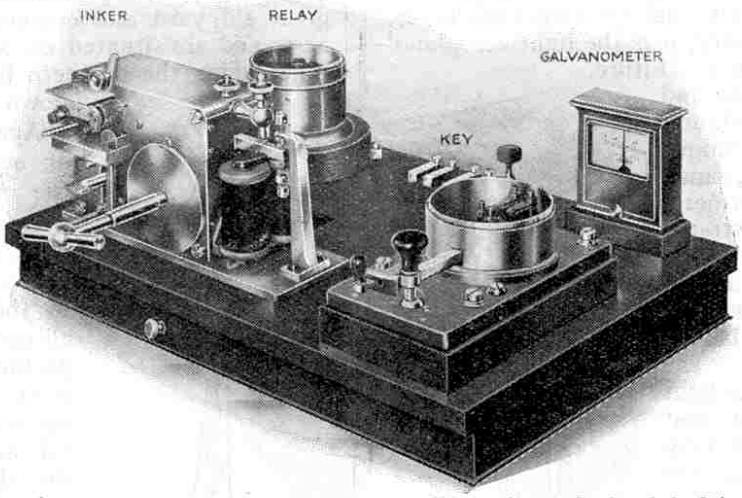
The first advance on this arrangement, which only provides for one-way communication, was made when the apparatus was so constructed that the key at one station worked the sounder at the other, but left its own sounder silent. This circuit is known as the open circuit single-current system and is shown in Fig. 4. When the key K at station 1 is pressed down on to stop "b," the current from the battery B flows along the line and through the sounder S at station 2 to earth by way of the rest "a" of the key, whence it returns through the earth back to battery B. Thus the key K at station 1 operates the sounder S at station 2, and in an exactly similar manner the key at station 2 operates the sounder at station 1. The galvanometers G are used merely as a check to make sure that the currents are passing through the line.



[Messrs. Siemens Brothers & Co. Ltd.

Polarized Relay

This system is one of many known as "open circuit" on account of the fact that no battery is connected to the line when the stations are not transmitting. "Single-current" working signifies that the current always travels round the circuit in the same direction and is not reversed as in "double-current" working, now to be described.



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

Double-current Simplex Set with Inker

Relay Working

When the circuit is very long it is necessary to use a powerful battery if ordinary sounders are to be worked at the receiving end. It is more economical, however, to employ a local battery to work the sounder and to arrange a relay to control this battery. The process is very similar to the relay working described in the article on "Electric Bells" in our issue for December last. Fig. 5 shows the connections. Instead of passing directly through the sounder to earth as in the previous circuit, the currents pass through the windings of the electro-magnet M and cause the latter to attract the armature A, thus completing the second circuit containing the sounder S. Only one station is shown in the figure the second being an exact duplicate of the first.

This type of circuit is in great use throughout America, but in England an instrument called a "polarized relay" is employed in a circuit on the double-current system. In this system a current is sent through the line continuously, and its direction of flow is reversed when the sounder is required to work. Thus the reversals take the place of the pulses of current used in single-current working. The relay consists of a small permanent magnet

(*Continued on page* 183)

* The principle of the galvanometer was explained in the "*M.M.*" for July last.

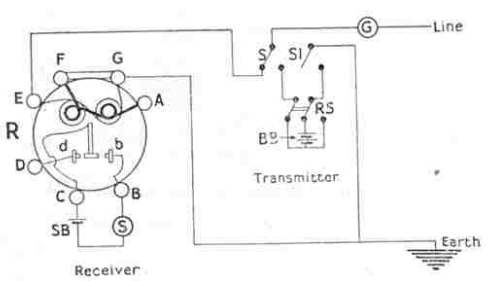


Fig. 7

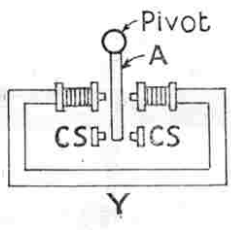


Fig. 6

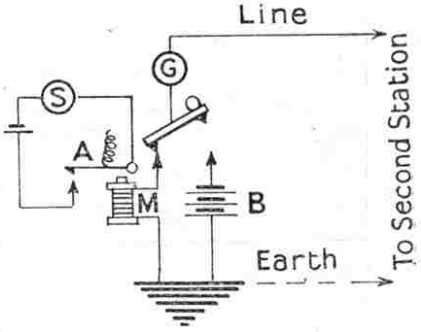
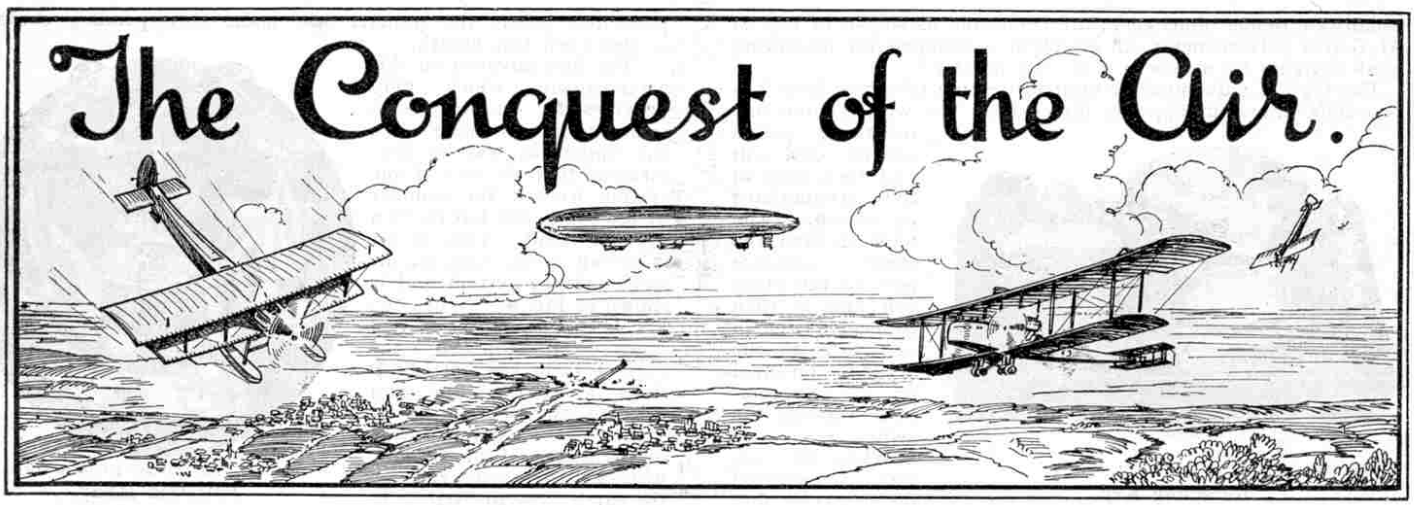


Fig. 5



II. THE BEARDMORE "WEE BEE I" AT THE LYMPNE TRIALS

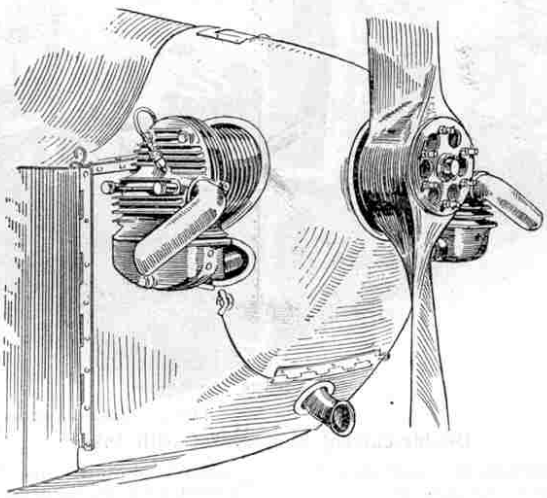
Last month we gave some account of the Air Ministry's contest for light aeroplanes held at Lympne, and described the performance of the Beardmore "Wee Bee I," the winner of the first prize of £2,000. In this article this fine little monoplane is described in detail.

AN increasing amount of attention is being paid to light aeroplanes, for although the larger machines will always be necessary, it is the light aeroplane that will be most useful in the future.

Apart from flying schools and light aeroplane clubs, for instance, the light aeroplane offers unique opportunities for the sportsman who wishes to run his own aeroplane. It is not too great a stretch of the imagination to anticipate the time—which cannot be at any very distant date—when privately-owned aeroplanes will be as common as motor cars. The small size of the engine of a light aeroplane keeps both first cost and running expenses down to a very low figure, and it should not be any more costly to run a light aeroplane than to run a two-seater car.

Giant Airships, "Flying-Boats," and Light Monoplanes

To come now, to "*Wee Bee I*," or to give the machine its correct series number, the "W.B.XXIV." The machine is built by Messrs. William Beardmore & Co. Ltd., of Dalmuir, Scotland. With this firm, aeroplane-building is but a branch of a great shipyard and engineering works that cover 110 acres and are situated on a strip of land stretching 1¼ miles along the northern bank of the Clyde, ten miles down the river from Glasgow.



Courtesy] ["*Flight*"

The "Bristol-Cherub" in position and cowled-in

Apart from the construction of aeroplanes and seaplanes of the ordinary type, of which the Company made many during the war, Messrs. William Beardmore also gave special attention to the great possibilities of the all-metal system of construction. As builders of the famous airships R.34, R.36 and two former rigids, the firm has had extensive theoretical and practical experience in the design and construction of aircraft units in duralumin, which—as most of our readers know—is a specially light metal of great strength and of particular value in the construction of aircraft. This experience has been of great value in the construction of the large "flying boats" for which the firm is famous, as well as in the more recent departure of very light monoplanes.

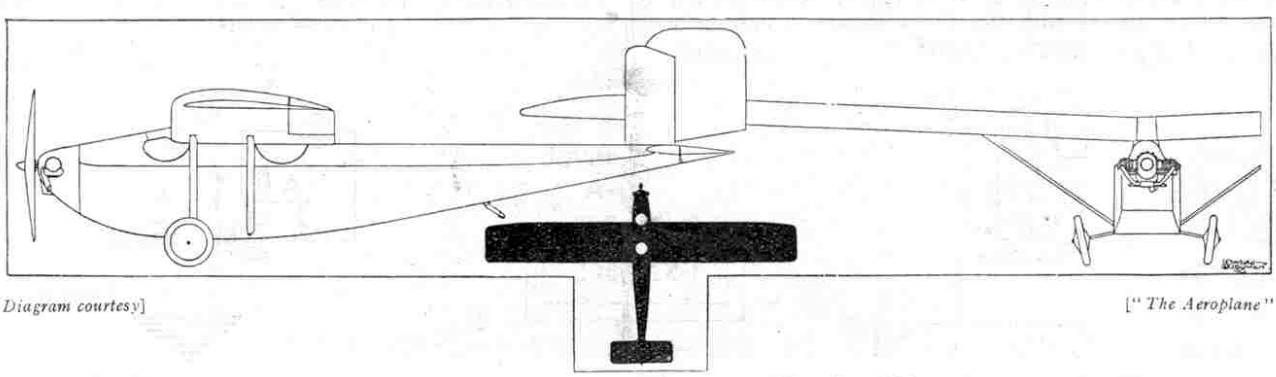


Diagram courtesy] ["*The Aeroplane*"

Plan and elevation of the Beardmore "Wee Bee I"

"*Wee Bee I*" is a thick-wing monoplane of very clean design, every effort having been made to reduce to a minimum any projections that might adversely affect the performance. The machine is not a cantilever monoplane, however, as its wing is divided in the centre, each plane being braced by two struts from the lower longerons of the fuselage. Apart from this fact there is no external bracing anywhere, either in the tail or in the under-carriage.

"Stream-lined" Pilots

The cross-section of the fuselage is the smallest possible to reduce head resistance, and altogether "*Wee Bee I*" comes very near aerodynamic perfection. As we stated last month, she has an extremely good top speed, having done 80 miles per hour in the Lympne trials, and this with a minimum of horse-power, which, in fact, is so low that the machine had a greater reserve of power than any other in the Air Ministry Competitions.

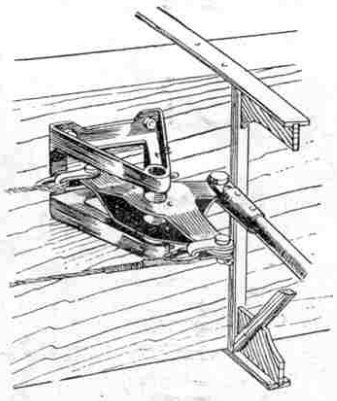
The fuselage is built on six spruce longerons, with formers or bulkheads of spruce and three-ply, the whole being covered with $\frac{1}{16}$ in. birch three-ply.

The deck fairing, instead of being arched, as is usually the case, is "hollow-ground." It thus roughly conforms to the shape of a man's head and shoulders, and enables an excellent view to be obtained without serious craning of the head or unnecessary contortions on the part of the occupant. Thus, the pilots are streamlined, and they are able to look past the fairing by moving their heads slightly to right or left, as the case may be.

Cockpits and Controls

Two cockpits are arranged, one aft of the wing, or rather aft of the rear spar, and one ahead of the front spar. There is a square opening in the trailing edge through which the pilot enters, and which is covered during flight by a celluloid window. The front cockpit is entered by swinging upwards a small hinged portion of the leading edge of the wing. When the pilot is in place the leading edge is brought down in line with the rest of the wing and locked in position. The view from both cockpits is very good, particularly so from the front one, from which there is practically an unobstructed view, if the pilot leans his head slightly to left or right. This position is ideal, particularly for landing.

The controls and the instruments are of the usual type, and it is interesting to learn that the machine is capable of being flown from either seat. When being flown solo, with the pilot in the front seat, it adds to his comfort and ease of control if a small weight is carried in the rear cockpit for trimming purposes. In the case of the pilot-owner, this weight would probably be made up by the owner's luggage, in which case the machine would not be carrying any unnecessary load.



