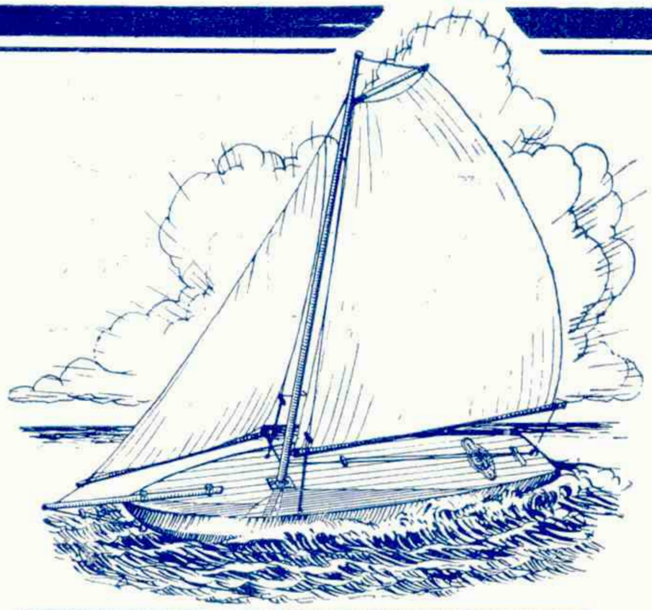
VOL. XII. No 7.

JULY 1927

MECCANO MAGAZINE

Super Dreadnoughts of the Air

(See page 586)



In full sail!

See her swinging down the pond, with every stitch of canvas straining to increase the pace. See her reel slightly under a sudden "roger" and then gather up and away in sparkling effervescence. A Hobbies yacht provides hours of such sport—great fun in any wind, with a boat of which you can be proud. They are well cut and finished in bright waterproof enamel; they will not topple or sink, and are fitted with detachable mast so you can carry and pack them the more easily.

HOBBIES SAILING BOATS

Every boat you see will not always sail. Hobbies Boats are carefully built, properly finished, and guaranteed to sail in almost any wind. When you buy an unknown boat you cannot be sure of good results. But with Hobbies name behind these yachts you are sure of good value, and a sound article. All good stores and toyshops should have them, but don't be put off with any other kind if they have not Hobbies. Ask them to get one for you or send direct yourself to Hobbies.

ACE

Cut from the solid with 14½ in. deck, lined for planking. Hull in two colours with painted mast and spars. Strong water cord lines and white linen sails secured and lashed, and fitted with running lines.

3/6

Post 6d.

WHITEWINGS

A real yacht with hollow hull and large white linen sails. Deck 20½ ins. long, fitted with mast and bowsprit and both detachable. Watercord running lines and strong white sails. Hull finished two colours fitted with a weighted keel and automatic running rudder.

8/6

Post 9d.

SEAGULL

The best boat of all—a wonderful piece of work for the money. Hollow hull, beautifully cut and finished, and fitted with weighted keel and running rudder. The white sails fitted to detachable mast and bowsprit can be set according to any wind, and are held by bowsies on strong water-cord running lines. A beautiful sailer and a fine piece of value.

15/-

Post 9d.

British Boys!
Buy British Goods.

FREE

A neat little wallet of these boats and of steam launches will be sent to any Meccano Boy sending a postcard to Dereham as below.

OBTAINABLE FROM:—

Gamages, Harrods, Whiteleys, Selfridges, Hamleys, and Barkers · C. Lucas and Bunneys (Liverpool), Beales (Bournemouth), Bateson (Blackpool), Dixon (Dublin), Pantoys (Cheltenham), Hobbies Branches at 65, New Oxford St., W.C.; 147, Bishopsgate, E.C.; 79, Walworth Rd., S.E.; 326, Argyle St., Glasgow; 10a, Piccadilly, Manchester; 9a, High St., Birmingham; 214, West St., Sheffield; 89a, Woodhouse Lane, Leeds; 25, Bernard St., Southampton; 68, London Rd., Brighton. Or direct, post extra, from

HOBBIES LTD. (Dept. 96), DEREHAM, NORFOLK
CANADIAN DEPOT : : 385½, YONGE STREET, TORONTO

NEXT MONTH: "WORLD'S LARGEST SUSPENSION BRIDGE." READY: 1st AUGUST (PRICE 6d.)

MECCANO MAGAZINE

Editorial Office
Binns Road
Liverpool

Vol. XII. No. 7
July, 1927

With the Editor

"If I were Editor of the 'M.M.'"

I have been studying the results of the recent competition, in which my readers were invited to send suggestions for improving this Magazine, the idea being for competitors to suggest what alterations (if any) they would make if they had the happy task of editing the "*M.M.*"

Apparently none of the entrants would make any drastic changes, the bulk of suggestions being for either an increase or decrease in the space devoted to certain particular subjects. Whilst from one point of view this is very pleasing, it is not—on the other hand—very helpful. It is obvious, for instance, that those readers who are very keen on aeroplanes and not greatly interested in railways, would, if Editors of the "*M.M.*," fill the Magazine with Air News and descriptions of aeroplanes to the exclusion of all, or almost all, railway articles. When the boot is on the other foot the situation is, of course, the reverse.

Much of the criticism and suggested improvements were made from this point of view, and where there were a hundred readers in favour of a decrease in railway matters, another hundred were equally as strongly in favour of an increase in the same subject. The same remarks apply throughout to almost every subject dealt with in our pages, and I am forced to the conclusion that the magazine is most acceptable in its present form to the majority of readers.

Suggestions for New Articles

Among the new subjects suggested are Wonders of the Heavens, A Tour Round the World, Nature Study, Hygiene, Fishing, Swimming, and Sport. Articles on Chemistry and Conjuring also seem to be in demand.

It would almost seem that some of the would-be editors have been peeping into the drawer where I keep my programmes of future issues, for several of these subjects have since been, or shortly will be, included in our pages. Astronomy, for instance, is covered to a certain extent by our recent articles on the Eclipse of the Sun, and Nature Study we have dealt with on more than one occasion. In our August issue I hope to commence a series of most interesting articles by Mr. Frank Hornby, describing his recent trip round the world. Fishing and Swimming have not yet been dealt with and they seem to be subjects that should be of general interest, but before including them I should be glad to hear from any other readers who would be interested in articles on these lines.

I may say that I am always pleased to receive letters from my readers, especially when such letters offer helpful criticism regarding the "*M.M.*" It is very easy to criticise but general criticism is not always helpful. What is wanted is "constructive criticism"—that is, helpful criticism. Instead of writing to say "I do not like this," or "I do not think that should be included," it is more helpful to an editor to learn *why* the subject is not liked or *why* it should not be included and what should be substituted and why. Any such letters should be addressed to me and marked in the top left-hand corner "Editorial Suggestions."

In the voting contest for the most popular articles that was arranged about the same time, it was interesting to note that Mr. C. J. Allen's articles on "Famous Trains" came out at the top of the list. The second on the list was the series "Exploring the Arctic," and third and fourth, in respective order, were "Famous Engineers" and "The Conquest of the Air." From what my many readers have told me in their letters during the past six months, I think that list is fairly representative of the general opinion.

Romance of Business

Of the many manufacturing romances surely that of the Ford motor-car will go down in history as being one of the most wonderful. Everyone knows the story of how this great undertaking came into being; of the innumerable difficulties in the way of Henry Ford; and of how he overcame them. It was recently announced that on three occasions in the last three years Mr. Ford has received offers of £200,000,000 for his business, and each time he has refused to sell! The fact that these offers have been made has been disclosed by the Wall Street banker who submitted them. Mr. Ford laughed at him, he said!

Mr. Norval Hawkins, formerly sales manager for the Ford firm, and often called "the world's champion salesman," has stated that the Ford profits in the period from the organisation of the company in 1903 to 1919 were over £58,000,000. He stated that Mr. Ford frequently told him that even selling cars at a profit only of £2 each he could make all the money he wanted.

It has often been said that a person or firm cannot prosper without helping other people to prosper also. In the case of the Ford Company, this is borne out by the fact that one agent alone (in Rhode Island) made as much as £1,000,000!

All of which are very amazing figures and "give one furiously to think!"

Sharp Eyes at the "Pictures"

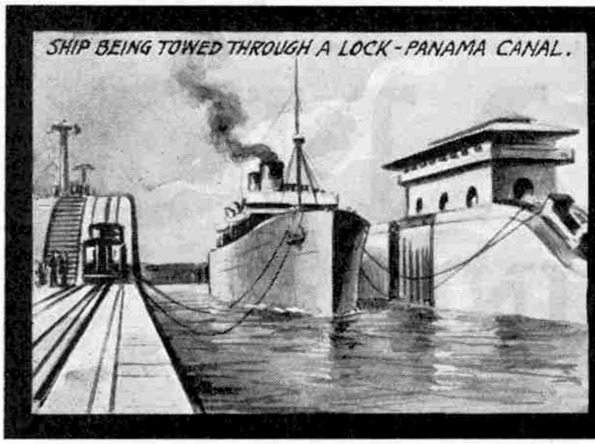
I wonder how many of my readers have detected technical errors when visiting "the pictures." As a rule, pictures are so well produced and so carefully thought out that one must have very sharp eyes and quick intelligence to find any faults. Yet there are times when the producer is badly at fault in some small inattention to detail, as, for instance, in Douglas Fairbanks' "*Thief of Baghdad*"—a wonderful film that almost out-does the magic of Maskelyne. Here a cart-horse is used to represent Pegasus, the winged horse, whereas, of course, an Arab should most certainly have been used for this flying steed. In the film "*The Amateur Gentleman*," a splendid story by Jeffery Farnol dealing with the time of the Georges, one of the actors who takes the part of Jasper Gaunt is seen wearing an aggressively modern wrist watch! Then again in "*Dr. Jekyll and Mr. Hyde*," the police carry "bull's-eyes," and in the "*Sea Beast*," a man performs an impossible achievement in swimming out to a whale and calmly inserting a harpoon in its side!

I shall be glad to hear from any of my readers who notice such discrepancies, and to the reader who sends in the longest list by 31st December next, I will send a copy of my book "*Engineering for Boys.*" Mark your envelopes "Cinema" in the top left corner and explain briefly but clearly the errors you detect. There must be quite a lot actually, but as I have said above, their detection is only brought about by sharp eyes and quick intelligence and it is with a view to encouraging the use of these desirable qualities that I am arranging the little contest.

Eclipse of the Sun

As mentioned on this page last month, we are not able to publish an account of the eclipse in this issue, because we commence printing the "*M.M.*" about the middle of the month prior to publication. The present issue, therefore, was actually printed off before the eclipse took place.

If the weather was favourable and if good observations resulted, we shall give some account of the event in next month's issue, and we shall endeavour to include the results of the special competitions that we arranged in this connection.

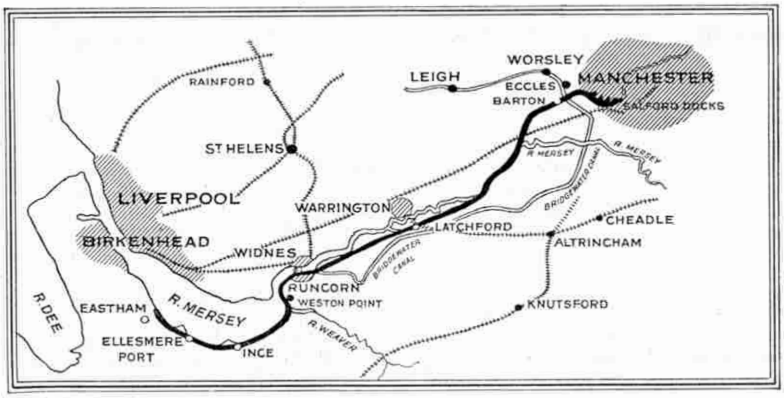


SHIP BEING TOWED THROUGH A LOCK - PANAMA CANAL.

FAMOUS CANALS OF THE WORLD

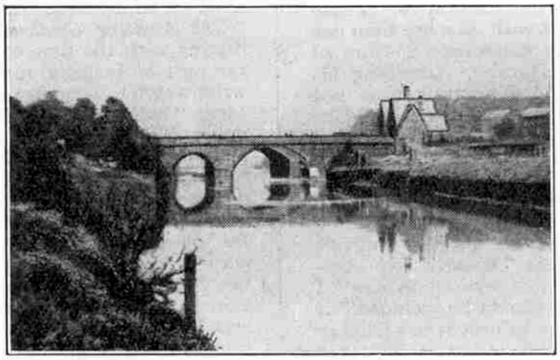
I.—MANCHESTER SHIP CANAL

BRITISH canals of the ordinary type have fallen on evil days and their fate provides a very striking example of the manner in which one means of transport succeeds another, by reason of its cheapness, its speed and general convenience.



Canals came into being as a result of the failure of the roads to meet requirements. At the time when James Brindley, the first English canal engineer, was just coming into prominence, the road system of the country was in a condition such as we can hardly realise to-day. Many roads that provided the only connecting link between towns of considerable importance were difficult to traverse in the summer and during the winter months were either impassable, or at any rate extremely dangerous. At this period the trade of the country was making appreciable headway and it became apparent to all thinking people that some alternative means of transport must be found.

The various rivers of the country provided considerable possibilities, and slowly the public began to realise that the solution of the problem lay in the improvement of these rivers and in the cutting of artificial waterways to connect one river with another and thus bring inland towns into direct connection with the sea. From this time onward one canal after another was cut, and for a long period of years these waterways flourished exceedingly. Then came the railway, and with it the beginning of the end for canals. Year by year, as the railway system of the country extended and developed, less and less traffic was borne by the canals, and to-day many of them are almost derelict, such as the Kennet and Avon canal, which the Great Western Railway would like to give away!



Courtesy] [*Manchester Ship Canal Co.*

Brindley's Aqueduct at Barton

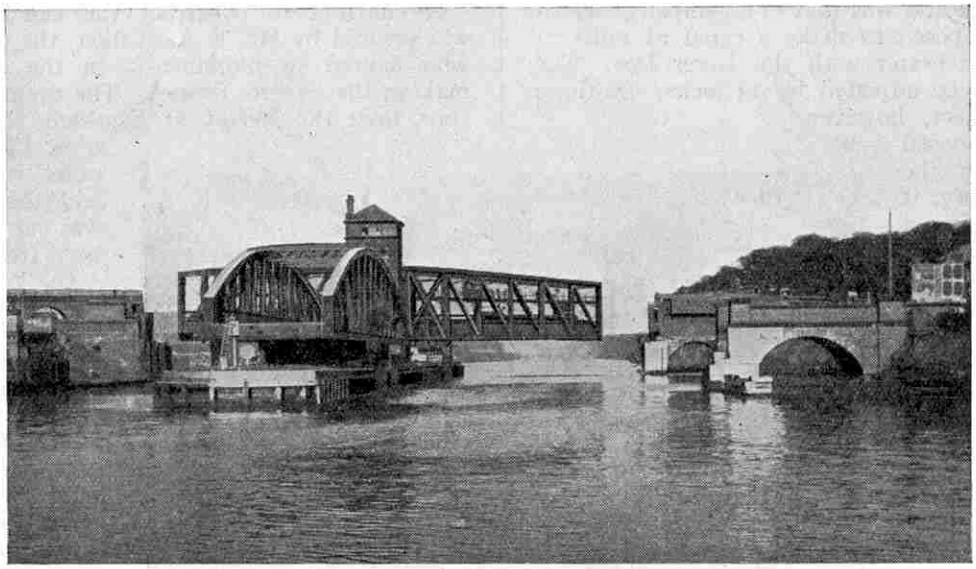
There is one type of canal, however, that stands on a different footing, and that is the ship canal. The essential difference between the ordinary canal and a ship canal lies in the fact that the former is only capable of carrying barges, whereas the latter can be traversed by large ocean-going steamships. One of the most successful ship canals is that which brings great steamships into the heart of industrial Lancashire and places Manchester in the position of a seaport.

Origin of Manchester Ship Canal

The Manchester Ship Canal virtually grew out of a visit of the third Duke of Bridgewater to France. While on his travels the Duke was greatly impressed by the Grand Canal of Languedoc, and the idea occurred to him that it might be possible to cut a canal by which the coal found on his estate could be readily conveyed to Manchester. The more the Duke thought about this idea the more enthusiastic he became, and in 1759 he obtained from Parliament powers to cut a canal from Worsley Mill eastward to Salford, and westward to Hollin Ferry and the Mersey. His next step was to consult James Brindley in regard to the best method of construction.

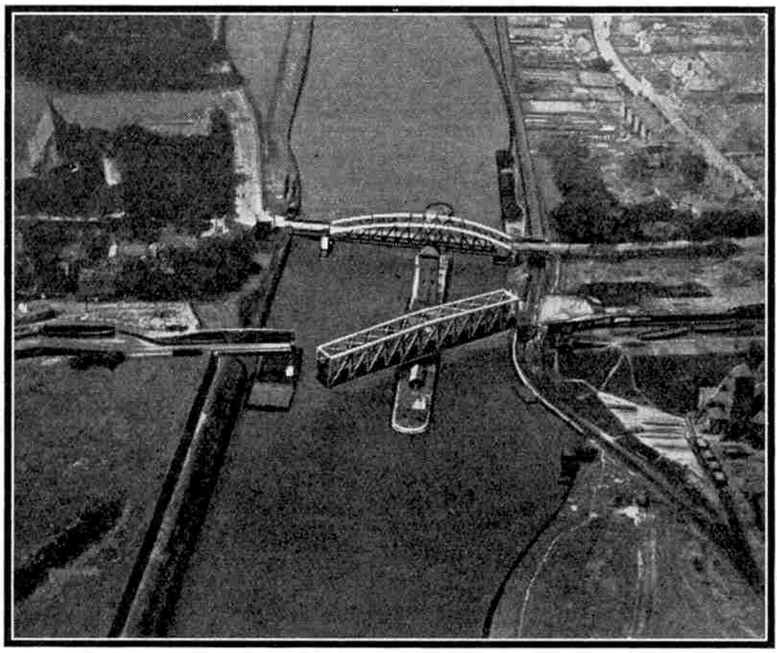
The original scheme had been to carry the canal by means of a series of locks down from the level of the coal mine to the River Irwell and up again on the other side to the proposed level. Brindley did not favour this scheme, however, and recommended that the canal should be carried right over the river and maintained at one level throughout. This was a bold proposition, quite beyond anything previously attempted in England, but ultimately Brindley succeeded in convincing the Duke that this scheme was the best for the purpose. After some difficulty Parliamentary sanction to the revised plan was obtained.

Brindley found his scheme ridiculed on all sides and openly regarded as the idea of a lunatic. The proposed aqueduct was nicknamed his "castle in the air." Criticism did not hinder the work, however. A stone and brick aqueduct 200 yards in length and 12 yards in width was built to carry the canal over the River Irwell, a tributary of the Mersey, at a point about five miles west of Manchester. The centre portion consisted of three arches, the underside of which was 39ft. above the river—sufficient to allow the largest barges to pass underneath without lowering their masts.



Barton Aqueduct as it is to-day, with Road Bridge (open) in foreground
(From the Editor's Book "Engineering for Boys," by permission of Messrs. T. C. & E. C. Jack, the publishers)

The project was successfully carried out and the first boat load of coal passed over the "Barton Aqueduct" en route to Manchester on 17th July, 1761. For a long time the "castle in the air" was regarded as one of the wonders of the country and people from far and near visited it, awed by the spectacle of one boat passing safely over the top of another.



Courtesy] [*Manchester Ship Canal Co.*

Aerial View of Barton Aqueduct and Road Bridge

The canal soon proved of great practical value. In Manchester, then a small but rapidly growing town, regular supplies of coal were received from the Worsley coalfield and retailed at 3½d. per cwt. against the old price of 7d. per cwt. What a contrast to present-day prices!

Linking up with the Sea

Encouraged by the success of his canal the Duke decided to construct a second one, this time extending westward from the existing waterway to some point of junction with the river Mersey. He would then have a means of shipping raw materials of trade from Liverpool to Manchester at a cheap rate, and of initiating what he felt would become a highly profitable enterprise. Accordingly Brindley was re-engaged, plans were duly drawn up and after some opposition had been overcome the consent of Parliament to the scheme was obtained on 4th March, 1762.

The new project presented a host of difficulties not met with in the making of the Worsley to Manchester length of canal, chief of which were the crossing of rivers, brooks and bogs. Sale Moor was the worst bog, as there the bottom was of quicksand. This difficulty was comparable with that faced by George Stephenson some 60 years later when he undertook to lay a railway across Chat Moss. Brindley again favoured a 'dead level' canal, concentrating all the necessary locks at Runcorn, the point chosen for leading the canal into the Mersey.

Five years later the entire length of the canal to the upper part of Runcorn was completed and opened for traffic, but the flight of locks carrying the canal down to the level of the Mersey was not finished until several years later. According to a record left by Brindley, "the gates were opened on December 31st 1772, when the '*Heart of Oak*,' a vessel of 50 tons burden, for Liverpool, passed through them." The cost of the two lengths of canal was £220,000, but the joint undertaking in due course yielded its owner an income of approximately £80,000, per annum.

The opening of the second half of the Bridgewater Canal was very unwelcome to the Mersey and Irwell Navigation Company. The tides of the Mersey were sufficiently high to permit small vessels to reach Warrington, and the Navigation Company had established a narrow waterway by canalising the Rivers Mersey and Irwell from there to Manchester. Their charges for the use of this were so excessive, however, that many merchants welcomed the reasonable freight rates introduced by the Duke of Bridgewater on his canal, and transferred their custom to the new enterprise.

It was the marked success of the Bridgewater undertaking, together with the increasing import and export trade of Manchester as the Lancashire cotton industry developed, that created a demand for a canal whereby ocean-going steamers could sail up to Manchester.

Schemes for a Ship Canal

The first scheme put forward for the construction of a ship canal to Manchester was that of a company formed in 1825, which proposed to make a canal 51 miles in length linking Manchester with the River Dee. The canal level was to be adjusted by 14 locks. Nothing came of this project, however.

In a scheme devised 15 years later by the Navigation Company, it was proposed to narrow down the deep channel of the Mersey by building training walls above Runcorn so that the increased swiftness of the current through the contracted passage would ensure a channel sufficiently deep for ships up to 400 tons burden to pass to and fro. Locks and weirs were to be constructed in the upper reaches of the Irwell. Vessels with fixed masts would have had to discharge and load up at Barton, however, owing to the Barton Aqueduct of the Bridgewater Canal being across the Irwell at that point.

The negotiations that finally resulted in the construction of the Manchester Ship Canal began in 1882, and in the following year the newly-formed Manchester Ship Canal Company accepted the plans of Sir E. Leader Williams for a ship canal with locks above Runcorn. In 1883 the sanction of Parliament to construct the proposed canal was sought, but the company's application was strongly opposed and finally rejected.

The scheme attracted considerable attention and numerous skits appeared in the press. "Punch," in an entertaining summary of the week's happenings in Parliament, dated 4th August 1883, humorously described the failure of the Bill to pass the Government Committee, of which Lord Redesdale was chairman, as follows :—

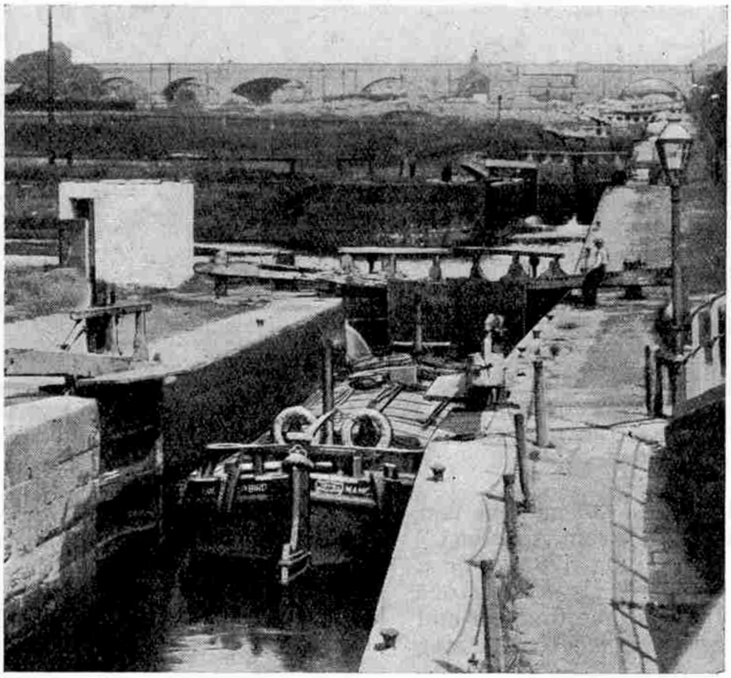
"Tuesday—Little row in the House of Lords to-night. Manchester Ship Canal down for second reading. Lord Redesdale doesn't like ship canals. 'Never had them in my day!' he growls. 'Content then with ordinary and proper thing broad enough for canal boats. If this thing goes on, have England cut up into mincemeat in a few years. Make a sort of Holland of this island. Never be able to drive half a mile without coming across a ship in full sail. Have steamers pouring smoke into your front bedroom window, and get hit on the head with maintop mizzen boom when you look out to see where the smoke is coming from. Have enough of ship canals at Suez. Have no more of them here as long as I am Chairman of Committee.' So puts his foot down on proposal."

A second application in the following year was also unsuccessful, but at a third attempt in 1885 the Bill was passed. By that time the prolonged legal negotiations had cost the company nearly £250,000.

Contract for £5,750,000

A contract to construct the canal for £5,750,000 was secured by Mr. T. A. Walker, the eminent engineer who figured so prominently in the difficult task of making the Severn Tunnel. The canal was planned to start from the Mersey at Eastham, six miles up-river from Liverpool and 35½ miles from Manchester, and there the first sod was cut on 11th November, 1887.

On 2nd December of the same year the first "steam navvy," or mechanical excavator, was set to work removing earth at the rate of 1,200 cubic yards per day. Seven hundred men were engaged in the early operations on the canal and as the work developed both men and mechanical equipment were greatly increased.



Flight of Locks at Runcorn, Bridgewater Canal

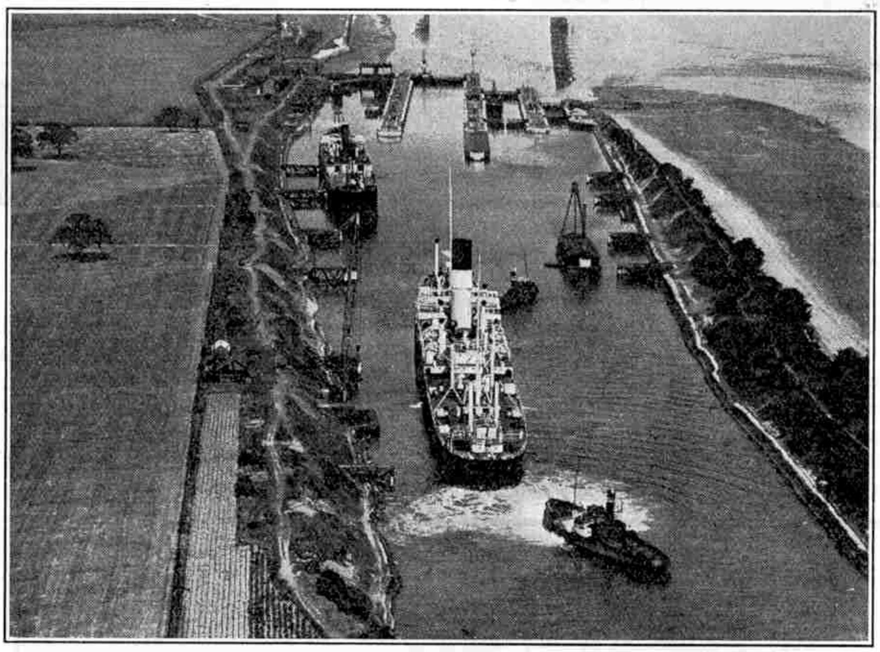
Strengthening of Embankments

From Eastham to Runcorn, a distance of 12¾ miles, the course of the canal was laid in close proximity to the Mersey, being in places separated from the latter only by extensive clay embankments. In the first six miles three of these were constructed, and are known to-day respectively as Pool Hall Embankment, Ellesmere Port Embankment and Ince Bay Embankment.

Wherever the canal had to be cut through extensive beds of clay, the embankments were faced with heavy coursed stone for protection. The Ellesmere Port Embankment, 6,200 ft. in length, had to be additionally strengthened by an elaborate pile foundation, on account of the serious weakening effect of an underlying bed of sand or mud through which water would have forced a way into the canal workings. Although at this point the deep part of the Mersey lies along the northern side of the estuary, it is always possible that it may sometime revert to the south side of the river bed. The Merseyside embankment of the ship canal would then become subject to tremendous pressure.

Wooden piles each 35 ft. in length by 1 ft. square were rammed down side by side into the canal bed by pile-driving machines. As the piles proved extremely difficult to sink by ramming in the ordinary way, a jet of water pumped under high steam pressure through a 40 ft. length of 1½ in. wrought-iron piping was directed downward in front of each descending pile, and this so loosened and softened the sand that the pile-driver easily forced home the piles. Each pile was rammed down until the top was level with the base of the embankment, and two parallel rows, each 5,400 ft. in length and spaced 78 ft. apart, were completed. To ensure the walls having the maximum security, two supplementary rows of 1 ft. square but shorter piles were similarly driven in. These piles were spaced equidistant at 6 ft., one row being 25 ft. from the outer wall of the principal piles and the other 20 ft. from the inner row of large piles.

In all 13,000 sheeting piles were used, equivalent to roughly 100 miles of timber. Twenty-one pile-drivers were simultaneously engaged, and during one week more than 550 piles were dealt with. Strong cross-timbers were used to connect the shorter piles to corresponding principals in the chief walls. Behind the rows of piles a channel was dug, measuring about 12 ft. in width by 15 ft. in depth. This was refilled with a mixture of gravel and sand in roughly equal proportions, and provided a substantial, watertight foundation for the embankment subsequently built upon it.



Courtesy] **Steamship approaching Eastham Locks** [*Manchester Ship Canal Co.*

Landslides and Floods

Eastward of Runcorn the Mersey follows a narrowing and erratic course. The canal, however, was led by a more direct cross-country route for 10 miles or so to Rixton Junction, where the Mersey, having meandered south again, was adopted and enlarged to serve as a section of the canal. In order to keep the route of the canal as straight as possible it was found necessary to eliminate a number of the bends of the river and short cuts were excavated across the divergencies. When each new length was ready, the dams at each end were cut and the river was allowed to flow into the new straight channel. Earth removed in making these cuts was used later to fill up the abandoned bends of the river.

The work of excavation was rendered slow and difficult owing to the sides of the cuttings having a marked tendency to fall in, due to the earth being mostly gravel and mud. After the removal of a subsidence an embankment was usually strengthened with "tailings" from some stone quarry.

The falling-in of the sides of cuttings was not the only form of setback experienced during this phase of operations, for during the third and fourth winters of work on the canal extensive damage was caused by premature flooding of cuttings. The river, when greatly swollen by winter floods in the upper reaches, rushed along and, bearing down upon the thin places serving as dams for some new cutting behind, broke through. In the Irlam section of the canal, for instance, the collapse of one dam resulted in a partially excavated cutting being swamped in a few minutes by 250 million gallons of water. The torrent carried everything before it, and when a new dam had been built and the cutting drained, the latter presented a weird spectacle. Machinery, great and small, was found flung all over the place, engines were overturned and strings of wagons literally knotted up! The track was a jumble of twisted rails and tools were found scattered everywhere. Such hindrances to progress were costly affairs.

When the work on the canal was at its height as many as 17,000 men were employed and the mechanical equipment included 80 steam-navvies and dredgers. Excavation in the Irlam section was carried out at the rate of 250,000 cubic yards per month.

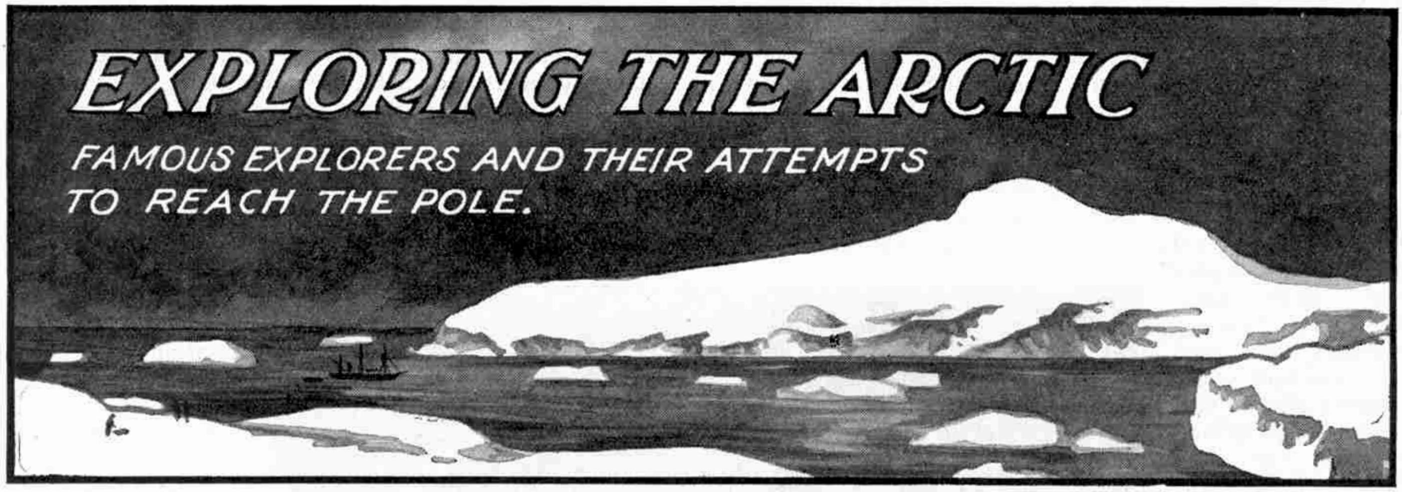
Four miles beyond the termination of the Ince Bay embankment the course of the canal led directly across the estuary of the River Weaver, and provision had to be made for the ingress and egress of tidal water to and from this natural waterway. The difficulty was overcome by constructing a series of huge sluices on the Mersey side embankment of the canal. These were erected on a massive stone platform 470 ft. in length and almost 4 ft. in thickness. Protection against the deteriorative influence of the water passing over the platform was given by a facing of sheet piles and stones.

Ten "Stoney" pattern roller sluice gates each of 30 ft. span and having a lifting range of 13 ft. were fitted between stone and concrete pillars, the latter contained in huge steel caissons measuring 36 ft. in length by 9 ft. in width. The requisite winding gear for the sluice gates was erected on a bridge built across the pier tops, and is such that it can be operated by a couple of men.

The facilities of the Weaver salt barges and other traffic en route from Cheshire to Liverpool were thus maintained, and under certain conditions this traffic was granted free use of the canal from the point of juncture with the River Weaver to Eastham Locks, where the traffic passed out into the Mersey.

To provide an outlet into the Mersey for land drainage from adjacent areas of a lower level than the canal, and for minor streams, cast iron siphon pipes were laid beneath the canal at a number of places. The largest set was laid at Stanlow Point between Ellesmere Port and Runcorn, to carry the tidal and fresh water of the River Gowey underneath the canal. This set consisted of five 1 ft. diameter pipes 400 ft. in length, placed near to each other, and erected in cast iron segments, the whole being underlaid with concrete. The passage of the pipes was made 4 ft. below the canal bed.

The canal scheme provided for sets of locks to be constructed at Eastham, Latchford, and other prescribed points en route, and these we shall deal with next month, as also with the new aqueduct at Barton that displaced Brindley's simple structure and the Manchester Docks.

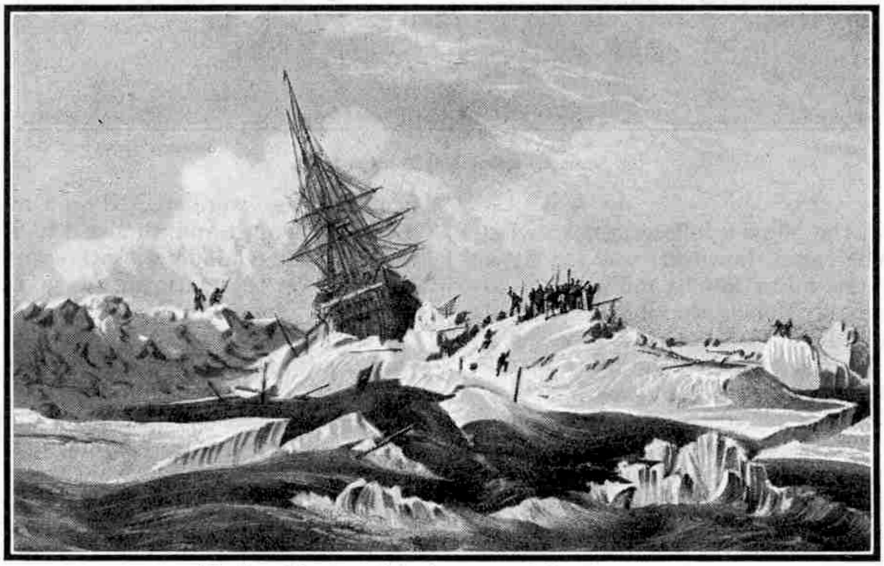


EXPLORING THE ARCTIC

FAMOUS EXPLORERS AND THEIR ATTEMPTS TO REACH THE POLE.

XI.—CAPTAIN BACK AND SIR JOHN FRANKLIN

LAST month we read of the hardships suffered by Back and Franklin in their exploration of the Arctic Ocean at the mouth of the Coppermine River. Whilst on this expedition, Franklin—in his absence—was promoted to commander and in 1822 was advanced to captain and elected a member of the Royal Society. At the same time Dr. Richardson, who was also a member of the expedition, was appointed surgeon of the Chatham Division of the Royal Marines, and Back, having been promoted to lieutenant, was sent for duty to the West Indies.



The breaking-up of the ice around the "*Terror*"

Undaunted by their terrible experiences, the three explorers could not long rest away from the Arctic. In fact, Franklin had not been home a year before he was suggesting that another attempt should be made to survey the northern coasts. His suggestion was accepted by the Admiralty and, accompanied by Richardson and Back, he left Liverpool on the 26th February 1825. The intention this time was to proceed overland through northern Canada, and to descend the Mackenzie River. Here it was arranged they should join the "*Blossom,*" which, under the command of Captain Beechey, was to proceed by way of the Pacific to enter the Arctic Ocean through the Behring Straits, and to sail eastwards to the mouth of the Mackenzie.

Franklin arrived at New York on 22nd March and proceeded by way of Lake Huron and the chain of Lakes to the north-west. On 15th July they were at Fort Chippewyan, from whence they travelled down the Great Slave Lake to the Mackenzie River. Having reached Fort Norman, Back proceeded to Great Bear Lake to construct winter quarters whilst Richardson, in the meantime, explored the northern shore of the lake and Franklin started down the Mackenzie in one of the boats to get information as to the condition of the ice in the Arctic Ocean at this time of the year.

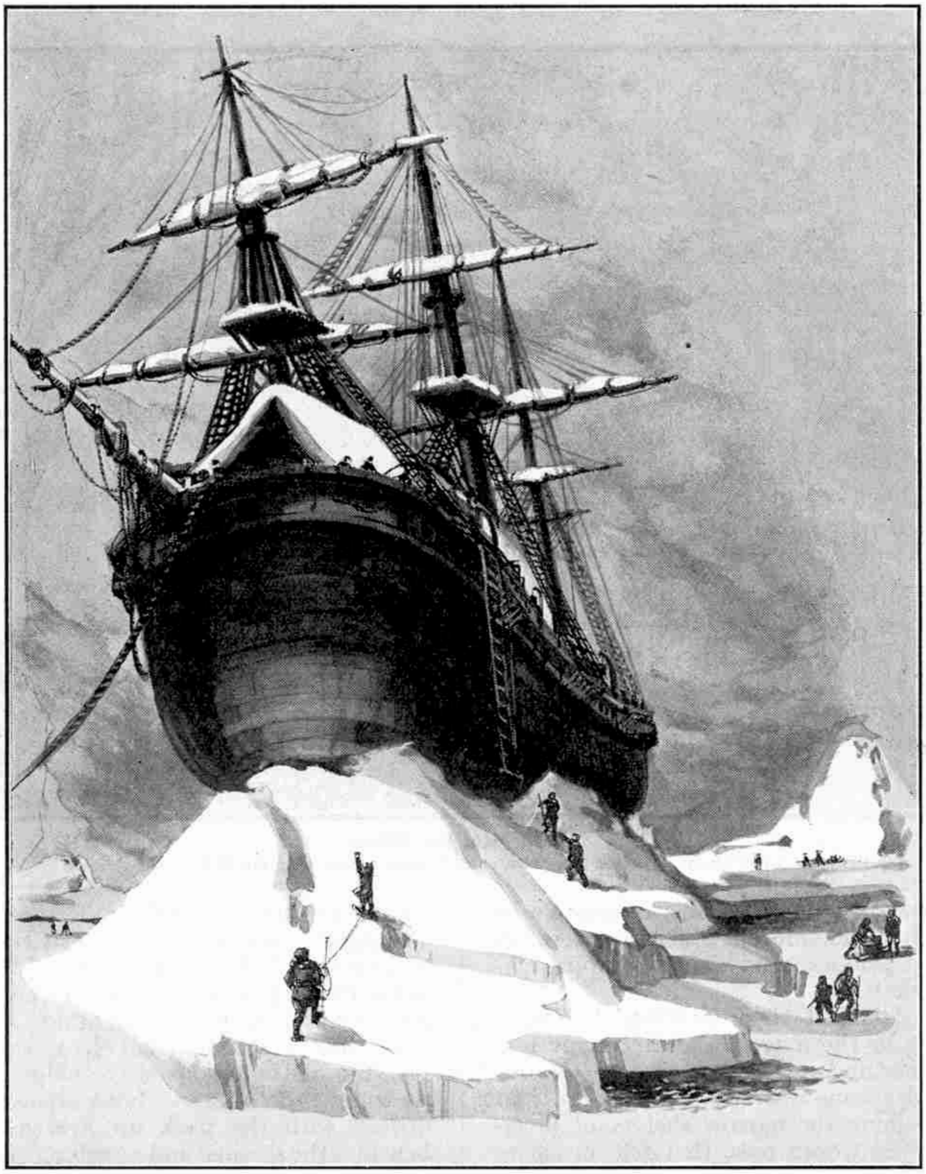
Early in September all members of the expedition had returned to the winter quarters and here, in the log huts erected by Back and his men and known as Fort Franklin, they spent the next nine months. When it became possible to travel again they set out (on 24th June 1826) and having travelled together to near the mouth of the Mackenzie they parted. Richardson went eastwards and in the following two months accomplished the amazing feat of tracing 900 miles of previously unexplored coast line, between the Mackenzie and Coppermine rivers. Franklin proceeded to the mouth of the Mackenzie, where he was attacked by a party of 300 Eskimos, but after a fight of some hours managed to get away. The Englishmen took to their boats and sailed to the west but progress was very slow owing to the masses of ice, the fog and the gales. They managed to map out 374 miles of coastline, however, but owing to the approach of winter they had then to turn back, without being able to meet the "*Blossom*" as arranged. As it happened, the "*Blossom*" had arrived at Icy Cape and sent out a boat to the east. This boat was only about 160 miles west of the point at which Franklin decided he must turn back.

All the members of the expedition were once again back at Fort Franklin by 21st September, and having spent the winter of 1826 here they left for England early the following year, where they arrived on 26th September, having been away two years and seven months.

Although Franklin was presented with the Gold Medal of the Paris Geographical Society, his services were not recognised in his own country until the spring of 1829 when he was knighted. Franklin's further work in the Arctic will be dealt with later, our attention now being directed to Back's work.

In 1833 Back undertook his third voyage to the Arctic with the object of searching for Sir John Ross, whose absence had caused much anxiety. The idea was to explore a river he had heard of near Great Slave Lake to its mouth in the Arctic Sea and thus to make his way to Regent's Inlet, where he thought Ross might be be-set. He was accompanied by Dr. Richard King—surgeon and naturalist—and by an experienced band of explorers.

Writing of this expedition Back says :—" It may be conceived with what sensations I set forth on my journey into the Arctic wilderness. I had escaped from the wretchedness of a dreary and disastrous winter, from scenes and tales of suffering and death and from wearisome inaction and monotony. Before me were novelty and enterprise ; hope, curiosity, and the love of adventure were to be my companions. Even the prospect of difficulties and dangers to be encountered, with the responsibility inseparable from command, heightened the enjoyment of the moment. In turning my back on the fort, I felt my breast lightened, and my spirit, as it were, set free again ; and with a quick step, Mr. King and I (for my companion seemed to share in the feeling) went on our way rejoicing."



The "*Terror*" lifted by the ice

Back reached the Great Slave Lake, and here at its north-eastern corner, he built Fort Reliance, where, on the 5th November, he began the long winter. Soon afterwards Akaitcho, the Indian, put in an appearance and expressed his intention of being of as much assistance as he could.

The cold was intense and drove all animal life away from the neighbourhood. The temperature ranged from minus 50 to 70 degrees and on one occasion when Back was washing his face, although standing within a yard of the fire, his hair was frozen before he had time to apply a towel !

On the 25th April news was received of the safe return of Sir John Ross to England, and although this relieved Back from the original purpose of his expedition, he determined to continue with the journey for general exploring purposes. Taking only one boat instead of two, however, and with Richardson, King and eight men, he started on the 8th July, on an adventurous journey down the Great Fish River.

For 530 miles the river ran through a desolate country, and not a single tree was to be seen on either bank. Flowing into large lakes, it was broken into falls, cascades, and rapids of which there were no less than 83.

The voyagers experienced the greatest danger at Escape Rapids, near Lake Franklin, where the stream was broken by a mile of heavy and dangerous waterfalls. In spite of the fact that the boat was lightened, the rush of the current was so overwhelming that twice she nearly capsized and would have been flung over one of the falls. On one occasion the party was only saved from disaster by the unintentional disobedience of the steersman's directions. The steersman was endeavouring to clear some sunken rocks on the left, but the man to whom he spoke misunderstood him and turned the boat to the left. Seeing the danger the steersman swept the stern round, and instantly the boat was caught by an eddy which threw her broadside on. Then, for a moment, it was uncertain whether the boat would be hurled into the fall or dashed stern forward on to the sunken rocks. Suddenly her head swung towards the beach and the crew, quick to take advantage of the opportunity, sprang into the water and exercising their combined strength, managed to pull the boat ashore.

The mouth of the river was reached in July 1834. Back visited Mount Barrow but mistook the head of Simpson Strait for an inlet, and although he failed to find one of the northwest passages, he discovered and named King William Land and sighted Point Booth at its eastern extremity. The return from King William Land was a wearisome journey, by way of the river and the lakes down which they had come, but at last the party reached Fort Reliance.

A week later Back discovered the Anderson Falls and had not proceeded more than seven miles when he observed the spray rising from another fall, which he named the Parry Falls. "From the only point," he says, "at which the greater part of it was visible, we could distinguish the river coming sharp round a rock, and falling into an upper basin almost concealed by intervening rocks. Then it broke into one vast sheet, falling into a chasm between four and five hundred feet deep, yet in appearance so narrow that we fancied we could almost step across it. Out of this the spray rose in misty columns several hundred feet above our heads, but as it was impossible to see the main fall from the side on which we were, in the following Spring I paid a second visit to it, approaching from the western bank.

Fresh Meat for Dinner

Polar Bears shot by the Algarsson Expedition on deck ready for skinning and then for the stew-pot

"The road to it, which I then traversed in snowshoes, was fatiguing in the extreme, and scarcely less dangerous. To say nothing of the steep ascents, fissures in the rocks, and deep snow in the valleys, we had sometimes to creep along the narrow shelves of precipices, slippery with the frozen mist that fell on them. But it was a sight that well repaid any risk. My first impression was of a strong resemblance to an iceberg in Smeerenberg Harbour, Spitzbergen. The whole face of the rocks forming the chasm was entirely coated with blue, green, and white ice, in thousands of pendent icicles. There were caverns, fissures, and overhanging ledges in all imaginable varieties of form, so curious and beautiful as to surpass anything of which I had ever heard or read.

"The immediate approaches were extremely hazardous, nor could we obtain a perfect view of the lower fall, in consequence of the projection of the western cliffs. At the lowest position we were able to attain, we were still more than a hundred feet above the level of the river beneath; and this, instead of being narrow enough to step across, as it had seemed from the opposite heights, was found to be at least two hundred feet wide. The colour of the water varied from a very light to a very dark green; and the spray, which spread a dimness above, was thrown up in clouds of light grey.