Courtesy] ["*Flight*"

Aileron Crank, with push-and-pull rod

Wings, Ailerons and Elevator

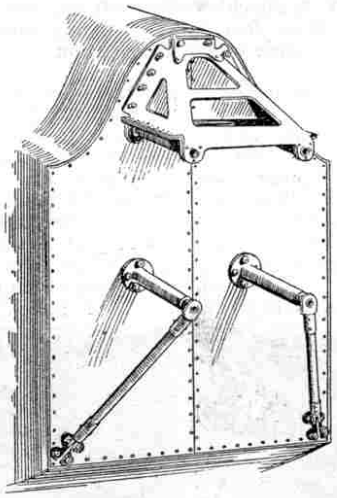
The monoplane wings are practically of orthodox construction in that they each have the usual two main spars of box section, with three-ply walls. Both flanges and walls taper in thickness towards the tips, being proportioned to the shear and bending movements along the span.

There is no internal drag bracing in the wing, at least in the ordinary sense of the term. This function is performed by the three-ply covering that extends along the entire leading edge up to the front spar and near the root as far out as the strut attachments—in fact, this three-ply covering extends back to behind the rear spar.

The ailerons are of high aspect ratio, and are hinged to a false rear spar or stringer. They are operated by crank levers through short push-and-pull rods, no control pulleys being employed.

The tail unit is also of interest. The fin is in two sections, located by dowel pegs, and the tail plane has but a single spar, built integral with the rear portion of the fin. The front portion of the fin is integral with the fuselage structure.

The elevator is hinged along the top edge, and the opening underneath is covered with a duralumin flap so that there is no gap at the hinge line. As in the case of the ailerons, the elevator is operated by a short push-and-pull rod, from cranks on a lay shaft.



Courtesy] ["*Flight*"

The neat Engine-mounting

Ingenious Engine-Mounting

The under-carriage consists simply of a single bent tube passing through the fuselage and anchored by suitable fittings at the sides. The axle is of chrome-nickel steel, and specially designed to allow of sufficient flexibility to absorb landing shocks. It is supported in the fittings on trunnions, which allow it to flex freely. One trunnion is rigidly fixed to the axle so as to resist torque loads and in order to locate the axle endwise. The trunnion on the opposite side takes uploads only, and is free to slide on

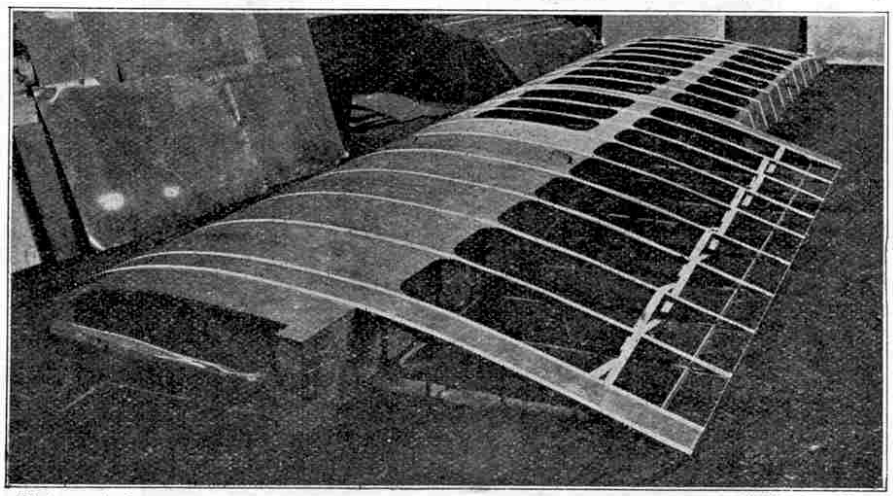


Photo courtesy] ["*The Aeroplane*"

Details of Wing Construction

the axle.

The mounting of the Bristol "Cherub" engine is ingenious, and has proved very satisfactory in practice. The weight of the engine is taken by a pyramid support of sheet duralumin, while the vertical position is maintained by two lower struts, also of duralumin. The lower supports are steadied by steel tubes running to the lower corners of the engine bulkhead.

The engine is readily accessible, as are also the usual petrol and oil connections, etc. A cowling surrounds the whole engine except the cylinder heads. The air in-take is particularly clean and unobstructed, and carries out the designer's idea of reducing head resistance to a minimum.

Photo courtesy of ["*Flight*"

The Designer (Mr. W. S. Shackleton) on left and the Pilot (Mr. Maurice W. Piercey) of "*Wee Bee I*" exchanging congratulations at the close of the Competition

An Interview with the Pilot

Mr. Maurice W. Piercey, who piloted "*Wee Bee I*" to victory at the Lympne trials, is very enthusiastic about his game little mount, and in an interview he gave us some interesting details of its behaviour.

"I realised," he said, "that the severest part of the trials was the high speed test, and I determined to get that over as soon as possible—on Monday, the opening day. The test consisted of 10 laps of 12½ miles each. Although the wind force was 28 m.p.h., and conditions extremely bumpy, the fine little machine brought me round at an average speed of 70.11 m.p.h. On the first day I had finished the hardest test of all, and nobody else attempted this test until the Wednesday.

"On the Tuesday I carried on for my 10 hours' reliability test of lapping the course at the most convenient speed and piling up mileage. On Wednesday I had a shot at the low speed test, which I did at 40.67 m.p.h., and as this was the lowest figure at that time, I left it at that.

"It was remarked that my machine was the most controllable of the lot, and it certainly felt so. We had to do 500 yards at a height not exceeding 20 ft., and such was my faith in "*Wee Bee I*" that I kept down to about 5 ft. off the ground the whole way. After that I went on lapping for the rest of the day, until evening, when I had a shot at the taking-off and landing test. I did the first take-off from 250 yards, and I left it at that, as this gained me 200 points right away, 450 yards being allowed. It was dark by the time I did the landing test, but the machine came to rest well within the 150 yards allowed.

"It was on this day that engine trouble first appeared, through the oil jet that sprays on to the starboard big-end bearing becoming choked. We quickly cleared the jet and put fresh oil in, but sufficient damage had been done to handicap me for the rest of the week and finally stall me altogether within the last two minutes on Saturday.

The Big-end Gives Way

"On Thursday I went on and I set out on the 125-mile run. I was doing nearly 80 m.p.h. when 2½ miles from the finishing line—a distance which would have taken me only one minute forty-five seconds to cover—the big-end gave way altogether. I at once stopped my stop-watch, and it was showing 46 minutes 35 2/5 seconds for the last 60 miles covered.

"Everyone had hard luck with engine trouble that week, but I think no one had worse luck than I had. Really this fine little machine never had a chance of showing its real paces, because of engine trouble.

"I find "*Wee Bee I*" wonderfully manœuvrable, and so very good at turns that I never had to waste a second on turning. Its chief feature, however, is its extraordinarily high aerodynamic efficiency. Although the normal gliding angle of the average type of machine is not as good as 1 in 10, the Beardmore, with full load, will glide at 1 in 15—an astonishing performance. With such a machine, if the engine 'conks' or if you stall by mistake, the machine just falls a few feet, and gently settles into an easy glide. It is as safe as a house."

"What do you think of the prospects of the "*Wee Bee I*" we asked.

"As to that, there should be a great future for this little outfit for club flying, for training, and similar utility purposes. It is light on controls without being sensitive. The lateral stability is excellent and the landing is very easy, the actual touching speed being below 35 m.p.h."

Our article on the Lympne trials last month has aroused considerable interest, as is evidenced by our mail bag during the past month. From the thousands of letters we have received already this year we know that aeroplanes are of great interest to our readers, and we are arranging to print an article on aeroplanes as a regular feature whenever space permits. Later we shall tell the complete story of the aeroplane from the earliest times in a series of illustrated articles.

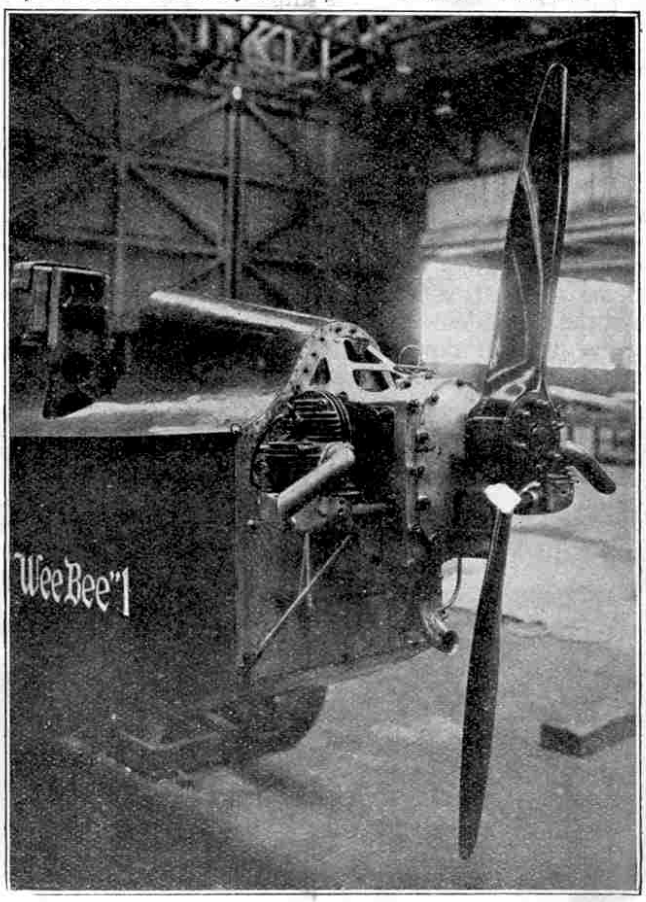
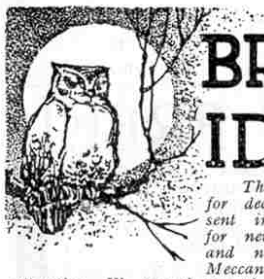


Photo courtesy of ["*The Aeroplane*"

Mounting of the Bristol "Cherub" engine in the "*Wee Bee I.*"



BRIGHT IDEAS

These columns are reserved for dealing with suggestions sent in by Meccano users for new parts, new models, and new ways of making Meccano model-building attractive. We are always pleased to hear from any Meccano boy who has an idea which he considers will be useful in the Meccano system.

W. Harvey (Thornton Heath, Surrey).—It is not possible to provide a variety of sizes of one particular piece. This would only be unnecessary duplication. (2) For what do you suggest the double bent strip would be useful ?

J. French (Bristol).—(1) A double boss on the Pulley is unnecessary for the purpose you mention. (2) Washers may be employed to centralise the wheel and so prevent the rim from coming in contact with the bearing strip.

Albert F. Hare (Fulham, S.W.)—We are considering the introduction of a worm wheel with a wider pitch thread.

Ernest Hambin (Haselbury, Somerset).—A spur gear does not hold any advantages over our present type of Gear Wheel. Helical gears would no doubt be useful. We are going into the matter.

P. A. Acton (Port Sunlight, Cheshire).—A bent strip such as you suggest has not yet made its introduction necessary to general construction. We shall bear it in mind, however.

A. A. Caswell (West Kirby, Cheshire).—We should like to hear of any application of the 12½" × 3½" flanged plate you suggest.

Stewart Watherspoon (Waterloo, Liverpool).—(1) We regret we do not quite see your difficulty in the matter of the bearings for the propellers in your model. From your sketch it appears to us that the wooden pieces you mention are more in the nature of engine casings than bearings. (2) A bucket may be constructed from existing parts, see the High Speed Ship Coaler Model for instance.

W. D. Butler (Redditch).—(1) The introduction of perforated rods and special wheels with pins to suit the rods would obviously duplicate the whole of the wheel and rod series. This could not be entertained, from the point of view of cost alone. (2) A very firm fastening can be obtained by filing a small flatted surface on the rod at the point of contact with the set screw in the wheel. This method is capable of sustaining abnormal strain.

Frank McPherson (Queensborough, Nr. Leicester).—We are considering the addition of a boiler element to the Meccano series.

Eric Kirkham (Burslem).—From your sketch and description we gather that your free wheel action is obtained by throwing the gear wheels out of mesh by means of a lever. This principle is employed in our model of the Drop Hammer No. 641.

John C. Griffiths (E. Dulwich, S.E.)—A flanged wheel without boss may be employed in certain instances, but it is necessary to have fixed wheels in some cases where the drive is transmitted to the axle.

F. W. Lamb (Sunderland).—(1) Decorated flags for models may be obtained from almost any fancy dealer. It would not be worth our while to manufacture them. (2) A ready-made double crank shaft does not lend itself very well to good construction. A very good crank head may be made from existing parts, as in the Small Horizontal Engine Model published in the June number of the "*M.M.*" (3) We do not see any special use for cone pinions.

J. W. Bennett (Liverpool).—Four types of pulley blocks are illustrated on page 78 of our complete Manual. Any of these may be used as an alternative to the cranked bent strips.

J. Salter Chapman (London, W.)—We have introduced Dog Clutches to take the place of the leather-lined wheels you suggest in so far as an auto clutch is concerned. We do not think there is any scope in the part you mention when used in the capacity of a friction drive.

W. W. Breedheet (Trowbridge, Wilts.)—Siding points and an engine shed are already on our list. We may possibly be able to bring them out this year. Your suggestion regarding G.W. marking is noted.

J. W. Davies (Stourbridge).—In our revised models we have eliminated practically all strip mutilations. Strips and rack strips made of spring steel such as you suggest are therefore unnecessary. Your suggestion for lengthening the 6" Rod by half an inch is good.

Harold V. Small (Finsbury).—We fear that our type of electric motor is too intricate to be assembled otherwise than by ourselves.

H. Collins (Peckham Rye, S.E.)—The curious girder construction you mention may be effected by existing parts, but for what do you consider it would be useful ?

H. Ellis (Tooting, S.W.)—(1) A variety of curved strips would be valueless unless they catered for definite purposes. (2) A double crank shaft is under consideration.

OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

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

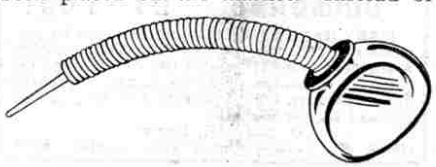
A Fountain-Pen Calendar

An invention which should prove valuable to those with bad memories is a fountain-pen calendar recently introduced in

America. It consists of a slotted metal cap with a roll of paper on the inside. On this paper are printed the days of the week and dates. The strip is perforated, and through a second slot, normally covered by a pivoted metal bar, the paper may be pulled forward until the correct date appears.

A Flexible Oil Can

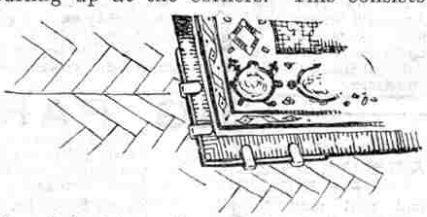
An oil-can that will reach awkward places without difficulty has recently been placed on the market. Instead of



the usual rigid metal nozzle, a flexible tube has been fitted and this may be bent and pushed into out-of-the-way corners and yet allow a clear passage for the oil. A handy pattern is being made specially for cyclists and motor-car owners and is to be sold in several different sizes.

A Household Hint

A useful domestic invention is a device for preventing carpets and rugs from curling up at the corners. This consists



of a thin triangular metal plate that is fastened to the floor and clipped over the carpet as shown in the accompanying illustration. By using metal plates the material will always lie flat, and, apart from giving a more tidy appearance to the room, there will also be less chance of people being tripped up in passing.

A Hole Boring Spanner

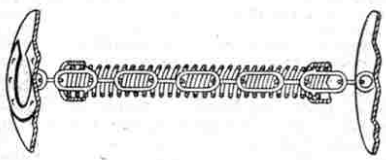
At present, the cutting of a round hole in metal or wood is a somewhat laborious task, and the larger the hole the more difficult the job becomes. With the aid of a new tool, however, holes from one-and-a-quarter to six inches in diameter may be easily and neatly made in almost any sort of material. A small device used in the same manner as a spanner is employed, and a ratchet handle permits the cutter to be used in any position, against a wall, overhead, in corners, or even on the floor. A great deal of pressure is unnecessary, as a turn of a large nut applies heavy pressure to the cutting knives. The total weight of this handy tool is only five pounds so that it can be easily carried about in an ordinary tool-kit.

Solderless Connections

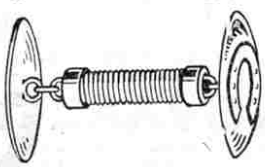
Wireless enthusiasts will welcome this method of connecting wires, which, while giving reliable contact, does not need the application of a soldering iron. The device consists of a brass clip connection with curved sides that act as springs, holding the wires firmly in place. When the two wires are in place they are locked together by means of a nut and bolt as shown. The inventor claims that his new fastener is proof against vibration and that once secured the wires cannot be pulled loose.

Expanding Cuff-Links

In order to save time and trouble connected with unbuttoning and rolling up



the shirt sleeves before washing or tackling a job, an inventor has patented an expanding



form of cuff-link. The two sides are held together by a series of coil springs that stretch to allow the sleeve to be pushed a considerable distance up the arm without having to unfasten the cuffs. The links are easily inserted and are manufactured in several neat and attractive designs.

Stamps for Sale

(See also page 182)

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40 BRITISH COLONIALS FREE
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VICTORIA SERIES of British Colonial Stamps.
Sets of **Australia, Canada, India, New Zealand, Africa,** etc. All obsolete many years ago, and a collection of value in itself. Also mint set of 6 Ukraine Republic (Pictorial). Set of 5 **French Colonies, Danzig, Aeroplane, Nyassa**; 50 grand stamps in all—a real New Year's bargain. Ask to see our Victory Approval Sheets, the last word in quality and cheapness. Application from Collectors in the Colonies particularly requested. Sole Address: **The British & Colonial Stamp Co., 57, Winchester Road, Twickenham, Middlesex.**

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14	,, St. Kitts, St. Lucia, St. Vincent and Montserrat		1/–
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17	,, Gold Coast, Sierra Leone, Nigeria and N. and S. Nigeria		8d.
19	,, Federated Malay States		10d.
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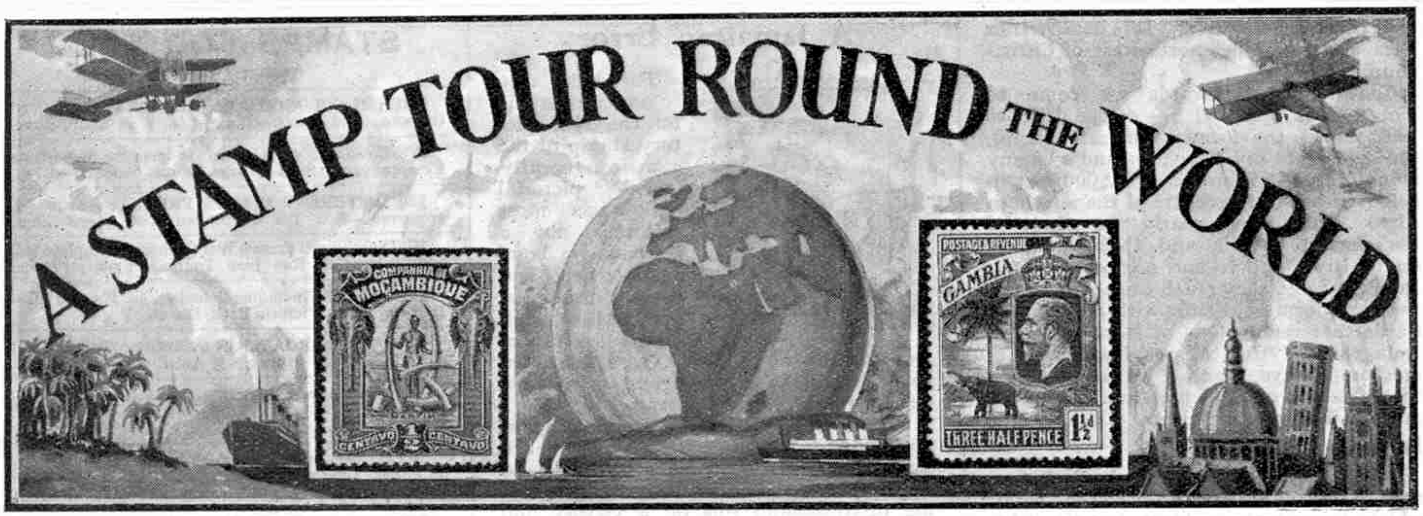


VIII. BORNEO, BRUNEI AND NEW ZEALAND

CONTINUING southwards from Formosa we pass the Philippine Islands on our left and at length arrive at Borneo, the fourth largest island in the world. Our ship passes into Sandakan Harbour on the north-east coast of British North Borneo and waits there while we board our fleet of aeroplanes and fly inland to explore Mount Kinabalu. This is depicted on the 18c. values of the 1894 and 1897 issues and it is interesting to note that as first issued the inscription at the sides of this value of the 1897 issue incorrectly read "Postal Revenue" and that it was shortly afterwards reissued with the inscription amended to "Postage & Revenue." The 24c. value of this issue, showing the arms of the colony, was also the subject of a mistake, for when first issued the words "Postage & Revenue" were omitted. These were inserted and the stamp was reprinted at same time that the 18c. was corrected.

Kinabalu is the highest mountain in Borneo and is the central feature of the range of mountains running parallel to the west coast of the island about fifteen miles from the coast. It is 13,700 ft. in height and is composed of granite and igneous rocks.

The Stamps of Brunei

From here we continue our flight for an additional 150 miles southwards to Brunei, the capital of the small British protected state of the same name with an area of about 4,000 square miles. The issues from 1907 to 1924 show a view on Brunei River where it flows past, or rather under, the city of Brunei. This is the capital of the state and is prettily situated on the river, the houses being built on slender piles composed of palms. Access to the mainland and to the various parts of the town is obtained by means of boat or canoe, although a few neighbouring huts are connected by planks.

Stamps of the type mentioned were first issued in 1907 in a complete series from 1c. to 1 dollar, all being printed in two colours. From 1908 to 1924 single colours were gradually substituted on grounds of economy. In 1922 nine values were overprinted "Malaya-Borneo Exhibition, 1922," and in 1924 four values appeared on the new script watermarked paper. For a design with so varied and recent a history very few copies are seen, owing probably to the small size of the colony's post bag.

The Malaya-Borneo Exhibition Issue

The first issue is now fairly scarce, the

lowest-priced being the 2c. (priced at 1/–) and the highest-priced the 1 dollar (priced at 12/–). Most values are priced the same whether used or unused. The four low values of the next series are quite common but there is a sudden increase in scarcity when the 5c. value is reached. The Exhibition issue is priced low unused at present owing to the small demand but it is very scarce indeed when postally used. The script values are also low in price when unused and used specimens have scarcely found their way on to the market as yet.

A general view of the city of Brunei is shown on the two values of the 1924 issue, the 6c. of which is illustrated here. This value is printed in black, the 12c. being in ultramarine. Both are recess-printed in sheets of sixty stamps on paper watermarked with the script CA and crown and perforated 14.

Brunei formerly included the whole of the northern part of Borneo and the southern part of Palawan, an island now included in the Philippine group. During the last century it has so diminished in size that it is now of little importance compared with the other states of Borneo.

New Zealand

We now return to our ship and commence our long voyage to New Zealand, a distance of over 5,000 miles.

New Zealand was discovered in 1642 by Abel Jansen Tasman, a Dutch navigator who accidentally found the islands when sailing in his boat the "*Heemskirk*." He did not land, however, and it was left for Captain James Cook, whom we have already mentioned in connection with the Cook and the Hawaiian Islands, to be the first white man to set foot on what is now so prosperous a British colony. This was in 1769, and by visiting the islands many times and sailing completely round them he was able to map them out with fair accuracy. In 1825, exactly one hundred years ago, colonization began. The British Government granted home-rule in 1852 and constituted it a Dominion of the Empire in 1907.

Mount Ruapehu and Lake Taupo

Our ship makes its way to Wellington, the capital of the islands, situated on the south-western coast of North Island, and thus near the centre of the group. While still only half way down the western coast of North Island, however, we board our aeroplanes once again and leave the ship so that we may visit Lake Taupo and Mount Ruapehu, both situated close together in the centre of North Island. Lake Taupo and Mount Ruapehu were pictured on the 1d. value (illustrated here) of the 1898 and 1899 issues and the 4d. of the 1900 issue.

Ruapehu is a beautiful volcanic cone, rising to a height of over 9,000 ft. and intermittently active. Northwards of this, Lake Taupo covers an area of nearly 240 sq. miles and is situated in the centre of a plateau covered with pumice. This prevents anything being grown in this district, which, however, attracts large numbers of visitors, for here are the hot pools so beneficial to sufferers from gout and rheumatism.

Reminiscent of the Fjords

From here we turn southwards and passing over our ship, now safely anchored in Wellington Harbour, we continue until we reach Otira Gorge, shown on the 5d. value of the 1898 to 1902 issues. This gorge is the finest in the country and lies on the chief route from the east to the

west coast of the island. It is near Arthur Pass, about 70 miles north-west of Christchurch.

Continuing southwards we come to Mount Cook (½d. and 5/- of the 1898 to 1902 issues, the former illustrated here), the greatest of New Zealand's many mountains. It is well over 12,000 feet in height and is in the centre of the Southern Alps. These cover nearly the whole of the central portion and their branches stretch from end to end of South Island. In many cases they reach the coast on the west and form bold cliffs with magnificent fjords that remind one of Norway. It is from the sea that Mount Cook appears most impressive, for then we are best able to realise its great height and to see its graceful but rugged shape.

Milford Sound

Further south we come to Lake Wakatipu and Mount Earnslaw (illustrated here), which formed the subject for the 2½d. value of the series already mentioned. Wakatipu is 54 miles in length and the chief of the deep lakes that fill many of the mountain valleys. It is somewhat like the letter Z in shape and at the northern end is Mount Earnslaw, a rugged snow-capped mountain over 9,000 ft. in height.

Milford Sound, shown on the very handsome 2/- value of the same series, is on the west coast near Mount Earnslaw. It is the most famous of the many sounds on this coast. In places it is no wider than 500 yards, while the cliffs rise vertically above the calm waters to a height of 5,000 ft. Many streams hurl themselves over the edges of these cliffs and form magnificent waterfalls, the largest being nearly 2,000 feet in height, the second highest in the world.

NEXT MONTH:—

AUSTRALIA AND SOUTH AFRICA

Gibbons' Stamp Catalogue (Part II.)

(Messrs. Stanley Gibbons Ltd., 391, Strand, London, W.C.2).

(Price 10/-, postage 9d. U.K., 1/1 abroad).

Messrs. Stanley Gibbons send us a copy of part II. of their 1925 catalogue, dealing with stamps of foreign countries. The publication of this catalogue has been long awaited by collectors, for nearly three years have elapsed since the last edition was published. In the meantime there has been a very large number of new issues and prices have altered considerably. The new edition no longer excludes the war-time issues of ex-enemy states and the catalogue is therefore of special interest, containing, as it does, all the ex-enemy issues and the enormous number of new issues of the past three years. The catalogue itself has been generally revised and an entirely new list of the stamps of Persia is included. This catalogue is indispensible to all collectors and is used all over the world as a standard book of reference.

It is interesting to know that in future both Part I. and Part II. of Gibbons' catalogue will be published at the beginning of October each year, so that collectors will be able to commence each winter stamp session with a new stamp catalogue before them.

A Jamaican Error

The artist who engraved the die for the 2½d. Victory stamp of the Jamaican recently-issued pictorial issue was most certainly not a Meccano boy! The artist had been presented with a photograph of the "return of a contingent from the war" and instructed to enclose it in a frame and so make a design for a Victory stamp.

Very unwisely, from his point of view, he decided to include a Union Jack in each side panel. But in drawing the left-hand flag he placed it upside-down, thus signifying distress—and this on a victory and peace stamp!

There are several possible reasons for his having done this. One might humorously suggest that the artist was a keen fighter, and was distressed to find the War over at last, or that he was pro-German, and was distressed at the result! Most probably, however, he was not aware that there are correct and incorrect ways of flying the British Flag. Had he been a Meccano boy, he certainly would have known better!