"Niagara, Wilberforce Falls on Hood River, the falls of Kakabikka near Lake Superior, the Swiss or Italian falls—although they may each charm the eye with dread—are not to be compared to this for splendour of effect. It was the most imposing spectacle I had ever witnessed; and, as its berg-like appearance brought to mind associations of another scene, I bestowed upon it the name of our celebrated navigator, Sir Edward Parry, and called it Parry's Falls."

Back returned to England after an absence of two years, during which time he had traversed no less than 7,500 miles, of which 1,200 was previously unknown country.

In the following year (1836) the Royal Geographical Society requested Back to take command of another expedition, the chief object of which was to map the coast-line between Prince Regent's Inlet and Cape Turnagain, and so link up with the earlier discoveries of Franklin. He sailed in the "*Terror*" but was beset in the drifting pack ice, in which the ship was imprisoned for four months off Cape Comfort. It was one of the most severe winters that had been known, and the pressure of the ice lifted the ship high above sea-level. At times the vessel was lying almost horizontal, as they drifted with the pack up Frozen Strait. They once beheld "the strange and appalling spectacle of what may be fitly termed a submerged berg, fixed low down, with one end to the ship's side, while the other, with the purchase of a long lever advantageously placed at a right angle with the keel, was slowly rising towards the surface. Meanwhile, those who happened to be below, finding everything falling, rushed or clambered on deck, where they saw the ship on her beam ends, with the lee boats touching the water, and felt that a few moments only trembled between them and eternity."

All through the winter the "*Terror*" continued to defy the persistent efforts of the ice to crush her. Although she was entirely out of the water for four months, during which time every timber was strained, at last she was free, and Back managed to bring her home, although she was in a sinking condition, with water pouring into her throughout the whole voyage.

The severe hardships of this voyage

(*Continued on page* 616

Coaling by Electricity

Interesting Plant Installed at Doncaster

ONE of the most notable features of industrial progress during the past 50 years has been the tendency to replace manual labour by machinery. This has been the case more particularly in regard to work involving strenuous and long-continued muscular exertion on the part of large numbers of men.

A typical instance of this is furnished by the railways of this country, the locomotives of which burn in the course of a year some 14,000,000 tons of coal which, when consumed, leaves a residue of more than 2,000,000 tons of ash. Thus, 16,000,000 tons of material are involved. and until quite recently the bulk of this huge mass has been handled by human labour. It is not many years since the substitution of machinery for man power in this direction was considered to be impracticable. but modern practice in the handling of materials has now reached such a state of perfection that the tedious tasks of a few years ago are to-day comparatively simple mechanical operations.

This progress has been brought about by prolonged creative thought devoted to the various special problems by a number of great engineering firms. In the forefront of firms who have specialised in the operation of coaling railway locomotives mechanically is the Mitchell Conveyor and Transporter Co. Ltd., of London, who may indeed be said to have succeeded in "turning hours into minutes." It is to this firm that we are indebted for details of a remarkable electrically operated plant for this service installed by them at the L.N.E.R. Locomotive Running Sheds at Doncaster.

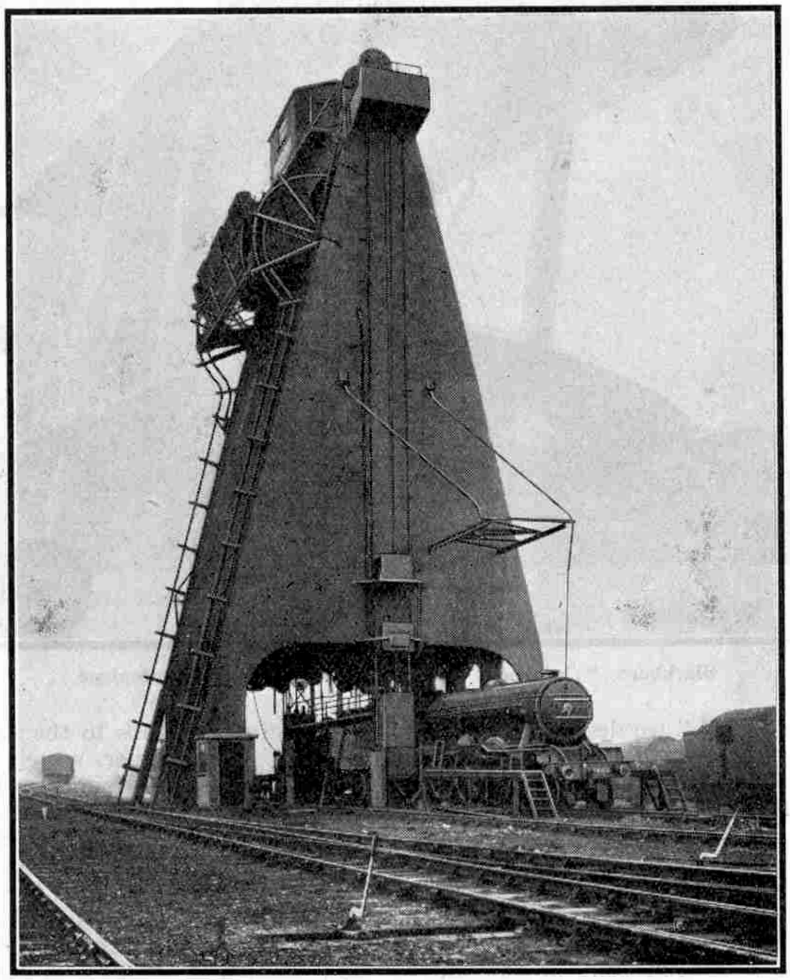


Photo courtesy] [*Mitchell Conveyor and Transporter Co. Ltd.*

The wagon being tipped at top of hoist

The equipment consists of a "Mitchell" patent wagon-tippler-hoist, which is undoubtedly one of the most interesting devices to be found anywhere in the field of material handling. With this machine full coal wagons of up to 20 tons capacity are lifted bodily to a height of 60 ft. 6 in. above rail level, at which point the coal is discharged into an overhead bunker having a capacity of 500 tons and divided to receive two bunker qualities of coal.

In addition, separate bunkers are provided for the storage of 20 tons of dry sand. The sand wagons discharge to a dryer from which the sand is elevated by air compressors to two ferro-concrete sand bunkers arranged at each end of the top of the coal bunkers. From these bunkers sand is supplied direct to the sand boxes of locomotives without interrupting in any way the process of coaling.

The method of operating the plant is briefly as follows.

First of all, the wagon is run on to a "cradle," and an attendant then operates a barrel-type controller that starts up a winch and causes the "cradle" to be hoisted. Immediately the cradle begins to rise, the wagon tilts slightly sideways and leans gently against a padded side support running the whole length of the wagon and holding it in such a manner as to render it impossible for the wagon to leave the track. In this position it is hoisted to a point above the coal bunker where the lower or inner side of the cradle is arrested. The winding process goes on, however, and thus the cradle and the wagon continue to rotate until the coal is completely discharged.

During this period of rotation at the top of the bunker a sustaining beam takes the whole of the supporting weight off the sides of the wagon, the latter being sustained entirely by the beam passing longitudinally over the wagon. This beam is arranged in such a manner that with it wagons of every size have a larger clearance for big coal discharged between the sustaining beam and the edge of the wagon.

When the wagon is emptied the controller is moved to the "return" notches and the reverse of the cycle of operations above described then takes place.

Wagons are hoisted, tipped and returned to ground level in less than four minutes each, so that, after making ample allowance for shunting wagons on to and off the cradle, coal is filled to the bunker at the astonishing rate of 240 tons per hour.

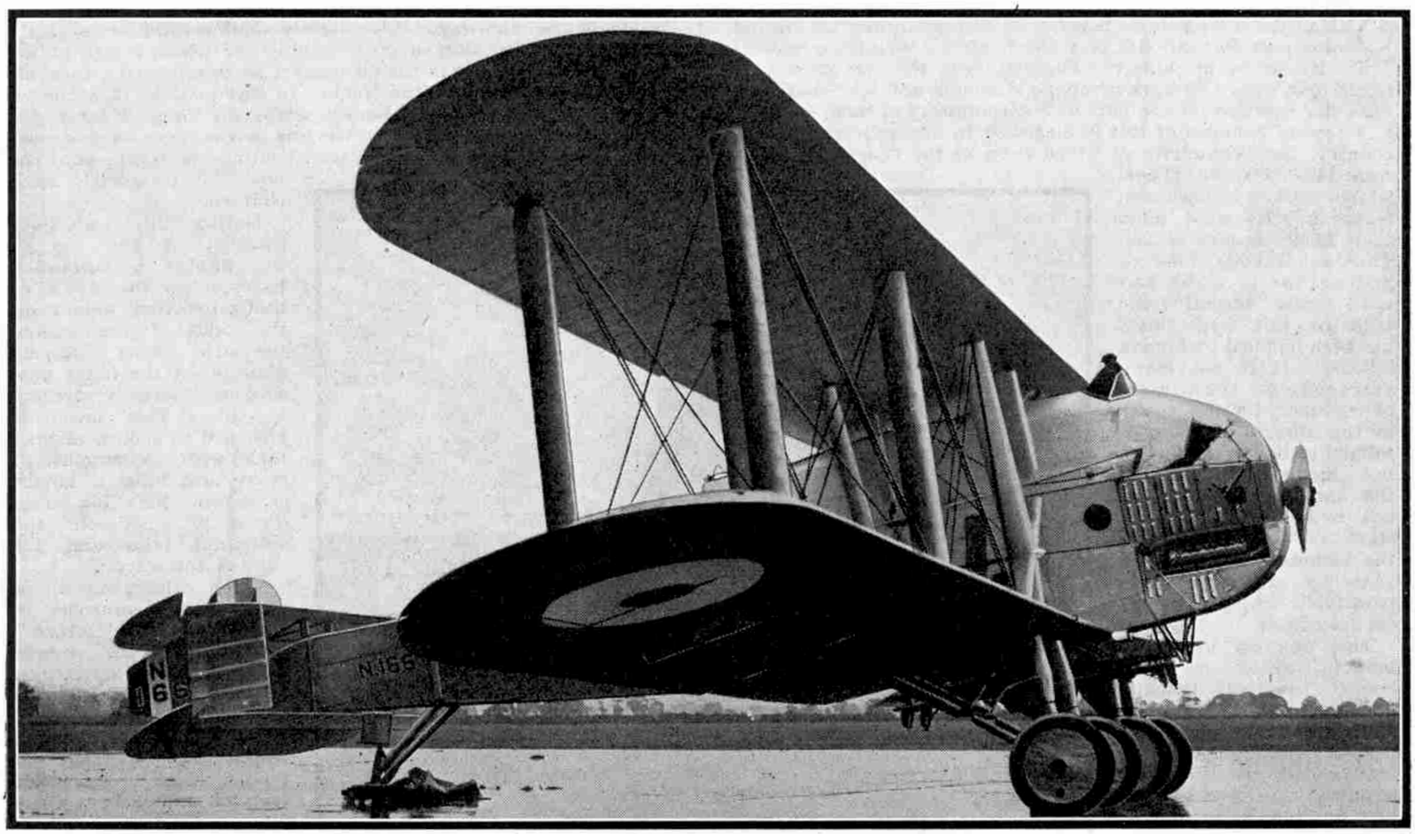
The bunker is of ferro-concrete construction, arranged to support all mechanical and structural parts attached to it. It is divided into three compartments, the two outer ones having a capacity of 167 tons each and the inner one of 165 tons. Another interesting feature is that the bunker is shaped so as to discharge the contents of either compartment through twelve sets of valves and chutes to the locomotive tenders, which are filled in a few seconds.

The time occupied in filling the storage bunker is a little over two hours and the various operations can be controlled by one man per shift. The coal is measured as it is delivered to the engine tenders and a record is kept of the quantity received by each. The power consumed by the plant is very small on account of the fact that the cradle, the wagon and part of the weight of the coal are balanced, so that the winch has to deal only with the remainder of the load.

It is claimed in fact, that the actual consumption of power per ton of fuel handled is less than with any other type of locomotive coaling plant, while the maintenance charges are practically nothing, as only the concrete bunker comes in contact with the coal. It is worthy of note also that the addition of the sand bunkers does not involve any increase in the dimensions of the installation, which is an important point.

The Conquest of the Air

XXVI. The Blackburn-Napier "*Cubaroo*" Torpedoplane



Blackburn "*Cubaroo*" Heavy Coastal Defence Torpedoplane

In the May issue of the "*M.M.*" we described briefly the Blackburn "*Velos*" Torpedoplane, a seaplane specially equipped for carrying out torpedo and bombing operations, and reference was made in the concluding paragraph to another remarkable and more recent production of the Blackburn Company. This newest machine, the "*Cubaroo*" Torpedoplane, forms our subject this month.

The illustration above gives a very good idea of the immense size of this latest dreadnought of the air. The "*Cubaroo*" is still on the "Official Secrets" list, hence details of performance cannot be divulged, but a general outline of construction can be given.

The machine has an overall length of 54 ft., and a wing span of 88 ft., while the height approximates 20 ft. It will be seen that the "*Cubaroo*" is of the biplane class, and having been designed for long-distance coastal defence work, extensive range rather than record speed has been the aim of those responsible for the machine. To this end nearly two tons of petrol can be accommodated on board for fuel purposes alone. The remainder of the machine's carrying capacity of roughly 3½ tons is accounted for by the deadly 21 in. torpedo weighing 1½ tons that can be slung in a special mounting between the two under-carriages beneath the fuselage. Alternatively, bombs to the same total weight may be carried. The Palmer wheels of these two separate undercarriages are 4 ft. in diameter, a fact that contributes considerably to the unusual height of the machine from the ground. Each inner tube, an official notice of the machine states, would make a raft capable of carrying half a dozen men!

It is not surprising to find that this giant torpedoplane is a three-storey structure. On the top, or second floor, and situated in the nose of the machine and above the rear portion of the engine to ensure the occupants an excellent view, is the pilot's cockpit, with accommodation also for an assistant pilot. Beneath this there is, on the first floor, a cabin containing various "mysteries," the identity of which cannot be revealed at present.

On the ground floor is a prone station for a machine gunner who can operate through sliding doors in the sides of the fuselage with a very wide field of fire downward, to the sides and to the rear below the tail planes. This member of the crew can also carry out bombing operations through doors further forward in the bottom of the fuselage. A gun ring on top of the fuselage and level with the pilot's cockpit is sufficiently elevated to enable an occupant to manipulate a machine gun installed there well above the top of the tail planes, and thus to command a wide range. Access from one floor to another is by means of ladders, one leading from the pilot's cockpit to the central compartment and another thence to the gunner's cockpit in the rear.

The tail planes are of the ordinary biplane construction, with two normal fins and rudders and a large central rudder, but the fuselage is of unorthodox shape, the forward portion being trapezoidal in section and the rear portion of triangular cross-section. The wings of the "*Cubaroo*" can be unlocked and folded back, thus effecting a welcome saving of room in housing this mammoth machine.

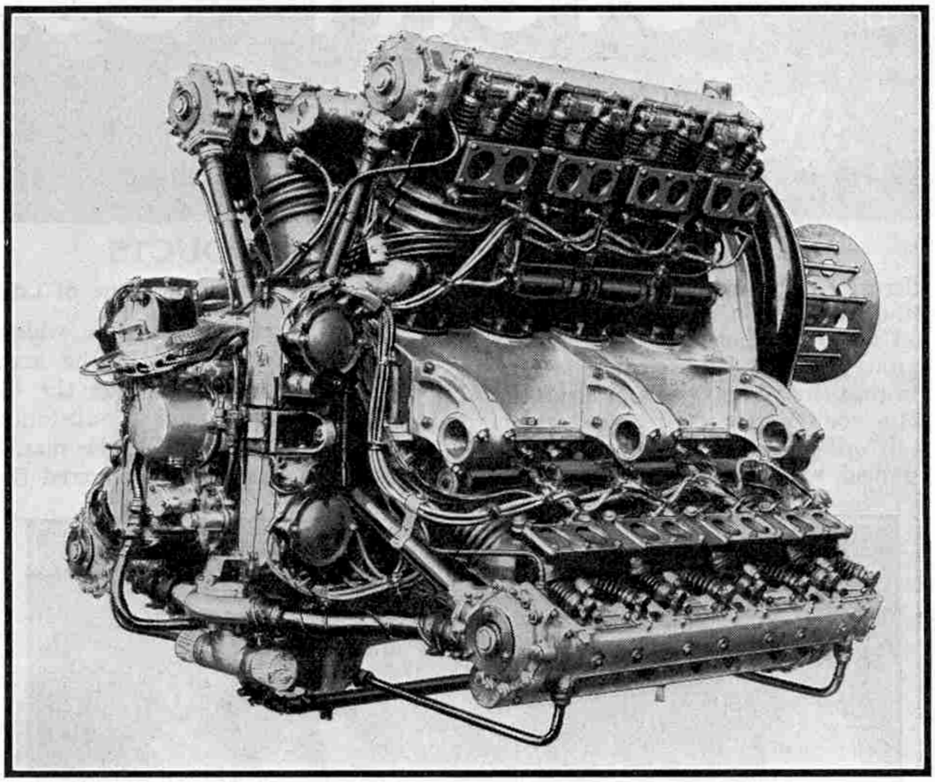


Photo courtesy] [*D. Napier and Son Ltd.*

The Napier 1,000 h.p. "*Cub*" engine

The qualifications of the engine chosen for the "*Cubaroo*" are in keeping with the powerful build of the machine. The engine is a 1,000 h.p. Napier "Cub" of 16 cylinders. These are arranged in four rows of four cylinders each, the two lower rows being placed at 26¼ degrees below horizontal, and the two upper rows at 26¼ degrees to the vertical. The steel cylinders are of 6¼ in. bore and 7½ in. stroke, with aluminium alloy pistons fitted with two gas and two scraper rings.

There are two inlet and two exhaust valves per cylinder, each fitted with two coil springs and operated by overhead camshafts and rocking levers driven through bevel gearing by shafts from the crankshaft. The whole of the camshaft mechanism is enclosed within a detachable oil-tight aluminium case.

The connecting rods are machined from special high grade steel. The master rod, coupled to the pistons of the top port block of cylinders, is formed with lugs on either side, to which are attached the short auxiliary rods for the pistons of the other three groups of cylinders. The big ends are white metal lined, and the anchor pins and other parts work in bushes of ample size.

The four throws of the crankshaft are in one plane, and all journal bearings and crankpins are of large diameter and bored out. This shaft is carried in five substantial roller bearings and a large plain bearing at the forward end. The airscrew shaft rotates clockwise, looking at the airscrew end. It is carried on two roller bearings and fitted with a large double thrust ball bearing, to take the thrust of either a tractor or pusher airscrew. Reduction between airscrew and crankshaft is through wide high-grade alloy steel spur gears. The shaft and its gear and cover can be withdrawn from the crankcase for inspection. The front end of the aluminium crankcase encloses the reduction gear for the airscrew shaft together with the shaft and bearings, while the rear end cover contains the two scavenger oil pumps, the pressure oil pump and the drive for the camshaft, magnetos, water and oil pumps.

A centrifugal water pump is mounted to the rear end of engine and runs at one and one-half crankshaft speed. The spindle is fitted with a metallic packed gland and a screw-down greaser. Water is delivered through a separate outlet to each of the four cylinder blocks. There are two suction and one pressure gear oil pumps, driven at engine speed through gears. The suction pumps are connected to the sump and the pressure pump takes oil from the supply tank through a suitable filter.

The four special eight-cylinder magnetos, rotating clockwise, are mounted on platforms at the rear end of the engine. Metal braided ignition cables are carried in aluminium troughs, and advance and retard links and levers are interconnected with throttle control.

Two twin carburetters are fitted, the bodies, which are of aluminium and stayed to the crankcase, being water jacketed. The gas inlet pipes to the induction on the cylinder heads are of steel and are also water jacketed. Altitude control cocks are fitted and are inter-connected with the throttle control.

Lubrication is effected by pressure throughout to big ends, gudgeon pins, bearings of camshaft and forward bearing of crankshaft. The reduction gears are lubricated by oil ejected on to the teeth from a pipe connected to the crankshaft lubricating system. Valve tappets and cams are lubricated by the oil escaping from the camshaft bearings, which drains into the sump and is delivered thence to the supply tank by suction pumps. An adjustable pressure relief valve is incorporated in the system.

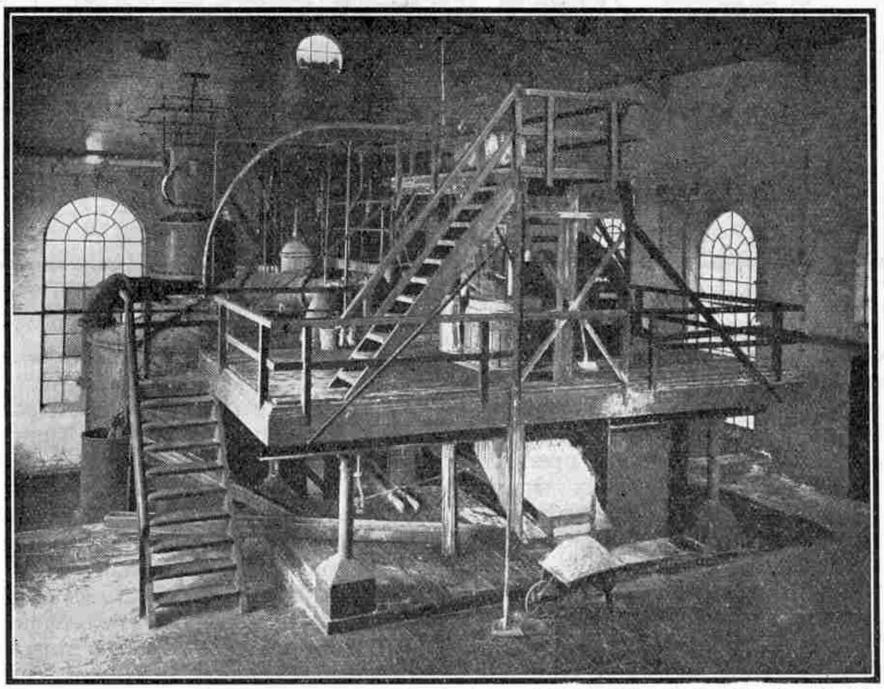
The approximate overall dimensions of the engine are :- Length to centre of airscrew, 5 ft. 11½ in. ; width, 4 ft. 9 in. ; height, 5 ft. 9 in.

Fuel consumption is at the rate of about .48 lb. per B.P.H. at full load, and the consumption of oil approximately .028 lb. under similar working. The weight of the engine, complete with airscrew boss, carburetters, induction pipes, magnetos, starting distributing gear and pipes, is roughly 2,450 lb., equal to 2.45 lb. per horse power.

THE STORY OF COAL

VI.—DISTILLATION FOR BY-PRODUCTS

LAST month we described the manner in which coal is utilised for the preparation of coal gas. This use of coal and also its direct use as fuel for domestic and industrial purposes have certain serious drawbacks, notably in that they do not extract anything like the full value of the coal and therefore are wasteful. This month we shall describe entirely different methods of utilising coal and deal with some of the amazing variety of by-products that may be obtained from this remarkable mineral.



Courtesy] [*Successors to the Otto Coke-Oven Co. Ltd.*

Sulphate of Ammonia direct recovery plant

The most complete and economic utilisation of coal has only been accomplished within the present century, and the processes as finally adopted were the result of three different lines of development. The first of these was the result of the need for coke for industrial purposes, particularly in the manufacture of cast iron, which is made by heating iron ore with carbon in the blast furnace. At first practically the only available form of carbon was wood charcoal, which explains why the earlier iron works were found mainly in the south of England where extensive forests supplied the wood necessary for making this form of carbon. As the demand for iron increased, and the forests disappeared, other sources of carbon had to be found, and this led ultimately to the use of coke, the material obtained by heating coal with insufficient air in the same way as charcoal was obtained from wood.

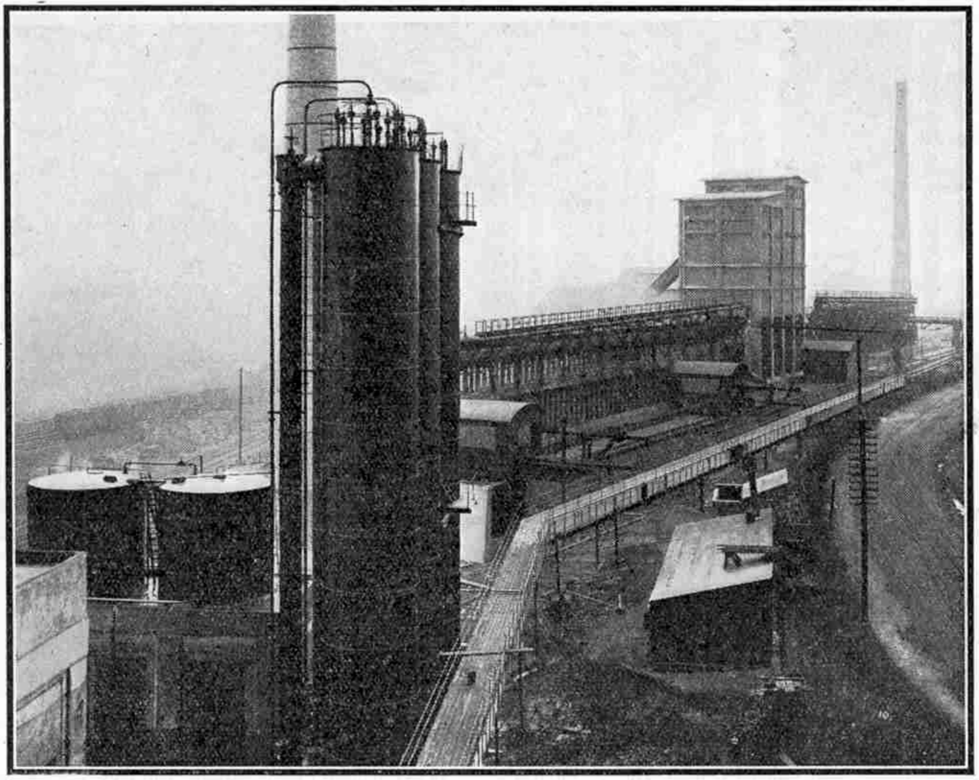
The second line of development commenced in a practical manner with Murdock, who, as we saw last month, was the first man to use coal gas as an illuminant.

Englishman Discovers Value of Coal Tar

The third contributory line, which perhaps more than any other has pointed to the necessity for improved methods of using coal, was the discovery of the importance of the chemical substances contained in the tarry liquors obtained in the manufacture of coal gas. Michael Faraday had discovered the well-known liquid benzene or benzol in coal tar in 1825, but the immediate cause of its increase in importance and value was the discovery in 1856 by W. H. Perkin (later Sir William H. Perkin) of a mauve dyestuff that he obtained from the chemical known as aniline, the commercial source of which was coal tar. This discovery was the beginning of the modern dye industry, which grew to enormous proportions, particularly in Germany, in a very short time. Not only dyes but many other valuable chemicals were manufactured from coal tar products and the demand for these led to the introduction of what came to be known as by-product coking.

In the gas industry the gas was regarded as the important thing and all other materials were correctly described as by-products. Coal gas as ordinarily burnt depends for its illuminating power upon the presence of many substances that were becoming increasingly valuable from an economic point of view in other connections, and the recovery of any quantity of these by-products was necessarily regarded as a secondary consideration in comparison with the maintenance of the quality of the gas. The gas obtained by the methods we are now to consider is of no use as an illuminant, but is valuable for heating purposes and can be used for lighting with the aid of mantles.

The process of by-product coking now developed is to a certain extent similar to that used in gas manufacture, the essential difference being that importance is attached to all the products of coal distillation, so that the word "by-product" is hardly a correct description of the tar and ammoniacal liquor and the immense range of valuable substances obtained from them.



Courtesy] *[Successors to the Otto Coke-Oven Co. Ltd.*

General view of large coke-ovens and by-products recovery plant

The original method of preparing coke from coal was to carbonise it in closed vessels, which were known from their shape as "beehive" ovens. These were constructed of fireclay. A layer of coal was fed into the ovens and ignited on top. The opening through which the coal was introduced was then bricked up and plastered, leaving only a small hole about six inches square for the admission of the air necessary for the burning of a portion of the coal. The heat developed by the burning of the upper layer of coal carbonised the remainder, the gases escaping through a flue in the upper part of the beehive. The coke remaining was quenched in the oven before withdrawal.

Wastefulness of Beehive Ovens

It is easy to see that this process was exceedingly wasteful. There was no difficulty in realising this even a century ago, before the existence or value of the many by-products was suspected. These and the gas are, of course, entirely wasted, while a low yield of coke is obtained in comparison with the amount theoretically possible. Thus with a coal containing 30 per cent. of volatile matter, and which should, therefore, yield 70 per cent. of coke, about 55 per cent. only of dry coke was obtainable under the best conditions with the beehive oven.

As early as 1781, 13 years before Murdock illuminated his office with coal gas, at least one individual endeavoured to avoid the losses incurred in this process, for in that year Archibald, Earl of Dundonald, was granted a patent for "allowing coals to burn or ignite without flame, so by their own heat to throw off the tar or oils that they contain." Incidentally his statement may be noted that, prior to his discovery, tar could only be obtained by distillation of the coal in closed retorts, thus suggesting that the method afterwards used on a large scale for making coal gas was already well-known in principle.

Better Methods Introduced in France

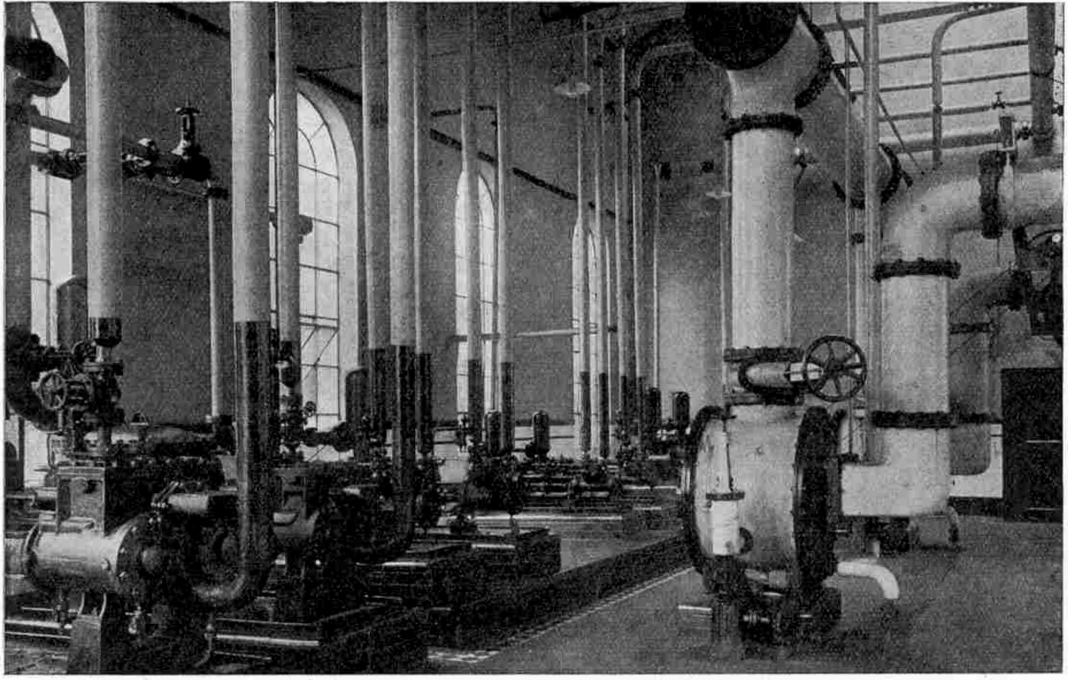
The first serious step towards the rational use of coal was taken in France by Knab, who erected a coal distilling plant in 1856. A far more prominent individual soon joined him in the person of the famous inventor Carves, who introduced improved methods of heating in which flues were arranged so as to heat the coal more effectually and carbonise it more quickly. A further improvement was effected by H. Simon, of Manchester, who introduced the use of recuperative methods, the air necessary for combustion being heated by passage through flues heated by the waste gases from the oven. Carves and Simon joined forces and eventually a complete system of coke production was developed in which the so-called by-products were recovered as an integral part of the process.

A great hindrance to the adoption of the coke-ovens so developed was that the coke produced in them was regarded with suspicion on account of differences in colour and many manufacturers of iron and steel clung to the use of coke produced in beehive ovens until almost the end of the last century. They were finally convinced that the coke from the new plant was equally as good as that produced in the more wasteful manner, with the result that there was an increase in the amount of coal carbonised in by-product ovens from 1,250,000 tons in 1898 to 4,500,000 tons in 1916. This was in Great Britain, and the new methods had established themselves even earlier in Germany and in the United States.

Modern Coke-Oven Systems

Other systems of by-product coking on somewhat similar lines to those followed by Simon-Carves were developed in the meantime, and to-day a choice of many excellent types of plant is available for the treatment of coal in this manner. Among these may be mentioned the Otto-Hilgenstock, the Koppers, and the Semet-Solvay systems. The retort or coke-oven used in all cases is a narrow rectangular chamber heated by flues in the side walls. These are usually about 33 ft. in length, 5 ft. 9 in. to 7 ft. 6in. in height, and 17 in. to 22 in. in width. They are arranged side by side in batteries of from 25 to 60 ovens, and the coking capacity of a battery built up in this way ranges from 100 to 350 tons of coal daily. Silicious firebricks containing 80 per cent. of silica are used in the construction of the oven linings and flues. In the United States bricks containing 94 per cent. of silica are used. These are splendid bricks as they conduct heat well, but they are not suitable when washed coal containing up to 15 per cent. of water is used.

At each end of the oven are fitted doors of cast iron or rolled steel that can be lifted by small cranes. The charge of coal is introduced from hoppers through three holes in the roof of the oven, but if the coal used is not a strong coking variety it is first stamped into a solid cartridge of proper shape and size and the mass pushed bodily into the oven through the doorway at one end. The doors are then made airtight by puddling them with clay. The gases evolved during the carbonising process are led away through a fourth hole in the roof of the oven, which communicates with the ascension pipe that carries them away to the recovery plant.



Courtesy] [*Koppers Coke-Oven Co. Ltd.*

Interior of Exhauster House at the Horden Colliery Ltd.

Coke Discharged by Electric Ram

At the end of the process the gas outlet is closed by a damper or valve and both oven doors are opened. A ram actuated by electricity is then introduced at one end, and this pushes the hot mass of coke out of the retort at the further end, when it is immediately quenched by a stream of water. The coke from each battery of ovens is pushed out for this purpose on to a sloping stage, known as the coke-bench, which runs along the whole length of the battery. The other side of the battery is always referred to as the " pusher " or pushing-engine side. After quenching, the coke can be shovelled direct into railway trucks on the lower side of the coke-bench, which is always raised to a convenient height above the track.

When seen at night time the discharging of a coke-oven is an impressive sight. It is often to be seen in colliery districts where batteries of coke-ovens erected at pit-heads are now comparatively common. Into the subdued light from the ovens a much brighter glare breaks when the oven doors are lifted, and then a mass of white hot coke discharged on to the coke bench lights up the surroundings with great brilliance.

The difference in the types of by-product ovens lies chiefly in the heating flues, some of which are arranged vertically and some horizontally. The aim in the design of these is always to secure uniform heating as far as possible, together with quick carbonisation. For heating purposes the gas obtained from the ovens is burnt in the flues after the valuable by-products have been removed as described later. The air required by the gas for burning is always heated before mixing, and this may be done in two ways. In one of these it is passed through a preliminary system of flues that run alongside the waste gas flues and are heated from them, while in the other the regenerating principle of producer-gas furnaces is used, the heated gases and the air being passed alternately over firebrick surfaces. These surfaces are first strongly heated by the waste gases and then give up their heat to the air required for combustion in the heating flues.

It will be realised that pre-heating is an economical process. The air required for burning contains a large proportion of inactive nitrogen and if it were not heated beforehand a proportion of the heat of combustion would be spent uselessly in raising its temperature. It is obvious that it is much better to raise the temperature beforehand as far as possible by utilising the heat that otherwise would be wasted.

The coke produced in beehive and by-product ovens is harder and heavier than that made in gasworks, where as much gas as possible is usually extracted from the coal. It is for this reason that it is regarded with special favour by iron and steel manufacturers.

Old and New Processes Compared

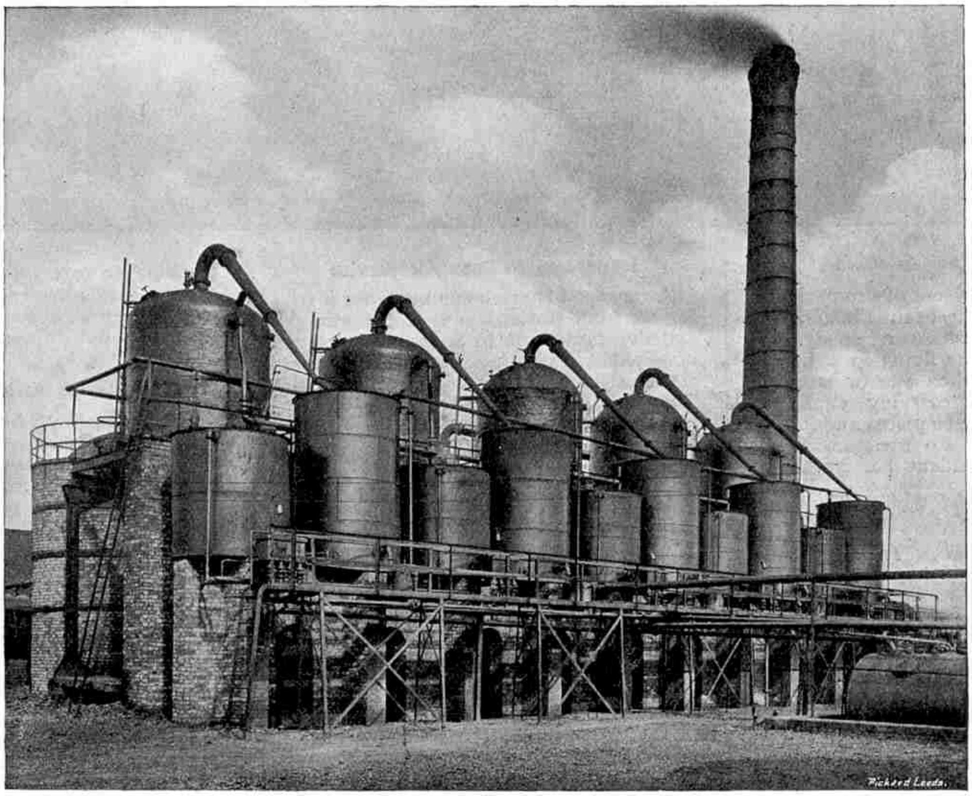
So far the coke-oven has been treated as a modernised form of the beehive oven in which heating is carried out with much greater efficiency and economy. The extent of the improvement may be judged by an actual comparison of the results. The particular coal referred to earlier in this article as giving a 55 per cent. yield in the beehive oven gave practically a theoretical yield of 70 per cent. in a modern oven, and the latter also had the advantage in output, giving 24 to 26 tons per week as against 10 tons from the old type. Careful experiments with this coal showed that the heat wasted with the beehive oven for each ton of coal used was sufficient to evaporate three-quarters of a ton of water, while in the modern oven sufficient heat to evaporate a ton of water for every ton of coal carbonised is made available for various purposes.

We must now turn our attention to the gases carrying with them ammoniacal liquor and tar. As already noticed, they pass from the oven through an ascension pipe which delivers them into the tar main running along the whole battery. In this main the heavier tar is condensed, but the temperature is still too high to allow much condensation to take place. It is considerably reduced straight away, however, for the gas now passes on to the coolers, which may be either air-cooled pipes or water-cooled chambers, the general principles of the process being the same as in the cooling of the gases in ordinary gasworks practice. In these condensers the bulk of the tar and a portion of the ammoniacal liquor are removed.

Removing the Tar Fog

Practically the whole of the small proportion of tar now left is in the form of very small particles constituting what is known as " tar fog." This must be completely removed before any attempt is made to extract the ammonia from the gases. In order to effect this an aspirator now comes into use, which delivers the gases at a higher pressure into the tar fog extractor, in which narrow passages divide them into thin streams of gas. These narrow passages are constructed in various ways, one of the most widely used extractors being so constructed that the gases pass through bundles of plates with very fine perforations. The tar particles cling to the sides of the obstruction and the gases passing on are quite clean and ready for further treatment.

The after treatment of the gases formerly followed gasworks practice in that the ammoniacal liquor was completely removed before any attempt was made to manufacture the valuable ammonia compounds from it. The gases were passed through scrubbers, where they met fine streams of water that removed the last of the ammonia. They were then washed to recover the proportion of the benzols that they contained, after which the residue passed on to the ovens or was put to other convenient uses. It may be noted here that it has become a fairly common practice for this surplus to be supplied to the nearest gas company. Thus the gas department of the city of Leeds mixes the surplus gas from coke-ovens at Middleton Collieries near by with the gas manufactured in its own works.



Courtesy] [*Koppers Coke-Oven Co. Ltd.*

Battery of Tar Stills and Condenser at the Cadishead Tar Works of British Tar Products Ltd., Sheffield

The tar and liquors from the tar mains, condensers, tar extractors and ammonia scrubbers used to be collected into separating tanks where the denser tar settled to the bottom. The two constituents were run off into their appropriate storage tanks and were treated separately for the production of the chemicals they contained.

The ammoniacal liquor from the store tanks was first heated and then allowed to run down a tower in which shelves were arranged to spread it out. Here it met an ascending current of steam that liberated the ammonia in the gaseous form. The liquor still contained combined ammonia, and to liberate this it flowed into hot milk of lime in the lower part of the tower, when a chemical change liberated the rest of the ammonia. The ammonia thus produced passed on with steam into a lead-lined vessel containing sulphuric acid, which absorbed it with the formation of ammonium sulphate. This crystallised out and was removed.

At times the ammonia was removed by water instead of by sulphuric acid, forming the well-known ammonia solution, which is noteworthy in that it is lighter than water. The tar was treated by distillation methods for the recovery of its many constituents, as will be described later.

Direct Recovery Processes

These methods are now being abandoned in favour of " direct " processes, which also have the advantage of being more nearly continuous. The deviation from the older routine begins in various places, but in all cases the first necessity is warm, tar-free gas. In the Koppers type of plant the gases, after the removal of the tar fog, are re-heated by passing through pipes surrounded by the hot gases from the oven. In the Otto system cooling in condensers is dispensed with altogether, the tar being removed from the gases by a spray at a fairly high temperature, followed by the use of an extractor. A centrifugal separator is used in the Simon-Carves plant, the heavier and denser tar being easily removed as the gas is whirled round like a cyclone. In all cases the hot gases now contain ammonia, benzols and naphthalene, for the separation of which suitable means are adopted.

The first to be separated is the ammonia. The hot gases are taken through an exhauster into a saturator, a lead-lined vessel containing sulphuric acid, where the process already described takes place. The ammonium sulphate that crystallises from the liquid falls to the bottom and is removed by various methods to a draining table from which the superfluous liquid runs back into the saturator. The crystals are finally dried by whirling them round in a centrifugal drier.

It will be seen that the ammonia is separated directly from the gases in their progress through the plant instead of from the liquid by a separate treatment as in the older process. This is the explanation of the term " direct recovery " usually applied to the modern methods. Their use avoids a long process and the usual condensing and scrubbing plant is either abolished or restricted, while circulating pumps and separating tanks are not needed. The process may also be used to deal with the combined gases in the ammoniacal liquor. In the Coppe process, for instance, this liquid is treated with steam-heated milk of lime to liberate free ammonia in the manner already described. After cooling somewhat, the ammonia thus produced is fed into the main stream of the gases as they are about to enter the saturator.

Separating the Other Main Products

The gases leaving the ammonia saturator are suddenly chilled by passing through a tower from the top of which jets of cold water descend under pressure. The object of this is to cause the naphthalene to separate out. This substance, like benzene, and methane or marsh gas, is a hydrocarbon. It contains as much as 93.7 per cent. of carbon, while benzene and methane contain 92.3 and 75 per cent. respectively. The variation in the amount of carbon contained is reflected also in their boiling points. Naphthalene is a solid that melts at 80°C. and boils at 218°C. while benzene is a liquid that boils at 80°C. Methane on the other hand is a gas which can be cooled and condensed into a liquid with a boiling point more than 150°C. below zero ! All of these, together with many similar substances, are produced in the distillation of coal.

The methane, of course, remains in the gases while that portion of the naphthalene not removed in the tar separates out at the stage in the treatment of the gases we have now reached. It is washed away with the stream of water from which it is separated by filtration. Naphthalene is a white crystalline substance with a peculiar odour and it is used as an insecticide and also for making fire lighters. It has acquired new importance of late years as the starting point in the manufacture of synthetic indigo.

The gases still contain benzols. This is a term that covers many hydrocarbons similar to benzene, with boiling points a little higher but not nearly so high as that of naphthalene. These are now separated in the benzol scrubbers. An aspirator takes the gases forward into a small cooler and then into the scrubbing towers which are 50 to 70 ft. in height and are fitted with wooden grids. Here as they ascend they meet a descending stream of wash oils from a later operation by which the benzols are finally washed out of the gases, which then pass on to be utilised, as already explained, either in heating the ovens or in steam raising.

The liquid from the bottom of the tower passes on to a benzol still, a large cylindrical vessel down which it flows over a series of trays that prevent it from falling straight through. Dry steam at 100 lb. pressure is passing up the still and as it bubbles through the liquid the benzols are vaporised by it, and together with the steam pass over into the condenser, thence flowing into the separating vessel. Benzene and similar compounds are much lighter than water and flow out of the separating vessel at the top, while the water flows out at the bottom. The crude benzol is purified by interesting methods to be dealt with next month.

Air News of the Month

Aeroplane Wrecked by its Own Bombs

A terrible flying accident of a remarkable nature has taken place in Finland. A machine of the Finnish Army, engaged in bombing practice, was flying at a height of about 3,500 ft. when one or more of the bombs it was carrying exploded, blowing the aeroplane to pieces and killing the crew instantly. No satisfactory explanation of the accident has yet been put forward.

* * * *

Air Force Route between India and the Far East

Allowance has been made in the Air Estimates 1927-1928 for a long-distance flight by the Royal Air Force with a view to the development of the Service air route between India and the Far East. The machines to be used will be flying boats and will be provided during this year. At present a ground party is surveying the route and it is intended that the flight shall be carried out next year.

* * * *

The Air Port of Berlin

The Tempelhofer Feld, a huge field well within the borders of the city and once the training ground of the ex-Kaiser's military forces, has become the air port of Berlin. This new air station has been built on the assumption that civil flying is certain to increase greatly in volume. No less than 8,000 people can be accommodated in an open air pavilion overlooking the landing stage for the machines. On this stage the passengers await the aeroplanes as they glide in on a long concrete runway.

Inside the building passengers and visitors find a small museum of objects of aerial interest; Customs and passport examination rooms and a post office with pneumatic tube connection to all parts of Berlin. An hotel with 40 rooms, each with separate bathroom; a tea room; a restaurant overlooking the aerodrome; hairdresser's shops and many other conveniences are provided. On the roof of the building the meteorological station is situated, the weather maps of all air routes in Germany being brought up to date every quarter of an hour.

* * * *

Capt. R. H. McIntosh, an Imperial Airways pilot, has set up a new record of 4¾ hours for the flight between London and Berlin, a distance of 620 miles.

Rotterdam to Suez Air Service

Arrangements are being made for a trial service from Rotterdam to Constantinople and Constantinople to Suez. A new type of Fokker machine, at present under construction, is to be used on this route. The Holland-India Committee is responsible for this venture.

* * * *

Air Trips Over London

Imperial Airways are introducing aerial trips over London in big liners during the summer. The fare will include transport to and from Croydon airport and tea at the aerodrome and the machines used will be 20-seater Armstrong-Siddeleys and 14-seater Handley-Pages.

* * * *

Pretoria-Capetown Flight

Colonel Sir Pierre Van Ryneveld, chief of the South African Air Force, recently made the first non-stop flight from Pretoria to Capetown, a distance of 1,000 miles, in nine hours. At Capetown he consulted with Flight-Lieut. Nixon, R.A.F., who had arrived from London, regarding the site for a mooring mast in connection with the Empire airship scheme.

* * * *

New Type Glider

A new type of glider employing sails like those of a yacht and weighing only 88 lb. has been designed by Herr Platz, a German yachting expert. This glider is collapsible and can be carried on a bicycle. Along the whole length of the machine there is a wooden keel with attachments at the centre for projecting wing-spars to carry the planes. The pilot sits on this keel and controls the glider by means of two triangular "jibs."

* * * *

Towing Engineless Machines

Last month we published a note regarding the mile-high glide accomplished by Herr Espenlaub, the famous German aviator. In order to reach the required height the glider was towed by an aeroplane and although this venture was undertaken as a normal experiment in gliding flight, the result suggested the practical possibility of towing engineless machines.

Further experiments on these lines have since been conducted by Herr Espenlaub. Several gliders have been specially designed for the purpose. Each of these was fitted with a special device to allow a steel towing wire to be inserted in the nose, and also with a quick-release clip gear to enable the machine to cast off while in flight. The experiments already made indicate that the haulage of a string of gliders in this manner is not impossible.

* * * *

New South African Air Services

The company formed by Sir Alan Cobham on his return from his Australian flight is inaugurating a commercial air service in South Africa. The first service is for passengers between Durban and Johannesburg, a distance of 550 miles. This will be covered in 3½ hours, in comparison with 22 hours by train. De Havilland "50" machines with accommodation for five passengers and 200 lb. of freight are to be used.

* * * *

Prison-Breaking by Glider

An attempted escape from prison by means of a glider was discovered recently at San Quentin, California. The glider was being constructed on the roof of the prison, the various parts being obtained from the prison workshops. The intention of the builders had been to glide from the roof over the prison wall and thus make their escape.

* * * *

Aeroplane to carry Motor Cars

A French inventor has designed an aeroplane body for the special purpose of carrying motor cars. It is intended chiefly to carry motor ambulances, which would be driven into the centre of the machine and secured there. The road journey would thus consist only of the distance from the scene of the accident to the landing ground of the aeroplane.

* * * *

An Aerial "*Black Maria*"

The Russian authorities have decided to invest in an aeroplane for use as a "*Black Maria,*" to convey prisoners to Solovesky Island, a lonely island in the White Sea. Hitherto this journey has been made by boat, or by sleigh when ice was formed.

* * * *

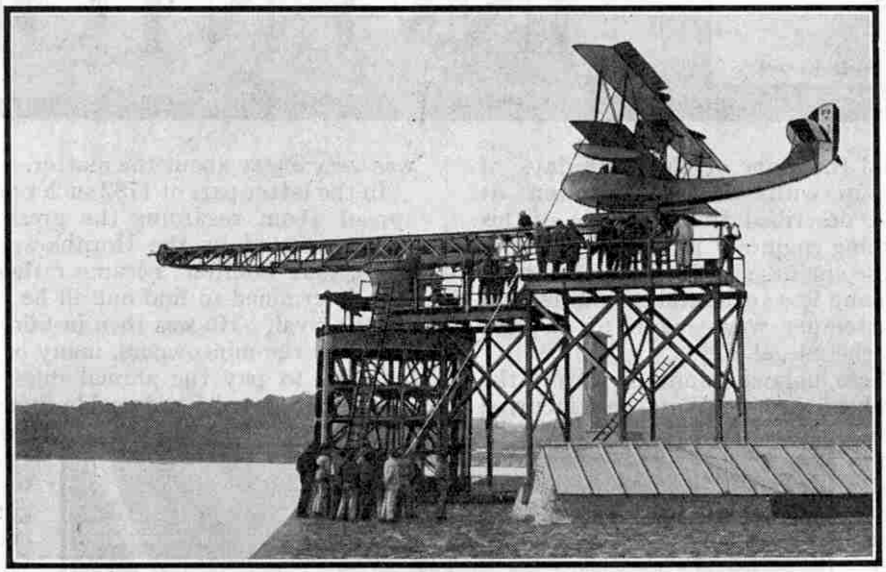
The Blackburn Aeroplane Company have designed a new private owner's aeroplane in which the seats for pilot and passenger are side by side, greater comfort being obtained by the abolition of the central member that previously divided the cockpit. The machine will be fitted with Armstrong-Siddeley "Genet" engines and the price will be £775.

The Development of the Amphibian

In a recent paper read before the Royal Aeronautical Society, Major R. Penny spoke of the future development of amphibious machines. He pointed out that it has been shown conclusively that the small flying boat is incapable of withstanding hard usage, and that, as in the case of ships, increased seaworthiness can be obtained only by increased size. As the flying boat increases in size, an increased water clearance for the propeller should be allowed. In actual practice the increase in weight in the latest machines has been followed by larger propellers instead of a greater number and, as a result, no greater clearance has been obtained. Until this practice is altered the seaworthiness of the large flying boat will be more apparent than real.

Major Penny also drew attention to the developments in the use of variable wings and of metal construction and said that similar developments in higher compression engines and geared variable pitch propellers might be expected in the near future.

"Some" Catapult!



Our illustration shows one of the specially designed catapults as used for launching aeroplanes on warships. The aeroplane is placed in position on the carriage and is then shot off by means of compressed air, which is released suddenly, launching the aeroplane at a speed of nearly 50 miles per hour, in absolute safety.

The machine shown in the illustration is a Richard Penhoet flying boat and will be described next month

* * * *

Hudson Bay Exploration

An English engineer, Mr. Henry Palmer, has been engaged to obtain information for a report upon Hudson Bay and Hudson Straits, and the relative merits of Churchill and Nelson as a port for steamers. For this purpose six Fokker commercial aeroplanes are to be employed, the aerial part of the survey being carried out by the Royal Canadian Air Force for the Department of Marine and Fisheries. Three bases are to be established along the coast bordering the Straits and each will form the headquarters of two aeroplanes.

The machines to be used can be fitted with wheels, pontoons or skis, interchangeably. Each will carry four passengers in addition to the pilot, and cameras and wireless apparatus will be included in the equipment.

* * * *

Fourteen landscapes painted from the air are now on exhibition in London. These are the work of Ernest Vollbehr, a Munich artist, and are stated to be the first paintings made from aircraft.

* * * *

Air Mails in 1926

The air mails for 1926 show an increase of about two per cent. over those of 1925. About 17,000 lb. of letter mails were carried during 1926. The mail to Germany shows an increase of 64 per cent.

A new self-starter for aeroplanes has been invented by a Detroit man. Compressed air is employed as a motive power and the whole apparatus weighs less than 20 lb.

* * * *

An aerial map showing eight square miles of Central London on a scale of 11.25 in. to the mile, has been issued by the Underground Railways.

Aerial Transport in Belgian Congo

During the period 1923-26 several air lines have been opened in the Belgian Congo. These run from the Lower Congo to Katanga (970 miles), Boma to Elizabethville (1,400 miles), Leopoldville to Luebo, Luebo to Katanga and Boma to Leopoldville. Only 31,243 miles were covered in 1925 but this grew to 98,951 in 1926.

New lines are to be established between Leopoldville and Coquilhatville (390 miles), Luebo and Ischikapa (90 miles), Luebo and Lusambo (240 miles), Coquilhatville and Stanleyville (562 miles), and Lusambo–Kabalo–Kongolo (375 miles).

The Belgian Government have been asked to grant a subsidy of £50,000 to assist the scheme.

* * * *

A New Air Camera

A new type camera has been designed by the United States Army Air Service for use in aerial survey work. A special type of film is employed that is sensitive only to the infra-red end of the spectrum, in other words to those rays that pass with the greatest ease through fog, dust, etc. The camera lens has a focal length of 36 in. and at a height of five miles will have a field of view 75 miles across. The machine carrying this camera will operate from the aerodrome at Dayton and will attempt to take photographs of Detroit 195 miles distant.

German World Flight

A Zeppelin of 105,000 cubic metres capacity is now under construction at Friedrichschafen and on completion will be used for a world flight under the direction of Dr. Eckner, the head of the Zeppelin factories. This flight is planned to take 12 days, three stops being made. The stages will be Friedrichschafen to Vladivostock, Vladivostock to Vancouver, Vancouver to Friedrichschafen. No stop of more than six hours, the time required for re-fuelling, will be made. A new fuel, "etano" gas, is being developed and Dr. Eckner does not intend to start his flight until this spirit is perfected.

Dr. Eckner also intends obtaining a contract from the Argentine Government for mail-carrying. A contract for this work has been obtained by the Compagnie Latecoère, who intend using aeroplanes, but it is not known whether this excludes the granting of other contracts.

* * *

New World's Records

A German pilot, Schnaebele, flying a Junkers type 33 machine fitted with a Junkers L.5 engine, has established a new non-stop record for machines carrying a useful load of 500 kg. The previous record of 15 hours was held by a Swiss airman. Schnaebele set up a new record of 16 hours, and a few days later made a non-stop flight of 22 hours, covering 1,710 miles, flying between Dessau and Leipzig.

* * * *

First Provincial Airport

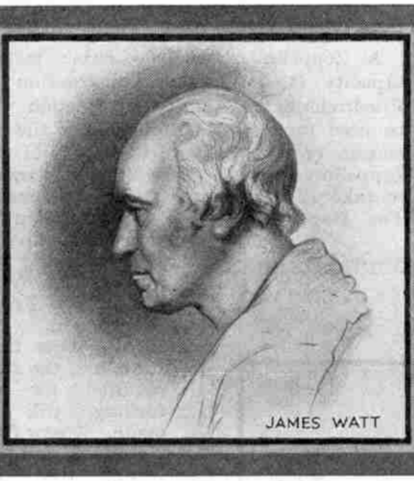
An officer of the Royal Air Force visited Merseyside recently on instructions from the Air Ministry and inspected several possible sites for aerodromes. It is stated that the Ministry are giving serious consideration to the question of establishing a military air unit near Liverpool. If this intention is realised it is probable that the airport would be available also for commercial and recreative flying purposes.

* * * *

Woman Pilot's Height Record

A world altitude record for light aeroplanes has been set up by Mrs. Eliott Lynn, who reached a height of 16,000 ft., flying an Avro "Avian." The class for which this record holds good is a new one for two-seater aeroplanes of not greater weight than 880 lb.

It is of interest to note that the greatest height ever reached by a woman pilot is 22,000 ft., this record being held by an American.



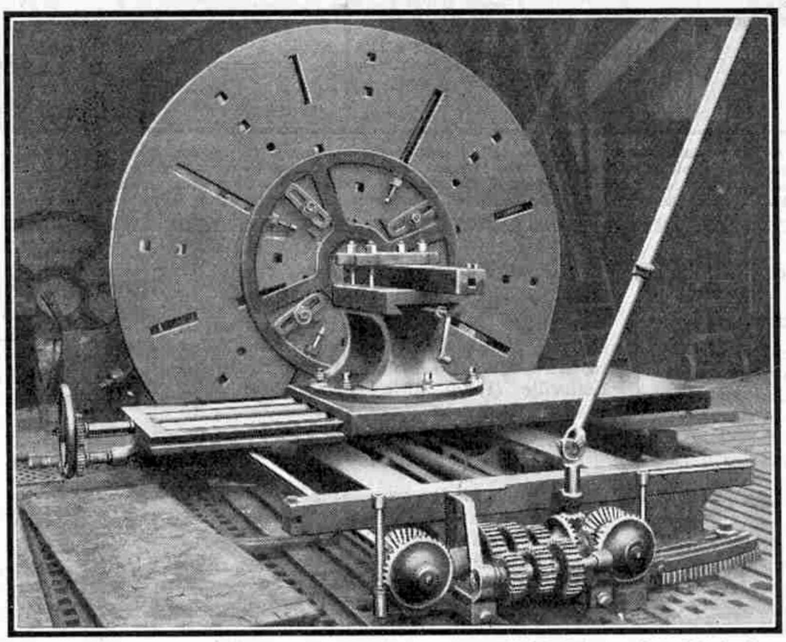
LIVES OF FAMOUS INVENTORS

V

WATT AND THE STEAM ENGINE

LAST month we told the story of the early days of Watt's partnership with Matthew Boulton at Birmingham and described the principle of his rotative and double-acting engines. It was only natural that the success of these engines should arouse a certain amount of jealousy among less successful inventors, and in 1780-81 various attempts were made to deprive Boulton and Watt of their legal rights.

Foremost among these unlawful imitators were the Hornblower family, whose enmity Watt had incurred by establishing his pumping engines in Cornwall. The Cornish tin mines that had discarded the Newcomen engine in favour of Watt's more efficient contrivance had in many cases been equipped with the former engines by Joseph Hornblower and his sons. The arrival of Watt upon the scene with his engine was therefore regarded with acute disfavour by the Hornblowers, and although Watt sought to overcome their jealousy by employing them on erecting his own engines, they accepted the work only in order that they might become thoroughly familiar with the construction and working of the new engine, and use the knowledge to their own advantage.



Photograph courtesy] [*W. & T. Avery Ltd., Birmingham*

Face Plate Lathe, 26 ft. in diameter, designed by Watt and used at Soho. It is a wonderful piece of mechanism and still in perfect accurate working order

Watt's Patents Infringed

In 1781 the Hornblowers secretly designed a steam pumping engine somewhat similar to that of Watt and set up as independent engine builders, announcing that they had perfected an original steam engine much superior to the engines of Boulton and Watt. In spite of the high reputation that the Soho engines had gained, the Hornblowers secured several orders for their alleged invention. Upon investigation Watt found, of course, that the engine was largely copied from his own, and he was very angry about the matter.

In the latter part of 1782 such remarkable reports were spread about regarding the great achievements of an engine erected by the Hornblowers at Radstock, near Bath, that Boulton became rather uneasy. He therefore determined to find out all he could about this mysterious rival. He was then in Cornwall, and the critical affairs of the mineowners, many of whom were pleading inability to pay the annual dues for their new steam engines, rendered it advisable to remain on the spot to safeguard his interests.

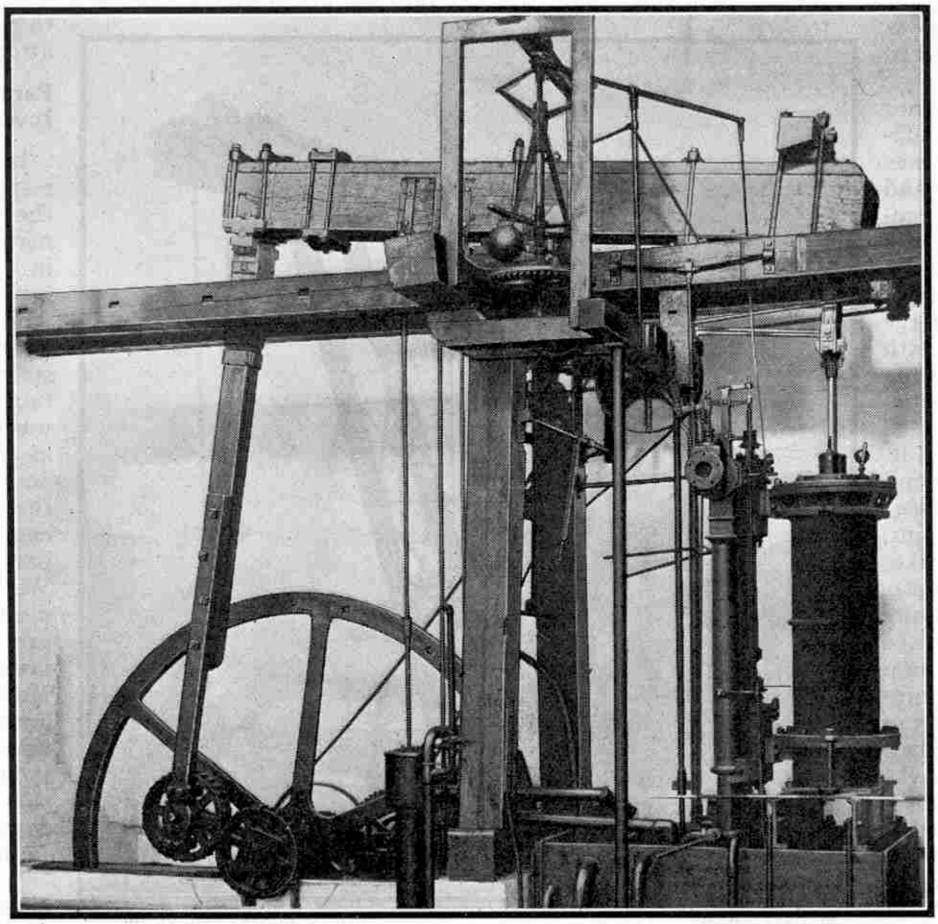
As he was thus unable to get away to investigate the Hornblower engine personally, Boulton sent a reliable Soho workman named James Law. On arrival at Radstock Law soon located the engine but found that the Hornblowers were keeping guard over it day and night. By the exercise of great caution he managed to get a peep through the engine house window but the engine was not then working.

Meanwhile, at Boulton's request, Watt had journeyed to Bristol to warn the employers of the Hornblowers that the engine they had bought was an illegal imitation of the Soho engine. On learning at Radstock that Major Tucker, the principal partner of the company, had gone to Bath, Watt journeyed thither, only to find on arrival that Tucker had gone on to Melcompton. So to Melcompton went Watt, there to discover that the object of his pursuit was out hunting. Watt waited in the village inn, and about mid-afternoon Tucker returned. After hearing Watt's business he promised to report the matter at the next meeting of his company, and that was all the worried inventor could get out of him. Apparently Watt did not like Major Tucker, for he later described him as "a potato-faced, chuckle-headed fellow!"

Before returning to Birmingham Watt arranged for the local press to publish a notice, prepared by Boulton, cautioning the public against adopting the Hornblower engine, and declaring this to be an infringement of the patent rights of Boulton and Watt.

New Uses for the Steam Engine

At the beginning of 1781 many steam pumping engines were in course of construction at Soho for erection at Cornish tin mines. Boulton even then was visualising the time when every mine in the country would be so equipped and he became desirous of adapting the steam engine to new work, so that there should be no falling-off in orders. During a visit to Wales in 1781 Boulton saw a large copper-rolling mill driven by water, and on learning that during the summer months it sometimes stopped owing to drought, he asked: "Why not use our engine? It goes night and day, summer and winter, and is altogether unaffected by drought." Although his suggestion does not appear to have been followed up, the incident suggested a new field for the steam engine.



A Watt double acting beam engine, embodying parallel motion and sun-and-planet gearing

Subsequently Boulton erected a steam forge, and finding this work quite satisfactorily he invited the local ironfounders to inspect it. This they readily did, and general astonishment was expressed by them at the ability of the engine to draw more steel in a day than could a neighbouring large rolling mill worked by water. The enterprising ironmaster, Wilkinson, promptly ordered one to be made on a big scale, and it was subsequently installed in the Bradley ironworks. A second order received shortly afterward was for a steam rolling mill to be installed in an ironworks at Rotherham.

At that period there were few ironworks in existence, however, and Boulton was anxious to sell steam engines to the many breweries and corn flour mills throughout the country. The patenting of the rotative engine in 1781 was a definite step toward the achievement of this ambition, but Watt, as sensitive as ever to possible faults in his devices, did not at first share his partner's confidence that the engine could be successfully adapted to the new purposes.

To one gentleman to whom Watt had expressed much doubt as to the advisability of applying the steam engine to drive a corn mill, Boulton wrote in 1782:—" You have had a correspondence with my friend Watt, but I know not the particulars . . . you must make allowances for what Mr. Watt says . . . he *undervalues* the merits of his own work . . . *I* will take all risk in erecting an engine for a corn mill . . . I think I can safely say our engine will grind *four* times the quantity of corn per bushel of coal compared with any engine hitherto erected."

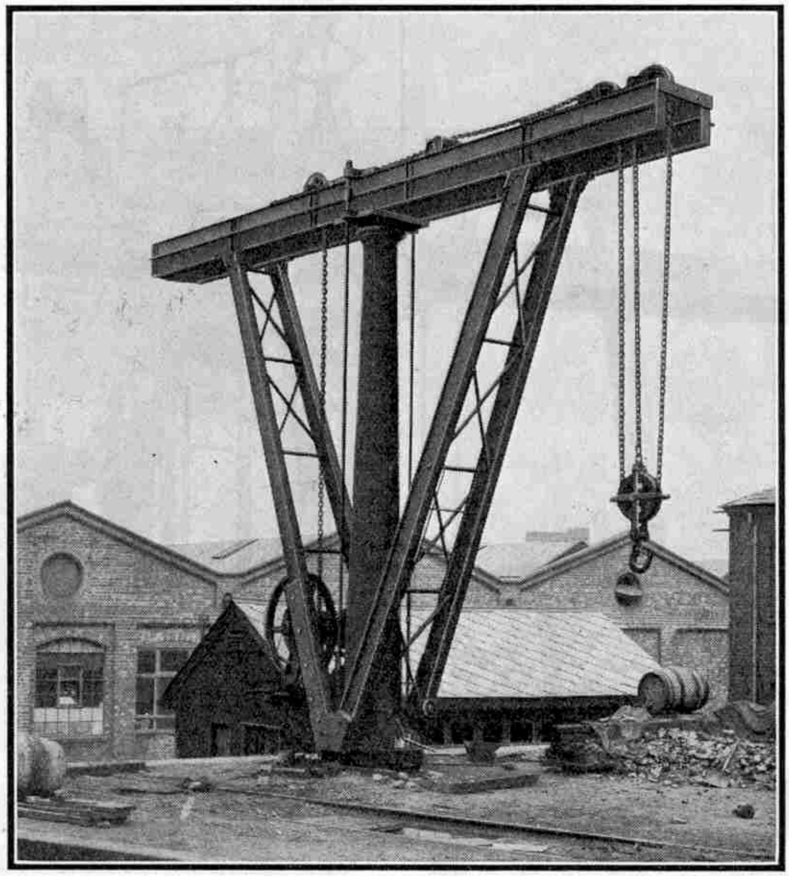
The first rotative engine made and supplied by Boulton and Watt was erected toward the close of 1782 for a corn mill at Ketley, and some time later a similar engine was erected in a London brewery.

Success of Steam Tilt Hammer

While Boulton was in Cornwall during the winter of 1782, Watt, at Soho, adapted the rotative engine to work a tilt-hammer for iron forging and steel making. On 28th November of the same year, Watt reported to Boulton by letter that " the rotative motion and mill part answered to every expectation, but the hammer-frame and anvil-block were not sufficiently secured, which, however, I have given orders for doing. And as the engine has a great overplus of power, I mean to increase the weight of the hammer to about 1½ cwt., and to cause it to make 250 or 300 strokes per minute, by diminishing the height it rises to 9 or 10 inches. The present facts are, cylinder, 15 inches diameter, and 4 ft. stroke, 25 strokes per minute; hammer makes 6 blows per stroke of the engine; fly under 5 cwt., and 7 ft. diameter; hammer 120 lbs., and 18 inches wide; it strikes a good blow, and forges iron very well. The camms were wood, and were cut all to pieces by the anvil-block sinking. I have ordered steel ones to be made, which I expect will stand it."

Two days later Watt wrote: " I saw the tilt go admirably from 16 to 24 strokes per minute, and it could have gone much faster, but our men could not work the iron under it. Joseph said that yesterday they made it go 28 strokes per minute, which is much more than the engine should do by my calculations; but in the midst of our glory, the hammer helve broke; it appears to have been rotten. The steel camms answer very well, and the whole will answer better when made to have a less lift and more strokes, as it will then answer for a common tilt for steel; at present the blow is so strong, that we dare not attempt to hack a piece of iron under 1½ inch square, otherwise it knocks it to pieces. By the help of some more weight on the outer end of the beam, it goes so regular that you cannot tell when the engine is going out or when coming in."

By dint of such minor improvements the efficiency of the engine was steadily increased, and writing on 13th December of the same year Watt informed Boulton that: "We have tried our little tilting-forge hammer at Soho, with success. The following are some of the particulars:—cylinder 15 inches diameter, 4 ft. stroke, strokes per minute 20. The hammer-head, 120 lbs. weight, rises 8 inches, strikes 240 blows per minute. The machine goes quite regular, and can be managed as easily as a water-mill. It requires a very small quantity of steam, not above half the contents of the cylinder per stroke. The power employed is not more than ¼ of what would be required to raise the quantity of water which would enable a water-wheel to work the same hammer with the same velocity."



Photograph courtesy] [*W. & T. Avery Ltd., Birmingham*

20-Ton Crane designed by Watt about 1798 and used at Soho

When Wilkinson, the ironfounder, witnessed the remarkable powers of Boulton and Watt's latest contrivance, he immediately ordered a large one for the ironworks at Bradley. This steam tilt hammer was duly made and by the end of April, 1783, was erected. When tried out it created a new record by attaining 300 blows per minute.

"We have had a trial of our new forge-engine at Bradley," wrote Watt to Boulton, who was still in Cornwall, "cylinder 42 inches diameter, 6 ft. stroke. Makes from 15 to 50 (even 60 strokes per minute) at pleasure, works a hammer of 7½ cwt. raised 2 ft. high, which makes 6 strokes per stroke of the engine, and has struck 300 blows per minute; we are, however, going to make it strike only 4½ blows per stroke of the engine, because we want the latter to go 20 strokes per minute, and they want only 90 blows of the hammer in that time; but will increase the weight of the hammer to 10 cwt. N.B.—The engine is to work two hammers, but is capable of working four hammers, of 7 cwt. each."

In 1783 Boulton was compelled to take a long holiday to avoid a complete breakdown in health, but neither friends nor doctors could persuade this indefatigable worker to be wholly idle. On his way to Scotland for a "rest," Boulton stayed at Newcastle long enough to visit the principle coal mines and inspect their machinery, for he had a hope of one day being able to sell steam engines suitable for coal mine operation. Several weeks of Boulton's visit to Scotland were spent at Carron, and at the ironworks there he initiated Roebuck's successors into the art of manufacturing tough bar-iron, a product they had not hitherto attempted to make.

Parallel Motion Invented

In spite of his manifold responsibilities during the absence of his partner, Watt was engrossed in perfecting further inventions, and on 28th April 1784, his fourth patent respecting the steam engine was obtained. The new patent was as comprehensive as the two preceding ones, and it included the adapting of the engine to work a tilt hammer. The item that Watt regarded as the most important, however, dealt with his invention of Parallel Motion. The immense advantages of this innovation can best be judged, perhaps, from the inventor's own words in his letters to Boulton.

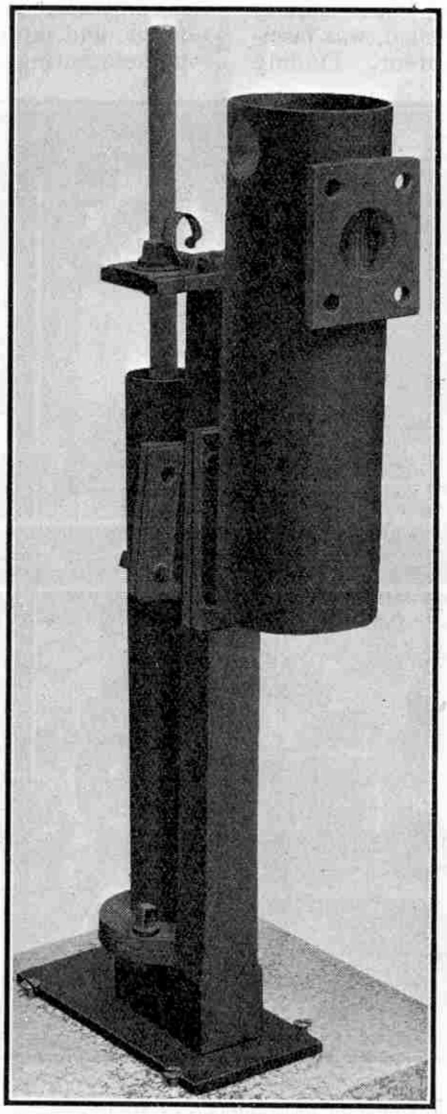
"I have got a glimpse," he wrote, "of a method of causing a piston-rod to move up and down perpendicularly, by only fixing it to a piece of iron upon the beam, without chains, or perpendicular guides, or untowardly frictions, arch-heads, or other pieces of clumsiness; by which contrivance, if it answers fully to expectation, about five feet in the height of the (engine) house may be saved in 8 ft. strokes, which I look upon as a capital saving; and it will answer for double engines as well as for single ones. I have only tried it in a slight model yet, so cannot build upon it, though I think it a very probable thing to succeed, and one of the most ingenious simple pieces of mechanism I have contrived, but I beg nothing may be said on it till I specify."

Later, Watt was able to relate further progress in his experiment:—"I have made a very large model of the new substitute for racks and sectors, which seems to bid fair to answer . . . It is a perpendicular motion derived from a combination of motions about centres, very simple, has very little friction, has nothing standing higher than the back of the beam, and requires the centre of the beam to be only half the stroke of the engine higher than the top of the piston rod when at lowest, and has no inclination to pull the piston rod either one way or another except straight up and down. It has rather more power at beginning and end of the stroke than in the middle—I think about one-sixth; which I believe will do no hurt in rotative motions, and little in any case. Beams mounted in this way need no arches. . . . However, don't pride yourself on it; it is not fairly tried yet and may have unknown faults. . . . ."

No untoward possibilities developed, however, and Watt rejoiced that "the new central perpendicular motion answers beyond expectation, and does not make the shadow of a noise."

The first engine to be fitted with the parallel motion device was a 30 h.p. rotative engine supplied in 1785 to Messrs. Whitbread's London brewery. This engine accomplished work hitherto done by 34 horses, and consumed only four-fifths of a bushel of coal per hour. It proved such a sensational success that some time later King George III. expressed a wish to see it, and a Royal visit was arranged. In May, 1787, the King accompanied by Queen Charlotte, visited the brewery, where Watt waited upon them and personally explained the working of his wonderful invention.

To most people Watt's greatest achievement is his invention of the separate condenser (as described in the March "*M.M.*") He was immensely proud of this parallel motion, and it always held first place in his esteem.



Original Model of a Surface Condenser made by Watt

Steam Wheel Carriages

The patent of 1784 also contained details of a method of applying the steam engine to drive a wheel carriage for the conveyance of either passengers or goods. This interesting item was the result of efforts made from time to time to persuade Watt to investigate the possibilities of so adapting his engine.

It will be recalled that Robison at Glasgow had, in their University days, first interested Watt in the subject of Steam by speculating as to how the Newcomen engine might be made to move road carriages. After a preliminary experiment, however, Watt had dismissed the idea as impracticable. The matter had later been revived by Dr. Small, who wrote in 1769 to Watt, then in Scotland, relating that "A linen draper at London, one Moore, has taken out a patent for moving wheel-carriages by steam. This comes of thy delays. I dare say he has heard of your inventions. Do come to England with all possible speed. At this moment how I could scold you for negligence! However, if you will come hither soon, I will be very civil, and buy a steam-chaise of you, and not of Moore. And yet it vexes me abominably to see a man of your superior genius neglect to avail himself properly of his great talents."

Moore's vehicle, however, does not appear to have been a success, but the possibilities it indicated further increased Small's enthusiasm, and later he told Watt that he had hit upon a "most easy and obvious method of moving carriages by a reciprocating engine, provided a tolerably tight piston can be found," adding that the engine would occupy only a small space within a carriage and weigh—including necessary water—no more than 300 lb. But Watt was fully occupied in perfecting his stationary engine and Small's enthusiasm met with no response.

The spirited interest of Dr. Small in this problem of steam locomotion was shared by a friend named Edgeworth, who, after Small's death in 1775, continued the effort to persuade Watt to apply his genius to this new possibility of increasing the usefulness of the steam engine. Watt seems to have been strangely apathetic, however, and although he did give the matter further thought many years later—as the patent of 1784 proves—he never put his scheme into actual practice. On the other hand, he even sought to dissuade his colleagues from going any further into the matter.

In his specification of 1784 Watt emphasised that steam engines for road carriages would have to be portable. He advocated that both boiler and steam vessel be cylindrical in shape, the former "for the sake of lightness" to be either of wood or thin metal, securely bound by hoops, or otherwise, "to prevent it from bursting by the strength of the steam; and the fire is contained in a vessel of metal within the boiler, and surrounded entirely by the water to be heated, except at the apertures destined to admit air to the fire, to put in the fuel, and to let out the smoke; which latter two apertures may either be situated opposite to one another in the sides of the boiler, or otherwise, as is found convenient; and the aperture to admit air to the fire may be under the boiler. . . ."

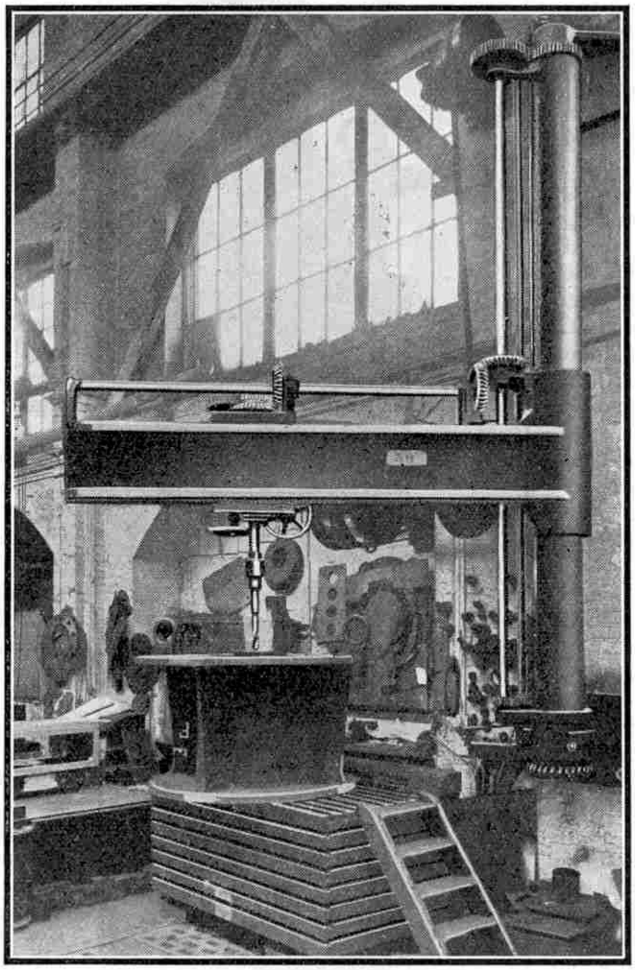
In the adjoining steam vessel advantage was to be taken of the expansive force of steam in actuating the piston, the "used" steam being discharged either into the atmosphere or into an air-tight condenser, made of thin plates or pipes of metal. Watt recommended that the exterior of the condenser should be exposed "to the wind," or to an artificial current of air produced by a pair of bellows, or by some similar machine wrought by the engine or by the motion of the carriage; which vessel, by cooling and condensing part of the steam, does partly exhaust the steam-vessel, and thereby adds to the power of the engine, and also serves to save part of the water of which the steam was composed, and which would otherwise be lost. Motive power was to be transmitted by means of sun-and-planet gearing or other satisfactory rotative motion, "to the axis or axle-tree of one or more of the wheels of the carriage."

"As carriages are of many sizes and variously loaded, the engines must be made powerful in proportion" observed Watt, "But to drive a carriage containing two persons, will require an engine with a cylinder seven inches in diameter, making sixty strokes per minute of one foot long each, and so constructed as to act both in the ascent and descent of the piston ; and the elastic force of the steam in the boiler must occasionally be equal to supporting a pillar of mercury thirty inches high."

Murdock's Steam Locomotive

Murdock, to whom the idea of making steam engines capable of driving vehicles greatly appealed, was fascinated by the scheme outlined in Watt's patent. Finding that the inventor was engrossed with other matters and very disinclined to enter upon any practical experiments with steam carriages, Murdock began to devote his spare time at his lodgings in Redruth, Cornwall, to building a small working model steam-driven vehicle, according to Watt's principles.

Murdock's locomotive, or "grasshopper beam engine" as it has since been called, has two large driving wheels in the rear, and a third and smaller wheel at the front, mounted on a swivel, is used for steering. Each of the wheels has eight strong wire spokes and is equipped with a small tubular rim. The "body" of the locomotive comprises a long narrow platform on the rear part of which the steam engine is mounted, while at the other end is the steering handle that passes down through the platform to the swivel. On the platform and in front of the steering apparatus is a tall vertical pole to the top of which one end of the engine beam is attached. The other end of this beam is connected to the cylinder piston rod that cants it up and down when the engine is working. Close to the piston rod is another rod that extends down from the beam, passing through the platform to a crank on the axle of the driving wheels. Steam is raised in the boiler by a small spirit lamp beneath it, the chimney of the lamp extending upwards through the boiler.



Courtesy] [*W. & T. Avery Ltd.*

Radial drill used by Boulton and Watt at Soho Works

The model locomotive worked successfully when tried out in Murdock's room, and he decided upon a more severe and longer test in the open. He dare not take the engine out during the day, however, lest it create alarm among the unenlightened townspeople. One dark night, therefore, Murdock took the locomotive to a narrow secluded thoroughfare suitably screened on each side by high hedges, and known as "Church Lane."

Murdock duly lit the spirit lamp beneath the boiler and in a very short time the necessary steam was raised. With the lamp flame shooting out of the short chimney, the locomotive moved off and gained speed so rapidly that Murdock was soon in full chase after his fiery hissing "monster." The story goes that the rector of the parish on his way home encountered the engine, puffing and hissing along in an unearthly manner and at first believed it to be an undoubted manifestation of the Evil One !

Watt Disapproves of the Invention

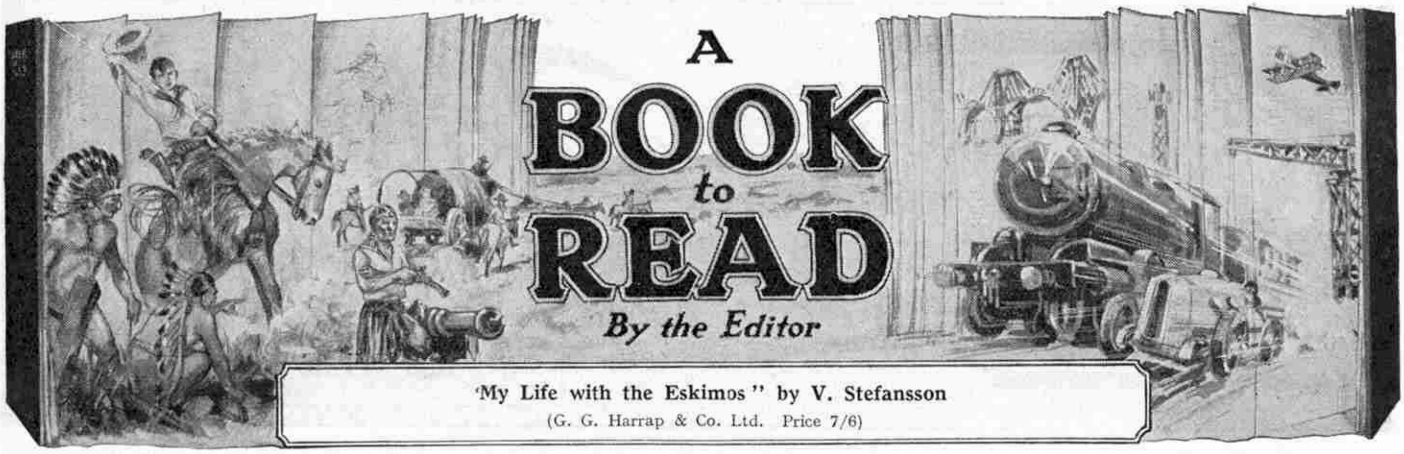
Murdock was delighted with the speed and power exhibited by his contrivance, and packing it carefully he set off with it to London in the hope of obtaining a patent for it, and later persuading Boulton and Watt to start manufacturing steam locomotives. Boulton happened to meet him at Exeter, however, and as it did not coincide with the ideas of the firm to lose their best engineer in this fashion, Murdock was persuaded to return. Writing to Watt of the incident, Boulton stated in a letter from Truro, dated 2nd September, 1786:—"He hath unpacked his carriage and made it run a mile or two up and down in River's great room, making it carry the fire shovel, tongs and poker. I think it fortunate that I met him as I am persuaded I can cure him of his disorder or turn the evil to good." From this letter it is clear that Boulton had no great opinion of steam-carriages and their possibilities.

When Watt heard of Murdock's experimenting he was somewhat annoyed, for like Boulton he regarded steam-carriages as impracticable. Murdock was loth to let such a promising matter as his locomotive be thus dismissed, however, and we find Watt writing to Boulton on 12th September of the same year in this strain :—"I am extremely sorry that W.M. still busies himself with the steam-carriage. In one of my specifications I have secured it as well as words could do it according to my ideas of it . . . I have still the same opinions concerning it that I had ; but to prevent as much as possible more fruitless argument about it, I have one of some size under hand, and am resolved to try if God will work a miracle in favour of these carriages . . . In the meantime I wish W. could be brought to do as we do, to mind the business in hand, and let such as Symington and Sadler throw away their time and money, hunting shadows."

On learning later that Murdock had ceased busying himself with the locomotive, Watt appears to have abandoned the practical test referred to in this letter, for nothing more is heard of the matter.

Dissuaded from following up his initial success on the locomotive, Murdock turned his attention to devising improvements for Watt's steam

(*Continued on page* 664)



A BOOK to READ

By the Editor

“My Life with the Eskimos” by V. Stefansson

(G. G. Harrap & Co. Ltd. Price 7/6)

“EXPLORATION,” says Stefansson, in the foreword to his latest book, “brings out all the highest human virtues; it also lays bare all the human weaknesses.” The truth of this saying is easily seen from this enthusiastic explorer's account of his five years in the unexplored Arctic regions, and those who are interested in our series of articles on the subject, would do well to carry their interest further and read this splendidly-written book.

It is a story of daring resolution, courageous endurance, and great achievement among a race of people who previously had never seen a white man. To Stefansson, who had previously made journeys into the Arctic, it seemed that possibly “there might exist on the north shore of the continent of America, and possibly on Banks Island and Victoria Island people who had not seen a white man, either they or their ancestors, and there almost certainly were other people who themselves had not seen white men, although the ancestors of some of them might have seen explorers of Franklin's own party or else men in the Franklin search.”

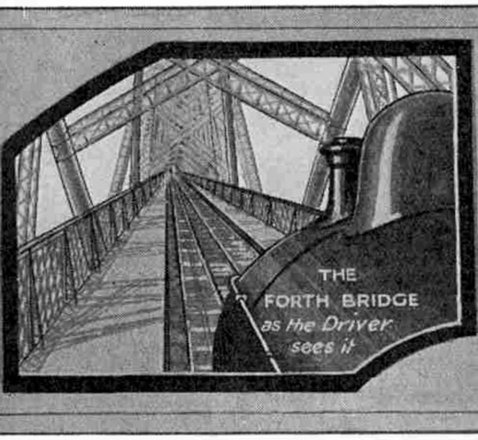
“These are not Eskimos,” said Stefansson's guide, “they merely talk and act like Eskimos.”
A group of the mysterious Victoria Island Eskimos, whom Stefansson believes to be descended from Europeans

To test this possibility, therefore, Stefansson, accompanied by Dr. Anderson, set out in 1908 for this region and reached it after two years' travel. The difficulties were many and at one time the explorers had to live entirely on seal-oil, which they imbibed by mixing with it tea-leaves, ptarmigan feathers or caribou hair! Even this unpalatable nourishment was at length exhausted and they were reduced to eating the lashings of their snow-shoes and several fathoms of raw hide thongs. As Stefansson points out, “one of the advantages of skin clothing over woollens in Arctic exploration is that you can eat them in an emergency, or feed them to your dogs if the need is not quite so pressing!”

The Eskimos who had never seen Europeans were ultimately discovered in the land bordering the Dolphin and Union Straits. At first they thought the explorers were spirits and they were greatly frightened, but when friendly intentions were made known they gave the white men a wonderfully warm welcome. These newly discovered natives were “not such men as Cæsar found in Gaul or in Britain; they were more nearly like the still earlier hunting tribes of Britain and of Gaul living contemporaneous to, but oblivious of, the building of the first pyramid in Egypt. Their existence on the same continent with our populous cities was an anachronism of ten thousand years in material development. They gathered their food with the weapons of the men of the Stone Age.”

An even more wonderful discovery was made among the neighbouring tribes in Victoria Island. As soon as Stefansson saw these people he knew he was “standing face to face with an important scientific discovery.” As his Eskimo guide said:—“These are not Eskimos, they merely dress and talk and act like Eskimos.” Stefansson's thrilling explanation of the mystery is given when he says:—“From childhood I had been familiar with the literature of the North. I knew that here a thousand and there a hundred men of Scandinavia and of England had disappeared into the Northern mists, to be hid by them for ever from the eyes of Europe. When I saw before me these men, who looked like Europeans in spite of their garb of furs, I knew that I had come upon either the last chapter and solution of one of the historical tragedies of

(Continued on page 616)



Railway News
OF THE MONTH

Speeding Up the Mails

A new belt conveyor has recently been installed at the G.W.R. Plymouth Docks for transferring mail bags direct from the mail ship's tender to the railway mail vans. Previously the mails were transferred by hand, and the services of between 100 and 150 men were required to handle the bags. The introduction of the new conveyor, which has a capacity of 60 tons per hour, has enabled the traffic to be dealt with by less than one-third of the number of men formerly engaged.

* * * *

Steep Gradients

The steepest railway gradients over which passenger trains are worked in Great Britain are the 1 in 23 inclines at Causewayend and Commonhead on the North British section of the L.N.E.R. This is very closely approached by the 1 in 29 Werneth bank on the L.M.S., L. & Y. section, near Oldham. The steepest gradient in the world, worked by ordinary methods, is in Switzerland on the Bernina Railway, which is electrically operated, the incline in this case being 1 in 14.

* * * *

Land Cruises

A travel venture entirely new to this country is being introduced by the G.W.R. in the shape of "Land Cruises." Passengers taking part in these cruises will board a train at Paddington Station and be conducted on a tour lasting either six or thirteen days through some of the finest scenery in the country, at a fare that includes first-class rail and motor coach travel, first-class hotel accommodation, gratuities, and admission to places of interest. An experienced railway official will travel with each tour to supervise arrangements and answer enquiries. The first cruise will commence on Monday, 20th June.

* * * *

Loud Speakers Startle Passengers

Passengers on a tube train from Charing Cross to Hampstead were startled on a recent occasion to hear a powerful voice booming through the car: "Mind the doors, please!" Quick glances up and down the carriage failed to discover the owner of the voice and the secret was not revealed until the train swung into the next station and the voice was heard again: "Strand Station change here for . . . Stand clear of the doors!"

The sound came from a square box placed in an inconspicuous position in the roof of the car. Other boxes were similarly placed in the remaining cars, and each concealed a loud speaker connected with the guard's compartment at the rear of the train. The loud speakers are intended to give information and directions to passengers and the first experiments have been so successful that the scheme is likely to receive an extended trial.

* * * *

German Locomotive's Handicap!

The German State Railways, probably inspired by the news concerning the Southern Railway's "*Lord Nelson,*" have decided to build an express locomotive that will be the most powerful in Europe. Its weight will be 179 tons and it will be capable of hauling 600-ton trains at a speed of 70 miles per hour.

L.M.S. Locos Recently Re-numbered

New No.	Old No.	Name	Class
5901	1161	Sir Robert Turnbull	Claughton
5999	2430	Vindictive	,,
6011	150	Illustrious	,,
5656	1084	Shark (S)	Prince of Wales
5672	867	Condor	,,
5674	1132	Scott	,,
5467	1988	Hurricane	Experiment
5477	667	Mazeppa	,,
5478	1304	Prometheus	,,
5485	496	Harlequin	,,
5492	1526	Sanspareil	,,
5332	896	George Whale	George the Fifth
5333	1559	Drake	,,
5334	2151	Newcomen	,,
5337	1195	T. J. Hare	,,
5386	1193	Edward Tootal	,,
5391	845	Saddleback	,,
5193	1102	Thunderbolt	Precursor
5225	1301	Candidate	,,
5230	2576	Arab	,,
5264	976	Pacific	,,
5292	366	Medusa	,,
5304	302	Greyhound	,,
5318	806	Swiftsure	,,
5110	1903	Iron Duke	Jubilee
5114	1915	Implacable	,,
5172	1910	Cavalier	Renown
5030	2002	Madge	Straight Link

Its description rather takes one's breath away:—"2 C1—*Zweizylindereinheitsheisdampfschnellzuglokomotive!*"

It is really quite tame when translated, however, and means "Two-cylinder, simple, superheated, express locomotive."

* * * *

Last of the "King Arthurs"

No. 806 "*Sir Galleron,*" the last of the projected locomotives of the "King Arthur" class, has recently been completed at the Southern Railway's Eastleigh works. These works will now take in hand an order for 10 goods engines of the 4–6–0 type. Later it is proposed to construct 20 engines of the "Lord Nelson" type and a number of 4–8–0 goods locomotives that incorporate in their design several of the "*Lord Nelson's*" principal features.

* * * *

Interesting Old Railway Order

The following old order, dated 1853 in reference to the starting of trains, is of historical interest:—

"Guards, engine drivers and others are hereby informed that in future any passenger train departing from Edinburgh station within five minutes of the appointed time will be considered as having started at proper time. Thus, supposing that the 5.55 p.m. Mail should depart at 6.2 p.m. it will only be considered as having started two minutes late."