A Curious Mistake

The King Edward issue of the Dominion of Canada is the subject of a most unusual error that was never corrected. As the error was only discovered a short time

before the set was to be withdrawn from sale it was not thought worth while going to the expense of preparing new plates, and thus it is that every copy of all the stamps in the set has the error.

The mistake was made by the designer, and is found in the crowns that appear in the upper corners of the stamps. Heraldry tells us that the crowns on these Canadian stamps are crowns of the pattern worn by queens and not those of the pattern worn by kings. The difference between the two kinds may be easily seen if a King Edward Canadian stamp is compared with a King George Canadian stamp. The crowns in the upper corners of the current issue are kings' crowns, the most obvious difference between the two patterns being in the width.

The dies, from which the printing blocks for these stamps were made, were by Messrs. Perkins, Bacon & Co., and the error in design only goes to show that even a firm well-practised in the art of engraving is liable to make mistakes.

A Useful Stamp Album

We have recently received copies of the Atlas Stamp Album published by Messrs. Stanley Gibbons Ltd. (391, Strand, London). This album, which is made in two styles with paper covers (price 1/-) and stiff boards (1/6), contains 113 pages ruled for stamps. Each page is arranged to take 30 stamps, spaces being included for all the most recent stamp-issuing countries. The first portion of the album is devoted to Great Britain and British possessions, and this section is followed by foreign countries.

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

"Engineering Wonders"

(By Ernest Protheroe).
(The Epworth Press, price 2/–).

This book will interest all Meccano boys, for it tells of many engineering achievements in which they are particularly interested. It includes a chapter on railroad engineering, describes railways at home and abroad, and also train ferries. Types of bridges are dealt with also and some account of famous bridges is given, including the Tay, Forth and Tower bridges. Tunnels, Canals, Reservoirs and Barrages are also described, and Docks, Harbour-works and Lighthouses. The last two chapters deal with girdling the earth by means of submarine cables and land telegraph lines and Power and Speed. Altogether a very readable little book.

"Wireless World and Radio Review"

(Wireless Press, London. Price 4d. weekly).

The contents of the *Wireless World* during the past month have been even more interesting than usual. For instance, No. 290 contains an interesting description of the new home of the London Broadcasting Station on the roof of the Selfridge Building in Oxford Street. In this issue also Mr. F. H. Haynes continues his articles on making an all-range receiver and there is a well-illustrated article on the ideal set for long range reception. In the following issue Mr. Haynes describes the building of a loud-speaker set, specially designed to eliminate distortion, and Mr. R. D. Bangay contributes an article for the special guidance of beginners, in which he explains the purpose and action of the wireless detector and describes the process by which aerial currents actuate telephone receivers.

"Conquest"

(Iliffe & Sons Ltd., London, 1/– monthly).

The most attractive feature of the March number of "*Conquest*" is an article by Dr. J. H. Fleming on hydro-electric supply stations in Switzerland. This article, which is to be continued next month, is written in an attractive non-technical style and is excellently illustrated by photographs. The preparation at the London Hospital of gut for the use of surgeons in stitching up wounds is a remarkable instance of the excellent results that may be obtained by persistent scientific experiment, and the two pages in which the Editor describes this enterprise are all too short. Other articles of particular interest deal with St. Paul's Cathedral; the banana industry, the mainstay of Central America; and with the dangers of non-scientific frontiers, which are so often the cause of serious national enmity.

New Baltic Tank Locos—(*cont. from p.* 159)

particularly is a British development, and in this field the L.M.S. is especially well represented, having 29 such engines of four different designs.

Baltic Tanks in the United Kingdom

In this country the first "Baltic" tanks to be built were in 1913, for the London Tilbury and Southend Railway, now incorporated in the L.M.S., and a number of these engines are working to-day between St. Pancras and Bedford. The London Brighton and South Coast Railway followed in 1914 with its handsome "Charles C. Macrae" class, whilst in 1921 the Furness Railway turned out some similar engines, but smaller in size and noteworthy in being the only examples of their class to have inside cylinders and no superheaters.

In 1922 the North British Locomotive Company built for the Glasgow and South Western Railway six "Baltics" of great size, and these cope very successfully with the heavy Clyde Coast traffic running out of Glasgow.

Finally, in March 1924 appeared the first of the Horwich "Baltic" Tanks, unique in having the 4-cylinder arrangement.

The name "Atlantic" was given to the 4–4–2 type, because the first engine of that arrangement to be built, ran between Camden and Atlantic City in U.S.A.—hence the "Atlantic." The first 4–6–2 engines appeared simultaneously on the West Australia and New Zealand Railways, and the type became known as the "Pacific." This term was singularly appropriate in that, continuing marine nomenclature, it also gave a clue to the place of origin of the type. The first 2–8–2 engines were built in America for use in Japan, and for this reason the name "Mikado" has been identified with this wheel arrangement ever since.

Electricity—(*continued from page* 175)

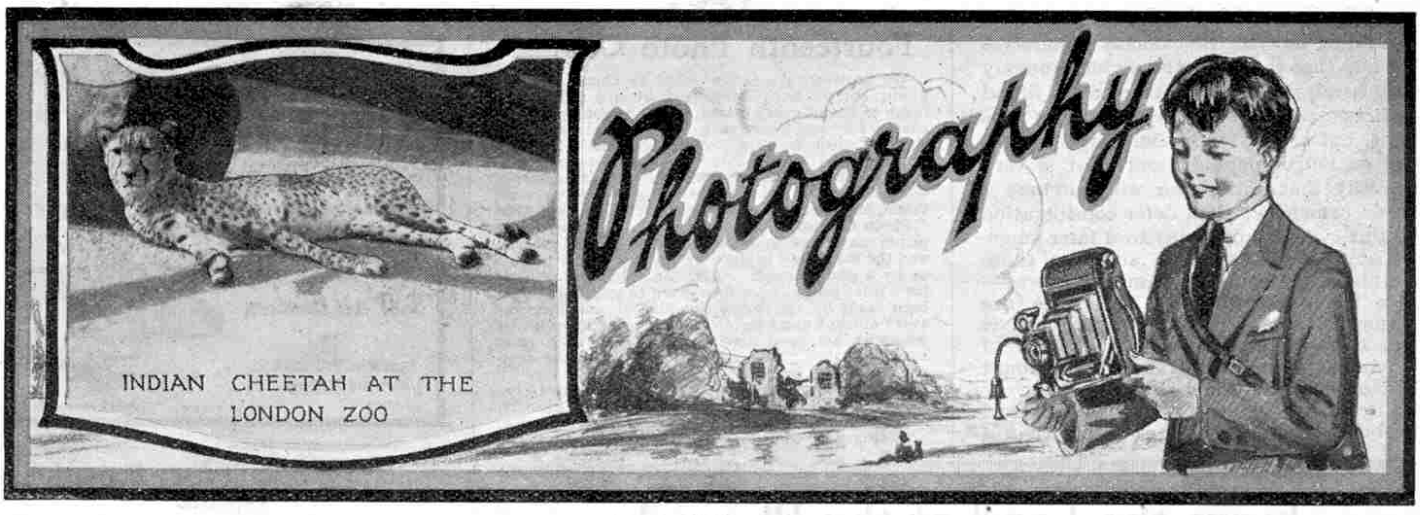
A, Fig 6, pivoted between the poles of two electro-magnets. On both sides of this armature A are contact screws CS, and according to the direction of the current flowing in the coils the armature touches one or other of the contact pieces. In Fig. 6 no attempt is made to show the actual arrangements of the magnets, these really being upright to save space and to shorten the yoke Y.

Fig. 7 shows the connections at one station for double-current working and at R is seen in plan a view of the relay with the connections to the various terminals. The same instrument is used in several circuits. The armature A, Fig 6, is not usually itself a permanent magnet, but its magnetism is induced by a large permanent magnet placed close by. This arrangement is adopted on account of the fact that small permanent magnets are liable to have their polarity reversed by lightning.

How the Circuit Works

The electro-magnets of the polarized relay have two coils of wire wound on each. These are shown in Fig. 7, where the thick line passing round both bobbins from terminal A to terminal F represents one winding and the thin line from E to G represents the other. Terminals F and G are joined by a brass strip. The connections for B, C and D are clearly shown.

NEXT MONTH:—
Simultaneous Messages on One Wire

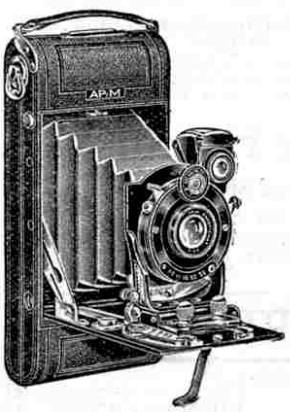


I. The Choice of a Camera

ALL through last Spring and Summer we were receiving almost every day requests for a Photographic Page to be included in the "*M.M.*" We were quite willing to include such a page but owing to pressure on our space it was impossible at that time. This year, however, the increase in the number of our literary pages has relieved the pressure to a certain extent and this month we commence Photography as a regular feature. In our future issues we shall deal with all branches of photography, commencing in this issue with some information on the "Choice of a Camera."

Recording Holiday Memories

There can be no doubt as to the great value of photography as a hobby. In one respect, indeed, it is unique, for it is not only a hobby in itself, but it may be applied with great success to almost every other hobby. Indeed, photography is a necessity in many hobbies and in many branches of work also, so that a boy who makes himself thoroughly familiar with the various photographic operations and processes may find this knowledge of the greatest use to him in later years.

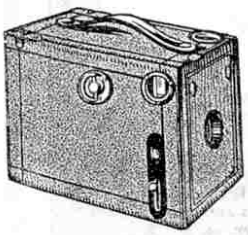


Folding Camera for Films

The range of possibilities within reach of a fairly successful amateur photographer is almost unlimited. His hobby enables him to make permanent records of his friends and of the happy days spent with them, either at home or when out cycling or walking, or perhaps on a holiday at the seaside or elsewhere. By means of his camera a photographer is able to bring home at the end of a holiday a record that is not only permanent but actually grows in interest as time passes. Without these photographs the memories of a holiday become dimmer and dimmer and finally fade away.

Make Your Hobby Pay

It may be as well to refer here to one objection frequently made against photography as a hobby, and that is its expense. As is the case with almost every other hobby, photography costs money, because various things have constantly to be bought. Photography costs as much as it is allowed to cost, however, and no more, and expenditure can be regulated to a minimum, especially with small cameras.


Box Camera for Films

Further than this, an alert photographer who turns out fairly good work can find many opportunities for making a few shillings by means of his camera, and such sums go a long way towards making the hobby self-supporting. Sometimes his parents or some friends want to be photographed, or sometimes a cricket or football team ask him to take their photographs. Occasionally also the amateur may have a print accepted by some weekly or daily newspaper, and in all these ways pocket money may be made towards the expenses of the season.

Plates or Films

At one time the choice of a camera was an easy matter, but to-day the range of cameras available is so wide as to bewilder the beginner, unless he has an experienced friend to advise him.

First of all the would-be photographer must decide whether he will use plates or films. During recent years roll films have become more and more popular, and to-day there are undoubtedly tens of thousands of photographers who have never used anything else. The difference between films and plates lies in the fact that in one case the sensitive emulsion is supported on a base of celluloid, and in the other case upon glass. The lightness and portability of films enables a large supply to be carried when necessary on a photographic outing, whereas a similar number of plates would not only be bulky but very heavy. Roll films have also the great advantage of being easily loaded into the camera, and unloaded after exposure, in full daylight, whereas a dark-room is required to change plates. The development of films and plates also differs in many respects. Some cameras are equipped for using both plates and films as required, and these are certainly useful. The choice is largely a matter of personal taste, for if properly used there is nothing to choose between films and plates so far as the quality of the respective results is concerned.

In addition to roll films there are also flat or cut films which, in the form of the Film Pack, combine to some extent the advantages of both films and plates. Flat films are not used, however, to anything like the same extent as roll films.

Size of Camera

Another matter to be decided before the camera is purchased is the size of plates or films to be used. In the days when glass plates had the field to themselves the most popular sizes for amateur work were ¼-plate ($4\frac{1}{4}'' \times 3\frac{1}{4}''$) and ½-plate ($6\frac{1}{2}'' \times 4\frac{3}{4}''$). Comparatively few amateurs now use the ½-plate size, and the most popular sizes to-day are ¼-plate and $3\frac{1}{2}'' \times 2\frac{1}{2}''$. Film packs are generally used in sizes varying from $2\frac{3}{8}'' \times 1\frac{3}{4}''$ to $5'' \times 4''$, but of course there are many other sizes. Perhaps the widest range of all, at any rate in small sizes, is obtainable in roll films, and there are several intermediate sizes between $2'' \times 1\frac{1}{2}''$ and $4\frac{1}{4}'' \times 3\frac{1}{4}''$. Larger sizes, with the exception of postcard, are not very extensively used by average amateurs.

One of the recent developments in photographic apparatus has been in the direction of the so-called "vest pocket" camera. Certainly rather a large vest pocket would be necessary to accommodate some of these cameras, but none the less many of them are exceedingly small and very fascinating to look at and handle. The beginner, however, would do well to avoid these very small cameras, as a considerable amount of experience is required to get the best results from them. Generally speaking the most useful sized camera is the ¼-plate for plates and $3\frac{1}{4}'' \times 2\frac{1}{4}''$ for films.


Vest Pocket Camera for Films

Coming now to the cameras themselves we find that these may be divided roughly into hand and stand instruments. Stand cameras were used exclusively at one time, but except for special purposes they are no longer popular, and as it is very unlikely that a beginner will purchase a stand camera we shall defer consideration of this type of apparatus to a later stage.

Cameras for roll films and also those for plates are made in two main patterns—box form and folding. As a rule the former type is cheaper, and although it has certain limitations it is capable of producing first-class work. If the amount of money to be spent on the camera is very limited, the beginner is strongly advised to buy a box form camera rather than a folding one, because the greater complexity of the design and construction of the folding camera makes it necessary to pay a good price if the instrument is to be of any use. The box form on the other hand is so simply designed that it can be turned out in large quantities at a cheap rate without the sacrifice of any efficiency.