Signed, THOS. K. ROWBOTHAM.

October 25, 1853.

* * * *

New Siberian Railway

It is proposed this year to make a start on the construction of the main line of the Turkestan-Siberian railways, which will be 875 miles in length. Several important towns will be covered in the region served by the new line. It is anticipated that the track will take five years to complete.

The construction of this line undoubtedly will have a very stimulating effect on the exploitation of the vast natural wealth that lies between Central Asia and Western Siberia.

* * * *

Luggage on Carriage Roofs

The following old railway order, in reference to luggage on carriage roofs, dated 1850, is of historical interest:—

"Several of the bridges across the railway on the Hawick and Kelso Branches are low and narrow and apt to injure passengers' luggage and other luggage and parcels if placed on the roof of the carriages.

"It is ordered

"That such luggage and parcels be not (except in cases of absolute necessity) placed on the roofs of carriages. And in any case when it shall become absolutely necessary so to place them the Station Agent and guards are to use the utmost precaution to arrange them so that they will not be injured by the bridges.

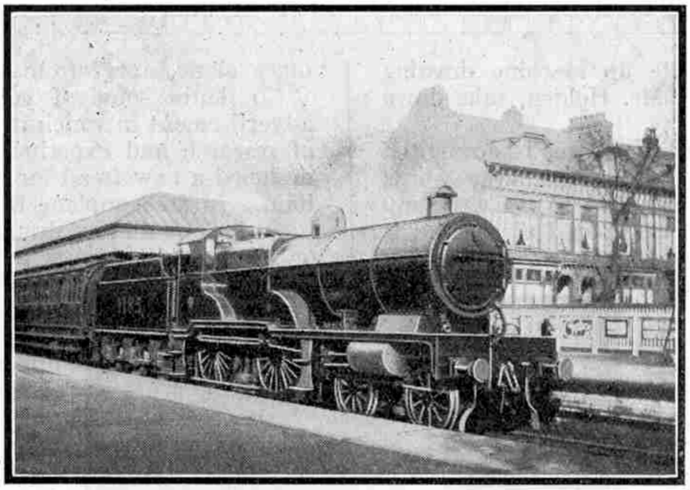
"Mr. Pearson will see that this order is attended to and if necessary will furnish the several stations with a luggage gauge to be used at all times when luggage, etc., may require to be placed on the carriage roofs."

Signed, CHAS. F. DAVIDSON.

July 20, 1850.

L.M.S. 3-Cylinder Compounds

The accompanying illustration shows No. 1185, an L.M.S. 3-cylinder compound working through St. Annes. This class of engine may quite fairly be termed the best compound in the country to-day and altogether nearly 150 are in use, principally on main line work, 40 having been built at Derby in 1924 and another 100 having been delivered since by outside contractors.



Photo] [B. Isherwood, St. Annes

L.M.S. three-cylinder compound No. 1185

The later engines differ slightly in some respects from those built in 1924 to Sir Henry Fowler's original design. The principal divergence is in the size of the cylinders, the dimensions in the case of the two low pressure cylinders having decreased from 21¾ in. diam. by 26 in. stroke to 21 in. by 26 in. Similarly the high-pressure cylinder has decreased from 19¾ in. diam. by 26 in. stroke to 19 in. by 26 in. The working pressure is 200 lbs. per sq. in. The diameter of the driving wheels has been increased by ½ in. to 6 ft. 9½ in.

The engine can be worked as simple, semi-compound or compound. All three cylinders drive the same axle, and three sets of Stephenson gear with six eccentrics on this axle are used. The exhaust from the high-pressure cylinder passes directly into a large steam chest common to the two low-pressure cylinders, thus eliminating the necessity for a receiver pipe.

Compound working is usual when running, and the exhaust from the high-pressure cylinder then passes into the two low-pressure cylinders. When starting, boiler steam at full pressure enters the high-pressure steam chest directly, and also through an additional chamber and port in the regulator, which has a pipe connection to the low-pressure steam chest. In semi-compound working the regulator is in a similar position when starting, but as the speed is considerable, there is a large pressure drop in the small steam pipe which connects the auxiliary port to the low-pressure chest. To change over from compound to semi-compound when running, the regulator has to be completely closed and then re-opened to the auxiliary steam position.

Other leading particulars of the latest engines are:—Heating surface tubes, 1169·50 sq. ft.; firebox 147·25 sq. ft.; giving a total of 1316·75 sq. ft.; superheater 290·15 sq. ft.; grate area 28·4 sq. ft. Tractive effort at 80 per cent. of boiler pressure, 22,649 lb. The tender carries 3,500 gall. of water and 5½ tons of coal, and the weight of the engine and tender in working order is 104 tons 8 cwts.

* * * *

A Locomotive Exchange

Many of our readers doubtless are aware that during the closing months of 1926 an exchange of express engines took place between the G.W. and L.M.S. Railways, No. 5000 "*Launceston Castle*," one of the newest of the G.W. "Castles," being loaned to the L.M.S. in exchange for 4–4–0, No. 1047, a Midland type compound engine.

The actual results of the trials are being retained for the private information of the lines concerned and no official announcement is to be made, but we are able to state that the "*Launceston Castle's*" performance both on the Crewe-Euston and Crewe-Carlisle runs represented the highest power output, in proportion to fuel burned, ever recorded on the L.M.S. track.

During the first fortnight of the trials the "*Launceston Castle*" worked the 10.50 a.m. from Crewe into Euston and the 10.30 a.m. from Euston to Crewe on alternate days, both runs being non-stop. In the second period of the trials "*Launceston Castle*" took the Crewe-Carlisle 1.10 p.m., returning on the alternate day with the 12.20 p.m. Carlisle-Crewe. No attempt at record-breaking speeds was made, the aim of the driver throughout being simply to display the most economical figures in coal and water consumption while at the same time keeping well within his time schedules for the trips.

* * * *

Longest Daily Run

The longest run performed daily in Great Britain by a complete train is the double journey of 271½ miles made each way between King's Cross and Newcastle-on-Tyne. This L.N.E.R. train leaves Newcastle at 8 a.m. each week-day and arrives at King's Cross at 1.35 p.m. Returning from King's Cross at 5.30 p.m., it reaches Newcastle on the return journey at 11 p.m.

* * * *

New G.W.R. Trains

The 174-mile journey from London to Exeter is scheduled to be covered in less than three hours with the introduction of the new express leaving Paddington each Saturday morning during the holiday season. The G.W.R. also are running a new train from Birmingham and Wolverhampton to Birkenhead to connect with the morning boat to the Isle of Man.

* * * *

Signalling Line-side Fires

The railway companies of Great Britain have instituted a new code signal to be used by enginemen who see an unattended fire burning on the side of the line or in fields or woods near to the track and which, of course, they cannot stop to extinguish. The signal, to be given by the engine whistle, consists of a "cockcrow," a long blast and another cockcrow. In this way the attention of workers in the neighbourhood will be attracted to the danger.

Locomotive Tractors for South America

Three powerful internal combustion engined locomotive tractors were recently shipped to South America by the Drewry Car Co. Ltd., of Burton-on-Trent, for service on the Buenos Aires Great Southern Railway 60 c.m. gauge track. Each of the tractors is of the 0–6–0 wheel arrangement and possesses two speeds when running forward or in reverse, four miles and eight miles per hour respectively. The engine fitted is of 60–65 h.p. with four cylinders, each 5½ in. diameter by 6 in. stroke. This provides sufficient power to enable the tractor to haul on a level track loads ranging from 175 tons at the lower speed and 87 tons at the higher speed. The tractors each have a wheel base of 4 ft. 9 in. and weigh eight tons in full working order.

The B.A. Great Southern Railways own over 230 miles of 60 c.m. track, this taking the form of light railway feeders for the main lines. Small steam locomotives and 20–45 h.p. petrol tractors operate the lines at present and during the last twelve months 13,000 passengers and over 134,000 tons of general traffic, principally agricultural, have been carried. The introduction of the new tractors will provide a big increase in the capacity of the individual power units and materially aid the development of the feeders.

* * * *

G.N.R. No. 1

The last trip of this, the most famous of the Stirling single wheelers, was completed recently when the engine ran under its own steam from Doncaster to York, there to take its place as one of the principal exhibits in the L.N.E.R. railway museum.

G.N.R. No. 1 was built in 1869 to the designs of the late Mr. Patrick Stirling and its outstanding features were the 8 ft. driving wheels, a domeless boiler and outside cylinders. It completed over 1,000,000 miles of active service before being retired, a large part of the mileage being run in front of main line traffic, for it was to engines of its class that the principal working of the East Coast expresses fell during the famous races to Edinburgh and Aberdeen in the "eighties" and "nineties."

After retirement, No. 1 was shown at the Franco-British Exhibition in 1910, but merely as a shell. From 1910 to 1925 it remained in the King's Cross locomotive depot. For the Darlington centenary celebrations it was restored to its original condition and was driven under its own steam in the procession.

* * * *

The West Coast "Postal"

Since the appearance of Mr. C. J. Allen's article on the "West Coast Postal," several readers who have taken the opportunity of watching the preparations for despatch of the train have raised a question concerning the lamps that appear on the sides of the coaches. These are for the assistance of the officials in charge of the mail exchanges, and by their aid they are able to ascertain that the apparatus is in order before each exchange, after the bags have been swung out ready for the ground-net.

A FAMOUS PIONEER CHATS WITH "M.M." READERS

The Young Engineer and Aviation

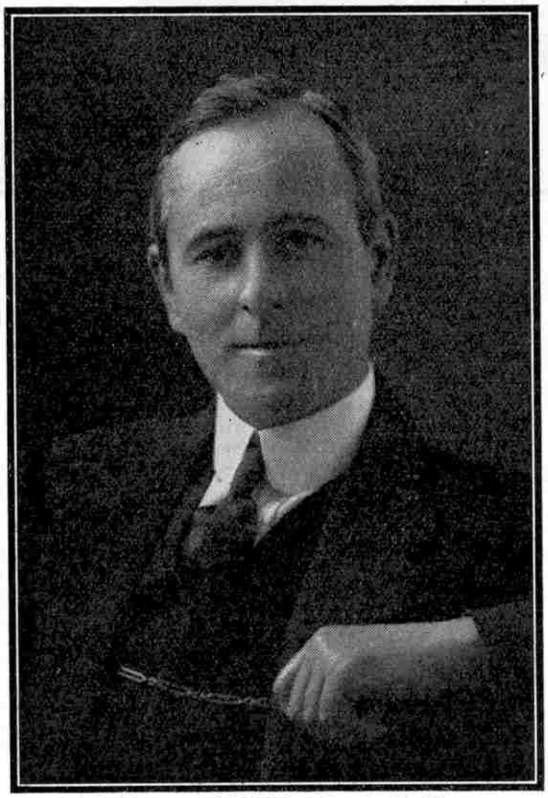
By A. V. Roe

"THOSE who wish to take up machine drawing hold up their hands. Mr. Holden, take down their names!"

These were the words I heard soon after I became the proud possessor of a Pauline cap. The very words "machine drawing" thrilled me, and so up went my hand. It came as a slight shock when I discovered it was a supplementary class to be attended after school hours—but I was too keen to think further of that!

Then came a craving to see the world, and when 14½ years of age I went out to a Civil Engineer in British Columbia to learn surveying. It turned out to be a very unsettled period. I did all sorts of things and, after an adventurous year, came back to England to learn a profession.

My father was a doctor, and he wanted me to follow in his footsteps, but engineering was the only thing I could think of. "It is a hard life, you know—six o'clock in the morning!" he warned me. Again my keenness came to the front, and I thought little of getting up at that time, as I was often up at four o'clock in the morning and cycled to Guildford and back (about 50 miles) before breakfast on one of the first pneumatic-tyred cycles! This was 35 years ago, when we lived at Earl's Court, London.



A Pioneer of Flight: Mr. A. V. Roe

After five years at the Lancashire and Yorkshire Railway Locomotive Works, Manchester, and a year on the engineering side of King's College, Strand, I went to sea as a marine engineer. Many things at sea interested me, but most of all I was fascinated by the albatross, gliding so majestically on the air with seemingly motionless wings. This made me think seriously of tackling the problem of flight.

Then in 1906 the "*Daily Mail*" offered £250 in three prizes for the best flying models. To my great surprise there were over 200 entries. I fortunately secured the highest awarded prize, my machine flying the fullest possible length indoors and the longest distance out of doors. Thus started my aviation career.

* * * *

To-day aircraft design is undergoing rapid development and there is more design and research work carried out in a modern aircraft factory during a normal day than was carried out in 50 years by many old-established firms. Nowadays quite a battalion of engineers of various qualifications are required in the drawing office alone, apart from the works.

No doubt some of you have seen Dunlop's latest advertisement in which it is announced that after years of research and experiment they have discovered and designed a new tread for their tyres. That is only one item. In an aeroplane there are literally thousands of items! Sometimes a draughtsman has to spend weeks, or even months, over a quite small but complicated detail. The reduction of weight, head resistance, and cost of manufacture are often diametrically opposed to each other.

Metals are entering more and more into aircraft construction. Steel is undoubtedly the most difficult material to use, as it has to be so thin. Much of it is only .012 in. (or 12/1000-ths of an inch) thick, which is no thicker than ordinary paper. One can readily understand the difficulty of avoiding local stresses in a spar built up of such thin material when it has to carry attachments that are subjected to very great loads, running into tons.

Flat surfaces have to be avoided. No doubt most people are under the impression that there are no flat surfaces on an ordinary sheet of corrugated iron, but there are! There is a flat portion as one curve joins the other, and the material crumples or fails at this portion when under compression. This can be avoided to a great extent by joining the series of corrugations alternately with corrugations of a much smaller radius. A three-foot length of tube of very thin duralumin, thus corrugated, weighing only an ounce, can be made to support a ton in compression!

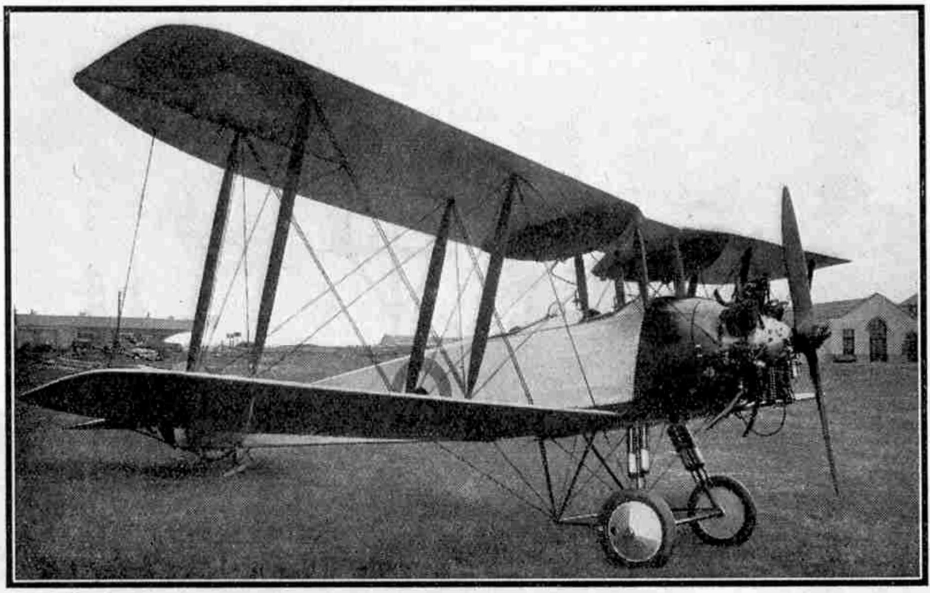
Few people realise the number of parts that are required to build up an aeroplane. The Standard Avro Training Machine of the 504 series is simple constructionally as an aeroplane, yet it contains about 15,000 parts, without counting the engine! Most of the parts are illustrated and numbered in a spare parts schedule.

As readers of the "*M.M.*" know, there are various kinds of aeroplanes, and of these the tractor biplane seems to be the most popular at present. The monoplane is coming forward, however, and offers distinct advantages in simplicity and in stream-lining, which can more readily be carried out, both in commercial and fighting aircraft. In the latter case, guns may be mounted in such a position that there are practically no obstructions to the field of fire in any direction even when two gunners are in action.

Then there is the tail-less aeroplane, with which Capt. Hill is the latest experimenter. This type of machine claims automatic stability and consequently less liability to get out of control. Provided that full control is not interfered with, this is certainly an advantage.

The helicopter has made a circular flight in America but beyond this success has accomplished little.

Senor de la Cierva, the Spanish engineer, has built an "Auto-Giro" by fitting a large horizontal (36 in. diameter) four-bladed propeller—or rather in this case sustainer—mounted so as to revolve freely on a vertical post projecting from the cockpit of a standard Avro fuselage. The engine and propeller are mounted as usual. When the propeller draws the machine along the ground the sustainer begins to revolve and, when it reaches about 100 revolutions per minute, the machine can be flown into the air more or less in the same manner as an ordinary aeroplane. It is claimed that when the machine is stalled it will only sink slowly down, and judging as an eye-witness of a flight by Capt. Courtney, it appears to me that there is good reason to believe this statement. It is evident, therefore, that we have not by any means arrived at finality in aircraft types.



Courtesy] [A. V. Roe Ltd.

An Avro 504 N. fitted with a 180 h.p. Siddeley Lynx Engine

This machine has a span of 36 ft. and a maximum speed of 105 miles per hour. It is fitted for dual control

Since the early days of aviation it has been known that the resistance to forward progress is reduced considerably by flying at high altitudes. For example it is very interesting to observe that it requires as much power to drive an aeroplane at 228 miles per hour at sea level as it does at 1,000 miles per hour at an altitude of 12 miles. Even to-day aeroplanes can be built to fly at the tremendous speed of 300 miles per hour at sea level.

The Germans during the later stages of the war astounded the world by firing shots into Paris from a distance of 75 miles by means of their gun known as "Big Bertha." This remarkable feat was made possible by the reduction of head resistance obtained by passing the shot through rarefied air at a high altitude during a large proportion of its flight.

If engines fitted with efficient supercharging apparatus were available it would be possible to build aircraft capable of flying at speeds approaching one thousand miles per hour at an altitude of 12 miles, where they would be able to take advantage of the winds, which reach a velocity of 200 miles per hour, and where they could fly in clear atmosphere, avoiding rain, snow and monsoons. The pilot and the passenger would be accommodated in an enclosed cabin with warmed air pumped in and kept at a pressure of about 14 lb. per square inch. The cabin being thus hermetically sealed would also help to insulate the passengers from the noise of the propellers and the engines but not from wireless noise, as of course wireless apparatus would be among the craft's equipment.

Since the outside pressure—or lack of pressure—at an altitude of 12 miles is only $\frac{3}{4}$ lb. per square inch there naturally would be an outward bursting stress on the cabin, which would be of round cross-section with domed ends, all forming a structural part of the fuselage or hull. This stress although great is slight in comparison with the usual stresses that have to be allowed for, so that there need be practically no increase of weight on that account. The glass windows would have to be small and numerous in order to reduce their thickness and weight.

The engine or engines of these high-flying craft would be supercharged, developing as much power at 12 miles altitude as at sea level. Strangely enough the temperature at from 8 to 12 miles altitude remains constantly at about —54 degrees C, and is slightly less cold at this altitude above England than it is over the equator—the reverse of what one would have expected. Aeroplanes of this type will be fitted with variable pitch propellers, the pitch being increased as the machine gains height and speed in the more rarefied air.

The trans-Empire aeroplanes may make long non-stop flights or jumps of from 3,000 to 5,000 miles. It has been proposed to have a chain of huge floating harbours and docks across wide oceans and in addition artificial lakes or reservoirs could be constructed near inland towns in order to enable large flying boats to serve such towns.

When we can fly at 1,000 miles per hour it will be possible almost to confound the old saying: "One cannot be in two places at the same time." London, New York and even San Francisco could be visited at the same time on the same day!

From these few remarks I feel sure that my readers will all realise that the young aviation engineer of to-day will have plenty of scope for the exercise of his abilities to-morrow.

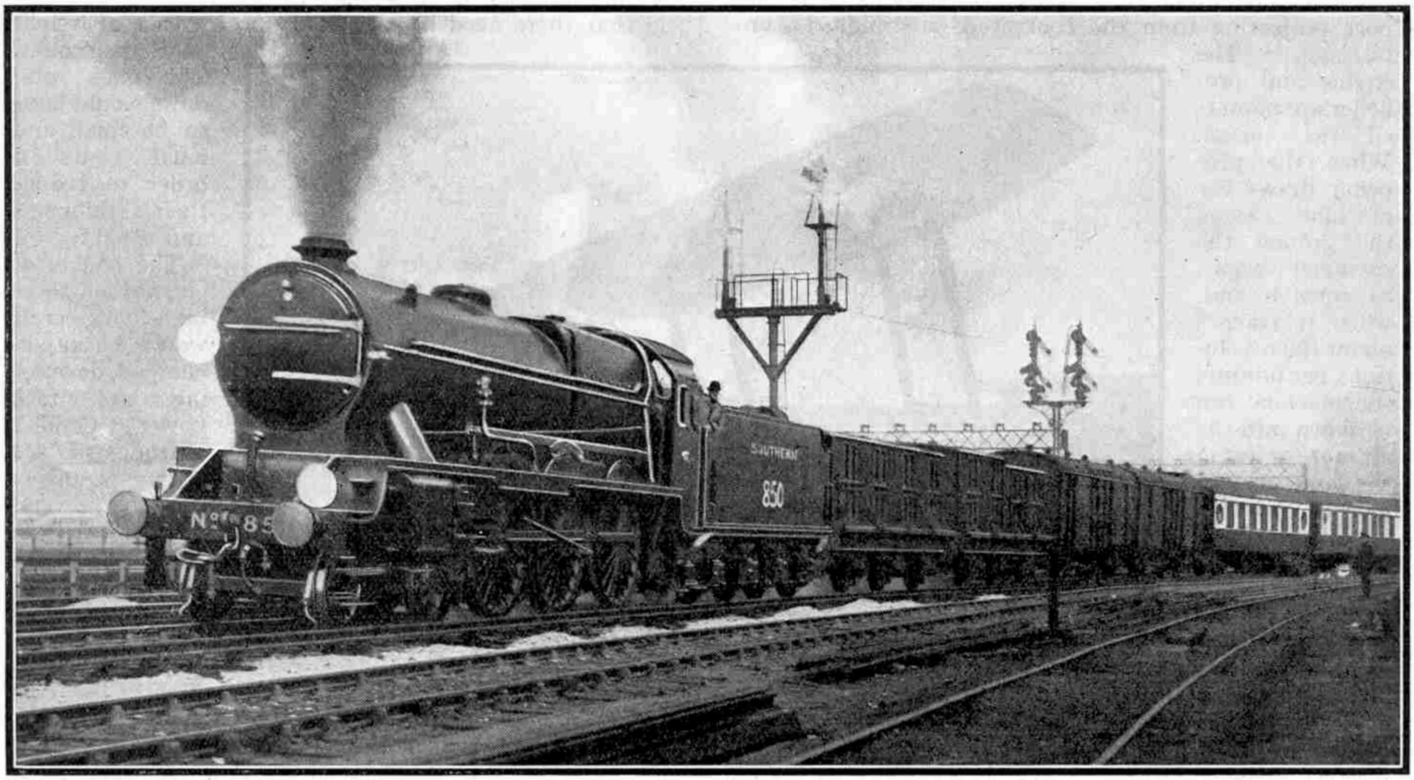
* * * *

The unique position held by Mr. A. V. Roe as the pioneer in aviation in Great Britain makes everything connected with the "Avro" machines a matter of great interest. The firm of which he is the founder and guiding spirit has designed and built many famous aeroplanes from a giant 60-passenger plane to their latest Avian light aeroplane, and next month we shall give a further account of Mr. Roe's career and his most famous machine, the Avro 504.

FAMOUS TRAINS: VII.

The Dover Pullman Boat Express

By Cecil J. Allen, M. Inst. T., etc.



Photo] [F. E. Mackay

Dover Pullman Boat Express leaving Victoria. Engine No. 850, "*Lord Nelson*," with Mr. Cecil J. Allen on the footplate

WHAT the real name of this train is I could not say. For many years past the "Eleven o'clock" service from Victoria has been familiar to travellers all over the Continent but our train this month cannot rightly be called the "Eleven o'clock," because it starts at 10.45! It is, in fact, a first portion of the 11 a.m. train, designed to give its fortunate passengers the choice of places on the boat at Dover. Sometimes it is called the "Golden Arrow," but that name belongs to the French express that runs in connection on the other side of the Channel, and which was described in the May article.

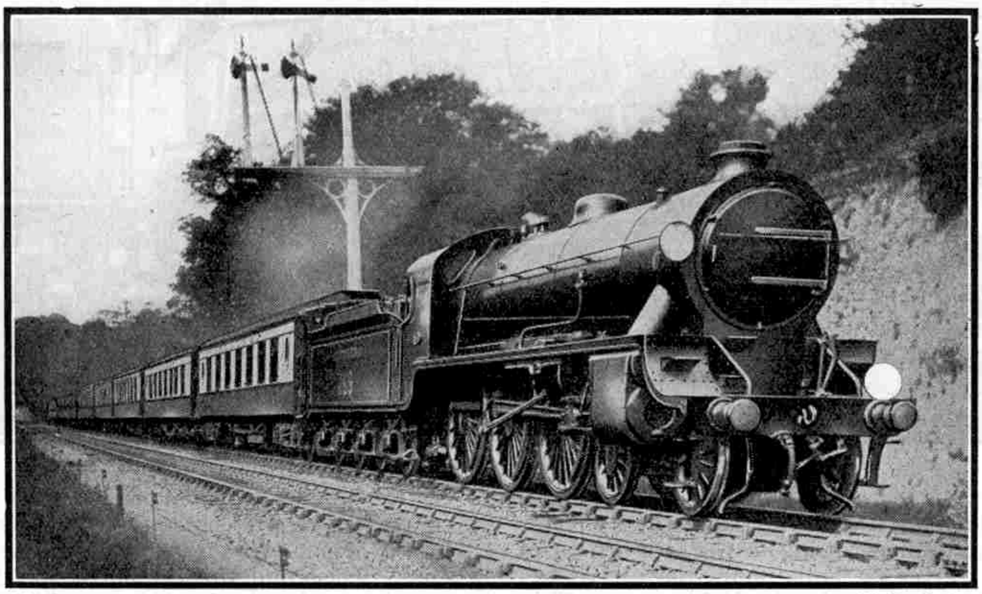
Leading Dimensions of Four-Cylinder 4-6-0 Locomotive "*Lord Nelson*," Southern Railway

Cylinders (Four) Diameter ...	16½ in.
,, ,, Stroke	26 ,,
Driving Wheels, Diameter ...	6 ft. 7 in.
Heating Surface, Tubes	1,282 sq. ft.
,, ,, Flues	513 ,,
,, ,, Firebox	194 ,,
,, ,, Superheater ...	376 ,,
,, ,, Total	2,365 ,,
Firegrate Area	33 ,,
Working Pressure	220 lb. per sq. in.
Tractive Effort (at 85 per cent. wkg. press.)	33,510 lb.
Water capacity of Tender	5,000 gallons
Coal ,, ,, ...	5 tons
Adhesion Weight of Engine ...	62 ,,
Weight of Engine, in working order	83½ ,,
Weight of Engine and Tender (full)	140¼ ,,
Length of Engine and Tender (over buffers)	69 ft. 10 in.

The rudest name that I have heard bestowed upon the 10.45 down is that of the enginemen who, in joint recognition of the beautiful cream and umber livery of the Pullmans and the enormous weight of the train, have nicknamed it the "*White Elephant*." It will be agreed that so famous a train as this needs a name of its own, and one day perhaps the Southern Railway authorities will think out some telling designation, to rank with the "*Southern Belle*" and the "*Atlantic Coast Express.*" Meanwhile it is difficult to write an article of this character in description of a train without a name!

Popularity of the Train

So far from being a "*White Elephant*" in reality, the 10.45 a.m. from Victoria is one of the best-paying trains on the line. Special fares are charged to Dover for the use of these Continental expresses and on this express not only is the accommodation restricted to first class, but a Pullman supplement of 3s. 6d. a head is charged in addition. The general arrangement in regard to Pullman cars, by the way, is that they are built and maintained by the Pullman Car Company, who pay to the railway company concerned an agreed fee for working the cars over their lines. Thus, in a case like this, the railway obtains all the first-class fares and the payment mentioned, while the owners of the cars receive the supplementary fares that are charged for their use, and the profits from this catering. As every seat on the 10.45 is not only occupied, but is generally booked in advance, you will see that this popular train can better be compared to the goose that lays golden eggs than to a white elephant !



Photo] [F. E. Mackay

Dover Pullman Express passing Sandling Junction. "King Arthur" 4-6-0 No. 766, "*Sir Geraint*"

Actually you can reach Paris in the best time of the day by catching the second part of the train, which leaves Victoria at 11 a.m. On this, too, you can make a Pullman journey through to Paris, as at least four Pullmans are usually included in the formation. By catching the "*Golden Arrow*" at Calais you may reduce your journey time between London and Paris to 6 hours, 40 minutes.

The 11 o'clock train also carries ordinary first and third class passengers, in corridor coaches that are vestibuled to the Pullman cars, so that meals and light refreshments can be served in any part of the train. At slack times, between the Continental "seasons," a full train of Pullmans is not always required on the 10.45, and at such times some of the cars are replaced by three or four corridor coaches. But you will customarily find nine of the latest and most luxurious 8-wheeled type Pullmans, weighing 40 tons each, included in the 10.45 a.m. formation, together with one first-class brake coach, weighing 32 tons, bringing up the rear of the passenger portion.

Accommodation for Registered Luggage

Behind that comes the accommodation for registered lugguge. This is no inconsiderable item ; it requires two 4-wheeled vans and two 6-wheeled trucks carrying the "luggage-boxes." Readers of the "*Meccano Magazine*" will remember that these were described in the article on the "*Golden Arrow*"; each truck carries four sealed "boxes," or containers, with the luggage registered through to destinations abroad, and at Dover these containers are hoisted off the trucks direct into the hold of the steamer and at Calais out on to corresponding trucks on the French railway, thereby saving a great deal of handling.

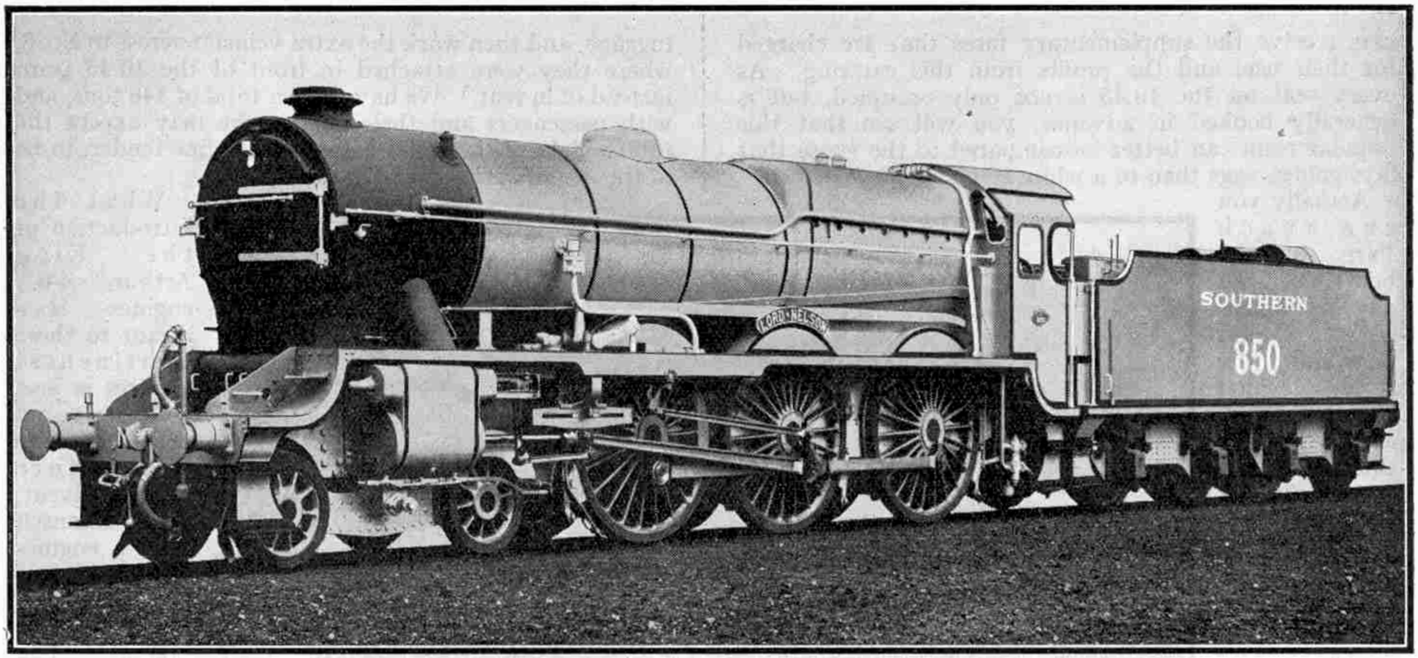
The two luggage vans weigh 13 tons each, the two trucks 10 tons each, and the eight boxes about eight tons in all, making together an addition of 54 tons to the empty train weight. On the occasion of the photograph at the head of this article, by the way, owing to the departure of the French President after his State visit to London, the usual No. 2 platform was not available, so that "*Lord Nelson*" had to drive into No. 2 for the luggage, and then work the extra vehicles across to No. 6, where they were attached in front of the 10.45 train instead of in rear. We have now a total of 446 tons, and with passengers and their luggage we may expect the total weight of the train, behind the engine tender, to be in the neighbourhood of 470 tons.

What the introduction of the "King Arthur" 4-6-0 engines has meant to these Continental services is best understood when I mention that, before their advent, the Maunsell 4-4-0 engines previously employed were not allowed to take more than 290 tons unassisted. Even when they were used in pairs, as they were on these trains, 400 tare tons was the maximum figure permitted. Now the "King Arthurs" are rated at 425 tons, without any help other than that of a bank engine up the steep incline out of Victoria. By adjustments in the Pullman stock employed, some of which weighs less than 40 tons per car, efforts are made to keep the maximum tare of the train as nearly as possible to this 425-ton figure. But if we have the good fortune to find the new 4-cylinder giant 4-6-0 "*Lord Nelson*" at the head of our train, the staff will not be worried if the load is well above the 425-ton mark, neither will there be any concern if there is no "banker" available to help at the start. Of this more in a moment.

Bridge Strengthening for Heavy Engines

It must not be thought that the introduction of heavy six-coupled engines on these services over the old South Eastern and Chatham lines was merely a matter of building them and putting them in commission. There existed, when the "King Arthurs" were built, a considerable number of underline bridges on the route, many of them of considerable age, over which it would not have been safe to work such heavy engines. The Southern authorities boldly faced this problem—as they have, indeed, during recent years faced every other problem affecting the improvement of their services—and decided that every weak bridge should be strengthened. The necessary work was first carried out between Victoria and Orpington—the old South Eastern main line was better equipped in the matter of up-to-date bridgework than the old Chatham section—and this gave the 4-6-0 engines free use of the main line from Victoria to Dover via Tonbridge.

Next the route between Swanley Junction and Ashford, via Maidstone East, was tackled, and the work on this section is now complete, so that boat expresses may be worked via Maidstone East, if so required. None



Southern Railway 4-cylinder 4-6-0 locomotive No. 850, "*Lord Nelson*"

of the regular down trains is booked to go by this dreadfully hilly and slack-infested route, but if the up trains miss their regular timings, owing to the late arrival of the steamers at Dover or Folkestone, they have frequently to travel up to town by the Maidstone route, in order not to upset the regular trains over the congested length of line between Tonbridge and Orpington. It should be added that, when an up regular timing is "missed" in this way, the up boat train concerned must be held in order to run by one of a number of "conditional" timings, which have been plotted through to London at times that will cause the least disturbance of the ordinary services.

There is still another route to Dover, and that is the old Chatham and Dover main line, which goes by way of Chatham, Faversham and Canterbury. Weak bridges on this route are also in course of being dealt with, so that ultimately the Southern Railway will have the choice of three routes for working their increasingly important Continental services between London and Dover. Whenever possible, however, the Tonbridge route is used, as it is both the shortest and the least heavily graded, which are considerations of no small moment in the working of heavy trains like these.

"Lord Nelson" at the Head of Our Train

But I am wandering from my real subject, and it is now high time that we should repair to Victoria and find the train that we are about to accompany. We are in luck on this particular day, for we find at the head of the string of beautifully-appointed Pullmans none less than the redoubtable "*Lord Nelson*" himself. As was the case last month, our journey is but a short one—78 miles all told—but the contrast in locomotive power between the 64-ton 4-6-0 of last month and the 83-ton giant of our present trip is indeed remarkable. On the basis of working steam pressure, cylinder and driving wheel dimensions, compounded into what is known as the "tractive force" formula, "*Lord Nelson*" is, at the moment of writing, the most powerful passenger locomotive in the country.

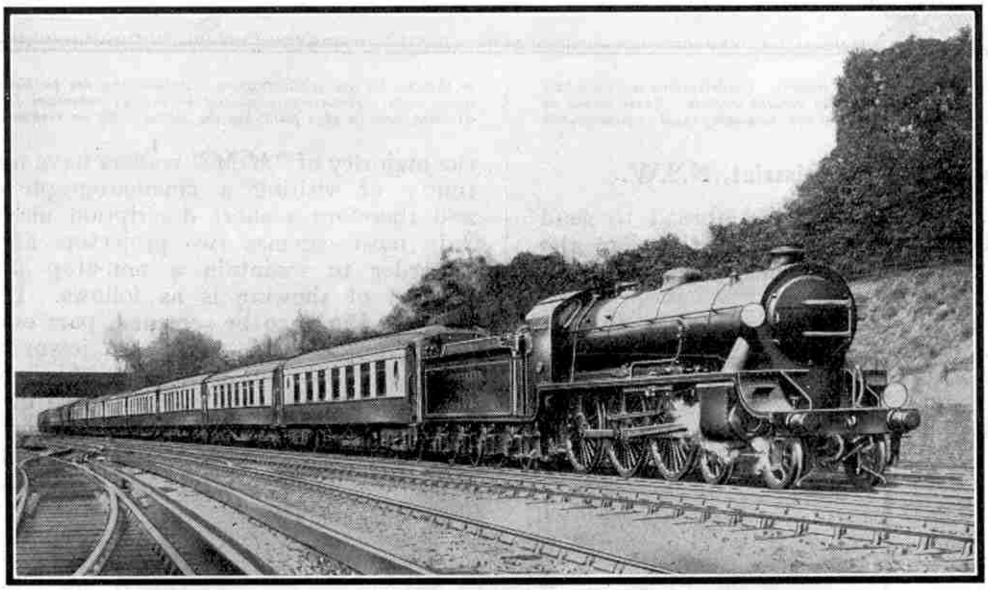
We shall find, on our journey, that the boiler and firebox are of more than ample size to furnish all the steam required to make that tractive force effective, and that the exceptional adhesion weight of 62 tons, on the three coupled axles, will enable the maximum power developed by the engine to be transmitted to the rail without slipping. This wonderful locomotive was described at length in February last in the "*Meccano Magazine,*" and I shall not stay further to go over the details of his construction. But as I have had quite recently the privilege of riding to Dover on "*Lord Nelson's*" footplate, on this very express, I want you to imagine that we are occupying that jealously-guarded point of vantage together, and so are able to watch the manner in which the crew handle their mighty charge. The cab is a more desirable place in which to travel, I am sure you will agree, than the most palatial of "Pullmans."

Victoria Station, Past and Present

Just a word or two about Victoria Station while we are waiting for the "right-away." Until the grouping of the railways became effective, Victoria consisted of two distinct stations side by side, the old South Eastern and Chatham terminus, from which we are about to start, on the north-east side, and the London, Brighton and South Coast on the south-west. The stations and the connecting railways across the Thames were built by a separate company—the Victoria Station and Pimlico—which leased the property to the two railways using them.

Now that the Southern Railway has taken control, part of the separating wall has been knocked down, and the two stations have been thrown into one, the platforms now being all numbered consecutively from the South Eastern across to the Brighton side. We are standing at the longest South Eastern platform—No. 2. The combined Victoria is one of the largest stations in London, with a total of 17 platforms and an area of 23 acres. If the fact be taken into account that the Brighton Company, when enlarging their part of the station, were not able to extend crossways, and had to extend lengthways, so that all but two of their nine platforms are really equal to two (and are actually so used, trains running into the inner ends of the platforms without disturbing those in the outer ends), Victoria has the equivalent of 24 platforms.

Out of Victoria the rise to the Grosvenor Bridge over the Thames is extremely steep. Brighton trains have to mount an incline of 1 in 64, but we, taking the inside of the curve, have in front of us the even more formidable ascent of 1 in 61. Worse still, it begins right off the end of the platform, so that there is no chance of "taking a run" at it. As I have mentioned previously, it is customary for the engine that brought in the empty coaches to help at the start by giving a friendly push in rear to the top of the bank, but our train is so long as to occupy the full extent of the platform, so that it has been pushed instead of pulled in, and there is therefore no engine at the far end. Realising this, our crew have had the foresight to drop some sand on the rails from the trailing sandboxes of "*Lord Nelson*" as he was backing down on to the train, to prevent slipping as we get away.



Photo] [F. E. Mackay

Dover Pullman Express passing Bickley. "King Arthur" 4-6-0 No. 769, "*Sir Balin*"

A Beautiful Start

At last comes the "Right away!" Looking at the indicator of the valve motion we see that "cut-off" is fixed only at about 40 per cent., and for the start we notice that the regulator handle is not moved right over the quadrant plate. Yet the engine responds grandly. No further than half-open do we see the handle pushed as the engine begins to move, and with an encouraging: "Now come along, my beauty, come along" from the driver to his steed, we advance steadily over the maze of switches and crossings and begin to climb. So with half a regulator and 40 per cent. cut-off—far below the engine's maximum possibilities—we sail up the incline, slowly and steadily accelerating, and without an atom of slip. We might be almost running "light," rather than pulling a train of some 470 tons behind us! Half way up the bank we spot Mr. Mackay, taking the fine photograph that heads this article, and give him a friendly hail as we pass. Now we have crossed the Thames, and are passing Battersea Pier Junction. The 1 in 61 is well behind us; we have made a triumphant start indeed.

But it will be many miles before we may expect to see anything of the speed capacity of our mount. Almost uninterruptedly for 18 miles we shall climb, and even where there are "breathers" in the ascent, we dare not take advantage of them, as we are sandwiched in between frequent electric trains, using the very metals that we are running over. So we notice that the driver now brings the cut-off of the engine back to 30 per cent., and closes the regulator to about two-fifths of full open, or less. We shall find that these are roughly the "running positions" of regulator and cut-off for most of the journey.

Effect of Crank Disposition

We were reminded by the rapid puffing of "*Lord Nelson*" at the start that the unusual disposition of the cranks of the four cylinders results in eight "beats" to each revolution of the driving wheels, instead of the usual four. The exhaust has now quietened until it is practically inaudible, but we notice the effect of this crank arrangement on the fire, in the beautiful evenness of the blast. The fire-hole door, by the way, is left partly open throughout the trip, to allow of the ingress of plenty of air for the combustion of the fuel.

Through Brixton and Herne Hill we are doing about 40 miles an hour. Immediately after this comes the stiff rise to Sydenham Hill, which demands a little more regulator opening. But with barely half regulator, and still at 30 per cent. cut-off, we breast 2½ miles at 1 in 100, and are still doing a shade over 30 miles an hour at the top. The regulator is now nearly closed as, with a prolonged blast from the whistle, we enter the smoky mouth of Penge Tunnel.

Only those who have travelled on the footplate can realise the extraordinary sensations of passing through a tunnel on the engine. The roar and rattle of the engine itself in the confined space of the tunnel walls; the steam and smoke sweeping past and sucking back into the cab; the glow of the fire lighting up the cab and its occupants, amid the Stygian blackness of the bore; all combine to leave an unforgettable impression on the mind. But we shall probably be glad when we are out once again into the fresh air.

Exceptional Route for Tunnels

This is, by the way, an exceptional route for its tunnels; Penge is 1¼ miles in length; then come Chelsfield and Polhill, before and after passing Knockholt, the latter 1½ miles in length; Sevenoaks Tunnel is all but two miles in length and last of all there are three tunnels between Folkestone and Dover, of which Abbott's Cliff is 1⅛ miles in length. The tunnels do not fail to leave their "trade marks" on the faces of the travellers in the cab, because tunnels are invariably the dirtiest parts of a footplate journey.

The regulator is nearly closed for the down-grade through Penge Tunnel and beyond, and as we pass Kent House there is a sharp application of the brakes, to reduce the speed from 55 miles per hour or so to about 40 miles per hour, over the curves between there and Beckenham Junction. Then we rise abruptly and

(*Continued on page* 645)

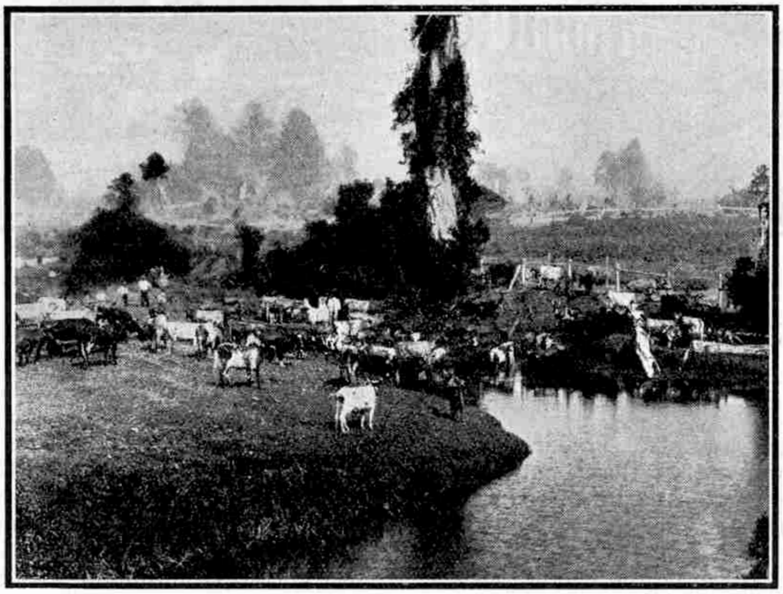
FROM OUR READERS

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

The Richmond River District, N.S.W.

The Editor has asked boys living abroad to send in accounts of their surroundings and therefore the following description may be of interest to some of my fellow readers.

I live in Lismore in the Richmond River district, New South Wales. The chief industry of the district is farming and dairy farms are dotted all over, their size varying from 100 to 1,000 acres. At Byron Bay, not far from Lismore, is the largest butter factory in the world, and I think some readers, at any rate, will have heard of the renowned "*Norco*" butter produced in this district. Recently these areas have been devastated by terrible bush fires and even as I write fires are raging less than five miles away. Also we are having a drought at present, and bush fires and drought combined are giving the "cookies"—as the farmers are familiarly called—a bad time.


Courtesy] [*High Commissioner for Australia*

A Herd of Dairy Cattle on the Richmond River, N.S.W.

We have many secondary industries in Lismore, including three timber mills, a milk goods factory, a motor body-building factory and two foundries.

In the early days cedar trees were to be found plentifully around here but now unfortunately there are few of these beautiful trees left, the chief timbers of the district being hardwoods. Potatoes are grown in large numbers although not enough for export. Corn is another factor and is used extensively for food for pigs. Cane is grown, not for the sugar, but for its food properties for cattle. Around Tintenbar, a small town near Lismore, opals are found.

The Richmond River is navigable as far as Lismore for large steamers. Recently sharks have been seen in the river and a warning has been issued to bathers.

N. J. GLEESEN (Lismore, N.S.W.)

In a Cinematograph Operating Room

The cinematograph has always had a great fascination for me and my favourite hobby is to study the making and projecting of pictures. Probably the majority of "*M.M.*" readers have not had an opportunity of visiting a cinematograph operating room and therefore a short description may be of interest.

In most cinemas two projectors are in regular use in order to maintain a non-stop programme. The method of showing is as follows. If a five-part or six-part film is to be screened, part one is put on projector No. 1 and while this is being shown part two of the film is put on projector No. 2. When the end of part one is reached the operator gives a signal, switches off the current to the arcs and stops his machine, simultaneously with which the second operator starts projector No. 2. Two good operators carry out the change-over with such speed and skill that it is practically impossible for anyone in the audience to detect any break in the continuity of the picture.

The first operator then takes part one of the film into the re-winding room and re-winds it back ready for the next performance. He then proceeds to put part three on projector No. 1, first placing the used part of the film in a tin box.

The danger of fire is very great wherever films are shown, owing to their highly inflammable nature, and hence the authorities are very strict when granting licenses to cinemas. The operating room must be built throughout of fire-proof material and no naked lights of any kind are allowed in it. Buckets of water and sand, a wet sheet and chemical extinguishers are kept close at hand for use in emergencies. If an outbreak of fire occurs, two fire-proof shutters are released so that they fall in front of the projectors, covering the observation windows and preventing smoke or fire from reaching the theatre.

The usual speed of projection is 16 pictures per second or 960 per minute, but this is often increased to between 17 and 19 per second. The light used for film purposes is the electric arc and anything from 2,000 to 3,000 candle power is produced at the centre of the arc. The heat is intense and if a film were to remain stationary in the "gate" of the projector for two or three seconds it would catch fire.

The responsibilities of the chief operator are very great for he looks after repairs to the projectors, dynamos, switches—in fact everything that concerns the running of the machines and the generating of the electric energy.

F. Williams (Warrington).

New Zealand's Wonderland

The thermal regions of New Zealand present such a variety and extent of scenic wonders that I think a brief description of some of the main features of the Taupo district will be of interest.

Taupo village lies on the shore of Taupo-Moana, New Zealand's largest lake, just at the point where our grandest river the Waikato issues, carrying 60,000,000 gallons of water hourly past the jetty. Three miles down stream, from a rocky cleft in which it has been penned up, the river bursts forth in a mighty sweep of waters, the Hulea Falls, into a seething cauldron below. Further down the three-quarter mile Aratiatia Rapids, the largest in the Dominion, present a beautiful sight of foaming, winding torrents ever varying between blues and greens of every shade. The trout fishing of the lake and the river attracts anglers from all over the world, and rainbow trout up to 23 lb. and brown trout up to 30 lb. have been caught.

Courtesy] [*High Commissioner for New Zealand*

A New Zealand Geyser: The Karapiti Blow-hole at Wairakei

The thermal activities occur in two groups, at Wairakei and the Spa. In the Wairakei Valley a succession of wonders greets the tourist. The "Champagne Pool" heaves its effervescent water 12 ft. into the air every few minutes and the "Great Geyser" plays with the regularity of clockwork every ten minutes up to a height of 30 ft. The most graceful sight, however, is the "Prince of Wales Feathers Geyser" which sends out its columns of boiling water in the exact shape of these familiar feathers up to a height of about 30 ft. Then there is the "Waterfall Geyser" which plays at the top of red coral-like terraces down which the water runs in a streaming fall. Another valley is full of delicately tinted mud lakelets and hot waterfalls amidst beautiful ferns and mosses. The famous "Crow's Nest Geyser" shoots out a column of boiling water measuring 40 ft. from its cone, playing irregularly in eruptions at intervals of about half an hour. At Rotokawa are peculiar hot and cold lakes separated by ridges of coral only a few inches in height, while close by yawning sulphur pits tempt the curio-hunter with their beautiful deposits of sulphur.

Lake Taupo is 26 miles in length and near one end Karangahape Cliff rises 1,100 ft. sheer from water fathoms in depth. Near here the "Fall Over the Brow" plunges hundreds of feet into deep clear water. The lake charms most in the evening, when an ever-changing play of light on blue waters and misty mountains, with three volcanoes in the background, forms a never-to-be-forgotten picture.

H. W. Turner (Hastings, N.Z.)

A Visit to a Fire Station

One of the most interesting afternoons I have ever had was spent at the headquarters of the fire brigade of one of the largest towns in England. Following my fireman guide I entered a yard that had opening from it many wide red doors, behind which the fire engines are kept. I saw the rescue tender, which is fully equipped with life-saving appliances and a special breathing apparatus that is used when dealing with poisonous fumes. Attached to the tender is a blower, operated from the engine, which is used to clear away fumes and smoke from basements, etc. I was then shown several fire engines fitted with a wonderful array of appliances, and I was particularly interested in one specially designed to take water at high pressure from a canal or river.

Passing through the repair shop, which is fitted with all the necessary machines for repairing the engines and appliances, I entered a circular tower with a steel ladder zig-zagging up its side. This is the drying room and also the place where the rents in the hoses are marked. I was told that there was room for over two-and-a-half miles of hose. In a neighbouring room two firemen were busy darning and patching hoses. I then slid down a slippery pole from this room to the covered yard, and I quite agreed with my fireman friend that this method of descent considerably lessens the time required to reach the floor below!

When I had sufficiently recovered from the shock I was shown a large engine fitted with a motor turntable escape. It is possible to elevate this from the horizontal position to an angle of 75 degrees in 25 seconds. The time taken for the ladders to be extended to 85 ft. is also 25 seconds, and in 50 seconds the escape can be revolved in a complete circle. If necessary all these operations can be carried on at the same time.

Finally, I witnessed a remarkable fire drill display including turn-outs and rescue work, and this brought my visit to a splendid conclusion. The various operations were carried out with astonishing speed and accuracy and I felt glad that it was only a display, without the danger accompanying a real fire.

P. B. Hodgkinson (Edgbaston).

OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

A MOTOR THAT WILL TRAVEL ON LAND OR WATER

Another Life-Saving Suit

A German addition to the multitude of life-saving inventions is an elaborate suit built on the model of a deep-sea diver's outfit. The material of the suit contains rubber, while the helmet is made of metal with a small window fitted in front of the face. When the wearer falls or jumps into the water the buoyancy of the air in the suit brings him immediately to the surface and keeps him there. As soon as his head appears above water he is able to open the window to replenish his air supply.

The inventor claims that the suit will keep its wearer afloat almost indefinitely, even in a storm, as the window may be kept closed except at favourable moments, or when the air supply needs replenishing. To enable the wearer to reach land or a boat, paddles are fitted to the wrists and hands.

* * * *

An Elastic Photographic Film

One of the drawbacks to the use of the popular small hand cameras is that the pictures taken are very small, a matter for regret when a really good picture is obtained. Enlargement is possible, of course, but a troublesome process must be gone through even with the aid of a daylight enlarging outfit, and the lack of a quick and easy method has prevented the enlargement of many snapshots to a more desirable size. A film has now been invented and put on the market with which the process is certainly easy enough, for it is simply stretched out to the size required!

After soaking in water the negative is stretched and transferred to a glass plate, to which it adheres when dry. The extent to which the film may be stretched depends on its thickness and on the temperature of the water in which it is soaked. The film to be sold is intended to be stretched to twice its original size, but in some experiments films were stretched until they were as much as ten times their normal size. During the stretching process the density of the image on the film becomes less and the grain becomes more noticeable, but this is not found to be detrimental when the picture is only doubled in size. The film has the added advantage of being cheap when prepared in large quantities.

* * * *

Luminous Rubber

A new process has been patented in Germany for rendering soft and hard rubber luminous. In the case of soft rubber articles the process consists of coating the article with a film of rubber solution that previously has been treated with petrol or a similar solvent. When dry, the surface thus produced is coated with a paste made by rubbing down a self-luminous substance in a practically colourless rubber solution.

A House that Follows the Sun Round

Two Parisian architects have invented a house that may be turned round to follow the sun. Their first model was somewhat defective, for a strong wind sent it spinning round like a wind-mill. A later and more successful model, however, has been exhibited recently at Nice.

The building with a surrounding of terrace is erected on a platform that resembles a locomotive turntable. This is constructed of eight steel girders arranged in the shape of a fan pivoted at the centre, and with rollers at the outer end running on a steel track. A small electric motor furnishes the necessary power and there are control switches in practically every room. Following the sun around involves little trouble for there are switches in the bath-room and even under the dining-room table! A further provision is an automatic device by which any chosen room may be kept facing the sun all day long.

There are endless possibilities in a house built on this plan. If undesirable visitors are seen approaching the front door it is easy to switch them to the back or even a blank wall, while an additional refinement is provided in the form of a special gearing that causes the house to revolve at a higher speed!

Underneath the house is a cellar. The cellar door and the steps only coincide at one point of the turntable, however, so that it is necessary to start down the cellar steps just at the right moment!

It is estimated that an eight-roomed house of the type exhibited would cost about £10,000.

* * * *

Ships of the Desert

For centuries past travelling in the desert has involved the use of camels, as these were the only animals able to survive the lack of drinking water. Recently the motor car has been adopted to desert travel by fitting a tractor belt tread and using a larger cooling system, and now a German has invented an "ocean liner on wheels" as the latest improvement on the camel.

Three hundred passengers will be carried on this ship of the desert, and they will have all the luxuries and comfort that are met with on a modern liner. The vehicle will be 300 ft. long and the close-fitting windows will afford good protection against the effects of sand storms.

The wheels of this land ship will be 40 ft. in diameter and will have very broad rims, to which paddle-like blades will be fitted to enable them to obtain a firm grip on the loose sand. Powerful headlights are to be provided to enable the vehicle to keep to its scheduled speed of 20 miles per hour in safety at night.

A New Internal Combustion Engine

The modern petrol engine is undoubtedly a complex piece of machinery and any simplification is welcome, so long as it does not involve loss of efficiency. Such a simplification is promised in an engine invented by a New York engineer, in which gudgeon-pins, connecting rods and crank case are done away with, and which can be stripped and re-assembled in less than 30 mins. (see illustration on next page).

The central feature of the invention is that the cylinders are in pairs, with a double-headed piston working between each pair. The crank shaft passes through holes in the sides of the double piston, so that the rotating bend of the shaft is completely enclosed. The piston can be made sufficiently stiff to prevent wobbling of any kind so that the wear on the cylinder walls is considerably reduced.

A very interesting method of transmitting the motion of the piston to the crank shaft is incorporated in this invention. Attached to the crank shaft is a four-sided bearing that moves in a diagonal groove inside the piston, so that the backward and forward movement of the double piston imparts a circular movement to the crank shaft bearing. The inventor has constructed an eight-cylinder engine with the cylinders arranged in horizontal blocks of four on the opposite sides of the crank shaft. The simplicity of the design is expected to reduce the cost of manufacture very considerably as compared with an equally powerful engine of the ordinary type. Fuel economy will also follow, as a greater proportion of the energy of the explosion is transmitted to the crank shaft owing to the more direct nature of the connection.

* * * *

Anti-Glare Windscreen Fitting

A simple yet extremely effective device that will appeal to motorists has recently been invented and consists of a panel of coloured, transparent non-inflammable material of the celluloid type, measuring 6½ in. by 4 in. The panel is provided with a slot for attachment to a suction pad that can be placed on the windscreen at any desired spot. The object of the panel is to cut out the dazzling glare of approaching headlights without interfering with visibility for night driving.

The complete outfit consists of a suction pad and three panels—the first coloured green for night driving; the second amber, for use when driving "into the sun"; while the third is of ivorine and serves as a memo pad. The rubber suction pad needs only to be moistened and placed in position. It will then remain on the screen until disturbed and it is the portable nature of this fitting that gives the device its advantage over the fixed type.

Ingenious Signalling System for Motor Cars

As motor traffic becomes more abundant and speeds greater, it becomes more and more necessary that a better signalling system than the hand waving methods now in use should be introduced. An efficient system is even more necessary for night driving, and although automatic devices are not yet popular there is no doubt that they will become a standard part of every car in future.

To meet these requirements the "A.S." signal has been invented. This consists of two rectangular ground-glass plates, one on the rear offside mudguard, and the other on the supporting arm of the wind screen, so that signals can be given in front as well as in rear. The signals are controlled by a four-way switch mounted on the steering wheel. According to the position of the tumbler of this switch, arrows to indicate the direction of any proposed turn appear in red on the white background of the ground glass plates, while the signal "pass" can be shown on the rear plate. In addition, the word "on" can be thrown on the front plate to indicate to traffic controllers that the driver intends to go straight on.

A further safety device that comes into operation automatically is a "slow" signal that can be shown on the rear plate. This is controlled by an attachment on either the brake or the clutch pedal, so that the speed of the car cannot be reduced without the simultaneous appearance of the warning signal to the drivers of following cars.

In another signalling device illuminated arms with arrows painted on the glass indicate the direction in which the driver proposes to turn. The arms are projected horizontally as required by the driver.

* * * *

Milk Sterilised Without Heating

An invention that has recently been patented in France promises to bring about a revolution in the treatment of milk as carried out on the large scale as in Denmark. It is the outcome of 20 years' experimental work by Dr. Stassano, of the Pasteur Institute, and is being tested by the Danish Government.

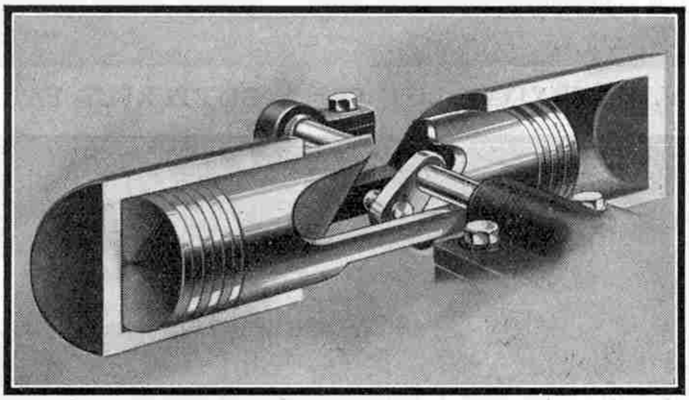
The methods hitherto used for the treatment of milk to prevent the transmission of disease involved heating it to a temperature of 180°F. at which temperature the harmful bacteria are killed. While the method may be satisfactory for this purpose, heating milk to so high a temperature is sure to bring about other changes and there is little doubt that some valuable qualities are destroyed. The new method of sterilisation does not alter the constituents of the milk in any way and cream formation goes on without interruption.

The actual details of Dr. Stassano's method have not yet been revealed and they are awaited with interest. There is no doubt that the invention is of great importance and careful tests are being made with it at the experimental farm maintained by the Danish Government, with a view to a variation in the stringent regulations under which the dairy industry is carried out in that country.

Electric Scissors

A recent patent issued in America describes a pair of scissors one blade of which is actuated by a small motor. The motor is enclosed in a small casing on the handle of one blade and a small shaft operating on the other handle opens and shuts the scissors, the long handle being curved to enable the necessary movements to take place with accuracy.

Each plate is provided also with a finger grip but the purpose of this is merely to enable the user to guide the scissors.



The double-headed piston of the new internal combustion engine described on the previous page

Towline for Motor Cars

When motor cars were less common and reliable than they are to-day it used to be said that no motorist's education was complete until he had come home at the wrong end of a tow-rope. Even to-day a tow is often necessary or advisable so that repairs may be made in comfort in the nearest garage instead of with uncomfortable publicity by the road-side.

Struck with the inconvenience and improvised nature of the ordinary method of towing, an American inventor has devised a better one. He uses a steel cable that rolls itself up by means of a spring on to a drum, except when the car in front is exerting a genuine pull. Then when the towing car slows down for traffic or any obstruction the spring simply takes charge and rolls in the slack of the cable. In this way there is no loose rope to get worn out by friction with the roadway or to become entangled with the wheels of the other car. With this invention being towed home will become a pleasure.

* * * *

Electric Fire Alarm

A neat fire alarm has been invented that indicates the whereabouts of a fire to watchers by a light on a control panel at a central station.

A compound wire three-sixteenths of an inch in diameter is used. In this is a steel tube, slotted along its entire length, and surrounded by a brass sleeve with thread insulation between. Each carries an electric current. Inside the steel tube is a core of an alloy of low melting point. The heat of the fire melts this and causes it to expand whereby globules are forced out of the slot through the insulation to cause a short circuit. This actuates the relay that gives the warning light.

Police Signal System in Montreal

A novel apparatus has just been installed in Montreal. The aim of its deviser was to improve the means of communication between police headquarters and individual officers on their rounds, and a system with many interesting features is the result.

Perhaps the most remarkable of these is the method afforded of giving direct orders to the policemen on beat. This is done through the medium of lights scattered on the tops of poles throughout the city. If the chief or inspector in charge wishes to speak to an officer, policeman or detective, the lights on the poles in the beat of the wanted man summon him to a telephone by flashing or even give him direct orders by code. In any serious emergency almost the entire police force in the city can be summoned to the police telephone boxes to receive orders.

Another feature is that by placing his key in the lock of the police telephone box, each patrol officer signals his presence there to headquarters. If the officer in charge of the latter wishes to speak to him a buzzer audible 200 ft. away is sounded, so that after placing his key in the box the patrol man continues his way with the knowledge that he will be called back if wanted.

* * * *

Slot Machine Photographs !

Anatol M. Joseph, of New York, recently patented a photographic booth in which a film is taken, developed, and printed in a few minutes. On entering the light-tight box—rather like a public telephone box—the sitter drops a coin in the slot. Lights are automatically switched on and the camera "clicks." A few minutes after leaving the box, eight prints of the photograph are delivered through a slot at the back.

Actually, the weight of the coin starts up an electric motor. This drives a roller carrying a strip of sensitized paper. As the paper is unrolled, a jerky motion similar to that of a cinematograph machine is imparted to it. The shutter of the camera opens and closes in sympathy with the movements of the film so that eight exposures are made. The strip then passes in succession through the various solutions necessary to transform it into a finished positive, and finally it is squeezed to remove excess moisture, carried through an electric drying chamber, and delivered through the slot. The time required for the whole process is only eight minutes, and the photographs are quite good enough for enlargement.

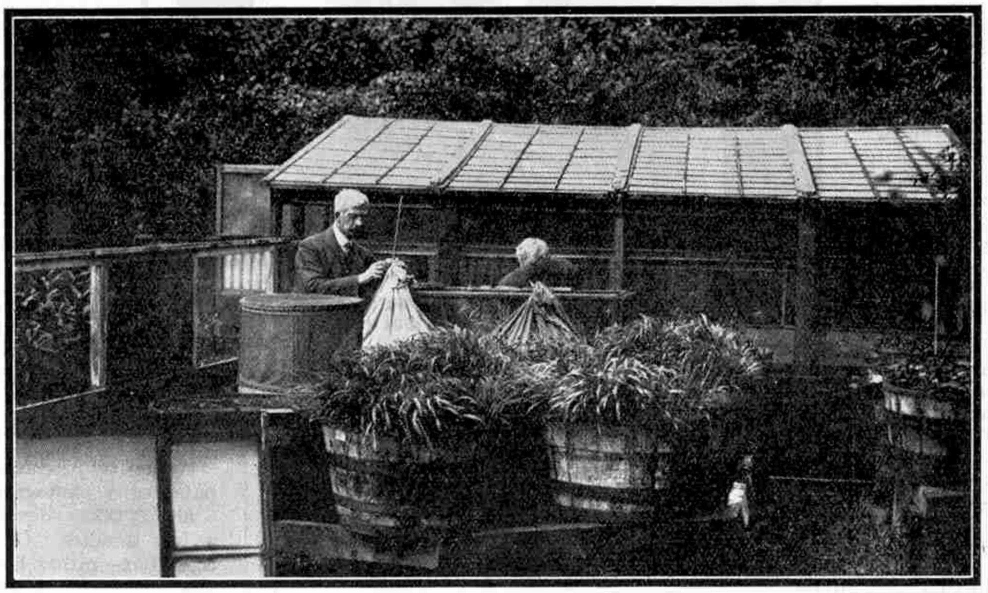
The operation is quite continuous, and other photographs can be taken while one set is being finished. It is interesting to note that the machine made such an appeal in New York, that in five days no less than 7,500 people dropped their shillings in the slot and received a set of prints. The Photomaton, as the inventor calls his machine, will undoubtedly be of great use for producing identification photographs for passports, and in numerous other ways.

Emperor Moth on Heather

The OUTDOOR WORLD

AND ITS HIDDEN BEAUTIES

IV. EVERYDAY LIFE ON A BUTTERFLY FARM

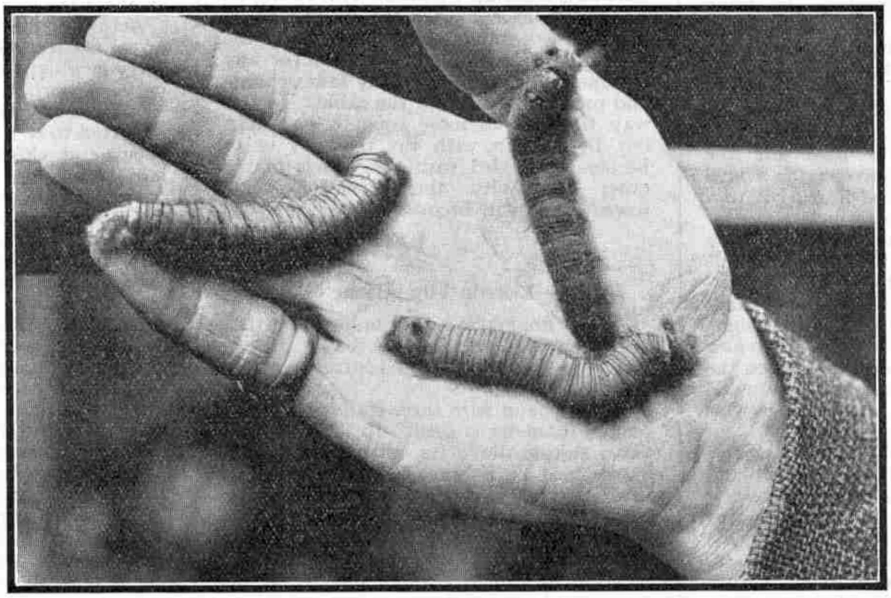


A general view of the breeding and rearing houses at the butterfly farm

THE mere mention of butterfly farming is apt to make people smile, but none the less this is an important industry although a small one. Very few people have ever visited a butterfly farm and therefore it will be of interest to give an outline of the everyday routine of such an establishment.

Life on a butterfly farm is most strenuous during the months of May, June, July and August. Livestock is then being sent from all quarters of the United Kingdom, and this has to be attended to at once. Each butterfly as it arrives is taken out of its box and fed with sugar and water or honey, and then placed in a gauze-covered cage or tub along with fresh flowers upon which to feed and its own particular food plant on which to lay its eggs. In hot weather the flowers are sprayed once an hour with a solution of honey and water so that the butterflies may obtain plenty of nourishment.

There are many different kinds of eggs to watch hourly, for as soon as the egg hatches, the young caterpillar requires immediate attention or it will die. The period of incubation of different species varies very greatly, as much as from five to seven days and from nine to ten months. In some species the egg changes colour just before hatching, while in others there is no apparent outward change.



Caterpillars of the Lappet Moth

The caterpillars are treated in different ways according to their species. Some are kept in glass-topped tins with the food plant placed ready for them to feed on. Others are "sleeved" at once on to the growing food plant, the sleeves being muslin bags tied over a branch of the particular tree. In some species the caterpillar requires to be transferred with a camel hair brush on to its own food plant, which is placed in a small bottle in a glass cylinder. In short, almost every caterpillar requires individual treatment.

Moths and butterflies deposit their eggs in vastly different ways and one has to go back to nature to find out their particular habit and give them the plant they need upon which to lay. Some moths appear to be very careless of the welfare of their offspring as they drop their eggs loose as they fly, but if these are watched it will be observed that the food plant of the caterpillar is always near. The eggs of moths are often found in very strange places; the common Yellow Underwing, for instance, is very fond of depositing them on a lawn tennis net!

Protective instinct is very widely developed in many moths and the female is often most fastidious in the manner in which she hides her eggs. She may select a twig or leaf of the exact colour that will afford her eggs the best protection, or she may cover them completely with fluff torn from her own body. There are also certain caterpillars that cover their backs with tiny pieces of the leaf upon which they are feeding. They gum these pieces on and it is almost impossible to detect the disguised caterpillars until they move. Others again are exactly like a twig and may be readily passed over as such, even by the lynx-eyed Tom Tit, which is one of the greatest of all "collectors" of these dainty morsels.

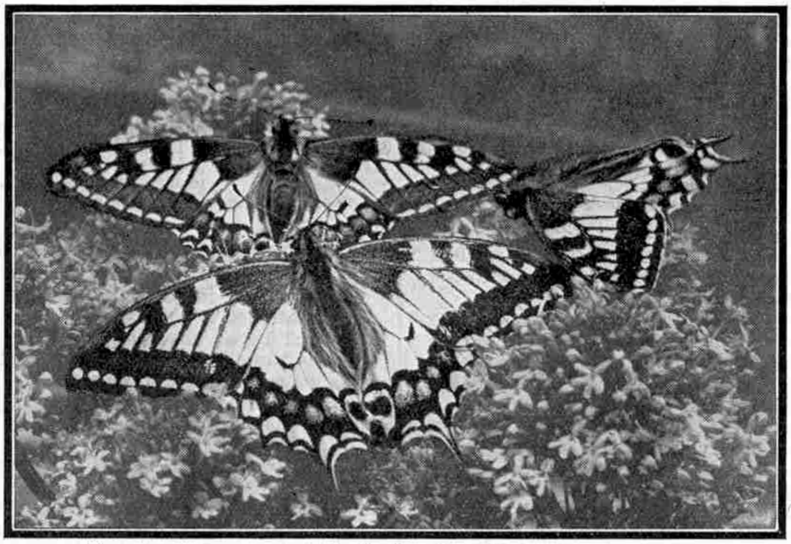
The feeding of the caterpillars on a butterfly farm occupies the greater part of each day. The extent of the operations involved may be gauged by the fact that on the butterfly farm at Bexley, Kent, owned and managed by Mr. L. W. Newman—to whom we are indebted for a great deal of our information—three men are required for this work alone. Hundreds of thousands of caterpillars are bred every year and they require careful attention and absolute cleanliness otherwise disease would wipe out whole broods in a few days. Sleeves are enlarged and leaves changed constantly, as some caterpillars will live only on young leaves whereas others will die for want of older and more mature leaves. They all have their likes and dislikes as we have ourselves.

Sleeving caterpillars on a growing plant by means of muslin bags

There is also collecting to be done on fine summer days. The stock is sought for all over the British Isles where a particular specimen is known to be plentiful, but only a few females are taken and no extermination is carried out by the man who understands his work.

Despatching forms another big item on a butterfly farm, for the livestock has to be carefully packed and sent off by post as soon as it is ready. Then there are hundreds of muslin sleeves to be made and also butterfly nets, setting boards, cork-lined cases in which to keep specimens, cabinets, and a host of other things that are necessary to the collector of butterflies. These articles are made mostly during the winter months.

Last, but not least, is the setting-out of the perfect specimens of butterflies bred on the farm. This is a tedious business and requires skill and experience. The butterflies are set-out on grooved boards, dried, and then carefully taken off the boards and put away in cabinets ready for sale. Some go to museums, some to private collectors, some to the Continent or across the Atlantic, and others to remote parts of the British Empire, to form show cases of British species. Still others go to art schools for students to paint.



Three beautiful specimens of the Swallow-Tail butterfly feeding on Valerian

It might be thought that the butterfly farmer would be fully occupied only in summer months but this is not the case. During the winter he is still busy digging out chrysalides from under trees, and collecting from the trunks of trees wingless females—wingless because they are not so easily detected by their enemies and because there are no leaves under which to hide.

Then again during the late autumn all the caterpillars that will turn to the chrysalis before winter have to be provided with their special requirements such as dead leaves, leaf mould, pieces of cork, moss, etc. Some are just taken out of the sleeves and put away in tins ready for sale or kept for stock for the following year. This is a job that lasts several weeks until all the creatures are safely housed.

There are also the hibernating caterpillars that pass the winter in a dormant state and wake up on the first fine sunny day, perhaps as early as February. These too, need to be fixed up in their winter quarters and to be looked at now and again to see that all is well.

Another important item that needs careful thought is the supply of food for a year in advance. Seed has to be harvested and sown in early spring, hundreds of pots of food plant have to be in readiness along with a plentiful supply of various plants and flowers. Indeed, to be a good butterfly farmer one needs to be a good gardener and something of a botanist.

Butterfly farming is a wonderfully interesting pursuit, but in order to be successful one must have endless patience, great powers of observation and a love of nature, together with the greatest of all gifts—commonsense.

The Swallow-Tail butterfly shown in the illustration on this page is the only example of the bird-winged butterfly that is to be found in Great Britain. It was formerly abundant in many parts of the country, but is now found only in the Fen districts of Cambridge, Norfolk and Huntingdon. Some of the tropical butterflies of this family have wings six inches in expanse.

As a protective measure, the larvæ of this and other species of both butterflies and moths are able when alarmed to exude juices with nauseating smells, while a large number of the butterflies themselves make use of the difference in colour between the upper and the lower surface of the wings for the same purpose. In flight they are brilliantly coloured objects, but at rest their wings are folded up so that the underside only is visible, and this matches their surroundings in colour.

It is interesting to note that the largest butterflies in the world are to be found in the Malay Archipelago, where gorgeously coloured insects with wings measuring fully seven inches across are abundant.

Of General Interest

Electrolytic Deposition of Rubber

Within the last few years a process has been developed in America whereby rubber can be 'plated,' or deposited on articles electrolytically, in exactly the same way as metals. Rubber of course is an insulating substance, but by adding ammonia to the latex, or liquid from the tree that gives rubber on treatment, a conducting liquid or electrolyte is formed. On passing an electric current through this electrolyte the rubber is deposited on the anode or positive pole.

The way in which this process simplifies the manufacture of rubber and rubber articles is remarkable. This is the case with vulcanisation, for instance, the process of combining raw rubber with sulphur to give a product that is both stronger and less affected by temperature. The necessary ingredients, including the sulphur, are added to the rubber plating bath, and on electrolysis they find their way to the positive pole, where they form an intimate admixture with the rubber. This mixture is then heated in steam under pressure to complete the process.

So many modifications of the process have been discovered that its general adoption will cause something like a revolution in the rubber industry. The use of moulds, for instance, will no longer be necessary for forming rubber articles, the rubber being 'plated' on to any sort of metal former and then stripped off. Another operation that is simplified is the waterproofing of garments with rubber. All that is necessary is to soak the cloth to be waterproofed in the electrolyte and place it in front of the anode, when the rubber will be deposited on it during the process of electrolysis. If this electrolytic method can be introduced on a commercial scale we may expect to see rubber overcoats and shoes without seams.

An interesting application of the process is to the manufacture of insulated copper wire. By making the wire the positive pole and passing it slowly at a uniform rate through the bath, the rubber can be deposited on the copper directly, and the vulcanisation can be carried on at the same time.

Perhaps the greatest achievement of the process, however, will turn out to be the method it provides for reclaiming rubber from old motor tyres and other articles. The old rubber is dissolved in petrol and water is added. This causes the rubber to separate out as a colloidal suspension, after which it is ground in a mill. Ammonia is then added and the rubber is plated out in the usual manner. Rubber thus reclaimed is almost certain to be of higher grade than that obtained by the various reclaiming methods already in vogue.

These methods do not allow for the elimination of the various mixings and fillings that are present in commercial rubber, and the product can only be regarded as a cheapening agent to be used in small proportions for mixing with raw rubber. Rubber reclaimed by this process contains practically no mineral matter.

Over a Hundred Years Ago!

"Yesterday evening the footpath on the north-side of Fleet Street was for some time rendered nearly impassable by the collected crowds. They were attracted by the appearance of a curious phenomenon in the atmosphere, the spire of St. Bride's Church, when viewed at an angle of about 45 degrees, being seen clearly defined in a reflection in the air."—"THE TIMES," 17th Sept., 1826.

Shades of Wilberforce!

"The Governor of Gibraltar has issued a proclamation forbidding any of the inhabitants, under pains and penalties of the statute, from engaging in, or in any manner aiding and abetting the slave trade, by fitting out vessels, lending money or otherwise."—"LIVERPOOL MERCURY," 3rd Nov., 1826.

"It is said, that 3,600 slaves have been captured and liberated on the coast of Africa during the last twelve months by the squadron under the command of Commodore Bullen."—"HANTS ADVERTISER," 24th April, 1826.

Time to Strike!

"The parish clerk of Winkleigh has a salary of a guinea per annum, for winding up the church clock daily; and it has been calculated that to earn this sum he has to travel 102 miles, ascend and descend 29,000 steps, and haul up 18 tons weight 3,600 yards."—"THE TIMES," 13th Nov., 1826.

Those Mystery Towers!

The mysterious towers constructed by the Admiralty during the war have come into prominence once again. Only two were completed, but many more were planned for the purpose of forming a barrier across the Straits of Dover. They were to have been only a few hundred yards apart and nets were to have linked them together. The nets, heavy guns, and a very powerful searchlight on each tower would have constituted a formidable barrier to German submarines, or indeed to the entire High Seas Fleet. As was explained on page 221 of our article in the "*M.M.*" for April last year, one of them is now serving in the place of the old Nab lightship, off Spithead, and goes by the name of the Nab Tower.

On 9th February last, a dramatic scene was witnessed from this "stone battleship," that would remind those present of the tragic days of the war. This was the "shooting" of scenes for the official film of the battles of Coronel and the Falkland Islands. A prominent figure in the scenes was the cruiser "*Yarmouth,*" a sister ship of H.M.S. "*Glasgow,*" which fought through both battles. As she was to undergo final tests before her departure for China, it was arranged that she should pass by the Nab Tower in order that the operators in the Tower might take a film showing her gun practice. Other operators were at work on the cruiser herself taking close-range pictures of the gun crews at their battle stations.

Clock's Human Works

When the clock in the tower of St. Paul's Cathedral, London, broke down recently, it was decided to make an effort to keep the hands pointing to the right time, at least in the day time. A team of men was organised and, stationed in the tower, took turns to keep the hands moving. Checked by an accurate watch, the clock continued to show the correct time, but those who glanced at it little dreamed of what was going on inside the tower!

Expert investigations disclosed that the cause of the breakdown was a worn-out pin.

World Without Disease in 1950

Almost every disease prevalent to-day will be conquered by medical science by 1950. "What a number of years ago were regarded as communicable diseases of the first order, to-day are extinct. In the past ten years there has not been a single case of cholera, typhus, or yellow fever reported in America, for instance, and in the past year not a single death occurred from smallpox. In ten or twenty years we expect not only to have conquered every disease, including cancer, but to have found preventives for most of those ravaging mankind to-day."—Dr. Lee K. Frankel, vice-president of a large United States life insurance company.

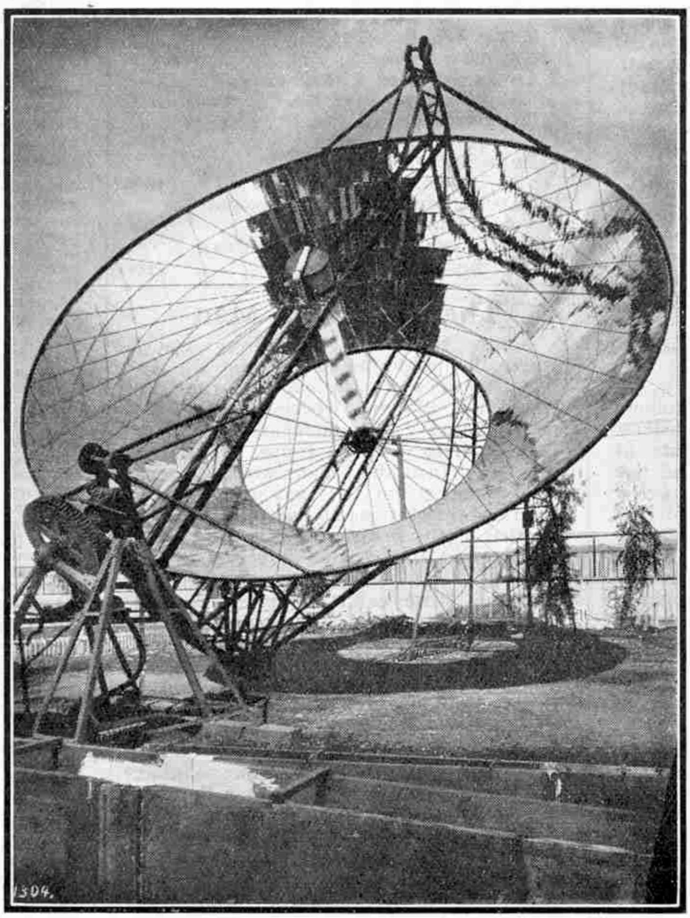
The Sun as a Servant

There have been many attempts to harness the Sun and to make him work at man's bidding, so that his rays, trapped and put to new uses, will take the place of coal as a producer of motive power. Clever minds in all ages have been at work to devise the necessary trap. Several more or less practical machines have resulted, but none so perfect, so full of promise, as the great sun motor now engaged in storing up the Sun's heat at Pasadena, in California.

By the Sun's heat, water is boiled, the steam working a powerful engine, capable of pumping some fourteen hundred gallons of water a minute.

From a distance, the Californian sun motor looks like a huge open umbrella, inverted, and with a piece cut off its top. It is balanced on a high, steel framework, and is set at such an angle that it will catch the sunbeams on its 2,000 mirrors. Each of these mirrors measures two feet in length, and three inches across, and reflects the sunshine on to a long cylinder, corresponding to the handle of the umbrella, which holds a hundred gallons of water. The boiler is made of steel, covered with a heat-absorbing material.

The hot, persistent Californian Sun that shines almost every day of the year, when reflected from the mirrors on to the boiler, causes such heat that it is possible to obtain 150 lbs. of steam pressure in one hour from cold water. When the machine is made ready for work—a task for a boy, who has merely to turn a crank until an indicator shows when the Sun is truly focussed on the mirrors—it will move round so that its face is kept turned to the Sun all day, without further manipulation, under the force of an automatic engine. The boiler is automatically supplied with water, a safety valve releasing the steam if the pressure should become too great.



The Solar Motor referred to on this page

All day and every day, from an hour after sun-rise to half-an-hour before sun-down, this tireless heat concentrator keeps its shining face turned to the Sun, storing up an energy which may be put to almost any use. It works, under the powerful Californian Sun, as well in winter as in summer.

It is not surprising that this exhibition sun motor in California has attracted the attention of leading engineers from all parts of the world. Among the orders for sun motors that have been placed with the company which own the patents are some from big mining companies in Arizona, South America, and India. Thus Old Sol is being made to do work for man in a way he little dreamed of a year or two back.

The Days Before the Microscope

Lucretius had a strong scientific imagination. A fine illustration of his power in this respect is his explanation of the apparent rest of bodies whose atoms are in motion.

He employs the image of a flock of sheep with skipping lambs, which, seen from a distance, presents simply a white patch on a green hill, the jumping of the individual lambs being quite invisible.—*Professor Tyndall.*

1,000 Varieties of Mushrooms

The Abbot Giacomo Bresadola, who has devoted fifty years to the study of mushrooms, has celebrated his eightieth birthday at Trento, Italy. He is known as the leading authority on mushrooms in the world, and has classified more than 1,000 from the most distant regions of the earth.

The Heaviest Known Star

Sirius, the brightest star in the northern sky, visible during the winter months, has a mysterious companion, a fact that has been known for some time. Quite recently many of the facts about the eccentric behaviour of this body have been brought to light, and as a result the amazing discovery has been made that matter may exist in a form of greater density than hitherto had been regarded as possible.

Platinum is practically the densest known element, but it is now known that in space there exists matter 2,000 times as dense as platinum. So dense is this matter that if we were able to make Meccano Parts from it it would be almost impossible to lift even the smallest. A Gear Wheel, which on the Earth weighs half-an-ounce, would weigh nearly half a ton, on the mysterious companion of Sirius, and everything would weigh more in proportion.

The dark companion of Sirius has a diameter of about 26,000 miles or three times that of our Earth. The Earth has a density of about five-and-a-half times that of water, but the density of Sirius's companion is about 53,000 times that of water, and it is a mystery how such an immense mass of material can be contained in such a comparatively small body.

The explanation, as given by Professor Eddington of Cambridge, is that this amazing density results from the atoms having been deprived of most of their electrons, so that little more than the nucleus of each atom remains. This makes it possible for them to associate more closely together, so that the atoms of the material are denser. This subject only touches the fringe of research in a very wide field.

New South African Goldfield

The possible existence of a new and extensive gold-bearing area of considerable extent in the Transvaal is interesting South Africa. Some months ago on a farm at Waaikraal, 25 miles north-east of Rustenburg and 42 miles north-west of Pretoria, an inclined sill of gold-bearing rock, ranging in thickness from 14 ft. to 3 ft. 6 in., was discovered. The rock has so far been found to a distance of 308 ft., and probably extends even farther in both directions. The richest ore found so far when opened up yielded over 6 oz. to a ton.

Gold-bearing rock is reported to have been found under similar conditions on farms at points situated respectively four miles and nine miles from Waaikraal. These reports have yet to be confirmed, but they appear to indicate the existence of an area of considerable promise.

Oysters Growing on Trees

A baby oyster moves about for two weeks, and then searches for a smooth clean surface on which to spend the rest of its life. A submerged rock, an empty shell, or even a glass bottle that has been carelessly thrown into the sea, will do quite nicely. Unfortunately, the supply of new-born oysters is so great that there is not usually sufficient suitable anchorage within easy reach, and the resultant overcrowding of the young molluscs results in serious loss of life.

Homes are now found for them, however, in the oyster beds on the coast of the United States. After many tests it has been found that birch twigs and branches are ideal resting places, and are able to accommodate thousands of tiny oysters. They are sunk by weights into the oyster beds, and can always be lifted out when it is necessary to transplant the oysters in order to give them room to grow to an edible size.

A Book to Read—*(continued from page 599)*

the past, or else that I had added a new mystery for the future to solve—the mystery of why these men are like Europeans if they be not of European descent."

In conclusion, Stefansson tells us that the daily vocabulary of the Eskimos exceeds 10,000 words—four times the vocabulary of an English speaking person. There are four forms of an English noun (e.g., man, man's, men, men's); fourteen declensional forms in Greek but 27 in Eskimo, and as particles may be inserted in the middle of the word, changing both form and meaning, there are "certainly a good many thousand different forms of any Eskimo noun"—while "the complexity of the verbs is even greater!" Such terrors as these cannot fail to make us all rejoice that we are not compelled to study Eskimo along with Latin and Greek!

MORE BOOKS TO READ

"The Radio Year Book, 1927"

(Sir I. Pitman & Sons Ltd. 1/6)

This valuable little publication follows in the main the lines of previous editions. There are the usual complete lists of stations, radio societies, etc., and, in addition, an interesting pictorial review of the outstanding wireless events of the past year. There are also many well-written general articles, among which we may note one by Mr. Baird on television, in which he risks the prophecy that "Televisors" will be on sale before the end of the year. We wonder!

"Out of the Ark" Books

(Warne, 1/9 the set, 2/- boxed)

There are six books in this set: "Grunty the Pig," "Ham and the Egg," "Jenny the Giraffe," "Jimmy the Baby Elephant," "Teddy's New Job," and "Wally the Kangaroo." These colourful and entertaining tales are, of course, for very young children and will make an excellent birthday present for your young sister or brother.

The stories deal with the adventures of various of Mr. Noah's animals—jolly wooden animals who are always getting into mischief and yet with whom everything seems to come right in the end! A word must be said of the sketches and coloured pictures, all of which are really excellent, the animals, wooden though they are, having humorously wise expressions similar to that of the famous "Bonzo."

"Hints for Holidays"

(Southern Railway Company. 6d.)

This well-known guide book contains photographs and detailed descriptions of all the holiday resorts, from Kent to North Cornwall and the Channel Islands, that may be reached by way of the Southern Railway. The contents include chapters by Mr. L. le Breton Martin, the well-known fisherman, on fishing the rivers and seas of the South Coast, and a list, with photographs, of the golf links served by the railway. In addition there are addresses of thousands of hotels, apartments and boarding-houses of recognised standing, with many particulars concerning accommodation that will be of value to holiday makers.

The book may be obtained at all S.R. Enquiry Offices and station bookstalls, or for 10d. post free from the Indoor Commercial Manager, Southern Railway, London Bridge Station, S.E.1.

Interesting New Books Received

"THE BROKEN TRIDENT"	*by* E. F. Spanner	(Williams & Norgate Ltd.),	7/6
"LESSONS IN PRACTICAL ELECTRICITY"		(Geo. Allen & Unwin Ltd.),	12/6
"METAL WORK"	*by* Adam & Evans	(Arnold),	6/6
"ADVENTURES IN ENGINEERING"	*Edited by* Arthur Malle, M.A.	(Collins),	1/9
"CHEMISTRY OF THE OIL INDUSTRIES"	*by* J. E. Southcombe		12/6
"DEEP SEA DAYS"	*by* Thomas M. Hemy		12/6
"NATURE JOTTINGS OF A MOTORIST"	*by* H. Mortimer Batten		7/6
"SPORT AND FUN ALL THE YEAR ROUND"	*by* H. Stuart Menzies		2/6

The Turntable Man

Across the maze of railway tracks where the platforms end at the big terminal stations are the engine turntables, where the whirring wheels of the locomotives find a few moments' sanctuary between trips with the trains. It is here that the turntable man works among cinders and steam. He has many clients from distant stations all day long, for it is a fetish of the British railways that their big engines should always travel funnel first.

In his little cabin, which looks out across the turntable pit, he swings round a 150-ton engine, costing £7,000, as easily as the peas run off a fireman's knife at mealtimes! Once the correct balance is obtained, the ballbearings of the table need little power to start the mass moving; but judgment is required to slow down the mechanism so that the rail ends of *terra firma* and the rail ends of the table synchronise exactly.

Main line locomotives are submissive steeds when they reach the turntable man's territory, yet a few moments before these mighty engines were careering across country, devouring the miles. The turntable is only the half-way mark of their daily links of duty, for after a spell of rest they take up the trail that leads to home.

Exploring the Arctic—*(continued from page 584)*

so told upon even his iron constitution that Back was practically an invalid for six years. He died 23rd June 1878, and the world was the poorer by his death, for he did noble work and there are few sailors who survived more perils and hardships than he did.

Back was knighted in 1839 and promoted to Admiral in 1857. In addition to receiving (in 1837) both medals of the Geographical Society and (in 1839) the Gold Medal of the Geographical Society of Paris, he was presented with a service of plate by subscribers to the Arctic Land Expedition. At one time he was employed by the Government to report on the Harbour of Holyhead, but later he lived in retirement on half pay.

NEXT MONTH:—

THE FRANKLIN TRAGEDY

OUR MAIL BAG

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

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

A. Kumar (Delhi, India).—We are glad that you were so pleased with your success in the "Doublets" Competition and we hope this will not be your last success of the kind. Some of our overseas readers used to think that they had little chance of winning prizes in "*M.M.*" Competitions but they realise now that readers all over the world have exactly the same opportunity.

W. H. Watson (Edinburgh).—The inclusion of more articles on railway matters has undoubtedly proved popular with the great majority of our readers. We have in preparation further articles dealing with miniature railways and we think you will find these very useful to you in bringing your layout to the highest possible efficiency.

Mr. W. R. Stepney (Acton, W.3).—We are greatly interested to hear that, after having had to neglect Meccano through pressure of work, you are now able to return to it at intervals and with all your old enthusiasm. There is no doubt that Meccano exerts a wonderful fascination and one that is not diminished by the passing of the years. We welcome your letter as affording additional proof of this when you write: "The desire has come back to see what others are following on with where I, with thousands of others, have had to leave off."

R. C. Price (Worcester).—We are glad to hear that you were so surprised by the realistic appearance of your Hornby train set. No end of fun can be had by combining Meccano with a train set on the lines that you suggest, and we quite agree with you that for this purpose the new coloured Meccano parts are more effective than the nickel ones.

C. Turnbull (Durham City).—Your enthusiasm is quite infectious and we are not surprised that occasionally you burst forth into poetry! We particularly like the following effort:—"There was an old woman who lived in a shoe, she had so many children she didn't know what to do; so she bought them Meccano and told them to play and now they are happy all through the long day!"

Miss Joan Hodge (Bristol).—You and your sister evidently have some fine times with your brother Tony and we quite believe you are just as keen as he is. It is great fun building bridges and laying your Hornby track beneath them, and we can imagine your excitement when an accident occurs and a breakdown train has to be sent along to pick up the pieces!

E. Duddridge (Frome).—"I never dreamt when I took up the "*M.M.*" for the first time that it would grow and grow until now it has 96 pages." When the "*M.M.*" was first started we, too, never dreamt it would reach its present size and circulation. All the same, Edward, we were determined from the first that the "*M.M.*" should be a success and we just pegged away month by month trying to improve it in every possible way.

H. W. Salman (Brighton, S. Australia).—It is good news to hear that the Meccano population in South Australia is steadily increasing. We can quite understand the interest that has been aroused by the "Mountain," "Pacific" and "Mikado" engines that have recently been imported. We shall be glad to hear how you progress with your chemistry and Latin, so send us a line when you have a few minutes to spare.

L. Carroll (Pretoria).—We are interested to hear that you have passed in your examination and are now leaving for Pretoria to take up a commercial course. We wish you every success. We are glad to be able to tell you that, as soon as we can find space, we intend to publish the story of the invention of Meccano and to describe the magnificent factories in which it is made to-day. We feel quite proud to know that your last letter to us is the longest you have ever written!