A folding camera of good quality, either for roll films or for plates, is probably the most useful all-round instrument. It is impossible to give any definite idea of the cost of such a camera as, quite apart from the quality of the camera itself, this depends to a very great extent on the type of lens and shutter fitted.

It is a good point to buy British-made cameras. There are manufacturers in this country who turn out excellent cameras, so that there is no necessity for purchasers to buy foreign-made apparatus.

The three Cameras illustrated in the previous page are made by the A.Pe.M., who are presenting free a fine booklet to all Meccano readers interested (see advertisement on page 184).

NEXT MONTH:—

LENSES AND SHUTTERS

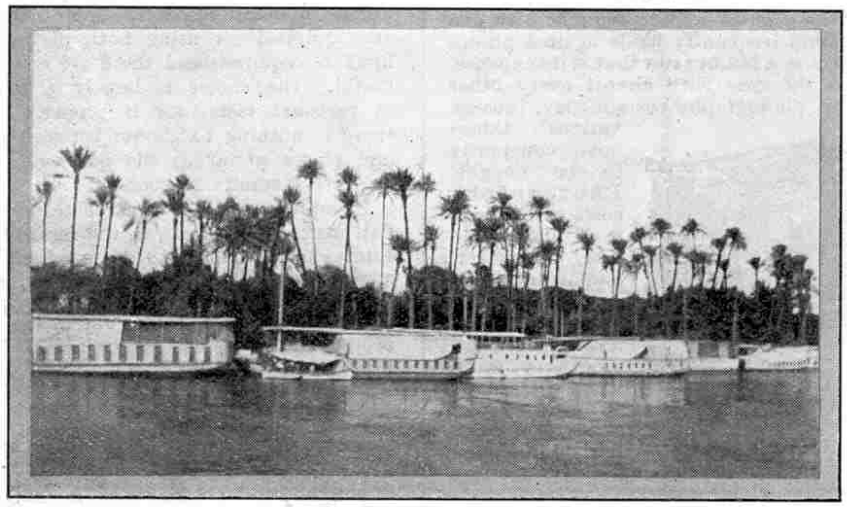
Fourteenth Photo Contest

We have always endeavoured to choose for our photo competitions subjects that are within the reach of almost every reader, and this month we have chosen for our Fourteenth Contest a subject that should appeal to every photographic reader without exception. This subject is "MY BEST PHOTOGRAPH." Each competitor should look through his negatives, select the one that he thinks is the best he has ever taken, and send in a print of it, marking his envelope "Photo Contest" in the top left-hand corner. The prints may be of any size and made by any process, and the work may be done by the competitor himself or by a photographic dealer. In the event of a tie for a prize preference will be given to prints that have been made by the competitor himself, and therefore every entrant must state on the back of his print by whom it has been made. In addition each print must bear the name, address and age of the competitor, clearly written.

Four prizes are offered—Photographic goods to the value of £1/1/– and 10/6, to be chosen by the winners, as first and second prizes respectively in each section.

Closing date 30th May (Overseas: 31st August).

From the Land of the Pharaohs



"The Banks of the Nile"

Photo by Aly A. Shawky and awarded First Prize (Section B) in our Tenth Photo Contest

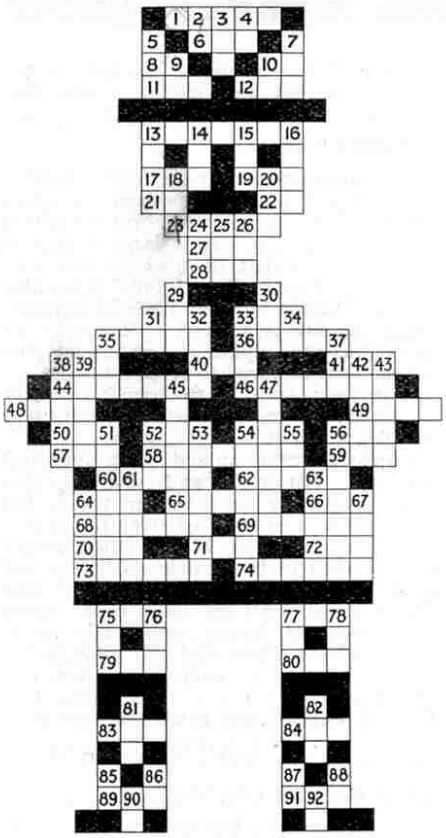
Tenth Photo Contest

OVERSEAS RESULT

Judging by the number of entries received in this contest, photography is as popular as ever with our Overseas readers. The subject of this competition was "A Beach or Riverside Scene," and many extremely interesting photographs were submitted.

In Section A (under 16 years of age), the winner is B. W. Roy, of Calcutta, who has been awarded a Meccano No. 1 Radio Receiver for his splendid snapshot of a bathing scene at Calcutta. The second prize (Meccano Goods value 5/–) was won by D. Morrison, Australia, with an interesting river study. In section B (over 16) a similar first prize has been despatched to Aly A. Shawky, of Egypt, and second prize to Chan S. Fong, of Singapore.

Puzzle No. 77



HORIZONTAL : 1. A hen-coop ; 6. A colour ; 8. A bone ; 10. Preposition ; 11. Refuse coal ; 12. A perennial Polynesian herb ; 13. A load ; 17. To expose hemp to moisture ; 19. A fish ; 21. Personal pronoun ; 22. Denial ; 23. Ghastly ; 27. Spanish word for river ; 28. Eternity ; 31. Juice from fruit of olive tree ; 33. Completely ; 35. South Indian weight ; 36. To choose ; 38. Belgian town ; 40. Decay ; 41. A son ; 44. Construction ; 46. One who sets in motion ; 48. Rolling frame for winding yarn ; 49. Low hill of sand ; 50. To increase ; 52. Established (abbrev.) ; 54. Australian bird ; 56. Induration of the membranes of the eye ; 57. Strong scented ; 58. Water channel between the arena and cavea of a Roman hippodrome ; 59. Concreted sugar ; 60. An Italian town ; 62. Pertaining to a form of colic ; 64. Form of address ; 65. Expel from ; 66. A hindrance ; 68. To please ; 69. A Portuguese coin ; 70. To go ; 71. To cease ; 72. Turf ; 73. Flowers that bloom in late summer and autumn ; 74. Comes in ; 75. A piece of work ; 77. To trouble ; 79. A service-book ; 80. A kind of gin ; 83. An English river ; 84. Goddess of mischief ; 89. A grimace ; 91. Kind of sorcery.

VERTICAL: 2. Denoting presence ; 3. Fan for grain ; 4. Denoting presence ; 5. London Guildhall effigy ; 7. Extinct bird of New Zealand ; 9. Adverb ; 10. Small pacific tree of the lily family ; 13. Mode of being ; 14. Behind ; 15. Kind of boat ; 16. Plant of the arum family ; 18. A fish ; 20. Conjunction ; 24. An English river ; 25. Spanish word for river ; 26. Produced by electrolysis ; 29. Concealed ; 30. Wet soft earth ; 31. Preposition ; 32. A musical instrument ; 33. A food plant ; 34. As far as ; 35. A vehicle ; 37. A small bird ; 38. To show contempt ; 39. A Laplander's sledge ; 42. A leguminous plant with leaves like clover ; 43. To trim ; 45. Began again ; 47. Uproars ; 51. Wide-spreading dominions ; 52. Contraction of ever ; 53. Journeys ; 54. Of either gender ; 55. Practice ; 56. A bull-fighter ; 61. Decision ; 63. To use wrongly ; 64. Tale in Iceland literature ; 67. Things long and slender ; 75. Striking-face of a steam hammer ; 76. Inclined hutch for washing ore ; 77. Any distinctive doctrine ; 78. Dry stalk of hemlock ; 81. Well-known tool ; 82. Genus of small American lizards ; 85. Part of verb to be ; 86. Aloft ; 87. Preposition ; 88. Chinese mile ; 90. Gold ; 92. Of minor importance.

April Puzzle Competition

First Prize : Meccano Goods value £1:1:0
Second Prize : Meccano Goods value 10/6
Third Prize : Meccano Goods value 5/–

EVERY reader who wishes to enter for this competition must send in the solution of the Cross Word Puzzle No. 77 together with the solutions of *four* other puzzles selected from this page. An original Cross Word Puzzle is not required.

Closing date—31st April.

Answers to Last Month's Puzzles

No. 69.

No. 71. 1. Swallow ; 2. Jay ; 3. Puffin ; 4. Chaffinch ; 5. Moorhen ; 6. Heron ; 7. Robin ; 8. Kingfisher ; 9. Wren ; 10. Nuthatch.

* * * *

No. 72. The fish was 6 ft. long ; head 9 in. ; tail 27 in. ; back 36 in.

* * * *

No. 73. The handkerchiefs cost the draper 3½d. each.

* * * *

No. 74. Hay ; say ; sad ; dial ; solid ; load ; lad ; sail ; the whole ; holidays.

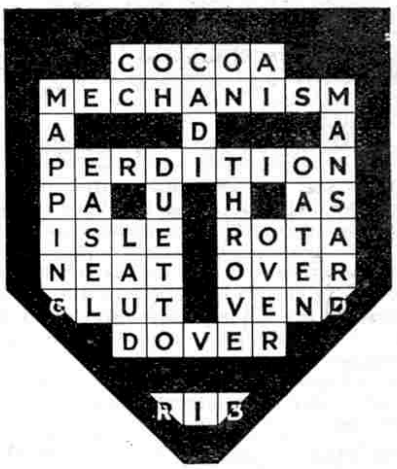
* * *

No. 75.

CANDID
OSTLER
WOOLLY
PALLID
ENGAGE
RATTAN

No. 76. The figures were 1, 2, 3, 4, 5, 6 ; or one tooth, Ree, for 5/6.

No. 70.



Puzzle No. 78.

The names of several familiar flowers are hidden in the following story :—

"Stop ! stop ! ink will stain your coat" said tabby. "I don't care. Oh, what larks !" purred the little white cat, trying to jump on to the table where were bread and butter, cups and saucers, as well as an inkstand. Tabby shut her mouth with a snap. "Dragons, or even wild boys shall not make me speak again," she thought. "If that beautiful jug, full of cream fresh from the cow, slips down, I will not stir a paw." The little white cat, looking sedate and prim, rose to reach the ink, but she did not speed well in her venture. The bottle broke, and on to pussy's coat of snow dropped a sable stream.

* * * *

Puzzle No. 79.

"How many miles did you motor yesterday and the day before ?" inquired Mr. Brown of his neighbour. The neighbour replied : "The number of miles I motored yesterday was the number I motored the day before with the figures reversed, and the difference is one-eleventh of their total.

How many miles did Mr. Brown's neighbour motor on each of the two days ?

Puzzle No. 80.

On a farm in France there were working 100 men, women and children, and they received altogether 100 francs for their work. Each man received five francs, each woman one franc, and each child one-twentieth of a franc. How many men, women and children were at work ?

* * * *

Puzzle No. 81.

HANNAH
HANNAH
HANNAH
HANNAH
HANNAH
HANNAH

It is required to find how many times "Hannah" may be found in this square. Counting is allowed backwards and forwards and diagonally or "zig-zag," but the same letters cannot be repeated in the counting until the word is made. The result will surprise our readers.

* * * *

Puzzle No. 82.

Arrange the numbers 1 to 25 inclusive in the form of a square so that the total of each line, horizontal, vertical or diagonal, will be 65.

The Story of Metals

III COPPER.

LAST month we dealt with the mining of copper ore in various parts of the world, and now we come to the processes through which the ore must pass in order that the metal may be obtained.

The chief ores used in the extraction of copper vary greatly in composition, but may be divided roughly into three classes when considering the means to be adopted for obtaining the metal in a pure state.

The first class includes the ores mined near the surface of the ground, such as ruby ore and malachite. These ores are made up largely of metallic copper and oxide or carbonate, with very little iron or sulphur.

The second class, found at a lower level, includes ores containing sulphur, such as copper pyrites and purple ore, and those containing both sulphur and iron in various proportions. It is curious that the ore chalcopyrite, which gives the best yield of copper, is almost always found at the bottom of a "lode" or deposit.

In the third class are those ores that contain only a small percentage of copper, but which can be worked profitably by cheaper methods so as to obtain copper compounds or even the metal itself.

The presence or absence of sulphur in the ore largely determines the method to be applied in extracting the metal. Most of the copper used throughout the world is got from copper pyrites and chalcopyrite, but the removal of sulphur and iron makes the process both difficult and tedious.

The Blast Furnace

In working ores made up of metallic copper with oxide and carbonate, the blast furnace is used in the same way as for the smelting of iron. The ore is charged into the furnace with coal which combines with the oxygen in the oxide to form the gas carbonmonoxide. In this way the copper oxide or carbonate is reduced to the metal, which collects in the bottom of the furnace and is drawn off at intervals. Any sulphur present is burned away and the iron is removed by forming a slag with silica, which is added if necessary.

The illustration on the next page shows a small circular water-jacket copper furnace, and the diagram below that illustration depicts a vertical sectional view of it. The jacket is made of the best "flange" steel, the sheets being either riveted or welded together as preferred, and fitted with tuyères, the latter serving the same purpose as in the blast furnace for iron described in our June 1924 issue.

The jacket is surrounded with a removable wind-box to which the blast-pipe is connected. This arrangement ensures equal distribution of the blast to each tuyère and hence the perfect delivery of air to every part of the charge, thereby producing a very uniform melting zone. The tuyères are entirely within the water space of the jacket and are thus protected from the action of the heat, so that they do not burn out or cause any trouble whatever. Peep-holes with removable mica coverings are placed in the wind-box opposite the tuyères. Water-jacket furnaces of this type have the advantage of simplicity, strength, perfect water-circulation and high capacity, and they will run for months without a stoppage.