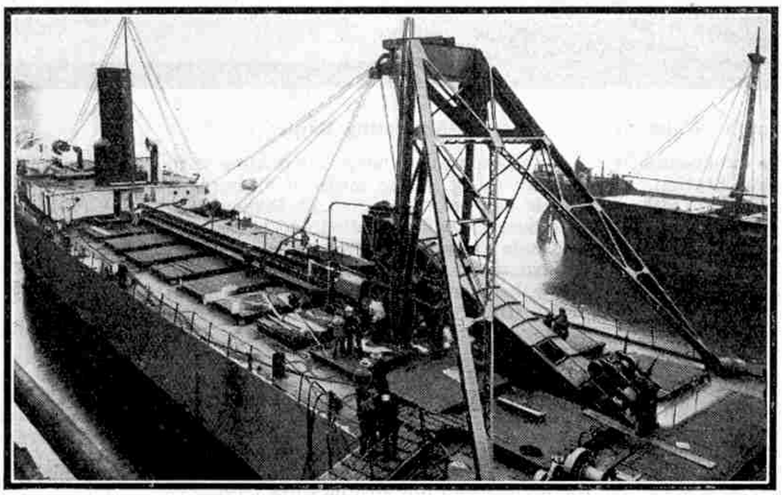
E. Harrison (Nottingham).—We were sorry not to be able to accept your article but we are sure you will understand that unless it appeared within a very short time it would be quite out of date. We receive an enormous number of articles for the Readers' Pages and at the present time we have awaiting publication sufficient articles to fill these pages for several months.

A Ship That Unloads Itself

The Remarkable Machinery of the S.S. "*Valley Camp*"

CARGO vessels in general have become standardised to such a large extent that there is a certain monotony about them. It is therefore all the more interesting to learn of a new vessel that possesses features unique so far as this country is concerned.

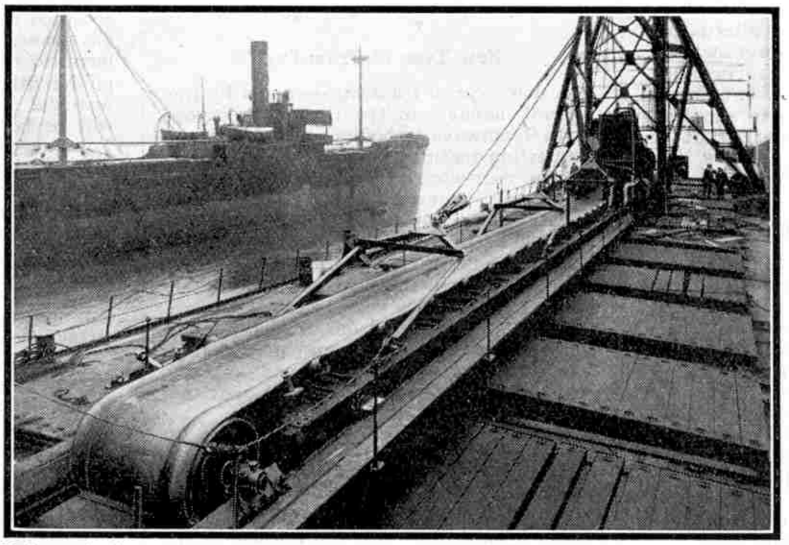
This vessel, the "*Valley Camp*," was launched recently on the Tyne from the Neptune Works of Swan, Hunter & Wigham Richardson Ltd. She is quite normal in most respects but is fitted with a remarkable self-unloading equipment that will enable a cargo of coal, gravel, stones, wet sand or ore, to be discharged at the rate of 600 tons per hour.



General view of deck, showing superstructure that supports the inclined casing containing the belt passing from the hopper

The self-unloading equipment is the patent of Mr. L. D. Smith of Sturgeon Bay, Wisconsin, U.S.A. It consists of two steel tunnels extending the full length of the three holds, one tunnel being on the port side and the other on the starboard. Within each tunnel is a huge scraper about 8 ft. in length that is pulled through the tunnel by an endless steel rope, actuated in turn by a steam hauling engine at the fore end of the tunnel.

Each scraper collects a load while travelling from the stern end of the tunnel to the fore end, the material in the hold passing to the scraper by way of openings 3 ft. 9 in. by 3 ft. 1½ in. in each side of the tunnel. From the fore end of the tunnel the scraper is drawn up an inclined plane until it is immediately over a large hopper or bin, into which its contents are discharged. When emptied each scraper is hauled back by a steel wire along the tunnel to the after end, travelling along a trolley beam in a raised position and passing above the material in the bottom of the tunnel.



Photos courtesy] [*Swan, Hunter & Wigham Richardson Ltd.*

The Boom Conveyor at rest on deck. The grappling irons and hauling cables for lifting it are clearly shown

The hopper receives material from either or both scrapers and drops it on to a rubber belt conveyor 4 ft. in width that is operated by a steam engine above deck. The quantity of material falling at a time from the hopper can be regulated. The conveyor belt is contained within an inclined totally enclosed passage, and as the material is received from the hopper it is carried upward until at the head of the passage it is dropped on to a lower endless belt, also 4 ft. in width. This second conveyor forms an integral part of a conveyor boom 85 ft. in length.

In our illustrations this boom is seen at rest along the centre of the deck, but it can be swung freely over either the port or the starboard side of the vessel by means of a double steam winch, the raising or lowering being controlled by an independent worm geared winch. When swung out to the full the boom can discharge cargo at a distance of 62 ft. from the ship's side to a maximum elevation of 30 ft. above the deck. Discharging may be done not only on to open wharves but also into lighters, barges, railway carts, hoppers, ships' bunkers, or in fact to any point within reach of the boom.

Extensive trials of the self-unloading gear were carried out while the vessel was lying alongside the builders' wharf. These trials were completely successful, and showed that the gear was thoroughly reliable and quite as effective as had been anticipated.

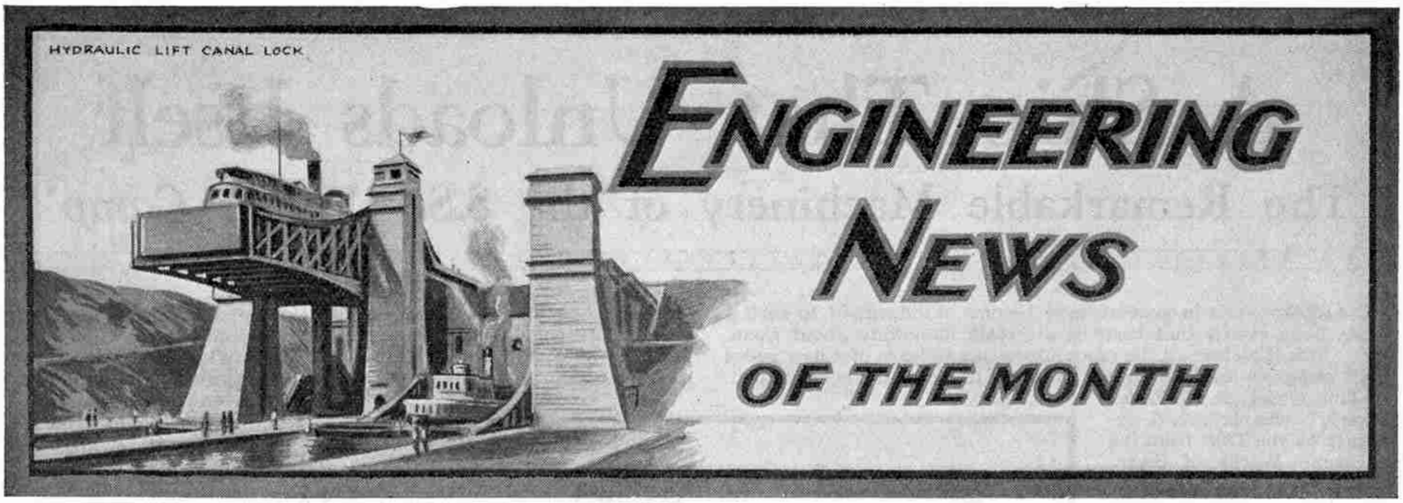
The "*Valley Camp*" has been built for service on the Great Lakes and the River St. Lawrence, where several other vessels equipped with this gear have been in use for some time. These vessels range in size from 2,000 to 6,000 tons and have discharging capacities of from 400 to 1,000 tons per hour, with overside conveyors varying in length from 75 ft. to 150 ft. Four of these vessels load sand and gravel with 18 in. and 20 in. centrifugal dredging pumps installed on the ship, discharging this non-free flowing material with the scraper conveyor gear.

An important feature that should not be overlooked in regard to this type of gear is that a vessel may have cargo in a number of different compartments, and if necessary these may be discharged separately to several quays.

Self-unloading vessels in general are used abroad for the delivery of materials to wharves where the yearly tonnages handled do not justify the installation or maintenance of fast dock gear. From Great Lakes experience it is considered that wharves whose yearly tonnage handled is less than 15,000 tons can use economically self-unloading deliveries. This figure will naturally vary with shipping conditions but there would seem to be a great field for such gear in North Sea trade to the Continent and in British coastwise traffic.

It is obvious that the shorter the cycle of trip operation the greater the saving in the time factor through rapid unloading. Developments in propelling machinery for increased speed and economy are frequently offset by slow discharging, and for this reason there would appear to be great possibilities in vessels of the type of the "*Valley Camp*."

It is interesting to note that this firm have recently launched their 50th vessel built for the Canadian Lakes service.



ENGINEERING NEWS OF THE MONTH

Electrical Development in South Wales

The recent completion of the extensions to the Upper Boat Generating Station, situated on the banks of the River Taff, about ten miles from Cardiff, marks an important stage in the development of the electricity supply of South Wales. This station supplies the county of Glamorgan and part of Monmouth, and originally comprised three generating sets, supplying 1,500 k.w. at 11,000 volts.

The new boiler house contains eight 60,000 lb. water-tube boilers, supplied with automatic coal-handling equipment and two under-feed ash conveyors, each of the latter being driven by a 9 h.p. motor. The coal-handling equipment comprises a continuous-band conveyor that throws the coal off the band automatically, and a travelling grab that picks up the coal and redistributes it.

A new 14,000 k.w. turbo-alternator has been installed and supplies current at 11,500 volts. Tenders are being invited for another alternator of 25,000 k.w. capacity. Two 600–1000 k.w. alternators supply the auxiliary station power and two 2,000 k.w. motor-generators are installed for supplying the G.W.R. Docks at Barry. A total load of 90,000 k.w. is supplied, which is about ten times the output in 1908.

* * * *

New Lifeboat Launching Tractor

A new type of tractor for the launching of lifeboats from sandy beaches has been constructed. This tractor has undergone extensive trials and has shown that it is capable of handling the heaviest lifeboat. An inclined body carries the boat and is supported on a rear caterpillar track and a turntable carried on the tractor, which has a creeper track and a pair of front wheels. Four-wheel drive is fitted and the magneto and the carburetter are totally enclosed in order to prevent a stoppage due to waves reaching the engine. The air intake to the engine is 8 ft. above ground level.

* * * *

The Marlow Lock, situated on the River Thames, was reopened recently after being closed some time for reconstruction. The sides of the lock, which were formerly of timber, now consist of reinforced concrete. New gates have been provided at each end of the lock and deepening has been undertaken throughout its length.

Oil-Separating Barge

An oil-separating barge for dealing with the oily water in the tanks of oil-burning vessels has been launched at Birkenhead. This barge is self-propelled and can steam alongside the oil-fuel ships in dock. The impure water is pumped into the barge and falls on to a series of perforated baffle plates, by which operation it is purified sufficiently to be discharged into the dock or river. The barge itself is 102 ft. 6 in. in length, 22 ft. 6 in. in breadth, and 10 ft. in depth. It is provided with one funnel, one mast, and a single screw, and eight separating tanks are carried.

The provision of this vessel will obviate the necessity of oil-burning ships having to steam to distant points before discharging their oily water. This was the chief reason for the construction of the barge, but it possesses the additional virtue of separating and saving the oil. The vessel has been constructed to the design of Alfred Holt & Co. Ltd., by Cammell, Laird & Co. Ltd.

* * * *

New Type of Tram-Car

A new type of tram-car designed by the general manager of the Bradford Corporation Tramways embodies several new and interesting features. The car is mounted on two four-wheeled bogies, the two pairs of wheels being coupled. Each bogie carries an electric motor rated at 63 h.p. at 1,000 r.p.m. The doors are mounted in the centre of the body and are operated pneumatically by a 2¼ h.p. subsidiary motor, which also supplies the power for the air brakes. When the doors are open it is impossible to start the car and, on the other hand, the doors cannot be opened until the car stops. An emergency valve to open the door from inside the car is fitted.

* * * *

Modern Refuse Disposal Works

A modern refuse disposal works has been opened by the Chesterfield Corporation. The refuse is dumped into a hopper and falls on to an endless plate conveyor that feeds into an elevator. A screen sorts out the cinders and dust, while the tins are separated magnetically, passed into a mechanical baler and saved. The remainder of the refuse is hand picked and, after all material of any value has been separated, the residue is conveyed direct to the destructor. The cost of the plant was £7,000.

Testing a Dam Scientifically

A dam is being constructed on Stevenson Creek, a tributary on the San Joaquin River, California, under the auspices of the American Society of Civil Engineers, in order to carry out scientific tests. The thickness of the dam is 7½ ft. at the base, tapering to a thickness of 2 ft. at the 30 ft. level and continuing at that thickness to the top of the structure. The dam is 60 ft. in height at present, and the radius is 120 ft.

Certain tests are being carried out at the 60 ft. level, careful measurements being made to find the amount of leakage taking place. When these tests have been completed the height of the dam will be increased to 100 ft. Pressures beyond its capacity will be applied and during its wreckage further scientific information will be obtained.

* * * *

Paris Water Supply Scheme

A scheme for bringing water from the Vals de Loire for the Paris supply has been accepted provisionally by the Paris Municipal Council, who intend asking the Government to declare the scheme a " work of public utility " in order to secure some financial backing. A number of wells will be bored along the left bank of the Loire, between Nevers and Gien, at distances from the river ranging from 55 yds. to 325 yds. The water will be pumped into an aqueduct, crossing the Loire near Gien, and will then pass along the main aqueduct to the south of Paris, a distance of about 87 miles. Two large reservoirs will be constructed there and will be capable of supplying nearly 12,000,000 cu. ft. of water per day.

An alternate scheme favours the construction of barrage reservoirs in the upper valley of the Seine, and probably this will be undertaken if the other proves impossible.

* * * *

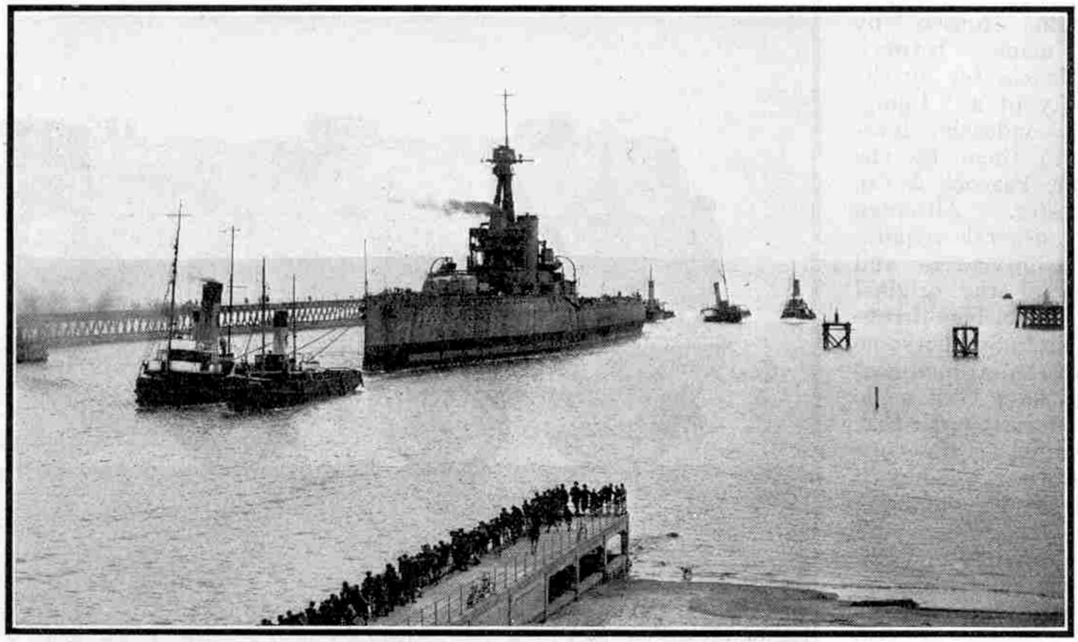
H.M.S. " *Adventure* " Commissioned

Recently the cruiser-minelayer H.M.S. " *Adventure* " was commissioned for service with the Atlantic Fleet. The main engines of this 7,260 ton vessel are Parsons turbines of 40,000 s.h.p. but Diesel engines are also installed for use when only a moderate cruising speed is desired. H.M.S. " *Adventure* " has a maximum oil capacity of 1,550 tons and a speed of 27.75 knots. Diesel engines have been installed in other warships but this vessel is the first cruiser to use this form of propulsion, even as subsidiary to the main plant.

Monster Bridge at San Francisco

The construction of the Carquinez highway bridge across the upper end of San Francisco Bay was completed recently when two huge steel spans, each 125 ft. in length and 750 tons in weight, were hoisted into position. This feat was accomplished by the rather unusual method of counterbalancing the spans by boxes of sand.

The End of a Famous Warship



H.M.S. "*Thunderer*" entering Blyth Harbour for the purpose of being broken up

Each span, forming part of the centre portion of a 1,132 ft. cantilever, was assembled on barges and towed into place beneath the bridge. Steel cables were attached to the section and passed over steel blocks suspended at the ends of the two cantilever arms. On the free ends of the cables boxes were suspended and gradually filled with wet sand. When the weight was sufficient they descended, hoisting the span through the 135 ft. to the cantilever arms. The load was regulated in such a manner that the spans were lifted at the rate of one foot per minute. In addition to hoisting the spans, this method formed a good test of the bridge, as during the operation each cantilever had to support twice the weight of one of the spans, a total of 1,500 tons per cantilever.

The cost of this bridge, which is the longest highway structure in the world, although surpassed in regard to the length of the cantilevers by several bridges, has been £1,600,000.

* * * *

A High Level Bridge over the Clyde

Approval of an order for the construction of a new bridge over the Clyde at Finnieston has been obtained by the Corporation of Glasgow. The bridge is to be a high level one and will remove the necessity for the four ferries and a harbour tunnel. The estimated cost of this bridge, which will be the only one westward from the city, is £1,000,000.

* * * *

A timber bridge, claimed to be the highest in the world, is under construction near Tacoma, Washington, for a logging company. It is 204½ ft. in height and 893 ft. in length and contains 836,000 ft. of timber.

Nile Barrage to Cost Two Millions

A new barrage is to be constructed over the Nile about 30 miles below Luxor and will be known as the Nag Hamadi barrage. Its total length is to be 2,500 ft., and 100 sluice gates will be constructed.

Large quarries are to be established and the quarried stone will be transported to the dam site by a fleet of river craft. Work will be carried on during the period from December to July, when the Nile is low, and probably will take about three years to complete. Practically a new town, complete with electric light, water, fuel and hospital accommodation, will be built to house the men employed on the work, the estimated cost of which is £2,027,300.

* * * *

Reconstruction of a Severn Bridge

The repairs at present being undertaken in connection with the old bridge over the Severn at Holt Fleet are based upon methods that have proved successful in the case of several bridges in France, particularly in connection with the Paris, Lyons and Mediterranean Railway. The Holt Fleet bridge is of cast iron and was built to the designs of Thomas Telford, one of the first engineers to construct iron bridges. Welding and casings of reinforced concrete will be employed for strengthening the ironwork, the masonry also being fortified. French engineers who have had experience of similar work are being consulted by the Worcestershire County Council. The original outlines of Telford's design are to be retained.

* * * *

An eight-floor garage has been constructed in Boston, providing accommodation for 2,000 cars.

* * * *

An electro-magnet nearly 5 ft. in diameter and capable of lifting 75 tons has been installed at the Krupp Works at Essen.

Scottish Electricity Scheme

The Central Scotland Electricity Scheme, formulated by the Electricity Commissioners, is a most important step in the centralisation of electricity supply undertaken by the Central Electricity Board. This step has been made economically important by the increasing number of manufacturing firms dependent on the public supply for electric power.

There are no fewer than 42 official undertakings in this district, controlling between them 36 generating stations. Under the new scheme 13 stations are to be inter-connected, a total of 105,350 k.w. resulting from this combination. It is anticipated that by 1937 seven stations generating a total of 643,650 k.w. will supply all requirements, the remaining six being closed down. During the succeeding period 1937-41, two new stations with a total capacity of 200,000 k.w. probably will be required, a final total of 843,650 k.w. being reached. In these stations the capacity of each turbo-alternator would range from 12,500 to 50,000 k.w.

The fact that the two principal plants, Glasgow and the Clyde Valley, transmit their power at a frequency of 25 cycles, while the national standard is 50 cycles, is complicating the re-organisation considerably. It is estimated that the change to the standard frequency will cost £2,921,250 spread over six years, this figure including the cost of substituting new motors. It is anticipated that the Board will begin supplying in 1929.

* * * *

Europe's Largest Power Plant

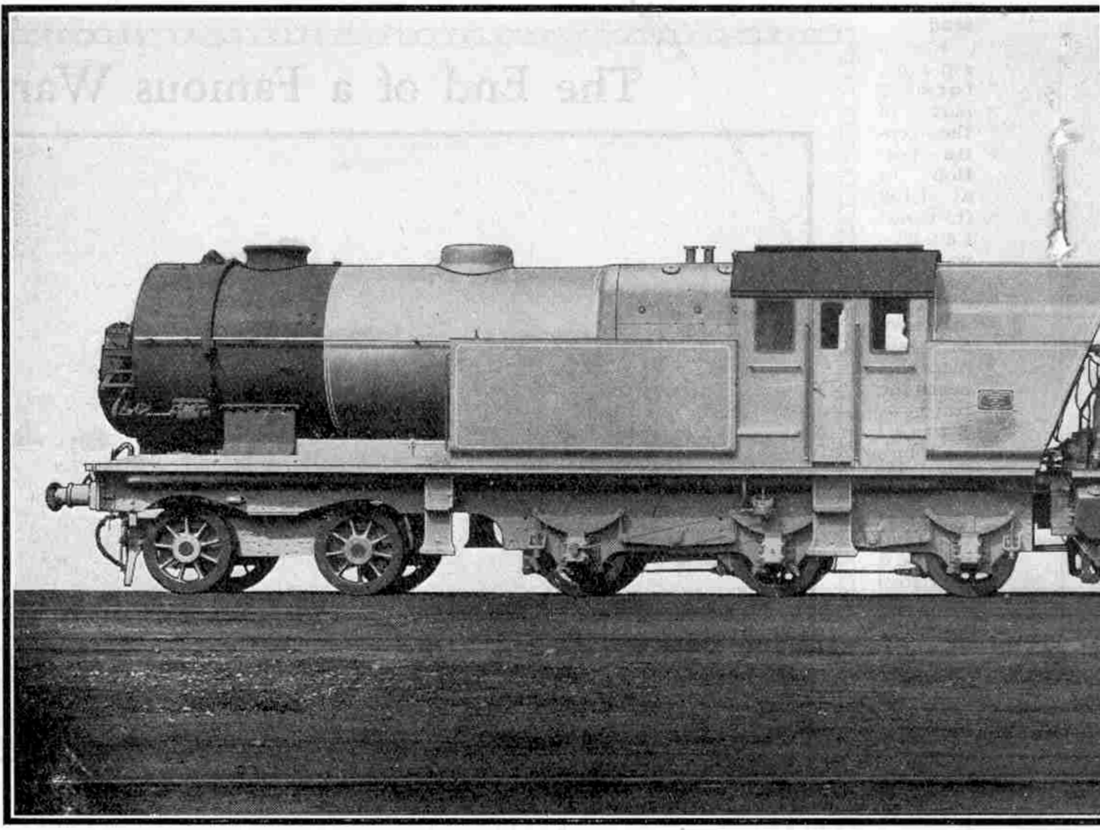
Plans for a huge hydro-electric installation on the banks of the Dnieper River have been prepared. This plant is to be the largest in Europe and will have a capacity of 630,000 h.p. Only one plant at present in commission, that at Niagara, is larger than this installation will be.

* * * *

A windmill utilising the rotor principle developed by Anton Flettner has been constructed in San Francisco, and is being used for driving machinery and for irrigation purposes.

A BRITISH “LJUNGSTRÖM”

Interesting Attempt to Extract the Utr



Courtesy]

The British “Ljungström” Locomotive, showing its massive

CONSIDERABLE interest has been aroused by tests made between Derby and Manchester by the L.M.S. Railway of a “Ljungström” turbo-condensing locomotive lent to them by the makers, Beyer, Peacock & Co. Ltd., Manchester. Although built to the general requirements of the inventors and manufacturers of the original “Ljungström” turbine-driven locomotive, built in Sweden some years ago, substantial modifications in design have been made by the British firm in order that this new example of the type should conform to the standard conditions of service obtaining on British railways.

The new locomotive is 74 ft. in length over buffers, and in working order weighs 143 tons 14 cwt. It consists of two vehicles, the first carrying the boiler and the second the turbine and condenser. The former is carried on three fixed axles and a leading sliding-type four-wheeled bogie, and the ten wheels are each 3 ft. 3 in. in diameter.

The boiler is of the ordinary locomotive type, having a Belpaire firebox and steel inner firebox with steel stays. It has an outside diameter of 6 ft. and contains 238 2¼in. diameter steel tubes, while the superheater is a M.L.S. small tube type. The boiler is built for a working pressure of 300 lb. per sq. in. Details of the heating surface are:—

Tubes	1,480 sq. ft.
Firebox	140 ,,
Superheater	640 ,,
Total ...	2,260 ,,

The grate area is 30 sq. ft.

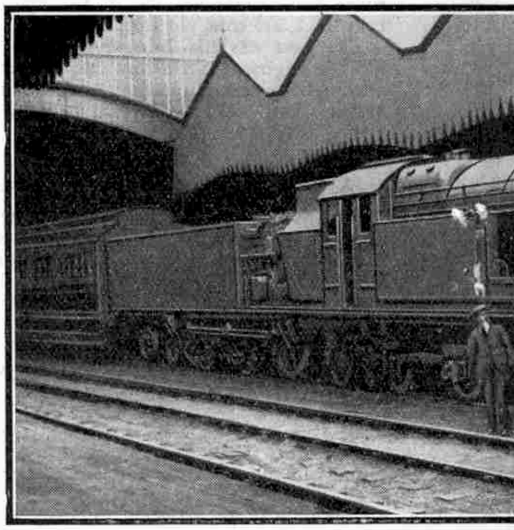
Access to the boiler tubes is facilitated by the front portion of the smokebox, wherein is the preheater, being set up on hinges.

The air-preheater is of the “Ljungström” patent type and has a heating surface of roughly 13,500 sq. ft. The nickel blades of the turbine rotor it contains are alternately heated and cooled by hot gases and incoming air respectively, the latter being induced by a turbine-driven draught fan attached to the front of the smokebox, as shown in our illustration. This fan can be controlled from the footplate by the fireman.

The boiler and turbine are connected by ordinary piping, a ball-and-socket joint allowing for movement between the two vehicles. Two regulators are fitted; one that remains full open when the engine is in service is in the dome, and the other, for regulating the admission of steam to the turbine blades, is adjacent to the main turbine.

At the rear of the boiler-carrying vehicle is a coal bunker to accommodate six tons of fuel, while side tanks to hold 600 gallons of water are fitted at the sides of the boiler. Between the boiler and the coal bunker is the engine cab or footplate, the size of which is in keeping with the generous lines of the whole locomotive.

The second vehicle takes the place of the tender to the usual locomotive and has three pairs of coupled driving wheels, 5 ft. 3 in. in diameter, followed

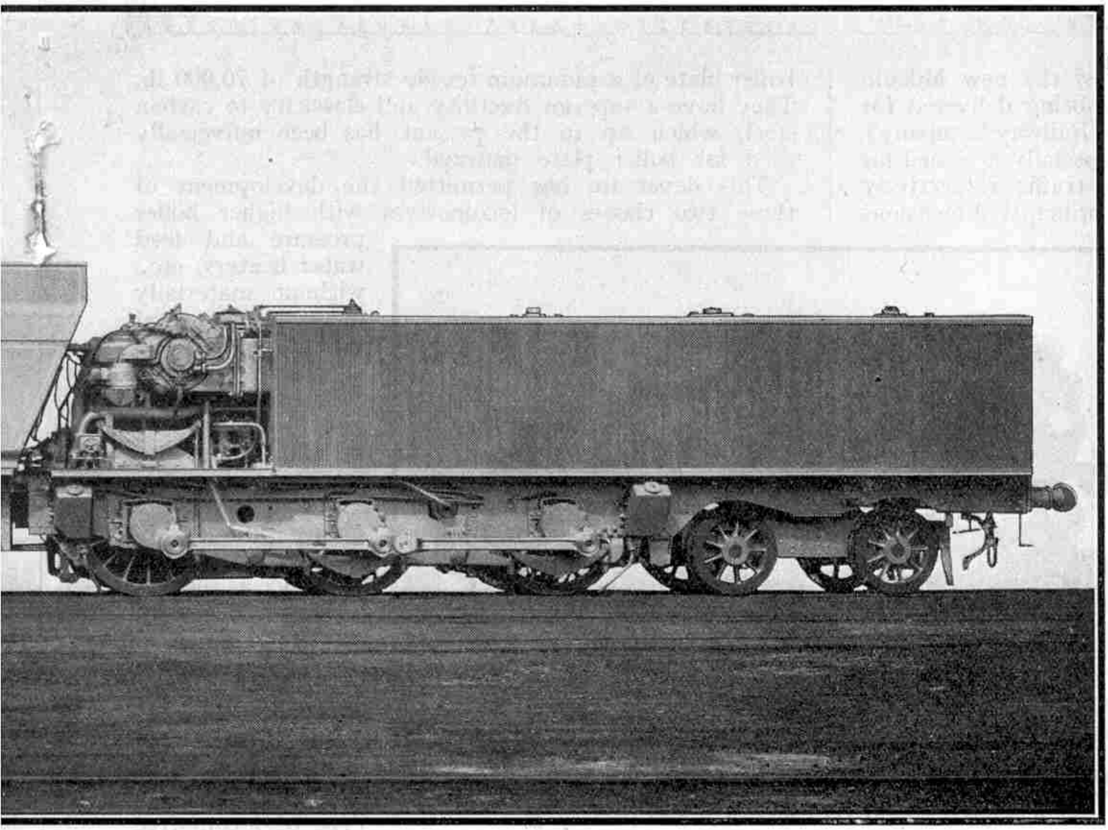


Photo]

View showing the fron

M" TURBINE LOCOMOTIVE

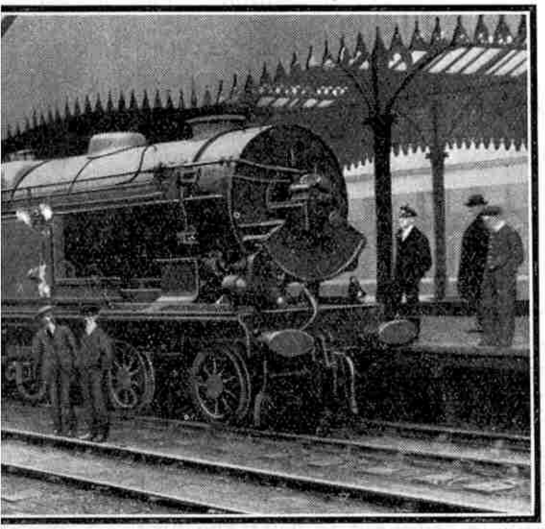
Utmost Possible Heat from the Steam



massive proportions and its many interesting external features

[Beyer, Peacock & Co. Ltd.

by a four-wheeled bogie to facilitate the rounding of curves. In the fore part of the vehicle and coming immediately behind the coal bunker is the main turbine. This drives the front pair of coupled wheels through direct double helical three-reduction gearing having a ratio of 1 to 25.22, the final drive to the driving axle from the last gear shaft being effected by a quill-type axle. The turbine runs in one direction only and reversal is carried out from the cab by hand gearing operating an idle shaft and gears. Motion is imparted to the intermediate and trailing coupled wheels by means of side coupling rods having outside cranks.



he front of the locomotive

[W. Smith

Dust-proof casing encloses the main gearing and is largely responsible for filling the space between the driving wheels. As a result the main frames, with external axleboxes and crank arms, are placed outside the wheels. The gear casing is attached to the main frames so as not to impede any movement of the latter.

The main turbine is of the axial flow type and capable of developing 2,000 h.p. at 10,000 revs. per minute, the equivalent engine speed being 70 miles per hour. Flexible couplings link the turbine with the main gearing.

The condenser immediately behind the turbine is of the "Ljungström" patent air-cooled type with auxiliary surface condenser, and includes some 2,500 flattened and ribbed copper tubes ranged vertically in groups on both sides. Steam is led from the turbine exhaust to top-collectors of the condensers and condensation is effected by drawing air between the tubes at a prescribed velocity, four 6 ft. 9 in. diam. turbine-driven draught fans operating from a separate turbine being used to achieve this. The condensate is received by bottom-collectors and passed to a sump, from which a diffuser returns it to the condenser body.

The capacity of the main condenser body is roughly 1,350 gallons of water, and the boiler is fed from this by two turbine-driven centrifugal pumps. Water is drawn from the side tanks on the front vehicle to compensate for the minor losses resulting from whistles, etc., and its admission to the condenser is regulated by a valve placed on the footplates.

In conclusion, braking is effected on the locomotive by a steam and hand-brake on the boiler-carrying portion and by a vacuum brake on the condenser vehicle. This latter type of brake can also be used for the train.

It is interesting to note that this locomotive is at present engaged in passenger service between Derby and Birmingham, and will shortly be running express trains between Manchester, Derby and London.

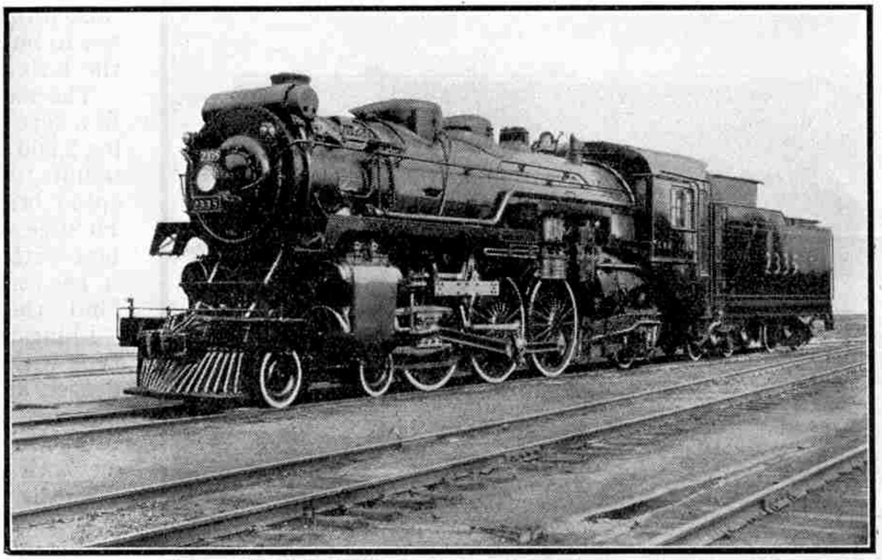
The thermal efficiency of the steam locomotive is low on account of the large amount of heat that goes to waste by way of the chimney. The great possibilities of the turbo-condensing locomotive in producing a higher thermal efficiency, by extracting the utmost possible heat from the steam, have been realised for many years and various engines of this type have been designed and constructed.

(Continued on page 632)

New Canadian Locomotives

"Pacific" and "Mikado" Type Engines for C.P.R.

THE following is a description of the new Mikado and Pacific type locomotives being delivered for service on the Canadian Pacific Railway Company's lines. The two classes have been specially designed for heavy mineral and fast passenger traffic respectively and are of enormous size. The principal dimensions of both types of locomotives are given in the accompanying table.



New "Pacific" Engine for Canadian Pacific Railway

These locomotives have several interesting features; in particular, they are the first locomotives on the Company's lines to operate at 250 lbs. boiler pressure. The flow of steam is controlled by a throttle arrangement consisting of four poppet type valves, which are contained in the superheated steam passage of the superheater header located in the front end of the engine.

The valves are actuated by a cam shaft, controlled by a throttle rod running through the hand rail on the right hand side of the locomotive. The use of a throttle in this location provides steam in the superheater units at all times, thus dispensing with the use of a superheater damper and also giving a supply of superheated steam at all times independent of the operation of the throttle valve. This feature permits the operation of the auxiliaries with the superheated steam.

	MIKADO TYPE.	PACIFIC TYPE.
Tractive Effort	57,100 lbs.	45,000 lbs.
Cylinders	23″ × 32″	23″ × 30″
Diam. of Driving Wheels	63″	75″
Boiler Pressure	250 lbs.	250 lbs.
Diam. of Boiler 1st Course	80″	79⅞″ O.D.
Size of Firebox	84¼ × 120-1/16″	84¼″ wide × 111-1/16″ long
Grate Area	70.3 sq. feet	65 sq. feet
Total Equivalent Heating Surface	3,436 and 970 superheater	3,272 and 864* 4,136 sq. feet.
Weight of Drivers	244,600 lbs.	184,000 lbs.
Total Engine Weight	335,200 lbs.	306,500 lbs.
Total Weight Engine and Tender	564,700 lbs.	497,500 lbs.
Total Wheel Base	72′ 1½″	67′ 10″
Overall Length	83′ 6¾″	78′ 9⅛″

*864 is type "A" superheater heating surface.

A closed type feed water heater has been used and water is delivered to the boiler through the heater by means of a duplex water-pump as furnished by the Elesco Feed Water Heater Company.

The rods on these locomotives are of both carbo-vanadium and nickel steel, which has permitted the refinement of design necessary to insure the minimum weight of reciprocating parts. The frames are of cast vanadium and cast nickel steel.

Probably the most interesting feature is the use, for the first time as far as is known, of nickel steel boiler plate of a minimum tensile strength of 70,000 lb. They have a superior ductility and elasticity to carbon steel, which up to the present has been universally used for boiler plate material.

This departure has permitted the development of these two classes of locomotives with higher boiler pressure and feed water heaters, etc., without materially increasing the total weight of the two classes of power.

The passenger engines are in use in the Company's fast passenger service and have been giving an exceptionally fine performance as regards acceleration and sustained tractive effort at high speeds together with very economical operation.

The evolution of the "Mikado" type of locomotive began with the introduction of engines having eight wheels coupled (0–8–0), originally intended for the haulage of slow but heavy coal and mineral trains. Their association with this class of traffic popularised them as "Mineral" type engines.

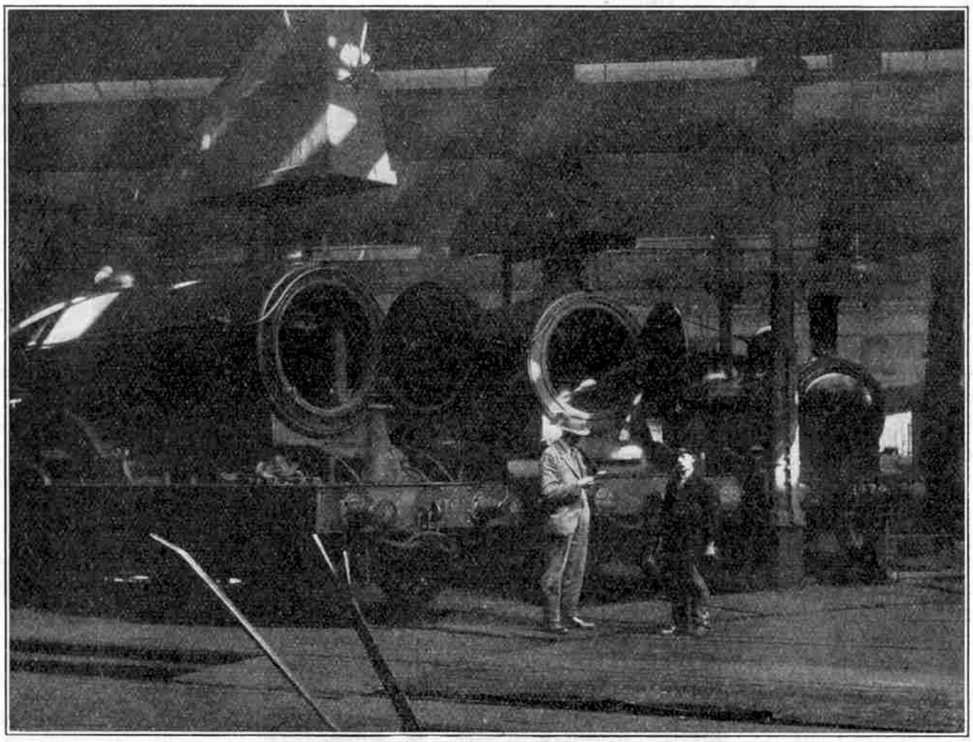
At a later stage, with the addition of a leading pair of small wheels, they became known as the "Consolidation" type (2–8–0) and the "Mikado" (2–8–2) type engine represents a further advance in construction by the addition of a second pair of small wheels following the driving wheels. The name "Mikado" became associated with this class of engine owing to the first representatives of the type being built for Japan.

An interesting example in this country of a "Mikado" engine working heavy mineral traffic is L.N.E.R. No. 2393, which was built at Doncaster in 1925 and since has done considerable service in working coal trains between Peterborough and London. These trains frequently comprise 100 trucks weighing some 1,600 tons, and are worked to a fast schedule in order not to delay the East Coast Route and other L.N.E. main line expresses.

A Day in a Running Shed

By "HEADLAMP"

The photographs accompanying this article were taken at the York Running Shed. The article, which is reprinted by permission of the Editor of the "*London and North Eastern Railway Magazine,*" is largely based on the working at York



York Shed Interior

THE locomotive has a great fascination for most people. This interest is maintained from the day they pull one behind them, through the time when, as schoolboys, they run their miniature trains, until—when in mature years—they stand on the station platform to see the latest type of engine start away with its huge load.

At this stage they discuss, to the best of their ability, the relative merits of "Atlantics" and "Pacifics"; superheaters and compounds; and refer to the wonderful performances in "the good old days" of the 7 ft. 6 in. singles.

There are few boys and men who do not, on the passing of a "flyer" racing through a wayside station, take note of the type of engine, and even its number, but pay little attention to the coaches, except to count them.

Few people, even railwaymen outside the Locomotive Department, although interested in types, and possessing a full knowledge of engine performance from observation, are aware of the organisation necessary and care that has to be expended to make an engine fit for each run.

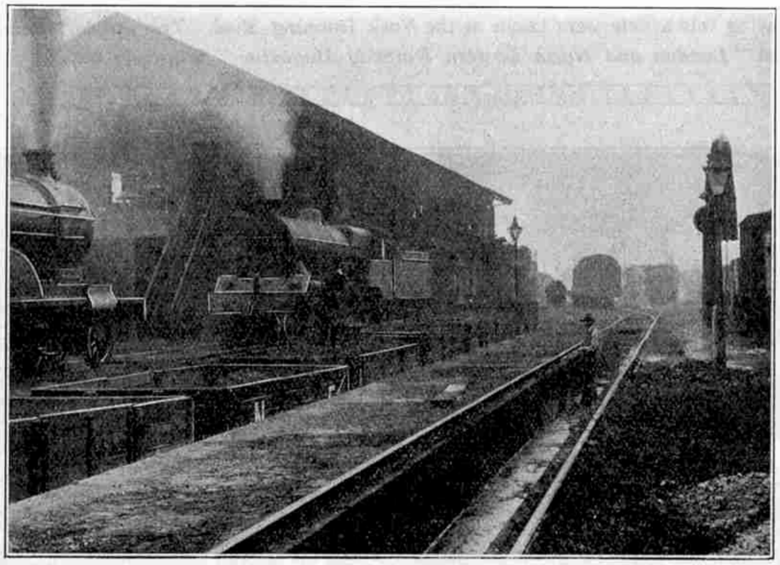
The foreman receives from the Operating Department a list of all trains to be worked, in addition to the regular booked trains for the following day. He then makes out the docket arranging a set of men for each turn, and on the longer trips sometimes providing additional men for relief. For a heavy day he will have to make more sets of men by using qualified firemen as drivers, and cleaners as firemen. He arranges the type of engine that is required to work each train, and in doing this he must, in addition to providing suitable engine power, so arrange the engines that the repairs and usual shed duties can be completed in time.

Lighting up Locomotive

Several grades of men attend to each engine. The boilersmith attends to the boiler repairs—perhaps a few leaky tubes have to be expanded or a leaky seam made tight—before the engine can be "lit up."

The tube-brusher cleans the boiler tubes with a brush, consisting of a 20 ft. long iron rod, with a wad fastened on the end. This rod has to be pushed right through each of the small tubes, in order thoroughly to remove all dirt. This is not a short operation, as there are over a hundred of these tubes in each boiler. The large tubes containing the superheater elements are usually cleaned by blowing compressed air through them. For the main-line engines the tubes have to be cleaned after almost every trip.

The steam-raiser, having made certain by an inspection and test of the water gauges, that the correct amount of water is in the boiler, proceeds to light up. He spreads some coal over the firebars and on this places some fire that he has carried from the shed fire. When raising steam from cold water, the steam-raiser must light up about three hours before the engine is due out. He must not raise steam too quickly, or the boiler will suffer from unequal expansion, and leakages will be started in the firebox.



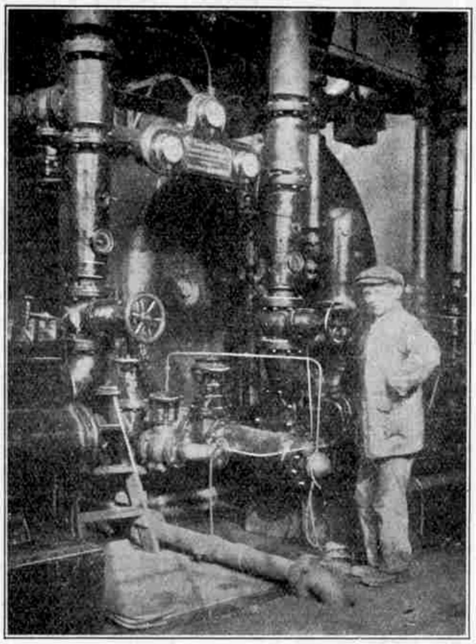
Engines at Coaling Stage and Stabling Pits

The waste heat from the shed fire is utilised to dry the sand that all engines carry to gain a better grip with their wheels on the rails.

In the meantime the fitters have been busy on repairs to the engine itself, changing a defective spring, renewing a broken stud, or perhaps packing a leaky gland, or adjusting the engine brake. Engines requiring extensive repairs are not booked for a turn, or "lit up" until near the completion of the repair.

The examining fitter, whose duty it is to examine specially all high-speed engines, scrutinises minutely all the moving parts liable to fail.

A preparing set of enginemen oil the engine before the trainmen sign on duty, thus ensuring that the engine is fully equipped for the trainmen.



Pumps for Hot Water Boiler, Washing-out Plant

Account is kept of all stores supplied, and oil is measured. In modern stores the oil is kept in bulk in elevated tanks. Large graduated vessels situated on the issuing counter are fed by gravity from these tanks, and the stores issuer supplies the oil direct from these glass measures into the enginemen's oil bottles. Considerable waste is avoided by this method.

During the early morning the trainmen, who are to work the engine in traffic, are called up for duty. They book on at the time office, and there obtain particulars of their work. Latest notices affecting the working of the line are perused and they then make their way to the engine, which by this time the preparing set have got ready. The turntable is set to the engine stall, and after a preliminary test of the brake, the engine moves slowly forward on to the table, balances, and stops. Safety catches are withdrawn and it is then swung round, and turned out of the shed.

In leaving the shed it passes over a fog apparatus similar to that on the main line, which tests the apparatus on the engine to ensure that everything is in working order. The engine is then ready for traffic.

Having completed its trip, the engine on its return to the shed passes by the coal stage, where the tender is filled up with coal and water. As much as 5 tons of coal has sometimes to be supplied. The coal tubs, each holding about 10 cwt., have been filled from the wagons on the elevated stage, and are tipped into a shoot, where the coal slides down on to the tender. A more modern method is to have the coal stored in huge elevated hoppers. The engines stop underneath, and the required amount of coal is dropped through an opening in the bottom of the hopper. The daily issue of coal at a large shed is between 300 and 400 tons.