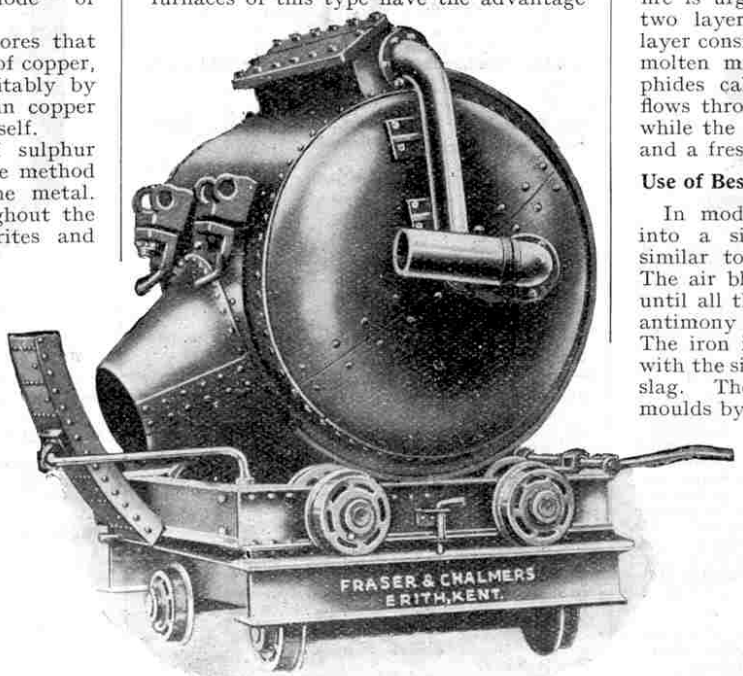


Photo courtesy [*Messrs. Fraser and Chalmers, Erith*

Hand-tilted Copper Converter

"English" Process

The most important method of extraction is the "English" process, by which the metal is obtained from ores containing sulphur and iron. If a large excess of sulphur is present it must be removed, and this is done by "calcining" or burning the ore either in kilns or in special furnaces. Once the fire is started little fuel is required, as the sulphur in burning supplies all the heat required to calcine the ore.

The next step is to concentrate the ore—that is to reduce the bulk as much as possible without loss of copper.

Calcined ore is mixed with unburned ore and limestone and charged into a reverberatory furnace, in which the flames from the fire pass over the charge spread out on the bed of the furnace as described in the article on "*Iron and Steel*" in our issue for June 1924. The fire is urged until the mass melts, when two layers of liquid form. The upper layer consists of iron slag and below it is a molten mixture of copper and iron sulphides called "matte." The slag overflows through a hole in the furnace wall, while the matte is tapped off at intervals and a fresh charge is added.

Use of Bessemer Converter

In modern practice the matte is run into a silica-lined Bessemer converter, similar to the converter used for steel. The air blast is turned on and continued until all the sulphur and any arsenic and antimony present have been burned off. The iron is converted to oxide and this, with the silica of the furnace lining, forms a slag. The copper is then poured into moulds by tilting the furnace.

In works where a Bessemer plant cannot be afforded, the treatment of the matte is carried out by mixing it with roasted ore and silica, and heating with a current of air in a reverberatory furnace. This burns off the sulphur and removes the iron as a slag just as in the Bessemer converter.

When the process is finished the molten metal is drawn off and flows into moulds or into small pits in the floor, forming "billets" or ingots when cold.

Wet Processes

Where the percentage of copper in the ore is low, the foregoing methods cannot be used as they are too expensive, but by employing a wet process the copper can be obtained with profit.

In the most commonly used wet process the ore is ground with common salt or sodium chloride, and the mixture roasted in a furnace. When cool the mass is extracted with water and a solution of copper chloride is obtained, from which the copper salt may be obtained by evaporating to dryness, or the metal may be deposited by throwing scrap iron into the solution, when the copper forms a coating on the iron.

Refining by Electrolysis

As a result of the introduction of electricity into chemical processes the copper is now separated by electrolysis, as this process is much simpler and gives a pure product. In each of the processes already described the resulting metal is always impure because the ores used contain many substances beside copper, including arsenic, antimony, lead, silver, gold and nickel in varying quantities. The first two are got rid of along with the sulphur in the furnace, but the others remain in the impure metal. The quantity is usually small, but in the electrical method of refining the gold and silver are recovered and form a valuable by-product.

In refining by electrolysis a thin sheet of pure copper called the "cathode" is suspended in a vat containing copper sulphate solution, and is connected to the negative pole of a dynamo. The ingot to be purified is also suspended in the solution, but it is joined to the positive pole of the dynamo, forming the "anode." When the current is switched on the copper in the ingot slowly dissolves and forms copper sulphate, while copper is deposited as metal on the thin copper cathode. Finally the whole of the copper is deposited on the cathode in a pure form and a solid block of metal results.

The quantity of electricity sent through the solution must be very carefully regulated so that only copper is deposited on the cathode, the impurities falling to the bottom as a sludge which contains the gold and silver, together with lead. The iron and nickel go into solution as sulphates, but are not deposited so long as any copper remains in the solution in the vat. The sludge is sold to works specializing in the extraction of precious metals.

The metal obtained by the electrolytic process is of excellent quality, and as it is of the highest degree of purity it can be used for every purpose without further treatment.

Courtesy [*Messrs. Fraser & Chalmers, Ltd.*

Copper Blast Furnace, circular type

Copper Alloys

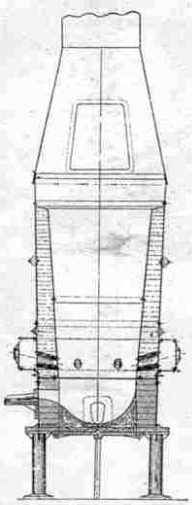
We have now seen something of the history, mining and extraction of copper, but our account of this metal would not be complete without reference to some of its important alloys such as brass, bronze, gunmetal, etc.

Brass, its History and Preparation

Brass is an alloy of copper and zinc in various proportions. The word brass occurs fairly frequently in the Bible from the time of Job onward, but it is almost certain that the metal there referred to is bronze.

There is no evidence that brass, as we know it, was in use before the time of the Romans. The Romans used a metal called "*oricalchum*," which apparently possessed the composition and properties of brass, and as the Roman Empire was extended by conquest after conquest, so the knowledge of the art of preparing this alloy spread throughout Europe.

In Great Britain the earliest traces of brass occur in the mediæval "brasses" found over the tombs of people who were prominent in the ecclesiastical, military or civil world. Proof that brass was being manufactured in England at the time of Henry VIII. is furnished by an Act of Parliament which prohibited the export of the metal, under very severe penalties. It is interesting to learn that this prohibition was not withdrawn until 1739. From the time of Queen Elizabeth the production of brass extended steadily and by 1721 it was estimated that the brass industry employed about 30,000 persons.



Sectional Elevation of Copper Blast Furnace

In the preparation of brass the copper is first melted, the zinc and other ingredients being added afterwards. The surface of the metal is covered with charcoal in order to prevent oxidation, and also to assist in the reduction of the copper oxide which is always found to some small extent in ordinary commercial copper. After the alloy has stood in the furnace for some time it is cast into ingots or moulds. If sheet brass is to be prepared, however, the metal is cast into strips which are passed cold through rolls.

The proportions of copper and zinc in brass vary according to the purpose for which the alloy is intended. A large proportion of zinc increases the lightness of the colour, but has the effect of reducing the tenacity and ductility of the alloy. A typical brass consists of from 63 to 72 per cent. copper with 27 to 34 per cent. zinc. The addition of from two to four per cent. of iron gives a very hard and tenacious metal. Brass rod to be used for turning contains a small quantity of lead, which has the effect of preventing the metal from tearing under the action of the turning tool.

Muntz Metal

Muntz metal is a kind of brass containing approximately 60 per cent. copper and 40 per cent. zinc. It can be rolled either hot or cold, and one of its chief uses is for sheathing wooden ships, for which purpose it is considerably cheaper than copper.

Bronze, Ancient and Modern

Bronze is essentially the alloy of copper with tin. The proportions of the two metals vary for different purposes, but a typical bronze, such as is used for bearings for heavy axles, consists of from 80 to 90 per cent. copper, 7 per cent. zinc and from 8 to 12 per cent. tin. Phosphor bronze, which is largely used for the working parts of machines and for telephone wires and wireless aerials, contains a very small quantity of phosphorous, which has the effect of greatly increasing its tenacity and hardness.

The composition of the bronzes of classical antiquity varied greatly at different times, the proportion of copper ranging from 67 to 95 per cent. Analysis of coins shows that the Greeks used an alloy of copper and tin for their bronze coins until about 400 B.C., from which period they began to use lead with increasing frequency. The Romans also used lead in their bronze coins but they gradually reduced the amount of it, and under the Emperors Caligula, Nero, Vespasian and Domitian their coins were of pure copper. Later, however, the alloy with lead was resumed.

Vast numbers of bronze statues were produced by the sculptors of antiquity, but very little of this work remains to-day uninjured. The fragments that remain however show that these castings were wonderfully perfect. The quality of Greek workmanship, for instance, may be gauged from the bronzes of Siris in the British Museum on which a thin plate of bronze may be seen in some places beaten out nearly half an inch until it reaches the thinness of notepaper.

Other Alloys

Gunmetal is an alloy of copper and tin together with small quantities of lead and zinc. This metal requires to be cast very carefully to prevent separation of its constituents and their compounds. Formerly it was largely used for casting ordnance, but is now chiefly employed for making castings for various engineering purposes.

German silver or nickel silver is really a brass containing from 15 to 25 per cent. of nickel. It forms a white, tough metal that takes a good polish, and it is

(*Continued on page* 172)

A Giant Electric Shovel

Rotating Monster that Handles 14,000 cubic ft. per Hour

The keen interest aroused by our previous articles dealing with giant mechanical shovels indicates that these huge implements are very popular with our readers. This is not surprising, for, in addition to their extremely interesting mechanism, there is something about one of these great shovels when at work that suggests a huge giant devouring his prey mouthful by mouthful—a fascinating spectacle !

AMONG the many interesting types of mechanical shovels is the Clère Rotating Shovel, invented and manufactured in France. This shovel embodies a wheel composed of a number of buckets, generally six, forming a solid whole and turning about a fixed axis of rotation. The characteristic feature of the invention lies in the special shape given to the buckets, the edge being specially curved. This permits material to be lifted no matter in what position the shovel may be, whether working laterally to right or to left, or straight forward. Each bucket has its surface curved in such a way that the material is continually sliding towards the emptying channel, and this movement, combined with the rotation of the bucket-wheel, causes the emptying of the material towards the external face of the shovel at the same time as it is lifted above the axis of rotation.

The emptying begins when the bucket is slightly above the axis of rotation and finishes before the emptying edge of the emptying channel has passed the edge of the chute hopper. The material received by the chute hopper is then fed on to a suitable transporter belt.

A Typical Shovel

We are able to illustrate a typical Clère shovel. The edge is of hard-tempered steel—the working part of which is sharpened—and it is riveted on to the buckets. In the case of very hard ground, teeth are added, the shape of which varies according to the nature and composition of the material to be worked. It is claimed for this shovel that it forms an indestructible whole of which no part is subjected to wear on account of friction, and that therefore it has a great advantage over bucket excavators in which the buckets are linked together by shackles and trunnions.

The principal dimensions of the Clère shovel—its diameter and width—are determined by the output per hour demanded of the apparatus. The theoretical capacity of the shovels varies between 700 and 14,000 cubic feet per hour for shovel diameters of from 6½ ft. to 19½ ft.

The evacuation of the material handled by the shovel is effected by means of a transporter of almost any type—a belt of Balata or rubber, a toothed metallic transporter, etc.—travelling horizontally or ascending. When it is necessary to raise material to an exceptional height the total length of the apparatus may be too great, and in certain special cases it may be necessary to empty the shovel by means of chain and buckets.

Wide Range of Movements

The Clère shovel shown in our illustration is arranged as a revolving crane resting on a truck running on an ordinary track. This truck supports the upper part of the apparatus, which essentially comprises two elements, the shovel proper and the transporter belt. The whole of this upper part borne by the truck is capable of being completely rotated, and the shovel itself can be raised or lowered in relation to the ground upon which the truck rests. The travelling movements of the apparatus—the swivelling of the upper part, rotation of the shovel and movement of the transporter—are all mechanically obtained from one motor. The actual raising of the shovel, however, is effected by hand. The control levers are all assembled at a convenient point from which the engineer has a clear view over the whole machine.

The possible methods of working the shovel are very varied. In consequence of the rotating movement of the whole of the upper part of the machine, it is possible to work either in prolongation of the track or laterally to it, which permits of the digging-out of trenches of any desired width.

Work in Narrow Galleries

Another type of Clère shovel is modified by the addition of a second transporter that may be swivelled at will independently of the first one, which is fed by the shovel. This modification has been applied to the Clère machines in order to permit of their use in narrow galleries. The machine advances to the end of the track and digs alternately from left to right, so as to excavate the whole breadth of the gallery. The overhanging earth is made to fall in by hand or by mine according to its hardness. The rear transporter is of sufficient length to permit of the placing of three wagons on each loading track so that work may be carried on uninterruptedly.