The trainmen are relieved by another set of enginemen for stabling after arrival in the shed yard. Before booking off at the time office, the train driver enters in the report book any defects he has found in the running of the engine. He has also to make out his voucher, giving a detailed account of the day's work.

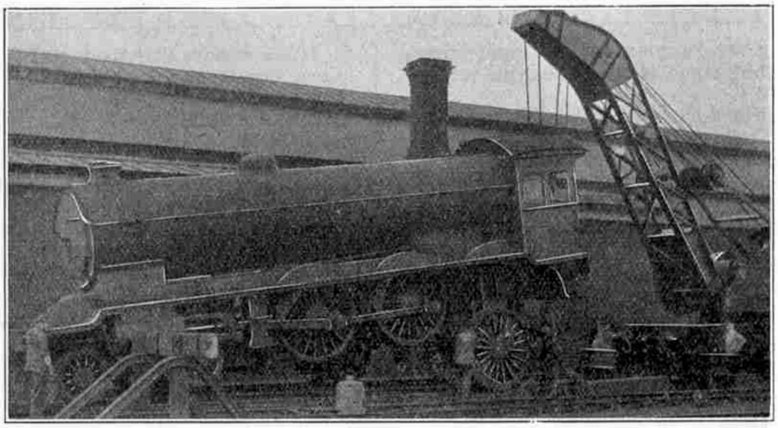
The stabling set who have taken charge of the engine, bring it on to the stabling pit, where they rake out the ashpan, lift all the scar and ashes out of the firebox, and empty the black ash out of the smokebox. The engine is then brought into the shed, and turned off into a stall, where the fireman replenishes the sandboxes, and takes the lamps to the stores to be retrimmed. The stabling driver meanwhile examines the engine for defects.

It is again in the hands of the shed staff to get ready for its next trip.

After about every seventh trip the boiler must be washed out to clear it of sediment, the amount of which varies according to the district. This sediment accumulates by the water being converted into steam, leaving in the boiler all dirt and salts it may have contained. The dirt, clinging to the tubes and firebox, prevents the full transmission of heat from the fire to the water, with consequent loss of efficiency. The salts in solution become concentrated, and cause priming, and in order to save coal and keep the engine at full power, it is essential that the boiler be kept clean.

Prior to washing out, all the steam is blown off, and the boiler allowed to cool down. This cooling must not be done quickly, as if rapidly cooled, severe strains would be set up through unequal contraction, causing leakage of water at the tubes and seams. Every time a boiler is washed out, it is examined by a boiler-smith for defects in the plates, tubes, and stays.

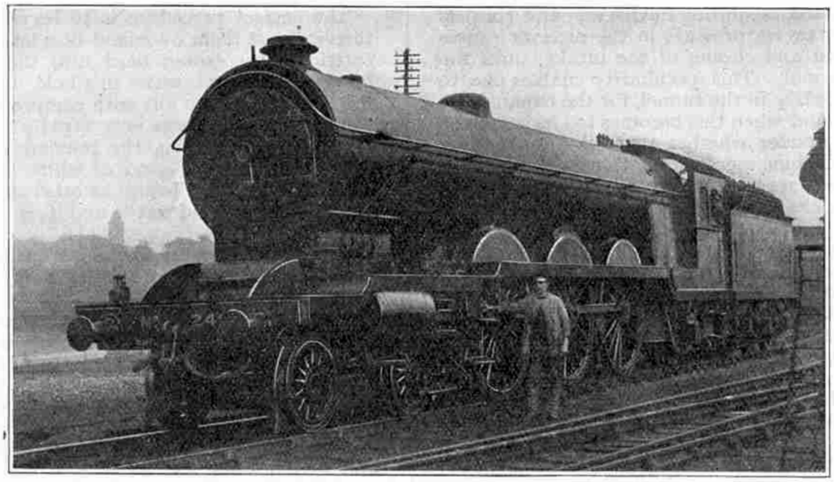
The fusible plugs in the firebox crown plate, which prevent damage to the plates by a shortage of water, require frequent renewal. When they deteriorate with the intense heat of the fire, they are liable to fail when the engine is in traffic, and disable it, although there might still be an ample amount of water in the boiler. A record is kept of all these examinations and renewals.



Lifting an "S 3" Engine

When washed out with cold water, the engine is of necessity out of service for a considerable time. This time is reduced by 60 per cent. if hot water apparatus is used. The gain in time, and the less maintenance required with hot water washing-out is a great advantage. A service of pipes is laid round the shed, and these in turn are coupled to the boiler to be washed out, the hot water being run through a pipe to a tank, and filtered. Hot water is pumped into the boiler through the service pipes to wash it out, and finally the boiler is filled with hot water, and steam can be very rapidly raised. This gain in time is so great that a shed equipped with hot-water wash-out plant can run the same service with fewer engines than a shed only using ordinary methods of boiler washing.

Although each engineman takes the opportunity daily of checking the pressure at which the safety valves lift, they are also examined by a fitter each month, and a record kept. The gauges showing the level of the water in the boiler are examined, and the passages cleaned out each month. These passages, if choked with sediment, would cause a false reading of the water level.



N.E. Type "Pacific" at York Shed

An express locomotive has a high piston speed. The 6 ft. 8 in. driving wheels revolve over four times each second when travelling at 60 m.p.h. At this speed each piston, and its connecting rod, is averaging over 1,000 ft. per minute, and as these and other moving parts change direction eight times each second, it will be realised that tremendous stresses are set up in all the moving parts. The failure of one, might have serious consequences before the engine could be brought to rest by the driver.

In addition to the daily examination by the enginemen when preparing and stabling, and by the cleaners when cleaning these moving parts, the opportunity is taken each time a part is removed from the engine to examine it minutely for flaws. The tyres, too, must be examined for wear, and a record kept.

Formerly, cleaners each had their own engines to follow up, and keep clean. This is not possible now with the more economical working of engines gained by double shifting. The cleaners, therefore, work in gangs. While cleaning they are gaining a knowledge of the engine, which will be to their advantage when promoted to firemen, and later to drivers. When they have attained a certain required standard of knowledge, they are certified for firing if physically fit, and they usually commence on preparing and stabling work. On occasion they are called in emergency for firing on more important work, and being only human, are happier when on any work other than that of their own grade.

When an engine is stopped for a hot bearing, it is turned off into the stall, where the wheel drops are situated, and so placed that the wheels with the hot bearing are standing on the platform of the drops. The drops are worked by hydraulic power, and are like an ordinary station lift, or hoist, but that there is a section of track across the platform.

After the wheels have been unfastened from the engine, the drop is lowered, and it carries with it the wheels and brasses. When lowered, the wheels are rolled through a tunnel on to another hydraulic lift, where they are raised to ground level. The necessary repairs can then be conveniently carried out. This method is much cheaper than the old method of lifting the heavy engine, and rolling the wheels out from underneath.

When the number of heating cases cannot all be dealt with on the drops, cranes, sometimes even the crane of the breakdown train are brought into service. An illustration is shown of the breakdown crane lifting a Class "S 3" engine in order to remove the trailing coupled wheels. In this case the tender had to be uncoupled from the engine, but if it had been dealt with on the drops, this would not have been necessary.

Each shed has its tool van for attending to breakdowns, or as our American cousins term it, the "Wrecker." At each of the large sheds there is a steam crane certified to lift up to 35 tons, and this is always ready at very short notice. The tool van gang are experienced men drawn from all grades of the shed staff. On receipt of a call they at once report to the foreman to

(*Continued on page 632*)

Tunnelling through Ben Nevis

The Lochaber Water-Power Scheme

By Thomas Blench

IN our April issue we gave a general account of this great water-power scheme and described some of the rock drills used in the various operations.

It now remains to mention the jack-hammer drills, which resemble the large drills or "drifters" referred to in April, but are lighter and can be used by hand by a strong man to put in holes for trimming, or survey pegs, or any other purpose for which it is not desirable to rig a column. Their defect is that water does not pass through the steel and in consequence the operator has to work in fine rock dust—very injurious to the lungs. There is no excuse for using them for prolonged work, for the "human rig" can be used on staging as conveniently as on the ground.

Stopers are convenient machines for trimming and shaft-rising for they consist of an ordinary drill to the end of which is attached a long pneumatic cylinder with a pointed piston rod end. This can be jammed against the ground so that, when the air is turned on, the cylinder acts as a pneumatic jack that keeps the machine rising as the hole is drilled.

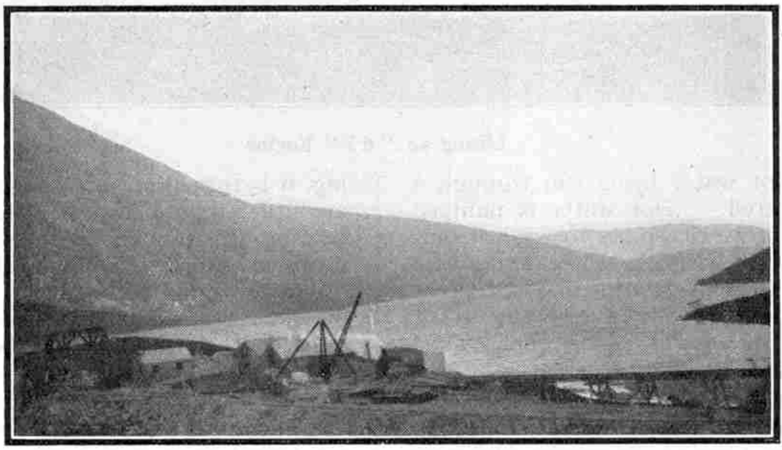


Fig. 1. Scene of Operations at Loch Trieg

Air-Compressing Plant

The full air-compressing plant consists of two Alley and McLellan two-stage compressors delivering into the receiver at 80 lb. per sq. in., and driven by 150 h.p. induction motors. The intermittent use of the air necessitates some automatic regulating device and this consists of an arrangement whereby excess pressure in the receiver causes both opening of the exhaust and closing of the intake, until the receiver pressure falls to normal. This peculiarity enables one to tell whether drilling is proceeding in the tunnel, for the exhaust has a very loud "chuff chuff," and when this becomes too insistent the tunnel foreman begins to wonder whether there is any slacking inside. It is not easy for machine men to take things easy!

Gelignite and liquid oxygen are used as explosives. The former is issued in ½lb. and 1 lb. sticks of 1¾ in. in diameter, except for jack-hammer holes, where ⅞ in. diameter is customary. Electric detonators with delay action fuses are used. These are ordinary detonators with varying lengths of fuse, which is lit electrically, the varying lengths permitting the firing of a system of holes in specified groups. The great advantage of electric firing is its safety.

Gelignite can be ill-used without danger unless it is frozen; detonators are safe if treated carefully; but fuse may burn more rapidly than it ought, and anyone having an accident at the face after the fuse was lit would be in a very unenviable position. Moreover, fuses lit one after the other will not go off together and it is easy to miss one entirely.

Liquid Oxygen Cartridges

With liquid oxygen, fuse burns very rapidly and must not be lit by hand. Liquid oxygen cartridges are made of dried moss, sawdust and aluminium dust—in fact of any old rubbish that will burn. When ready for use they are soaked for 15 minutes in liquid oxygen contained in a vacuum vessel. This thoroughly impregnates them with oxygen, and detonation causes immediate combustion all the way through, instead of merely on the surface as is the case when a combustible body is burnt in air. "L.O.X," as it is popularly called, is as powerful as 80 per cent. gelignite and costs practically nothing, for the solid material is extremely cheap and the oxygen is obtained by compressing air and allowing it to expand again rapidly. Since the power for the compressors is obtained from the river Spean, this latter item is very small.

It is a wonder that the users of L.O.X. are not charged entertainment tax, for the whole business is most thrilling. When the face is ready for blasting, the cartridges are placed in soaking vessels and the L.O.X. is poured in from large vacuum flasks holding some 60 lb. When the intensely cold liquid reaches the comparatively hot sides of the soakers it seethes and boils, and on being spilled on the ground it runs about in little hissing globules just as water does on a hot kitchen grate. The intense cold causes condensation in the surrounding air and gives the impression of clouds of smoke. So cold is the oxygen, indeed, that it is able to give a very nasty burn to anyone who does not handle the cartridges gingerly!

Excitements and Dangers

Loading is performed by teams, one team to six 8 ft. holes. One man tosses in the cartridges while another rams them home with a wooden stemming rod. A third man hands up the earth tamping and some responsible person goes round the holes making the connections of the detonator wires. The whole business must not take more than six minutes because the L.O.X. is evaporating all the time. Very soon the loss becomes so great that insufficient remains to bring about complete combustion and then, on firing, carbon monoxide is formed and the men are poisoned.

The correct procedure is to leave the charges for an hour and then exhaust them by means of a long auger—no easy job when the cartridges are frozen hard into the hole! The real fun starts, however, if there is water in a hole, which may happen even though the holes are blown out with compressed air before loading. Then the oxygen evaporates very rapidly and, just as the last stemming cartridge is thrust in, the pressure of imprisoned gas drives the whole lot out in a cloud of white vapour. This results in some unfortunate man being smothered in a mass of earth, shiny aluminium dust and water, and if he is not used to the game he gets a very bad scare!

A funny incident occurred on one occasion. A certain foreman conceived the notion of putting badly fitting wood blocks into wet holes so that any oxygen leaking through could escape, while at the same time the cartridges would be held back. Unfortunately someone put an airtight plug in one hole and the foreman got it in the head, which was really most unjust!

L.O.X. is safe, powerful, cheap and fumeless and it saves time in charging. It is useless in wet holes, however, and it is very difficult to charge a large number of holes in a confined space within the time limit. In addition, the first cost of the plant is heavy and confines its use to jobs where a very great quantity of explosives is to be used.

Hydro-electric Scheme Supplying Power

We now come to the little hydro-electric scheme that supplies the contract with power. This is situated on the river Spean near Glen Roy. Fig. 2 shows the broad, gently flowing river where the water enters the tunnel leading to the power station. The steel grating catches rubbish that might be drawn into the tunnel and give trouble later. The river changes its nature about twenty paces from the intake, to a deep pot-holed gorge, which continues to the power-house. Just to one side of the gorge is the tunnel and along the other runs the Fort William to Glasgow Railway.

After about half a mile the tunnel comes out into the open and is continued by an 8 ft. diameter steel pipe, on which is fitted a large concrete surge pipe the sole purpose of which is to act as a safety valve. If a heavy load is thrown on the turbines, the action on the pipe is similar to the closing of a valve. Obviously no pipe line could stand the tremendous pressure that would result from the sudden stoppage of the flow of water in a half-mile length and a fracture would occur to relieve the pressure. The surge pipe is a fracture placed there intentionally, so that nothing worse can happen than a surging of water up the pipe. It is most interesting to sit on top of the surge pipe and watch the usually gentle rise and fall and the strong vortex that forms. The surge pipe on the main contract consists of a 30 ft. diameter shaft over 200 ft. deep, and the water will come out of several pipes, not one only, embedded in a huge concrete chamber.

A few yards past the surge pipe—which can be seen from the railway by anyone visiting Fort William—the pipe runs downhill to the power house, where the water drives three Francis type reaction turbines, each of which is coupled direct to an alternator generating current at 11,000 volts which is sufficient to meet requirements. The water flows up the inclined pipe into the turbine and out axially from the centre of the machine, where it falls down draft tubes of tapering shape, whose bottoms are submerged in the waters of the river.

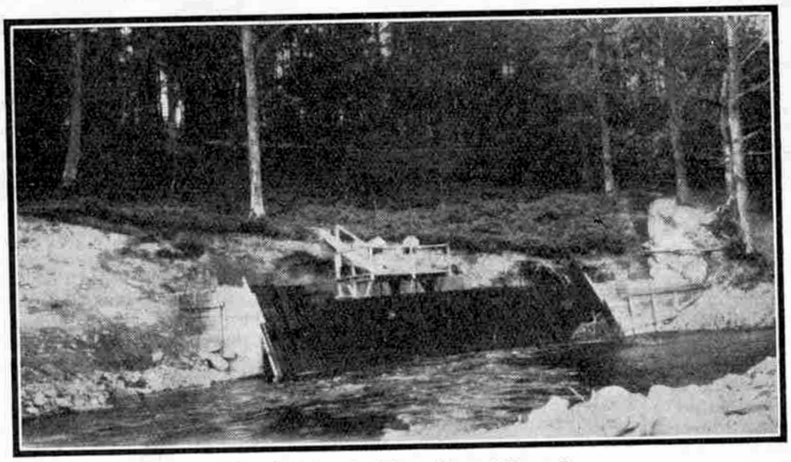


Fig. 2. Intake to Tunnel on River Spean

The only essential difference between this scheme and the big one is that here there is no reservoir. In consequence, during a very dry summer there is a power shortage due to the river falling very low. Of course, the Spean derives its water from Loch Trieg and Loch Laggan, but the levels of these lochs fall in dry weather. Eventually the two lochs will be joined by a tunnel so that their combined storage capacity can be utilised for the main scheme. This introduces a new complication, for the level of Loch Laggan is some 35 ft. higher than that of Loch Trieg. The level of the latter, therefore, will be raised by a dam, and this means that the West Highland Railway will have to be re-built for some distance because its present track will then be submerged.

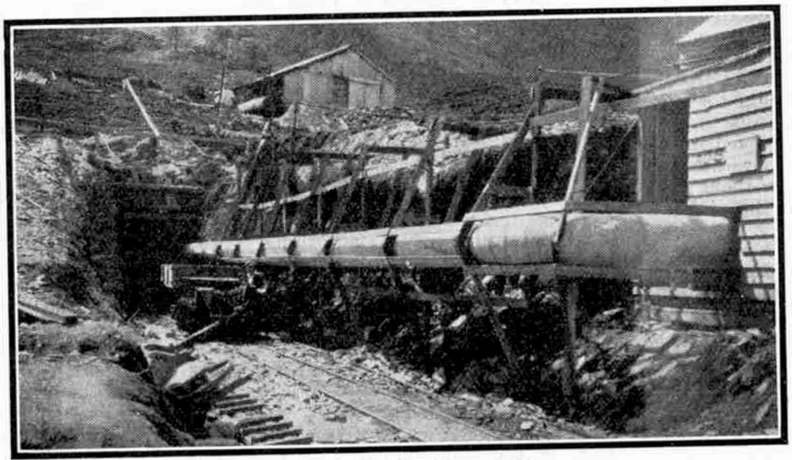


Fig. 3. Mouth of an Adit

[Note Ventilation Pipe and Compressor House. Electric Engine and Skip emerging from Adit]

Breaking into the Loch from the Tunnel

The problem of breaking into the loch from the tunnel is rather a ticklish one. There is the straightforward method of surveying the lake basin and determining the finishing point for the tunnel at, say, 10 ft. from the water; subsequently completing all the valve work and concreting and then blowing out the remaining 10 ft. with a mined charge. This method has worked quite well in Switzerland, but there is always the danger that one may be unlucky enough to strike badly fissured rock that lets the water through in great quantities. A surer way would be to build a watertight compartment for entry to and exit from the working face, and flood the working chamber by means of pilot holes. This, of course, involves working with divers and renders the job very elaborate. Yet another method might be to work from a pneumatic caisson, but this would be expensive.

Whichever method may be chosen, we may be sure that the tunnel ultimately will go through and add yet another great feat to the triumphs of British engineers.

A description of the Lochaber scheme would be incomplete without reference to the method of ensuring the cutting of the tunnel in the right place. The first essential is a map of the district with adequate detail to enable the tunnel course to be decided upon. Then the contractor must perform a survey of his own and place permanent marks—such as concrete pillars on which are fixed vertical ranging rods—from which and to which he can make instrumental observations. The tunnel line is marked out on the surface ultimately by means of these monuments.

Method of Cutting the Tunnel

Let us suppose now that it is decided to run an adit from the vicinity of station "X." We construct a monument above the tunnel where we wish to meet it, and make a station on the ground on the centre line of the adit. This station will consist of an iron bolt set in concrete and centre-punched. The positions of the station and of the monument having been determined from the main survey stations "X" "Y," we know how far the adit must be driven from the station to the monument, until the centre of the tunnel is reached. The engineer hangs strings from the adit roof at intervals so that the foreman can verify the direction of the adit by sighting through the strings. When the tunnel is reached, the main survey results give the angles that the two branches of the tunnel make with the centre-line of the adit, so that the tunnel direction can be fixed by theodolite and later the foreman can check his direction by means of strings.

During the main survey, bench-marks, or points whose height above sea level is accurately determined, are fixed for future use, for the level of the various portions of the tunnel is quite as important as their direction.

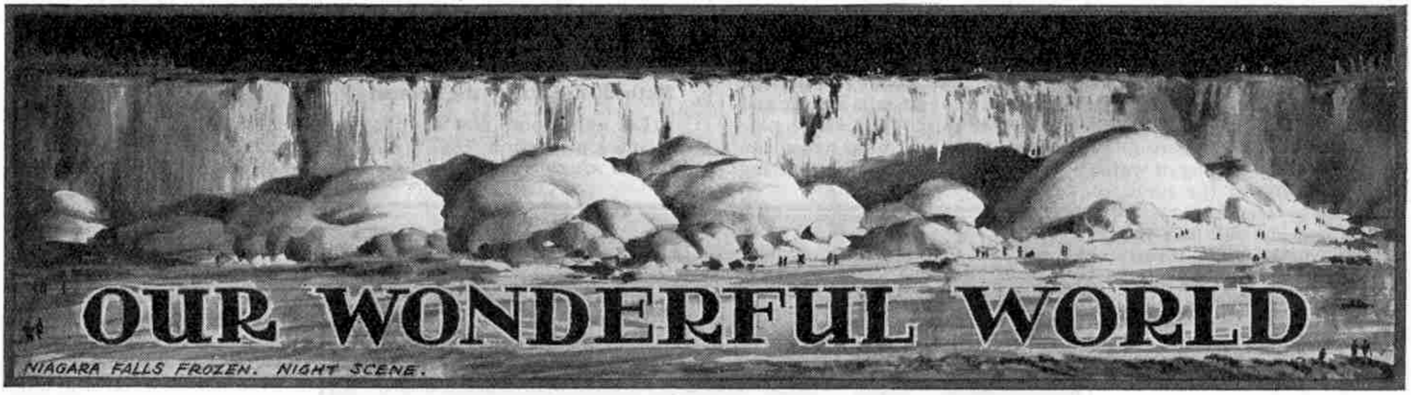
It will thus be seen that, no matter where the contractor wishes to work, his permanent survey marks are somewhere near, so that he can do all his local measuring without having to go away back to the base lines. The line of the tunnel is decided by the engineers of the company undertaking the job, and it is up to the contractor to transport their overhead line into the heart of the mountain.

To the uninitiated the manner in which engineers succeed in getting different sections of tunnel to meet accurately appears nothing short of marvellous. In reality, however, it is simply the application of very elementary mathematics to large dimensions. Except in the case of surveys over vast areas, the task is quite an easy one to the engineer, but it demands of him the exercise of great patience and thoroughness.

When the project of cutting the Mont Cenis tunnel through the Alps was undertaken 70 years ago, boring operations were begun simultaneously at each end of the chosen route. When the two headings ultimately met, just over 13 years later, they were found to be in agreement, except for a difference of one foot in the level. The completed passage proved to be 15 yards longer than was calculated from the overhead survey at the commencement of operations. The tunnel is almost eight miles in length and roughly 3,800 ft. above sea level.

It is interesting to note in connection with this tunnel that boring was at first done by hand, but progress was so slow that after several years of patient labour pneumatic drills were adopted and the rate of advance was thereby increased threefold. A task that looked like taking 30 years to complete was successfully accomplished in 14 years.

The famous St. Gothard Tunnel, the construction of which was commenced in September 1872—the year following the completion of the Mont Cenis Tunnel—was similarly bored from each end at the same time. The two headings met in February 1880, when the error in direction was found to be only 13 inches and the discrepancy in the level of the two sections only two inches.



OUR WONDERFUL WORLD

NIAGARA FALLS FROZEN. NIGHT SCENE.

Nature's Efficient Lighting Methods

The way in which man makes light is inexpressibly clumsy and wasteful in comparison with nature's methods. The most efficient from the purely lighting point of view of our artificial methods results in a very small portion only of the energy consumed being made available in the form of light, the rest being dissipated, chiefly as heat. Thus a candle as a source of light is efficient to the extent of 2 per cent. only, ordinary electric light bulbs waste 93 per cent. of the energy supplied to them in various ways, while the arc lamp only returns 15 per cent. of the power supplied in the form of light.

The Sun on the other hand supplies the entire solar system with heat as well as light and even in this case as much as 35 per cent. of the energy radiated is light. When we turn to the luminosity of fireflies and fishes we realise how completely inefficient our methods are. With us the higher the temperature the brighter the light, but nature appears to have solved the problem of light without heat! The firefly is a splendid example of this. Glow-worms are fairly common in England, but the most brilliant example is found in South America and Cuba in an insect that diffuses from spots on its thorax a beautiful light that is strong enough to enable print to be read. Two or three of these fireflies placed in a glass vessel give sufficient light for ordinary household work, while ladies use them for ornaments, placing them in their hair during the evening promenade.

This living light is almost 100 per cent. efficient. Practically none of the energy of the light organ is wasted in the form of heat so that the firefly is 50 times as efficient as the finest incandescent lamp. The case of fishes is similar, the light emitted by the deep sea fishes referred to on p. 119 of the February "*M.M.*" being also cold light. For instance, a tiny crab-like creature that lives in Japanese waters carries little lighting plants in its body. When the dried bodies of a number of these are moistened with water they immediately give flashes of bluish-green heatless light.

The origin of this light appears to be a chemical change of an obscure kind and scientists are not without hope that they will be able to learn the secret. At present the nearest approach to it that is under man's control is the glow emitted by many substances under the influence of ultra-violet light.

* * * *

Animal Craftsmen

It is said that the inventor of paper was a Mongolian who got the idea by watching hornets build their nests from a pulp made of weeds and straw. This is a reminder that many animals and insects carry on activities of a type usually associated with man.

The caterpillar as a maker of silk threads is a notable example, and the manufacturers of artificial silk try to spin the pulp they use in the same manner as this insect. The beaver is an architect and builder, besides being an expert wood cutter; while the marmot is a veritable civil engineer, for he constructs aqueducts and drains to keep dry the house that he burrows out of the soil.

The nautilus is a navigator who raises and lowers his sail and casts anchor just like any human sailor. The bee must be a mathematician, for he makes the cells of his honeycomb of the exact shape necessary to hold the maximum amount of honey for the quantity of comb used. After that it is no great stretch of the imagination to consider birds as musicians, and the country of the ants as an ordered commonwealth with architects, statesmen, trade unions and a regular army.

* * * *

Stars of Millions of Years Ago

Astronomers are continually making discoveries that cause us to readjust our ideas of the size of the universe. They measure the distance of a star by the number of years that its light requires to reach us when travelling at the rate of 186,000 miles per second, so that one light year is almost six million million miles. At one time a distance of 400 light years was regarded as enormous but bodies have been discovered which, according to the evidence of astronomers, must be far more distant thar that.

The limit seems to have been reached, for the present at all events, in the case of the spiral nebulæ. At least one of these, that in the constellation of Andromeda, is so near as to be faintly visible as a luminous patch to the naked eye, but a telescope has to be used in order to detect any spiral form in the thin luminous material constituting the nebulæ. This is a mere million light-years away!

Dr. Hubble, a well-known astronomer who has made a special study of nebulæ, has come to the conclusion that the smallest in appearance of these spiral nebulæ must be at a distance of something like 140,000,000 light-years away! It is difficult to imagine anything so far away that we now see it in the light that it sent out 140,000,000 years ago, but this is the meaning of Dr. Hubble's statement, which brings to mind the verse:

> " For the rays that reach us here
> May have left your photosphere
> Ere the fight of Waterloo,
> Ere the pterodactyl flew."

These lines were written before any suggestion was made that heavenly bodies existed to which the last line is applicable. They appeared in "*Nature*" in 1898 and were addressed to an imaginary star by Mr. G. M. Minchin.

There have been many controversies in the past century concerning the age of the Earth but, if Dr. Hubble's measurements are substantiated, then we are certainly able to see some portion of our universe as it was before life on Earth had begun, and possibly before the Earth itself as a definite planet had taken shape.

* * * *

Where is the Magnetic Compass Useless?

Any schoolboy who has studied magnetism a little will immediately think of the vicinity of the magnetic poles in Canada and the Antarctic continent when asked this question. But there is also a district in Arkansas, in the United States, where the compass is useless. The reason is the existence of large deposits of magnetic iron ore at a place that is well named Magnet Cove. Here are found the largest deposits of magnetic ore in the world, and the effect of the earth's magnetism on the compass needle is completely masked in consequence. One remarkable result of this state of affairs is that the district is almost an ideal place for "listening in!"

* * * *

Iceberg Warnings in the Atlantic

The southward drift of icebergs from the vicinity of Greenland is a serious menace to shipping in the North Atlantic Ocean, particularly in the neighbourhood of Newfoundland. The greatest of all disasters due to an iceberg was the sinking of the "*Titanic*" in 1912, when 1,500 people lost their lives. To-day such a disaster is almost impossible, however, as a "water report," similar to the well-known weather report, is available.

It is by no means difficult to detect the proximity of an iceberg when it cannot be seen, for measurements of the temperature of the surrounding sea water and of the proportion of dissolved solids in it will give the required indications. Further, a careful study of the general drift of the currents that carry the icebergs southward has been made by means of sealed and marked bottles, and a comparison of the conditions obtaining for some years and the distribution of icebergs following upon these conditions has enabled methods of forecasting to be developed. "Icebergs from Greenland" may soon become as common in water reports as "depressions from Iceland" in our weather reports.

This is not the only purpose of the water report. In addition, fishermen will derive great benefit, for the mass movements of fish are largely dependent on the variations in temperature of the sea and are connected with the directions of the ocean currents.

The Deepest Hole Ever Made

It is generally believed that the interior of the earth consists of an exceedingly hot mass of liquid, surrounded by a crust of cool solid rock, somewhat in the manner that an orange is surrounded by its skin. If this is the case underground temperatures ought to be greater than those at the surface, and the results obtained in making deep borings show that this is the case.

The temperature at the bottom of a coal mine, for instance, is greater than that at the surface, and the close atmosphere resulting is a source of great discomfort to miners. The deeper the mine the greater the temperature. The deepest mine ever worked is the St. John del Rey gold mine in Brazil, which has reached the depth of 6,726 ft., or more than 1¼ miles, as a result of the work of 100 years. The temperature at this great depth is unbearable, and work is only possible with the aid of cold air pumped down to the workers from an expensive cooling-plant installed at the head of the mine.

The deepest hole ever made in the earth was in Pennsylvania, near Ligonier, where a boring 7,756 ft. in depth was carried out by an oil company—unsuccessfully as far as production was concerned. A similar boring in California, however, struck oil at a depth of 7,591 ft. This is the deepest producing well ever drilled and measurements by experts of the U.S. Government while the boring was actually in progress showed that, in general, the temperature rise was about 1°F. for every 65 ft. descent.

In other parts of the world the temperature rises at different rates. The average rise in the Rand gold-mines, for instance, is 1°F. for every 255 ft. descent, while in one district in Wyoming in the United States the temperature increases so rapidly that a descent of only 3,500 ft. would have to be made to reach the temperature of 212°F., at which water boils! The famous Yellowstone Park, with its hot springs and geysers, is also in the state of Wyoming, so that it is not surprising to find the conditions there so abnormal that the depth increases by 22 ft. only for each degree rise in temperature.

It is interesting to note how much less these depths are than the ocean depths recorded in the *"Wonderful World"* columns on page 119 of the February *"M.M."* They are, in fact, far less than the average depths of the ocean, such as the 13,000 ft. of the Atlantic Ocean, or the 15,000 ft. of the Pacific, and a comparison such as this enables us to realise that man has done little more than scratch the surface of the earth.

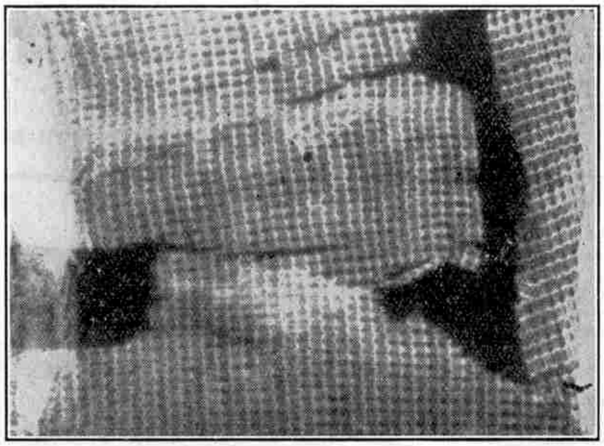
* * * *

Death-Dealing Sound Waves

Although a good deal of prominence was given last year to the so-called "death-ray," the death-dealing sound-ray does not appear to be known to many. The phenomenon has been discussed before the National Academy of Science by Prof. R. A. Wood and A. L. Loomis, of the John Hopkins University.

The "death noise" would be inaudible to human ears, but it certainly is due to sound waves. In experiments made recently the waves killed small fishes and other aquatic animals in vessels of water in less than a minute.

The two scientists mentioned employed an apparatus generating exceedingly high frequency sound waves by electrical means. The waves were produced at a rate of from 100,000 to 400,000 per second. (The upper limit of audibility of the human ear is between 20,000 and 30,000 vibrations a second). Prof. Wood stated that if a beam of these sound waves is directed towards the surface of the water, it becomes heaped up in a mound. The vibrations also heat the water, for a rise of nearly 10°F. within the period of one minute was measured.



A Photograph Taken in the Dark!

The above photograph illustrates the actinic properties of thorium. It was obtained by T. R. Barnard of Manchester, who wrapped a photographic plate in opaque black paper. This was placed on a flattened gas mantle and left in contact in the dark for a week. Upon developing, the result was as shown.

Gas mantles are impregnated with a mixture of the oxides of thorium and cerium, and it is the radio-activity of the former that affects the sensitive plate.

* * * *

A World-Time Clock

Some little time ago Professor Nernst, the celebrated scientist, constructed a clock that represents the origin and end of the world. The face of the clock is divided into twelve hours and subdivided into minutes as in an ordinary clock. Each hour represents an interval of time of 600 million years, and each minute, therefore, is equivalent to 10 millions of years. The time to-day is 5.50.

Professor Nernst calculates that life could have existed on the earth at 5 o'clock, as the average temperature of the earth would have been about 172 degrees (at present it amounts to 64 degrees). By 7 o'clock the temperature will have dropped to 76 degrees below zero, but life will still be able to exist at the equator. After another hour has passed on the clock the temperature will have fallen to nearly 200 degrees below zero.

The temperatures are derived from the measurements of the Sun's temperature, at present estimated to be 11,400 degrees. About 2,400 million years ago, that is at 2 o'clock, the Sun was 18,000 degrees. At this rate the radiation from the Sun will cease when the time as shown on the clock will be 9 o'clock.

World's Largest Optical Flats

Surfaces so flat that any deviation from perfectness is too small for measurement have been produced by the United States Bureau of Standards. These, it is expected, will be the "last word" in deciding whether or not a surface really approaches flatness or straightness. Measurements on the surfaces of these discs, from ten to eleven inches in diameter and one to one and one-half inches thick, fail to show any places where they are more than two ten-millionths of an inch from being absolutely flat! Such accuracy means that, magnified until the discs extended from Washington to Chicago, no point except along the margin would be out of absolute flatness by more than an inch!

The discs are made of clear fused quartz, a product that has many properties making it superior to optical glass. It is much harder than glass, and it expands much less than does glass upon being heated. The surface of glass, formerly used for optical flats, changes considerably in shape when touched by the hand, so sensitive is it to heat. Clear, fused quartz, which expands only one-fifteenth as much as glass does upon being heated, may be handled with much more impunity in this respect. The low co-efficient of expansion of clear fused quartz also recommends its use for astronomical mirrors, and for the manufacture of standards of length. Its resistance to change at high temperatures has led to its use in the manufacture of thermometers that may be used at far higher temperatures than can be approached with glass ones.

In addition to serving as a test for flatness of surfaces and straightness of edges, these standards are used in the production of standard angles and for calibrating or checking instruments that measure curvature.

* * * *

Blindness Cured by Ultra-Violet Rays

The beneficial effects of the ultra-violet rays in sunshine were referred to in the January *"M.M.,"* where the good results obtained by using windows made of glass transparent to these rays were described. For a long time most hospitals have been equipped with apparatus for the artificial production of ultra-violet rays, which have proved of great value in curing skin diseases, such as lupus. Recently a somewhat sensational application of the rays was made in Nottingham, for curing blindness and deafness.

Only certain suitable diseases have been successfully treated. Blindness due to ulcers on the cornea, the outer structure of the eye, and deafness due to inflammation of the membrane within the passages of the ear, have both been cured, and extensions of the method are looked for with some interest. In addition, application of the rays has improved the condition of patients suffering from the mysterious sleepy sickness, and has even been known to bring about a noticeable improvement in cases of consumption.

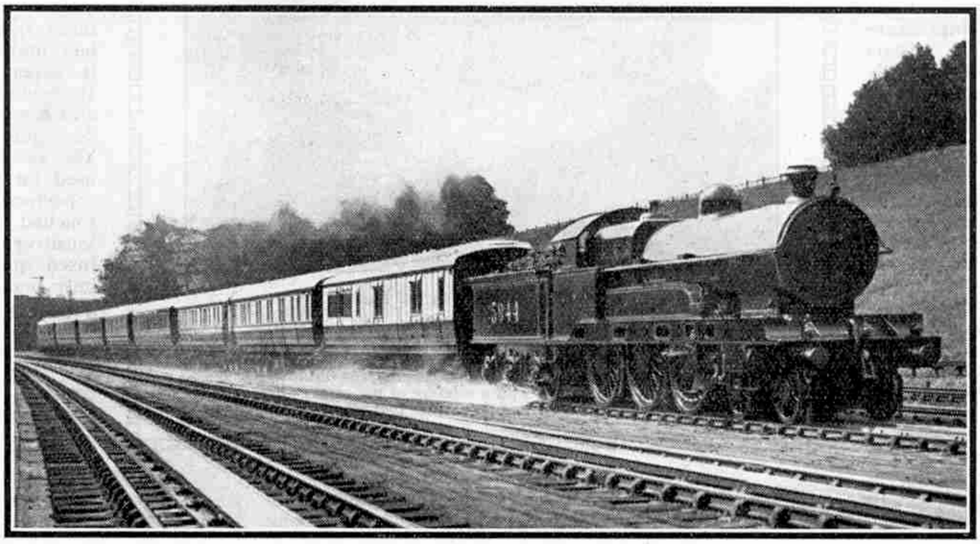
How Engines Pick Up Water

The Troughs on British Railways

By R. D. Gauld, M.Eng., A.M.Inst. C.E.

THE announcement that the London, Midland and Scottish Railway are about to lay down additional water troughs on their two Anglo-Scottish routes served as a reminder of the useful part played by these appliances in modern railway working.

It was in 1860 that Mr. John Ramsbottom, at that time chief mechanical engineer of the London and North Western Railway, introduced the water trough and pick-up system. Twenty-five years passed before any other railway company adopted them, and then the Lancashire and Yorkshire Railway put down the first of several installations. Since then practically all the main routes in the country have been equipped, enabling engines to make long non-stop runs, and also reducing the work to be done at the terminus or next stopping place.



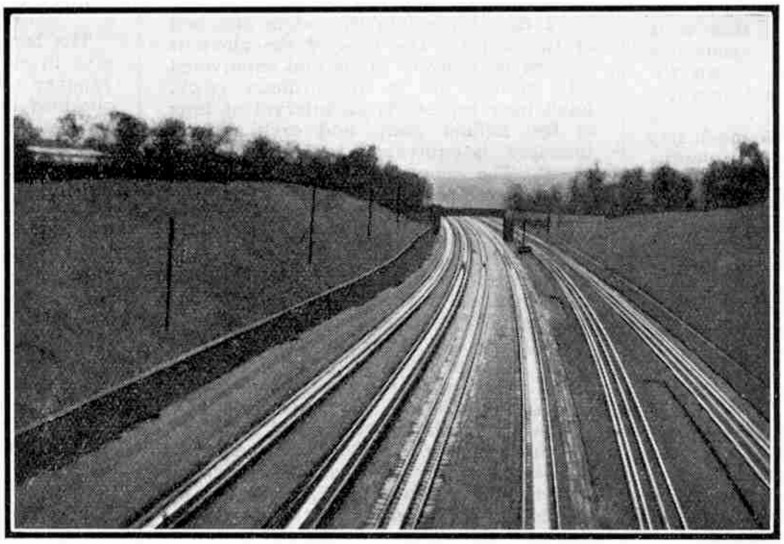
L.M.S. Down Royal Train Picking up Water near Bushey

Situation of Troughs

The troughs are always laid on a level portion of the line and generally on a straight portion. The well-known troughs at Bushey, near Watford, however, are on a curve. In this special situation the troughs are so supported that the cant on the rails is neutralised, but the troughs are a little deeper than usual on account of the engine and its scoop being inclined to the horizontal. Traffic considerations chiefly decide where the troughs are to be laid, but a site is always chosen where there is an ample supply of water of a suitable quality for boiler purposes.

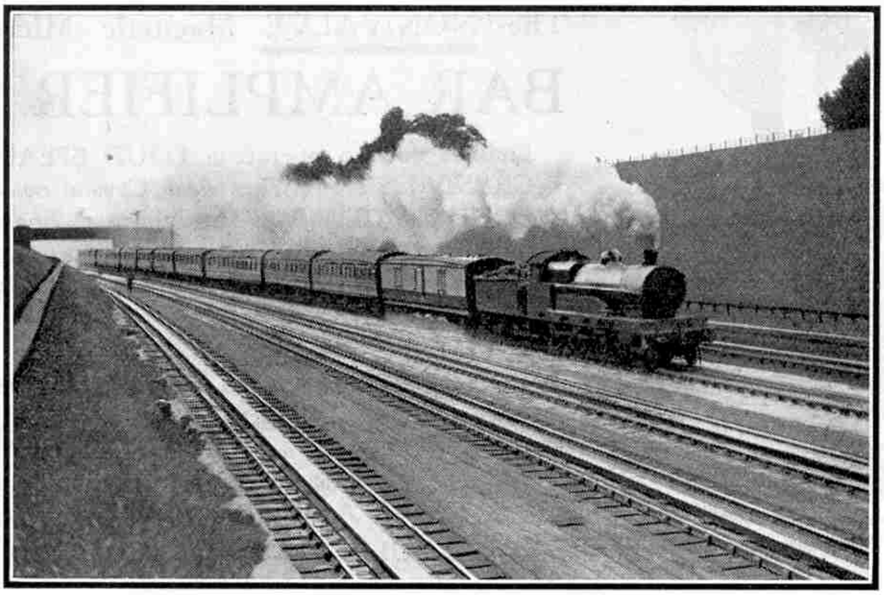
The total length of the troughs varies, but it is usually about 500 yards, the ends gradually tapering out. Towards the end of the troughs the track is graded at 1 in 300, down at the entering end, and up at the leaving end, while the end portions have a gradient of 1 in 192. The rails are parallel to the surface of the bottom of the trough, so that if the fireman does not raise the scoop in time, it comes out of the water automatically.

The operation of picking-up water at speed splashes a good deal of water over everything in the neighbourhood, and special measures have to be taken to drain the permanent way at these places. Extra large ballast is used, with cross and side drains, and to give extra solidity to the track an extra two or three sleepers are put into each 45 ft. rail length.



The L.M.S. Troughs at Bushey

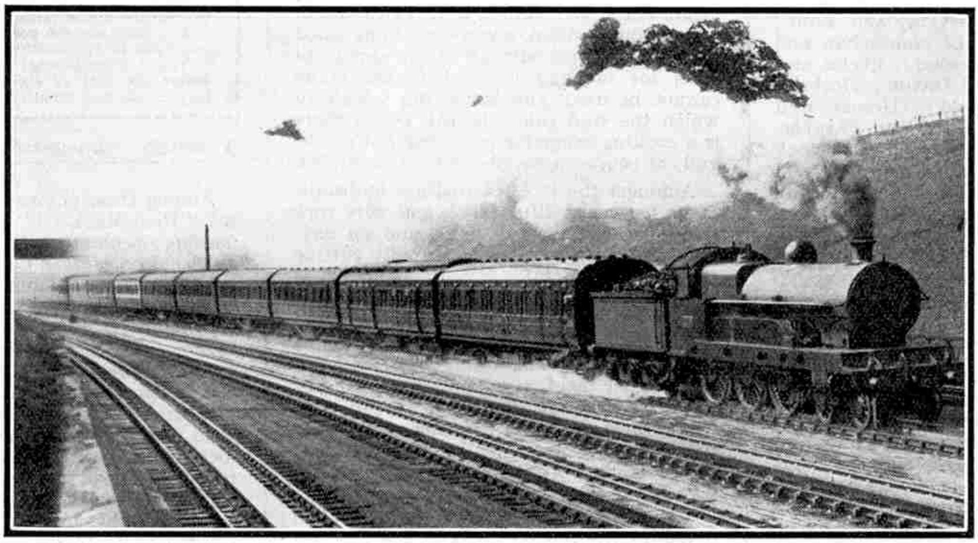
The troughs consist of steel plate bent to the required shape, supplied in lengths and riveted together. They are about 1 ft. 6 in. in width and 6 in. in depth, and are placed on the middle of the sleepers and supported at the sides upon baulks of timber, cut to shape. The rim of the trough stands 3 in. above the level of the rails, and the water surface is at 2 in. above rail level. When the scoop is down it dips 2 in. into the water, being thus at rail level and, therefore, well clear of the trough bottom and any possible obstacles. Arrangements have to be made to keep the troughs full of water automatically, and as this must be done fairly rapidly, the water is fed to the troughs at several points, the flow being governed by float valves similar to the domestic ball cock in the cistern. The troughs require frequent cleaning out as small pieces of ballast get washed into them and also leaves and other small pieces of rubbish.



L.M.S. Down 11.10 a.m. non-stop at Bushey. Engine "*Rupert Guiness*" No. 668

The Engine Apparatus

The apparatus required on the engine is quite simple in construction. There is a gun-metal scoop, which has a thin steel cutting edge, easily renewable and adjustable for wear and tear and for settlement of the engine due to spring weakening and tyre wear. The scoop is hinged to the lower end of an iron pipe that passes up through the tender, and is jointed to the vertical delivery pipe, which has a half-round bend at the top for discharging the water into the tank. In order to allow excess water to escape, there is a hinged lid above the box covering the delivery pipe, and this opens when the tank is full. This is very necessary, as the water enters at high speed and sets up great pressure. Some tenders are provided with a pipe that discharges excess water back into the trough.



Third part of L.M.S. 10 a.m. Scotch Express (4-6-0 Loco No. 2427) at Bushey

Owing to the pressure set up by the water, it is not easy to raise the scoop when the engine is travelling fast, and it may be necessary to raise it before the end of the trough is reached. This is usually done nowadays by a small cylinder and piston, actuated by steam, compressed air or vacuum. A balance-weight keeps the scoop normally up, the cylinder being employed to push it down. On tank locomotives, which may run either chimney or bunker first, two scoops are required. They may be separate fittings, or made to lower together. In the latter arrangement one of the scoops simply trails idly in the water while the other is picking up. A hinged flap in the vertical pipe prevents the water escaping by way of the idle scoop.

The lowest speed for the locomotive at which the water will rise high enough in the delivery pipe to discharge into the tender tank is about 15 to 20 miles per hour, and the higher the speed the more water can be picked up. When a train has two engines drawing it, the leading or pilot engine dips in first, and about half-way along the trough the train engine dips in and the pilot takes out his scoop. Many of the late Midland Railway engines, on account of the extensive piloting resorted to on that line, had steel shields fitted in front of the leading wheels to prevent small stones being thrown up into the motion by the water-splash created by the pilot engine. This refinement is not in general use however.

Troughs on British Railways

In order that readers may be able to look out for these troughs whenever they are travelling, we give below a list of all those on the British railways. They are invariably laid in both the up and the down lines.

L.N.E.R.

Between Lucker and Belford; between Northallerton and Danby Wiske; near Charwelton and Killamarsh stations; between Bentley and Ipswich; between Burston and Tivetshall; at Langley; between Knebworth and Stevenage; at Werrington Junction, N. of Peterborough; between Newark and Carlton, N. of the Trent; between Scrooby and Bawtry; at Hatch End, between Pinner and Bushey.

L.M.S.R.