For certain purposes it is desirable to get rid of the necessity of using the truck travelling on rails, and this may be accomplished very

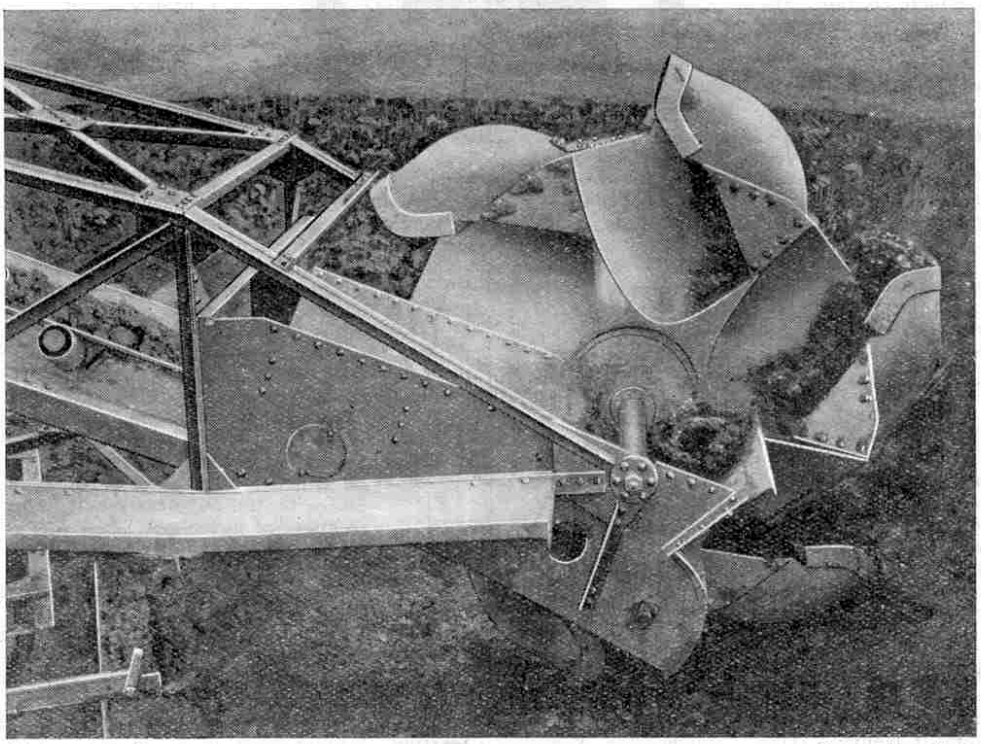


Photo courtesy of [*Louis Clère, Paris.*

Shovel Wheel at Work

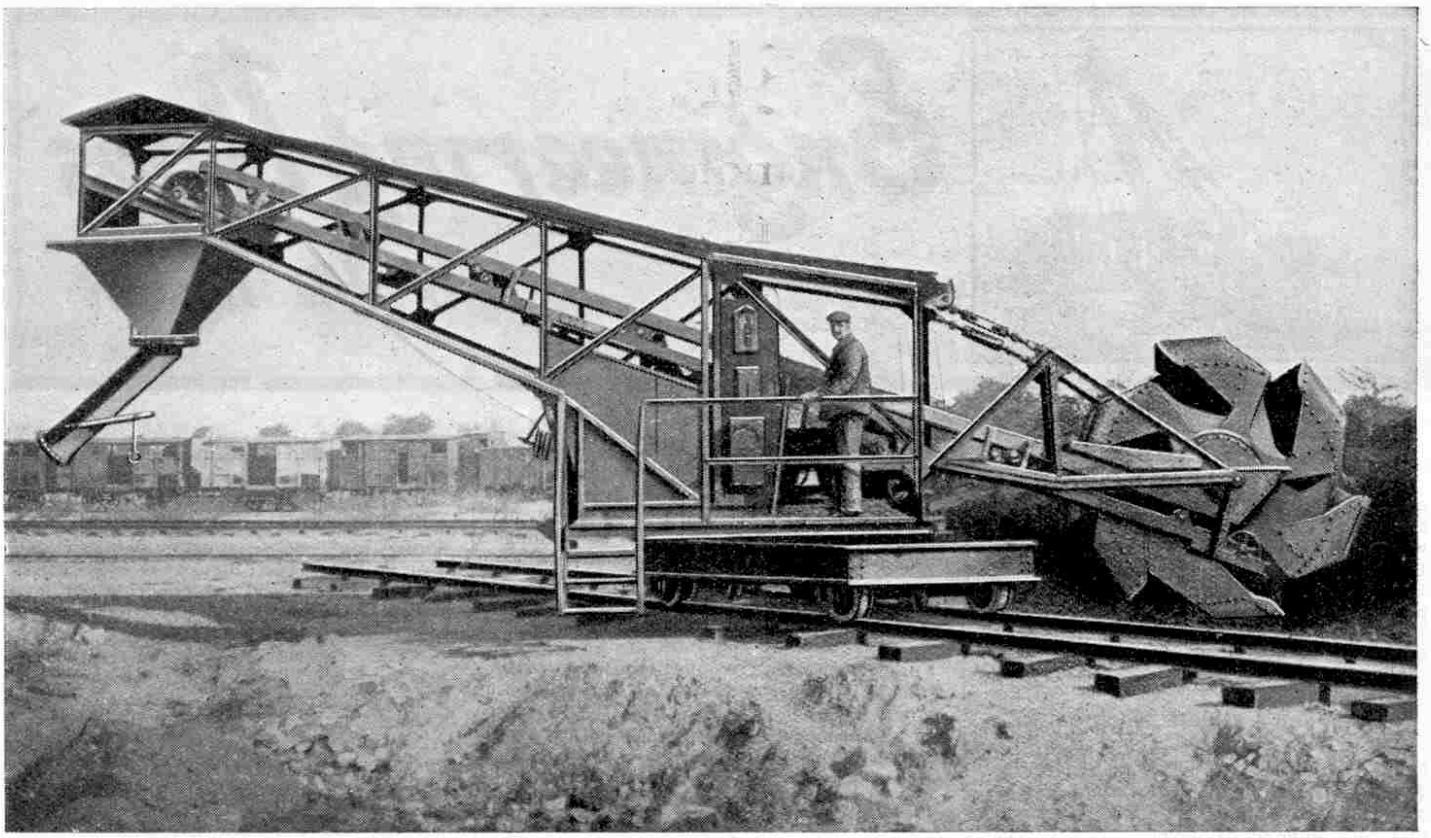


Photo courtesy of] [*Louis Clère, Paris*

A Typical Clère Shovel

effectively by mounting the shovel on a caterpillar in the well-known manner of the "Tanks." Except so far as the method of transport is concerned, the arrangement of the apparatus remains the same as in the type travelling on rails.

Shovel Mounted on Gantry Crane

Large outputs are required in certain kinds of work, such as the construction of canals and railways or in mining operations, and for such purposes the Clère shovel is mounted on a gantry crane. Two men only are required to manipulate this apparatus. The motors working the shovel, the transporter, the winch and the rotating movements of the crane are placed in an upper cabin, while those working the travelling movements of the crane are placed in a lower cabin. The engineer of the lower cabin feeds the compressor and the closing hopper, while the engineer of the upper cabin is in charge of all the other manipulations.

In cases where the apparatus is opposed to a job offering too great a resistance, or has to lift blocks of too great dimensions, safety devices are provided in order to avoid the breakage of the wheel or any other part of the shovel. These safety devices consist of suitable couplings and maximum and minimum releases, which are brought into operation as required.

We are able to illustrate the Clère shovel at work, and our photograph gives an excellent idea of the manner in which it eats its way into the material with which it has to deal.

Lives of Famous Engineers—

(*Continued from page* 161)

architecture. Some idea of the elaborate character of his proposals may be obtained from the following account given by his brother-in-law, Mr. John Callcott Horsley, R.A. :—

"His conception of the towers or gateways at either end of the bridge was peculiarly grand and effective, as may be seen from his sketches still existing. They were to be purely Egyptian ; and, in his design, he had caught the true spirit of the great remains at Philea and Thebes. He intended to case the towers with cast iron, and, as in perfect accordance with the Egyptian character of his design, to decorate them with a series of figure subjects, illustrating the whole work of constructing the bridge, with the manufacture of the materials—beginning with quarrying the iron ore, and making the iron, and ending with a design representing the last piece of construction necessary for the bridge itself. The subjects would have been arranged in tiers (divided by simple lines) from top to bottom of the towers, and in the exact proportion of those found upon Egyptian buildings.

"He made very clever sketches for some of these proposed figure subjects, just to show what he intended by them. I remember a group of men carrying one of the links of the chainwork, which was excellent in character. He proposed that I should design the figure subjects, and he asked me to go down with him to Merthyr Tydvil, and make sketches of the iron processes. We accomplished our journey, and all the requisite drawings for the intended designs were made."

Works Temporarily Abandoned

The Leigh abutment was not completed until 1840, great delay being caused by the failure of the contractors. This delay led to an expenditure far in excess of the original estimates. In 1843 the whole of the funds raised, amounting to about £45,000, were exhausted, and there still remained to be completed the ornamental additions to the piers, half of the ironwork, the suspension of the chains and rods, the construction of the flooring and the finishing of the approaches. Great efforts were made to raise further subscriptions but without success, and in 1853, when the time limit for the completion of the bridge had expired, the works were closed in and the undertaking was abandoned.

Bridge Completed After Brunel's Death

Several proposals for completing the bridge were made in Brunel's lifetime, but it was not until about a year after his death that the superstructure was actually commenced. In 1860 some of the most prominent members of the Institution of Civil Engineers formed a company to carry on the construction of the bridge, on account of their "interest in the work as completing a monument to their late friend Brunel, and at the same time removing a slur from the engineering talent of the country." Work was carried on with great vigour and the bridge was finally opened on 8th December, 1864.

Although we thus see that Brunel did not complete the Clifton Suspension Bridge, his connection with it gave him the opportunity of making a name in his profession. In subsequent years he used to say that his success was due to his victory in the second competition for designs for this bridge.

NEXT MONTH :—

Brunel and the G.W.R.
THE BATTLE OF THE GAUGES

Engineering News of the Month

World's Largest Airship

Rapid progress is being made with the construction at Cardington, Bedford, of the R101, the world's largest airship, which will fly on the Empire air route to India. The engines, seven in number, will burn heavy gas oil fuel, and will produce a total horse power of 4,210. It is expected that the airship's maximum speed will be about 70 miles per hour.

* * * *

London's Oldest Machine

A steam-driven beam-engine at King's Cross (L.N.E.R.) is on the verge of its 120th birthday. It is believed to be the oldest piece of machinery in London still regularly developing power. Every day the old engine is hard at work providing power for the "shop" machinery. "Her action has been much admired by modern engineers," an official said recently, "and never in 120 years has the piston worked more than 1/32nd of an inch out of the vertical." The Company bought her second-hand from a wood sawyer in 1850 for £500, and since then she has always kept up at least a 48-hours' week.

* * * *

New Cement Works

Portland cement is playing such a great part in engineering that it will be of interest to all our readers to learn that the foundation stone of the largest Portland cement works in the United Kingdom was laid at Bevans, Northfleet, last month. The new factory will have a productive capacity of 10,000 tons of cement a week, or 500,000 tons a year—nearly one-sixth the total cement production of Great Britain. The installation of modern plant and the fact that the raw materials are on the spot, will, it is claimed, enable cement to be produced more cheaply at Bevans than at any other works in the country.

* * * *

No Palace of Engineering this Year

We feel sure that all our readers will read with regret the announcement that pride of place in the Palace of Engineering at Wembley is this year to be given to a display of housing, which is being organised by a special Committee. The exhibit will show the practical uses for the various new methods and materials now recommended for the building of houses and side by side with the display of houses will be exhibits devoted to such details as heating, lighting, ventilating, etc.

However interesting a Housing Exhibit may be—and no doubt it will be very attractive in its way—it cannot approach in interest the magnificent display of British engineering products that occupied the same space last year. It is doubtful, indeed, if there has ever been such an exhibit and it will certainly be a long time before we are privileged to see another like it.

It is pleasing to learn, at the same time, that this year the railway companies hope to show in some part of the Palace of Engineering large transport exhibits, which will illustrate the results of 100 years' progress. It is also hoped that there will be a representative display of water transport, in which the most important of the big steamship companies will take part. Further details will be announced on this page as soon as they are available.

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Four new steamers are being laid down at the Baltic Shipbuilding Yards, Leningrad. They will be used by the Soviet Government for the export of timber.

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Tunnelling on Mountain

Work will shortly be begun on a tunnel 16 ft. in diameter and 15 miles in length under Ben Nevis. This tunnel is being cut to carry the waters of Lochs Treig and Laggan to a new powerhouse at Fort William, for the Lochaber hydro-electric project of the North British Aluminium Company. The tunnel will cost something like £1,750,000, and the scheme will find employment for between 2,000 and 3,000 men for over three years. Large works for the production of aluminium, in connection with which extensive electrical energy is utilised, will ultimately be built at Fort William.

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Unroofing a Tunnel

A difficult engineering task is being carried out in the demolition of Chevet Tunnel, on the L.M.S. railway between Leeds and Sheffield. The tunnel, which is over 700 yards in length, is now being unroofed to allow another two sets of metals to be laid between Chevet and Snydale Junction in order to eliminate a very awkward "bottle neck."

The line is one of the busiest on the system, tapping the heart of the Yorkshire coalfield and some 240 trains pass through the tunnel every day. The total length of tunnel that is being widened is three and three-quarter miles.

The work entails the cutting of a passage through nearly 80 ft. of solid sandstone, as the rail level is about 94 ft. below the surface. Giant shields are placed beneath the arched roof to prevent bricks from falling on to the metals.

Flooded Under-Sea Mine

About half-a-million gallons of fresh water have been flowing daily into the Ellington Colliery, Northumberland, from some mysterious source beneath the North Sea. The inrush is completely under control, and, except that 40 men who were in the district when the burst occurred have been removed to other districts, the colliery is working as usual, and output is being fully maintained. Twelve hundred men and boys are employed in the pit, which belongs to the Ashington Coal Company.

It is supposed that this vast quantity of water has been stored in some huge receptacle existing in the strata between the sea and the mine galleries.

* * * *

Mammoth Water Tower

A notable scheme now in hand at Goole, in Yorkshire, is the construction of a ferro-concrete water tower, which will be the largest of its kind in the country. It will have a capacity of 750,000 gallons, against the capacity of 30,000 gallons of the town's present tower.

The new tower is part of a big undertaking to provide new waterworks at Pollington, where three connected wells will be augmented by a new bore-hole, 500 ft. in depth, and 3 ft. in diameter.

The height of the new tower will be about 147 ft. from the ground, and the tank 20 ft. in depth and 90 ft. in diameter. In the base alone there will be 30 tons of ironwork, the total weight being about 4,000 tons.

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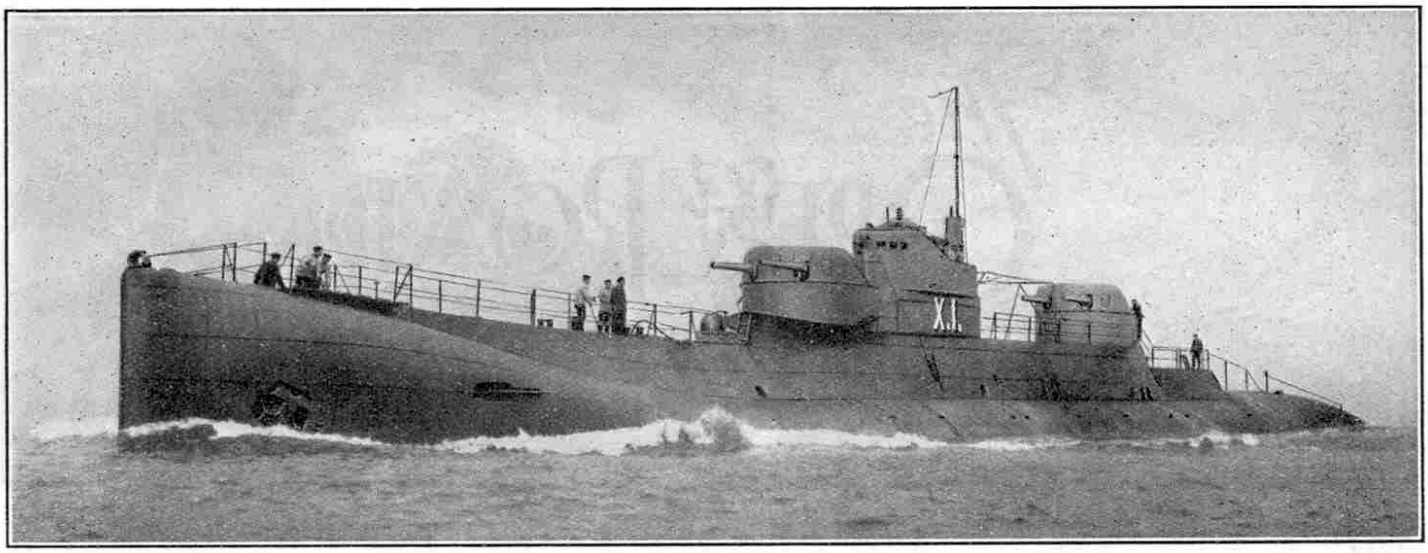
A Sliding Hill

Following on the news of the moving mountain in Wales, it is now announced that two villages—Feetham and Low Row—in Swaledale, North Yorkshire, are in danger of being carried into the valley by the slipping of the hill-side above them.

The main road from Reeth to Kirkby Stephen is threatened, although at present it is still possible to use it. In some places the earth coming down the hill-side to the road resembles waves rolling on to the beach.

The movement is said to have been going on for 35 years, but has only recently become threatening. Perhaps some explanation is to be found in the fact that in Swaledale lead mines are believed to have existed in the reign of King John and the district where the landslide has occurred is riddled with mines.



Britain's New Submarine

Recently there arrived at Portsmouth the submarine X.1, reputed to be the largest and fastest submarine in the world. She is of an entirely new type, and having been built at Chatham in secret, has recently been engaged on tests.

Her dimensions are :—Length 350 ft., Beam 39¾ ft., Draft 17 ft. Her displacement is 2,780 tons on the surface and 3,600 tons submerged. Details as to the construction and performance of the submarine have not been published, but we understand she has a high turn of speed. She is said to have been designed as a commerce-raider, but she would be equally serviceable for many other purposes. She carries a crew of 100, each member of which has been specially chosen for proficiency, because submarines of such length and enormous weight as the X.1 require very careful handling.

Apart from her imposing size, there are several remarkable features, including two turrets, each containing a pair of guns so mounted as to be clear of the water even in stormy weather. The number of her torpedo tubes, and other details, have not yet been officially announced. She is the first submarine to have a canteen on board.

The building of the X.1 is particularly interesting in view of the fact that a German, Professor Flamm, some time ago took occasion to cast doubt on the skill of British submarine designers, alleging that they were baffled by the problem of the construction of large submarines. Professor Flamm himself designed two submarines, one of 4,000 tons and the other—which he called a " diving cruiser " —of over 7,000 tons—neither of which have yet been built.

Other countries are also building large submarines, as for instance the V2, recently built for the United States. This vessel is 341½ ft. in length and of 2,164 tons displacement on the surface. Her speed is 21 knots, and armament one 5" gun and six torpedo tubes. She carries a crew of 80. France is also building two large submarines, " *Vengeur* " and " *Redoubtable,*" each of which has a displacement of 3,000 tons.

Proposed New Bridges

Several new bridges are proposed in the London area, the most important of which is necessitated by the present condition of Waterloo Bridge, to which further reference is made below.

One proposal is for a new bridge at Aldwych, whilst another is for a bridge at St. Paul's. There has been some talk, too, of the possibility of moving Charing Cross Station to the south side of the River. This scheme, which is entirely in the air at present, would be a gigantic engineering task and the expense involved would be colossal. Its completion would, however, make way for a new bridge at Charing Cross, the approaches for which would pass either under or over the Strand. A plan has been put forward for a bridge over the Strand with approaches reaching ground level near the National Gallery. The reason that makes it necessary for any new Charing Cross bridge to pass under or over the Strand is that the influx of cross-river traffic into the Strand would hold up the east and west traffic to such an extent that a bridge on any other plan would be impossible.

* * * *

Waterloo Bridge

The special Committee appointed to report on the bridges of the Thames have recently stated that in their opinion Waterloo Bridge should be demolished. This decision has given rise to considerable discussion, as Waterloo Bridge is one of the best known bridges in the world. The Committee state that they " would have been willing to make sacrifices in traffic improvements to save so famous and beautiful a bridge, but this would be useless. It must now be held as established that the old bridge is worn out and must be taken down to prevent it from falling down."

Waterloo Bridge was built by the famous engineer Rennie, and the special Committee recommend the construction of a new bridge with not more than five arches and of a sufficient width to carry six lines of vehicular traffic.

The Chief Engineer of the London County Council has ordered the closing of Waterloo Bridge entirely from the 1st May to the 30th June to permit the launching of the girders for the large span of the temporary bridge.

* * * *

Coal Transporters for the Sudan

Large engineering projects are being commenced shortly in the Sudan. These include a bridge over the Nile, tramway and waterworks schemes, and the erection of an important coal-handling plant. This latter structure at Port Sudan will comprise four of the largest electrically-driven travelling and slewing bridge transporters in the world. Erected on the " Temperley " principle, they will each have a length of 425 ft., span 215 ft. and lift of 45 ft. above the ground. The transporters will be fitted with high-speed grabs of 2 tons capacity, and will be used for loading and unloading steamers and barges, the coal being either distributed over the storage ground or delivered into the wagons of the Sudan Government Railways. It is claimed that the equipment will form one of the most important modern coaling installations.

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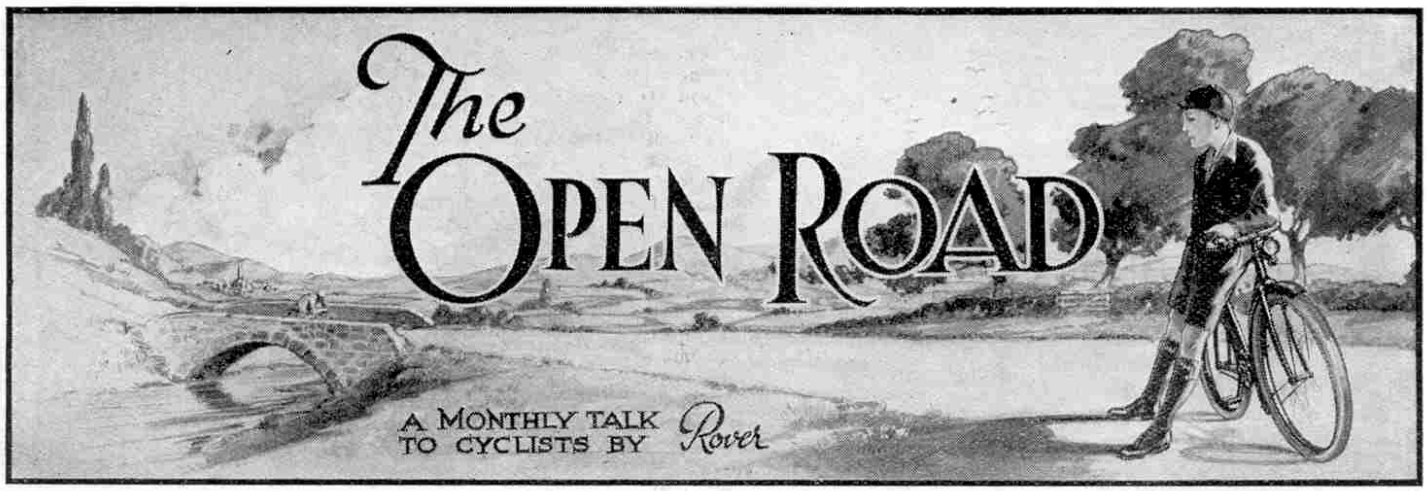
Berengaria's New Record

During the voyage from New York which finished at Southampton on the 6th March, the Cunard Liner Berengaria accomplished the fastest day's steaming of her career. From noon on the previous Sunday to noon the next day she covered a distance of 579 miles at an average speed of over 25 knots. She made the whole crossing at an average speed of over 23½ knots.

* * * *

Canal Drained Dry

In the construction of a culvert through the Trent and Mersey Canal, between Burton and Wellington, an old water-course was disturbed, and started a leakage in the bottom of the canal. In spite of the efforts of workmen, hastily summoned, the leakage rapidly increased until the bottom of the canal gave way. The surrounding fields were flooded and the whole length of the canal was drained dry. The borough surveyor, in conjunction with the canal engineer, at once grasped the importance of the situation (which entailed a fine of £50 a day for each day the canal was closed), and by great energy built up a concrete retaining wall well past the danger zone and thus enabled the canal to be used again.



WE know from our mail bag that a very large number of our readers own bicycles, and it is very evident that an even larger number would like to own them! Many of our readers tell us that they have "great expectations" this spring, and this applies more particularly to those readers who are lucky enough to have birthdays during the next month or two.

A Fine Recreation

Of course, we know that every one of our readers would prefer a motorcycle to a "push-cycle!" It is so much more interesting to sit in the saddle and control an engine than it is to be the engine yourself. However, motorcycles are beyond the reach of all but a favoured few, although in this connection we hope in the near future to give some details of how a motorcycle works and other information for which we have so often been asked. Sitting on a motorcycle becomes very monotonous on a long day's run, and the push-cyclist has the benefit of knowing that he is giving healthy exercise to all his muscles, whereas the motorcyclist must of necessity get off his machine now and again to stretch his cramped limbs.

There is no finer recreation than cycling and it has the benefit of being economical, for beyond the first cost of the bicycle, the machine occasions very little expense and this is chiefly concerned with tyres and such parts as usually wear out. The cyclist too, has a splendid opportunity of gathering a considerable amount of useful knowledge of the countryside, whereas the attention of the motorcyclist is mainly occupied with watching the road ahead and controlling his machine.

A Holiday Tour

Now that spring is here and the days are lengthening, all cyclists are beginning to think of the runs they intend to have in the near future and many are also turning their thoughts towards longer jaunts. They look forward to the time when they can leave home for a few days and enjoy an extended tour in some particularly beautiful part of the country, and those who have already experienced glorious days spent in this manner always feel the call of the open road when the sun is shining.

No doubt, to the majority of our readers the suggestion of an extended cycling tour sounds somewhat of an adventure—and an adventure it certainly is. You map out your tour beforehand, and plan to ride through an unknown country, like some explorer of old. From your maps and guide books, which you will find in every reference library, you get some idea of what the scenery will be like and of the chief objects of interest. So far as you are able you deal with facts, but you can also give your fancy full play. In imagination you can picture the sights you will see. You can think in advance of the delights of the mid-day halt under the cool shade of some woodland trees, and a bread-and-cheese lunch. You know that, if you are fortunate, you will be able to enjoy a dip, during the heat of the day, in some inviting stream or river, or if your tour is planned near the coast, a bathe in the sea.

Whether all your plans bear fruit in the actual tour is another matter, for a good deal—in fact everything—depends upon the weather. If you are sufficiently fortunate to get the Clerk of the Weather in a reasonable frame of mind, however, it is very certain that a cycling tour will afford you endless fun, healthy recreation, and a beneficial supply of fresh air, and you will return home with the feeling that if only the school sports were to be held the next day, you would create some new records in the high jump!

Choosing Your Route

Although Easter is generally a little early for a tour away from home, sometimes a very enjoyable holiday may be spent at this time of the year. Whitsuntide, which comes six weeks later, is better. Certainly the country is then more interesting, for as a rule the trees are bursting into leaf and everything is beautifully fresh and green, giving promise of even better times to come.

In planning a tour the first thing, of course, is to decide where to go. Even this preliminary step is interesting and liable to cause a certain feeling of excitement. Of course, if you are to have company on the tour your friend or friends will have to be consulted as to where the tour is to be. There are many other details to be discussed also—the question of expense, the duration of the tour, the distance to be ridden each day, and such points. It will also have to be decided whether the tour shall start from home or whether the train will be taken to the starting point.

Personally, the writer always favours getting as far away from home as possible and always takes the train from Liverpool to some distant point. On one occasion, for instance, a very enjoyable tour started from York and ended at Carlisle. Another commenced at Bristol and ended at Oxford. Probably, when the cyclist lives in a large town, or in some industrial area, it is better to save the time and energy required to get into the country by taking the train to, say, ten or fifteen miles beyond the outskirts of the home town, if not further afield. So much depends on the actual situation of the cyclist, however, and the funds available.

A Meccano Cyclist

Our photograph shows J. H. Boreham, who is an enthusiastic cyclist and was until quite recently secretary of the Grimsby Central Meccano Club. A Special Merit Medallion has been awarded to him for his excellent work on behalf of his late club and the Guild in general.