Between the following places:—Wolverton and Castlethorpe; Rugby and Brinklow; Rugby and Brandon and Wolston; Tamworth

(*Continued on next page*)

How Engines Pick Up Water—

(*Continued from previous page*)

and Lichfield; Whitmore and Madeley; Preston Brook and Moore; Brock and Garstang; Hest Bank and Bolton-le-Sands; Low Gill and Tebay; Waverton and Chester; Connah's Quay and Flint; Prestatyn and Rhyl; Llanfairfechan and Aber; Diggle and Marsden; Eccles and Weaste; Halebank and Ditton; Horbury Junction and Wakefield; Hoscar and Burscough Bridge; Kirkby and Fazakerley; Lea Road and Salwick; Lostock Junction and Bolton; Rufford and Burscough Junction; Rochdale and Smithy Bridge; Sowerby Bridge and Luddendenfoot; Moorside and Wardley and Walkden; Knottingley and Whitley Bridge; Oakley and Sharnbrook; Loughborough and Hathern; at Melton Mowbray; at Tamworth; at Hawes Junction.

G.W.R.

Near Goring; near Keynsham, between Bath and Bristol; near Creech, between Bridgwater and Taunton; at Exminster; near King's Sutton, between Oxford and Banbury; near Lapworth, between Warwick and Birmingham; between Charlbury and Ascott-under-Wychwood; between Aldermaston and Midgham; at Westbury; at Chipping Sodbury; near Severn Tunnel Junction; between Ferryside and Carmarthen; near Ludlow; at Denham.

There are no water troughs on the Southern Railway or on the Irish railways.

"MECCANO MAGAZINE" BINDERS
Your Magazines may be kept clean and tidy by enclosing them in one of the special binders we supply. Two sizes, price 3/- and 3/6 post free, from Meccano Ltd., Binns Rd., Liverpool.

A Day in a Running Shed—

(*Continued from page 625*)

arrange for their work to be carried on, and then proceed to the vans.

The tool van train consists of the large steam crane with runner to carry the jib in its running position, a van containing wood packing, another with an ample supply of tools for tackling jobs where the crane cannot be used, and lastly the vehicle in which the staff ride. In this coach there is a cooking range for providing hot meals, and, of course, a supply of food is carried.

Amongst the tools carried are hydraulic jacks for heavy lifts, block and wire rope tackle for very heavy pulls, and an oxy-acetylene cutting plant for rapidly cutting through any metal.

Out on the line each of the gang takes a pride in helping to clear the wreckage in record time. After a big job, when gathered at the table in the riding van for their well-earned meal, tired out, none are too tired to compare their recent job with what they did at the same spot on a previous occasion. Whilst not doubting their veracity, you must grant them the proverbial fisherman's licence for yarning!

The yard of a main line locomotive shed is one of the busiest areas of the line, for at a shed like York it is a common matter for over 150 engines to enter, and also leave, the shed every 24 hours. This is at the rate of an engine either entering, or leaving, at less than 5 min. intervals throughout the day.

Nearly all these engines clean their fires, and the ballast thus obtained, amounting to about 250 tons per week, has to be cleared away daily.

Readers' Sales and Wants

If you have anything to sell or wish to buy anything, take advantage of the service offered by a small advertisement in the columns of the "*M.M.*" (see page 664).

Advertisers please note that advertisements of Meccano goods cannot be inserted.

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

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

A British "Ljungström" Turbine Loco

(*Continued from page 621*)

Among these engines may be mentioned the "Reid-MacLeod" geared turbine condensing locomotive, built by the North British Locomotive Co. Ltd., of Glasgow, in 1924. This engine differs from the "Ljungström" turbo-condensing locomotive in many respects, notably in that its turbines are placed longitudinally. The driving wheels are actuated directly from the turbines and there is a complete absence of reciprocative motion.

In Germany also a good deal of experimental work has been carried out in regard to this type of engine. In 1924 Messrs. Krupp constructed at their Essen Works a turbine locomotive embodying many interesting features, and for this engine a reduction of 20 per cent. in fuel consumption was claimed. More recently, Messrs. J. A. Maffei of Munich constructed a turbine engine on somewhat similar lines to the Krupp locomotive. This engine, which was designed to develop 2,500 h.p. and to have a maximum speed of approximately 75 miles per hour, underwent extensive trials last year on the Bavarian section of the German State Railways.

Over 200 Miles of Cables

Interesting Facts About a Modern Liner

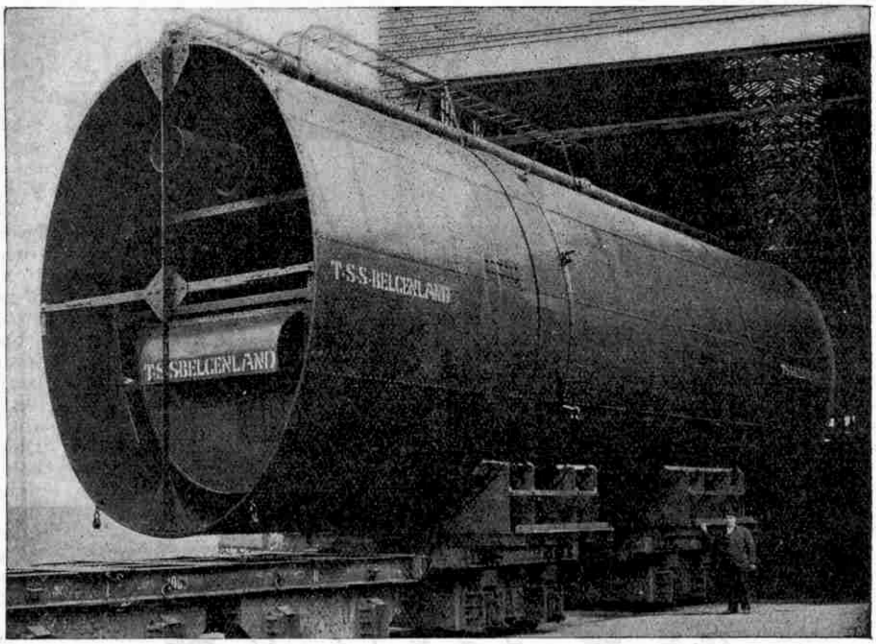
By Captain John R. Mackay, Chief Engineer, "*Belgenland*"

This article is the 4th of an interesting series of talks broadcast from the "Belgenland," when in the Bay of Bengal last year. The first three of the series have already appeared in the "M.M.," being printed by special permission of the Editor of "The Ocean Ferry."

The "Belgenland" belongs to the Red Star Line and has the distinction of being the largest ship to circumnavigate the globe. The first ship to complete the round voyage was Magellan's flagship, the "Victoria" (1504). Whereas she required four years for the voyage of circumnavigation, the "Belgenland" made the trip in 132 days—and even then proceeded at a leisurely pace to permit her passengers time to travel in fourteen different countries and to visit 60 cities !—EDITOR.

* * * * * *

THOSE who visit the engine-room of a large liner are naturally greatly impressed by the power of the propelling engines. In the case of the "*Belgenland*" the engines are of the combination type and develop about 22,000 h.p. The two wing screws, of about 20 ft. diameter and 15 tons in weight, are driven by four-cylinder triple expansion engines. The exhaust steam from these engines passes into a turbine and drives the centre screw, which is about 13 ft. in diameter and weighs about eight tons.



One of the "*Belgenland's*" Smoke Stacks

The turbine only runs in the ahead direction, and is stopped when the ship enters pilot waters. The main reciprocating engines run about 80 revolutions per minute and the turbine about 180, and each gives out about the same power at full speed.

As many of the auxiliary engines are generally out of sight, passengers seldom realise the power of some of them. On the "*Belgenland*" the steering engine is of about 500 h.p. maximum and the dynamos of 1,800 h.p.

Through some 200 miles of cables, they supply current for the 150 motors installed for various purposes. The ship has over 600 portable fans, and some 6,000 lamps of from 16 up to 1,000 candle-power supply the light.

There are numerous other details of auxiliary machinery, such as, for example, pumps for the circulation of water—hot and cold, iced, salt and fresh, drinking and washing; refrigerating machinery; machines for cooking purposes and laundry gear; and many other necessary machines and accessories that require in all a total of up to about 4,000 h.p.

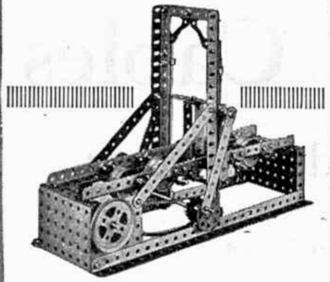
In addition to the 200 miles of electric cables already mentioned, there are over 20 miles of large sizes of piping, and several times more than this of the smaller sizes, with innumerable taps and fittings for the sanitary engineers to keep in order.

One of the most striking things about the "*Belgenland*" and other modern liners is the odorless condition of the ship generally and the absence of cooking odours, especially in the restaurant. To make this possible the air is changed in that compartment every four minutes. The ship is fitted with one of the most complete systems of ventilation, and of water supply, of any ship of her tonnage afloat.

To supply steam for the machinery we have 10 double-ended boilers. These burn 1,350 barrels, say about 200 tons, of fuel oil a day at full speed. At this speed the ship can, if necessary, be run for about 9,000 miles without rebunkering.

It may be stated in passing, that owing to frictional resistance, etc., the power required to propel a ship varies approximately as the cube of the speed. For instance, it takes eight times the power to drive a ship twice as fast, as eight is the cube of two, while the power of a 20-knot ship would require to be doubled to add five knots to its speed.

To keep all the mechanical equipment of a modern liner in good running order, it is obviously very necessary that the work of examination, inspection and overhauling of the numerous auxiliaries shall go on night and day, at sea and in port, so that the engineers have a very busy life.



Suggestions Section

Edited by "Spanner"

(89)—Two-Speed and Reverse Planetary Gear Box

(E. J. Wright, London, W.C. 1.)

A PLANETARY gear box of the type shown in the accompanying illustration is unique so far as Meccano construction is concerned. In actual practice planetary or epicyclic gears are used to a large extent, but in almost every case an internal-toothed wheel or drum is employed to actuate the planet wheels or idler pinions. Perhaps the most familiar form of two-speed and reverse epicyclic gear box is that used in the famous Ford model "T" car, in which the various gears are controlled by means of separate foot and hand levers that affect the rotation of internal-toothed drums engaging the planetary wheels.

In the Meccano model about to be described our contributor has avoided the necessity of providing internal-toothed wheels by using two fixed Gear Wheels that may be brought in or out of engagement with a corresponding pair of movable Gear Wheels. The movable wheels are secured to a short Rod carrying a single planet wheel. When the model is set in motion they are carried round the teeth of the fixed wheels and are rotated thereby about their own centres, the speed of rotation depending upon the relative diameters of the particular pair of wheels engaged. The gear box provides two speeds forward, reverse, and neutral gears.

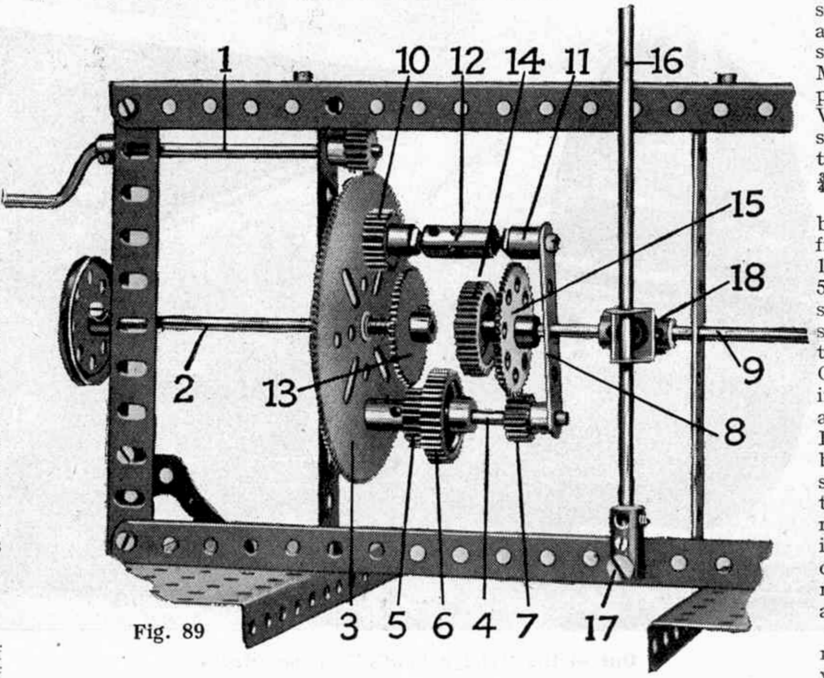


Fig. 89

Important Advantages

The following are some of the principal advantages of the apparatus. Compact construction; the whole mechanism may be mounted on the face of a 3½" Gear Wheel or secured to a 2½" Strip. Simplicity; only one rotating countershaft is required. Easy changing; it is impossible to place the gears so that more than one speed can be engaged simultaneously, while the throw of the moving portions, by which the changes are effected, need be little more than ⅜". The moving portion slides in its bearings but does not rotate. The countershaft is not employed in top gear.

The drive from the motor or other source of power is directed to the Rod 1, and the motion is transmitted through the gear box to the driven Rod 2. A ½" Pinion on the driving Rod engages with the 3½" Gear Wheel 3, which is free to rotate independently about the Rod 2. The 2½" Rod 4 is journalled in one of the holes in the face of the Gear Wheel 3 and carries a ¾" Pinion 5, 1" Gear Wheel 6 and ½" Pinion 7, all fixed to the Rod. Its other end is supported in a 2½" Strip 8 that is free to turn on the Rod 9.

The ¾" Pinion 10 is immovable, being gripped by its set-screw to a 2" Threaded Rod secured to the Gear Wheel 3 in a hole opposite to the Rod 4. Two nuts, one placed behind the 3½" Gear Wheel and the other on the Threaded Rod immediately against the boss of the Pinion 10, are screwed up very tightly to secure the Pinion and the Threaded Rod rigidly to the wheel 3. Two Washers are placed between the Pinion and the 3½" Gear Wheel.

The other end of the Threaded Rod enters a Threaded Boss 11 secured to the Strip 8 by a ⅜" Bolt. The Coupling 12 is added to assist in balancing the weight of the Rod 4 and its components, so that the entire mechanism may rotate smoothly about the Rod 2.

Reversing and Speed-Changing

The 50-teeth Gear Wheel 13, which forms the sun wheel, is secured to the driven Rod 2, and a short compression spring (extracted from a Meccano Spring Buffer) is placed between this Gear Wheel and the wheel 3. The spring normally tends to hold the wheel 13 in gear with the ¾" Pinion 5.

The Rod 9 is slidable in its bearings but is prevented from rotating. It carries a 1" Gear Wheel 14 and 57-teeth Gear Wheel 15, both secured in position by their set-screws. The Rod protrudes about ⅛" beyond the Gear Wheel 14. The operating lever 16, which pivots about a point 17, carries a Double Bracket fitted with a bolt that enters a Coupling 18 secured to the Rod 9. Hence this Bracket prevents the rotation of the slidable Rod in addition to forming a convenient pivotal connection between the latter and the lever 16.

The photograph shows the mechanism in reverse gear with the Gear Wheel 15 engaging the Pinion 7. In this position the driven Rod 2 rotates in the same direction as the driving Rod. "Neutral" is obtained by pushing the lever 16 forward so that the Gear Wheel 15 is disengaged from the Pinion 7; in this position the mechanism rotates bodily round the Rod 2 without turning the sun wheel 13. Additional movement of the hand lever brings the Gear Wheel 14 into engagement with the corresponding wheel 6, thereby causing the Rod 2 to turn slowly in an opposite direction to the driving Rod. This corresponds to a slow forward speed.

Straight-Through Top Speed Gear

Still further movement of the lever causes the protruding end of the Rod 9 to press against the end of Rod 2 and throws the wheel 13 out of gear with the Pinion 5 and into engagement with the fixed Pinion 10. This locks the wheel 13 to the wheel 3 and the two rotate as a single unit, thus producing, in effect, a straight-through drive. The Rod 2 now rotates at maximum speed.

If desired the 3½" Gear Wheel 3 may be replaced by a 2½" Strip, corresponding to Strip 8 and bolted to a 57-teeth Gear Wheel or similar part. In this case the drive from the Motor would be applied to the 57-teeth Gear Wheel or its substitute. The framework shown in the illustration is designed merely for demonstration purposes.

TYPES OF MECCANO BRAKES

(90)—Internal Expanding Brake

An external contracting brake is a fairly simple matter to reproduce in Meccano—a piece of cord tightening round the groove of a Pulley Wheel is an excellent example—but the design of an internal expanding brake is altogether another problem. This particular kind of brake receives a great deal of attention from our readers, however, and Fig. 90 is a combination of typical suggestions submitted on this subject by E. B. Edmett, London, N.8, A. Sheffield, London, N.17, and G. E. Owen, Bristol. The brake is efficient in operation and may be fitted to numerous models.

Two Collars serve as brake shoes and when applying the brake these are pressed against the inner side of a Wheel Flange 1 secured to the shaft 4, which is to be controlled. The Collars are fitted with ordinary bolts in place of their grub screws, and these bolts are connected one to the other by a short length of Spring Cord. The same bolts serve to secure the Collars to ½″ Bolts 2 passed through slots in the Face Plate 3. The latter is bolted rigidly to the framework of the model, the shaft 4 rotating freely in its boss.

Three Washers are placed on each of the bolts 2 in order to space their heads at the correct distance from the Face Plate. Two 2½″ Curved Strips 5 (small radius) are bolted to a 3″ Strip 6 that pivots about the Rod 4, and the lower end of this Strip 6 is connected by cord or other means to the operating brake lever. On moving the lever the Strips 5 are rocked about the Rod 4 and the bolts 2 are pushed outward along the slots in the Face Plate, thereby applying the brake shoes to the Wheel Flange 1. When the hand lever is released the brake is returned to the "off" position by means of the Spring Cord stretched between the brake shoes.

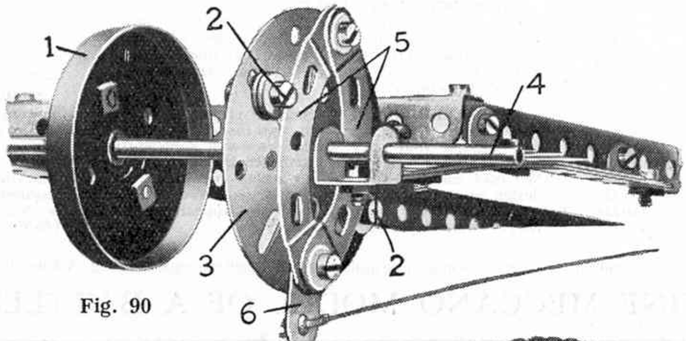


Fig. 90

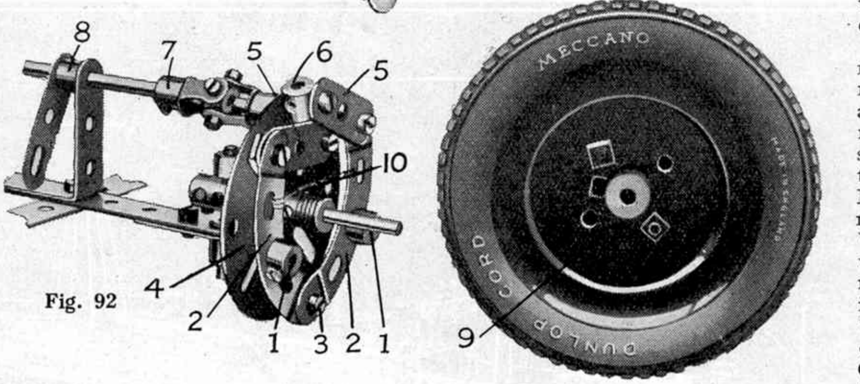


Fig. 92

(91)—Reversible Friction Brake

(*J. Matraves, Horsham, Sussex, and E. W. Cooper, London, W.3*)

Fig. 91 illustrates an improved type of Meccano strap and lever brake that is arranged to apply to a shaft a braking effect in one direction only. The particular direction of rotation may be predetermined, however, by a simple movement of a lever. Thus the device forms a kind of ratchet, the controlling effect of which is more gradual and smooth than that obtainable in the more usual pawl and toothed-wheel method.

The 1½″ Pulley 1 is secured to the shaft that is to be controlled and its groove is engaged by a cord 2, the ends of which are tied to opposite ends of a 3½″ Strip 3. The latter slides in an Eye Piece 4 secured to the frame. Two bolts are inserted in the Strip 3 to prevent it from sliding beyond certain limits.

With the lever 3 in the position shown, the wheel 1 is free to rotate in an anti-clockwise direction, but if it is turned clockwise a powerful retarding effect is generated. By sliding the Strip 3 until the other stop strikes the Eye Piece, the effects of the brake are reversed and the wheel 1 is then free to rotate in a clockwise direction only. The brake is entirely automatic, and is applied immediately the rotational direction is reversed.

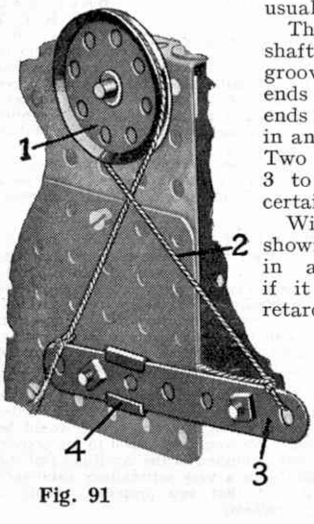


Fig. 91

(92)—Internal Expanding Front Wheel Brake

This brake is designed on similar principles to Suggestion No. 90 but is specially adapted for use on the front wheels of a motor car. The essential point to be considered in a brake of this kind is the method by which the movement of the brake lever or foot pedal may be conveyed to the braking mechanism.

In the model under consideration the brake shoes 1, which consist of Collars and set-screws secured to the shanks of ordinary Meccano bolts, are mounted on two 2½″ small radius Curved Strips 2 pivoted on a ½″ Bolt 3. This bolt is secured rigidly to the Face Plate by two nuts, as in Standard Mechanism No. 262, and a Collar placed on its shank serves to space the Curved Strips at the correct distance from the Face Plate 4.

Two 1½″ Strips 5, pivoted by bolts and lock-nuts (S.M. 263) to the upper ends of the Curved Strips 2, are free to move upon ⅜″ bolts inserted in the Coupling 6. The latter is secured to a 1″ Axle Rod that is connected by means of the Universal Coupling 7 to a longer shaft carrying the Crank 8. The brake lever or pedal is connected by any suitable method to this Crank; hence movement of the lever turns the Coupling 6 and thereby forces the Curved Strips 2 apart. This brings the brake shoes 1 into contact with the Wheel Flange 9 secured to the road wheel.

In the illustration the road wheel is shown removed from the stub axle for the sake of clearness. Three Washers should be placed between the boss of the Face Plate 2 and that of the road wheel to enable the Wheel Flange to clear the various parts of the brake mechanism. The brake is normally held in the "off" position by means of a short length of Spring Cord 10 secured between the Curved Strips 2. The Universal Coupling 7 enables the stub axle carrying the road wheel to move about its pivot without affecting the operation of the brake.

Particularly good suggestions for front wheel brakes were received from J. Redding, of Salisbury, and C. Wilson, of Great Yarmouth. H. Finch, Ayling Hill, Aldershot and W. J. Cleland, Peebles, also submitted interesting contributions dealing with this subject.

(93)—Internal Expanding Brake (Simplified Form)

The brake shown in Fig. 93 is similar to that described under Suggestion No. 90, except that it is of more simple design.

The lever 1 is secured by means of a Coupling 2 to a Rod carrying at its outer end a second Coupling 3. The latter has two links, formed by 1½″ Strips 4, pivotally mounted on ordinary Meccano bolts inserted in each end of the Coupling. These Strips are also pivotally connected to the ends of two 2½″ large radius Curved Strips 5, which, in turn, pivot about a ½″ Bolt secured to the frame. The Curved Strips are spaced at the necessary

(*Continued on page* 639)

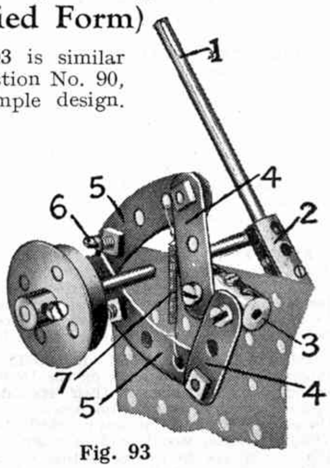
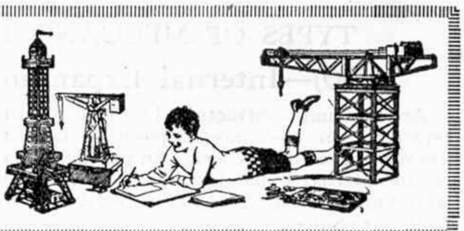


Fig. 93

In Reply

*In these columns we reply to suggestions regarding improvements or additions to the Meccano and Hornby Train systems. We receive many hundreds of such suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration **in this section** must be written on separate sheets of paper and **the** name and address of the sender must appear on each sheet used.*



Suggested New Meccano Parts

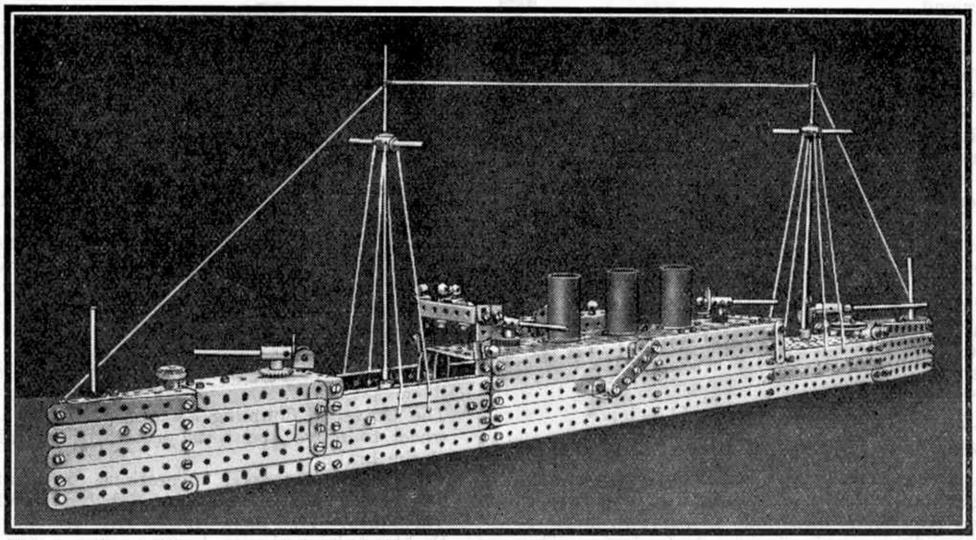
WINDING DRUMS.—We note your suggestion regarding the construction of winding drums from a piece of stout cardboard bent round the flanges of two Flanged Wheels. Various sizes and types of winding drums may easily be constructed from Meccano parts, however. As pointed out in a previous issue of the "*M.M.*," the Meccano Wood Roller (Part No. 106) secured between two Bush or 1½" Pulley Wheels forms an excellent drum, while among other alternatives we recommend the use of Double Angle Strips of any convenient length bolted between two Bush Wheels, Face Plates, or 3" Pulleys. (*Reply to J. Scaife, Helperby, near York*).

DOUBLE-ARM CRANK.—There appears to be considerable demand for a double-arm crank, resembling a 1½" strip with boss and set-screw riveted to its centre, and we hope to add such a part to the system in the near future. (*Reply to E. Parker, London, N.W.8, and B. Murphy, St. Leonards-on-Sea*).

IMPROVED SECTOR PLATES. — A new Sector Plate having three rows of holes punched in its face will be introduced shortly. (*Reply to K. Black, London, N.21, and D. W. Ausden, Watford*).

MECCANO LETTERING. — We note your suggestion concerning the introduction of metal lettering punched with the Meccano equidistant holes. This idea is very interesting but would serve no really useful purpose. We pointed out in the "*M.M.*" for March last, in connection with a suggestion regarding number plates for model motor cars, that accessories of this type might be obtained from one of the name-stamping machines found on station platforms. (*Reply to P. Collins, Northchurch, Herts.*)

A FINE MECCANO MODEL OF A BATTLESHIP



This excellent Meccano model of a battleship was built by S. Roden, aged nine years, of Beryl Road, Upton, near Birkenhead. Every piece of the vessel is well put together and the complete model presents a most pleasing appearance. As will be seen from the illustration, its fittings include guns, bridge, binnacle, capstans, and port and starboard lights

GUILLOTINE BLADES.—Your suggestion regarding the addition of Strips provided with knife edges for use in paper-cutting machines, or guillotines, etc., is very novel. These accessories would certainly not be purely ornamental! We fear, however, that they would be the cause of many cut fingers and other minor mishaps, and therefore they are scarcely suitable for the Meccano system. As we have shown in numerous models, an old safety-razor blade proves very useful when it is particularly required to fit a knife in Meccano models. (*Reply to P. V. Hastings, Madrid*).

NEW FLAT GIRDERS.—The introduction of Flat Girders bent at the ends in a manner resembling the existing Double Angle Strips appears to offer few important advantages that are not already covered by existing parts. However, we shall keep your idea before us. (*Reply to D. Theedom, South Farnborough*).

IMPROVED DREDGER BUCKETS.—The provision of two chain catches on the Dredger Buckets would certainly increase their stability when in operation, but it would also necessitate duplicating the chain drive in all models in which they are used. This, of course, would tend to complicate matters. We should like to receive further opinions on the subject. (*Reply to J. Wray, Remuera, Auckland, N.Z.*)

UNIVERSAL COUPLING.—We shall consider the desirability of listing the Universal Coupling in two separate parts, i.e., spider and fork. (*Reply to J. Dippy, Bexley, Kent*).

IMPROVED FACE PLATE.—We do not think the provision of additional holes in the Face Plate would constitute any great improvement; so far we have been unable to find more than one model in which the extra holes could be used. (*Reply to E. Parker, London, N.W.*)

PROPELLER BLADES.—Smaller propeller blades might prove of value for one or two models but we do not consider that they would possess a sufficiently wide range of utility to justify their introduction. We may mention that we are about to change the design of the existing Propeller Blade, however, and an announcement concerning this will appear shortly. (*Reply to A. Taylor, Shifnal, Salop*).

NARROWER WHEEL BOSSES.—Your suggestion that narrower bosses should be fitted to Gear Wheels, etc., is receiving attention, although we have found very few cases where the width of the bosses interferes with the construction of gearboxes, etc. The alteration, if adopted, would tend to impair the strength and efficiency of the wheels. (*Reply to L. P. Storey, Clifton, Bristol*).

½" SPROCKET WHEEL.—We fear that your suggestion concerning the introduction of a ½" diameter Sprocket Wheel is scarcely practicable. In order to allow sufficient space for the chain to engage properly with the teeth of such a wheel it would be necessary to employ a boss of smaller diameter than the standard size now used throughout the Meccano system. Moreover, considerable friction would be produced by running the Sprocket Chain round a wheel of so small a diameter. (*Reply to D. H. Williams, Ipswich*).

2½"×2½" FLANGED PLATES.—We are dealing with a number of suggestions concerning a part of this description and a further announcement will appear shortly in the "*M.M.*" Meanwhile, as pointed out previously, an efficient substitute may be obtained by using the existing 2½"×2½" Flat Plate in conjunction with two 2½" Angle Girders. (*Reply to P. Pottier, Purley, Surrey*).

3 : 1 GEAR RATIO.—We note that you are unable to obtain a gear ratio of three to one with the existing Meccano parts, but we would point out that this ratio may be obtained by using a ½" Pinion (19 teeth) and a 57-teeth Gear Wheel, as shown in Standard Mechanism No. 2. Another method, of course, is to connect a 3" and 1" Sprocket Wheel with a length of Sprocket Chain. Many other ratios are given in Section 1 of the S. M. Manual. (*Reply to G. and M. Cavallini, Rome*).

NEW CRANK SHAFTS.—The applications of the new crank shafts that you propose, having two or more cranks, would be somewhat limited, for the reciprocating engines that Meccano boys build are of all sizes. We find it better in nearly every case to build up the crankshaft from existing parts to suit individual requirements. A typical Meccano built-up Crankshaft is described under Standard Mechanism No. 274. (*Reply to E. J. Tout, West Hatch, near Taunton*).

MOTOR RADIATOR AND BONNET. —We are experimenting with designs for a combined motor radiator and bonnet and a further announcement will appear in the near future. Meanwhile there are several methods by which these accessories can be reproduced with the existing parts. Lengths of Spring Cord, for example, stretched vertically between a pair of parallel Axle Rods form realistic condenser tubes for incorporation in a radiator, while the existing Flat Plates and Hinges lend themselves readily to the construction of engine bonnets. (*Reply to J. Stevenson, Rugby, and E. Smith, Wareham, Dorset*).

BALL AND SOCKET JOINT.—We are interested in your suggestion concerning a Meccano ball-and-socket joint and agree that a ½" Steel Ball bored along a diameter to take standard Axle Rods and provided with grub screws to secure the Rods in position would prove useful in this connection, as well as for other purposes. Many manufacturing difficulties, however, must be overcome before your suggestion can be considered as a practical proposition. (*Reply to D. A. F. Allmond, Tavistock, Devon*).

NEW ORNAMENTAL BRACKETS.—We note that you advocate the introduction of brackets similar in design to those largely used as vertical panel supports in wireless constructional work. Although these parts would undoubtedly prove useful to radio enthusiasts, they would serve no really useful purpose in Meccano model-building. Moreover, existing parts, such as the Flanged Brackets, can be put to the same purposes. (*Reply to A. L. Kemp, Byfleet, Surrey*).

IMPROVED PULLEY.—Your suggestion that we should notch the pulley round its perimeter in order to prevent cord-slipping is interesting but would be difficult to adopt. We would refer you to Suggestion No. 81, which was published in the April issue of the "*M.M.*," as this forms a very satisfactory substitute for the special part that you propose. (*Reply to E. S. Copinger, Bentham*).

Suggested Hornby Train Improvements

⅝" GAUGE RAILWAYS.—We regret that we cannot consider the introduction of train sets designed for ⅝" gauge, as this would mean duplicating all the existing track and rolling stock. Our present "0" gauge (1¼") appears to be the most satisfactory from almost every point of view. (*Reply to B. Morris, Whitchurch, Glam.*)

NEW PASSENGER SET.—We shall consider the introduction of a No. 2 suburban train set with tender locomotive. (*Reply to W. Ciose, Diss.*)

RAILWAY VIADUCT. — We note your suggestion regarding a Hornby viaduct fitted with permanent track, but is not your idea already covered by the existing Viaduct? The latter may be obtained fitted with ordinary track for clockwork trains, price 7/6, or with electric track, price 8/–. (*Reply to M. C. C. Melville, Coventry*).

EIGHT-COUPLED ENGINES.—Your proposed design for a 4–8–2 type freight locomotive, fitted with a double-spring motor, is interesting but we fear that it would not be suitable for Gauge 0 track. In addition, the cost of manufacturing such a model would be prohibitive. (*Reply to S. Packley, Transvaal*).

ENGINE SHEDS.—We are at present engaged upon the design of suitable engine sheds to accommodate Hornby locomotives. (*Reply to R. H. de Montmorency, Sunningdale; G. Roblin, Port Talbot; Alan Hallett, Penarth; H. W. Jacomb, Godalming; A. Payne, Stroud; F. Valcke, London, S.E.1; R. Ounsworth, London, N.W.7; N. E. Woods, London, S.W.18, and many others*).

ELECTRIC CROSSOVER.—We shall give further attention to the possibility of introducing Hornby Crossovers equipped for use in connection with electric railways. (*Reply to E. Parker, London, N.W.8*)

JUNCTION SIGNAL ARMS. — The Hornby Junction Signal may be obtained fitted with either "home" or "distant" arms. The purchaser should specify the particular type that he requires. (*Reply to R. Roos, London, W.12*).

HORSE VAN.—This accessory would resemble very closely several vans already included in the Hornby rolling stock. However, we continue to receive many requests for its introduction and we shall bear the matter in mind. (*Reply to L. H. Porter, Stoke-on-Trent; S. Ellins, Kensworth, Dunstable; A. Hallett, Penarth, Glam.; P. Harrison and D. Lambert, Southbourne; J. V. H. Cookson, Bury; J. Thorburn, Kilmacolm; S. Bruce, York; and I. Hearder, Ilkley, Yorks.*)

THREE-WAY POINTS. — We note that you support the suggestions for a three-way point. Up to the present there appears to be comparatively little demand for this accessory, but we shall keep your ideas before us. (*Reply to D. Black, Wallington, and W. Gunn, Gourock, Scotland*).

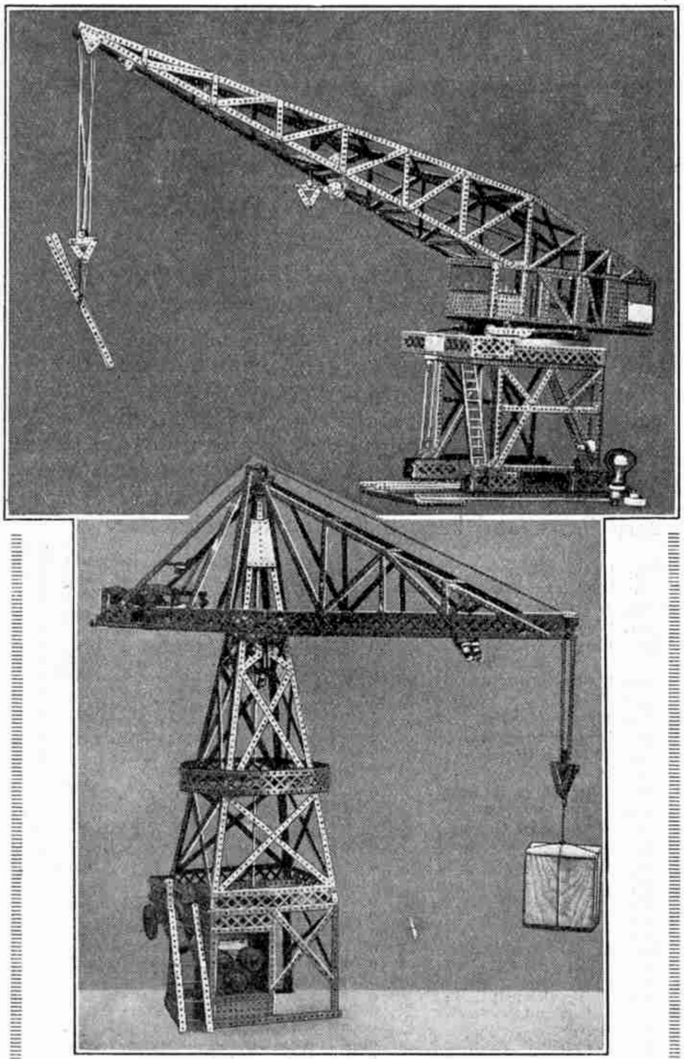
SIX-COUPLED LOCOMOTIVES.—We have received many further suggestions concerning the introduction of six-coupled locomotives and several ideas have been put forward concerning methods by which to overcome the difficulty of adapting such locomotives to small radius curves. The whole question is receiving careful attention and we are keeping a record of all suggestions received. (*Reply to P. Summers, Three Arches, Glos.; A. Shone, Wigan; G. M. Fidler, Yarm-on-Tees; J. Orr, East Lothian; D. Craighead, Edinburgh; F. R. Martin, Southampton; G. Bootham, Fenniscliffe, Blackburn; K. Nelson, Montreal; F. Selfridge, Glasgow; A. W. Langley, Ashford, Middlesex; W. S. Watson, Edinburgh; D. Cochran, Guernsey; B. Graves, Taunton; W. Close, Diss; F. Valcke, London, S.E.1, and many others*).

4–4–2 TANK LOCOMOTIVES.—We note your suggestions to the effect that the present 4–4–4 Hornby Tank engines should be converted to the 4–4–2 type. We do not think that much advantage would be obtained from this alteration, but we shall give further consideration to the possibility of introducing a new model having the desired wheel arrangement. The same remarks apply more or less to the various suggestions concerning a 2–4–2 tank engine. (*Reply to A. J. Evans, Bicester; N. E. Woods, London, S.W.18; R. Baxter, Grimsby; K. Berry, Helensburgh, Dumbarton; R. Bryant, Aberdeen; G. F. Roberts, Hull; C. Yates, Chorley; S. G. Sanders, Rossendale; V. Eckersall, Manchester; G. Allen, Brisbane; and J. E. Phelps, Johannesburg.*

SMALL SIGNAL POSTS.—Although posts of smaller diameter might improve the appearance of the Hornby signals, we fear it is impossible to decrease their dimensions without losing a great deal of constructional strength. (*Reply to O. Sanders, Melton Mowbray*).

OVAL BUFFERS.—We note that you support the suggestions regarding oval buffers. We are keeping a careful record of all ideas on this point. (*Reply to S. Buckley, Luton*).

TWO NEW MECCANO CRANES



The Meccano cranes shown above were designed and constructed by O. Meeuwes (Roodeschool, Prov. Groningen, Holland). Each is an excellent example of Meccano construction. The upper model is of somewhat unusual design, in that the base is similar to that of a giant block-setting crane while the boom is raised at an angle and in appearance suggests an ordinary jib crane. The second crane is of the hammerhead type much used in dockyards, and is constructed exceptionally well. Both models are controlled throughout by electricity.

HORNBY CONTROL ON NON-PERMANENT TRACKS.—We note your suggestions concerning the Hornby Control System. The System is perfectly satisfactory when adapted to non-permanent layouts; indeed, one of its chief advantages is the ease with which it may be assembled or disassembled to suit any particular kind of layout. The rails may be fixed together by means of the special Hornby Connecting Plates, and the Signals, Lever Frames, etc., clamped rigidly in any desired position in the layout by means of the small locking levers. (*Reply to R. Plumb, Ruislip*).

BRAKES ON ROLLING STOCK.—We doubt whether it would be possible to introduce brakes on Hornby passenger rolling stock so that they could be controlled by a hand wheel on the top of each coach. Even if they were fitted it would be a difficult matter to operate such brakes while the train is in motion. (*Reply to F. R. Martin, Southampton*).

TERMINAL STATIONS.—As we have stated in these columns in previous issues, we are giving careful consideration to the possibility of introducing covered terminal stations. Meanwhile a very useful and realistic terminus can be constructed by connecting two Hornby Passenger Platforms at right-angles to the existing station, thus providing for the accommodation of two or more trains in the station at one time. The number of platforms may be increased still further by using one or more Island Platforms. (*Reply to B. Morris, Whitchurch; E. Crilley, Kenilworth; and R. H. de Montmorency, Virginia Water, Surrey*).

SIDING POINTS.—Many further requests for siding points have been received and we are now carrying out experiments with a view to introducing this accessory. (*Reply to J. V. H. Cookson, Bury; E. S. Miller, Hanworth; J. Archer, Poulton-le-Fylde: and E. Parker, London, N.W.8*)

HINGED RAIL.—We are interested in your suggestion regarding a hinged rail, but we do not consider that there would be much demand for this accessory, although we agree that it would be useful when it is desired to include in a permanent track a movable portion in front of a door. It should be a fairly simple matter, however, for Hornby enthusiasts to attach a section of their track to ordinary hinges in order to overcome this difficulty. (*Reply to L. Ison, Northcote, Victoria, and H. R. Dobbie, Christchurch, N.Z.*)

CONSTANTINESCO TORQUE CONVERTER.—The Constantinesco Torque Converter is scarcely suitable for reproduction in a model locomotive. Even if it worked satisfactorily the cost of production and difficulty of assembly would almost certainly prohibit its introduction. (*Reply to R. F. Whittle, Bacup*).

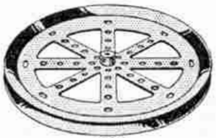
GUNPOWDER KEGS.—We note your suggestion re the manufacture of gunpowder kegs, but we do not think that these accessories would prove particularly useful. They may easily be represented by small pieces of wood shaped as required. (*Reply to B. Herbert, Sunderland*).

BOGIE WHEELS FOR METROPOLITAN TRAIN.—We note your suggestions regarding the attachment of bogie wheels and a flexible drive to the Hornby Metropolitan Electric Train Set. We agree that these alterations would improve the appearance of the locomotive but we fear that their adoption would prove extremely costly. In addition, there would be a constant danger of short circuits being caused while handling the locomotive by the bogie wheels making contact simultaneously with the outer and inner rails. (*Reply to P. B. Lucas, Uttoxeter*).

ARMOURED TRAIN.—Your proposal regarding the design of an armoured train is interesting, but we fear there would be little demand for an accessory of this kind. Incidentally, we may mention that a very realistic model of an armoured train may be constructed from Meccano parts. (*Reply to B. Kirby, London, W.14*)

MODEL GRAIN ELEVATOR.—We note your request for a model grain elevator, but we do not think that the interest in this accessory would be very great. When required it is a simple matter to construct a working model of an elevator from Meccano parts. (*Reply to R. Brotherton, Grimscar*).

ELECTRIC RAIL CONNECTIONS.—The change from a right-hand curve to a left-hand curve is a little difficult to effect when constructing a model electric layout, but we do not consider that it would be advisable to delete the fixed central pegs in the Hornby electric rails and to provide in their place a loose spring clip. Small pieces of this description are lost very easily and their use might impair the efficiency of the track through faulty connections, etc. (*Reply to E. W. White, London, N.1*).

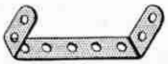

19C


139


9B

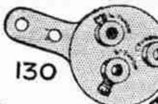

30


44

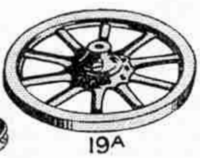

46

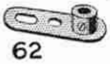

136


114


130


22

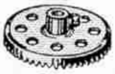

19A

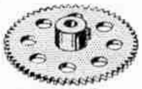

62

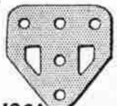

108


31


29


28


27A


126A

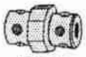

26

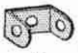

123

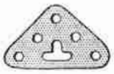

80A


23A


140


63A


11


133


143


43

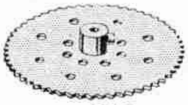

12


127

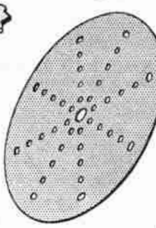

147 & 148


35


27


95B


96


146


138

THE NEW

MECCANO

Accessory Parts in Colours

WE illustrate a selection of accessory parts that every Meccano boy will find useful in building the larger and more interesting models.

The steel Meccano parts are now brightly coloured in red or green, and the beauty of Meccano models is very greatly enhanced. If nickelled parts are preferred, however, they may still be obtained from your dealer at the same price as the coloured parts. Ask your dealer for a copy of the complete illustrated list of Meccano Accessory Parts, and keep it by you for reference.

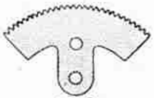
			s.	d.
*10.	Flat Brackets	½ doz.	0	2
*11.	Double Brackets	each	0	1
*12A.	Angle Brackets, 1″ × 1″	,,	0	1
19A.	Wheels, 3″, with set screw	,,	0	8
20.	Flanged Wheels	,,	0	6
	Pulley Wheels:			
19B.	3″ dia., with set screw	each	0	8
22.	1″ ,, ,, ,,	,,	0	4
22A.	1″ ,, without set screw	,,	0	2
24.	Bush Wheels	,,	0	6
25.	¾″ Pinion Wheels	,,	0	6
26.	½″ ,, ,,	,,	0	4
27.	Gear Wheels, 50 teeth	,,	0	9
27A.	,, ,, 57 ,,	,,	0	9
28.	1½″ Contrate Wheels	,,	0	9
29.	¾″ ,, ,,	,,	0	6
30.	Bevel Gears	,,	0	10
31.	1″ Gear Wheels, 38 teeth	,,	1	0
32.	Worm Wheels	,,	0	6
33.	Pawls (complete)	,,	0	4
43.	Springs	,,	0	2
*44.	Cranked Bent Strips	,,	0	1
45.	Double Bent Strips	,,	0	1
50.	Eye Pieces	,,	0	2
57B.	Hooks (loaded)	,,	0	5
59.	Collars and Set Screws	,,	0	2
62.	Cranks	,,	0	3
63.	Couplings	,,	0	6
63A.	Octagonal Couplings	,,	0	8
63B.	Strip Couplings	,,	0	8
63C.	Threaded Couplings	,,	0	6
64.	Threaded Bosses	,,	0	2
94.	Sprocket Chain	per length	0	6
*96.	Sprocket Wheels, 1″	each	0	3
101.	Healds, for Looms	doz.	0	9
108.	Architraves	each	0	2
109.	Face Plates, 2½″ diam.	,,	0	4
113.	Girder Frames	,,	0	2
*114.	Hinges	per pair	0	4
115.	Threaded Pins	each	0	2
*116.	Fork Pieces	,,	0	3
118.	Hub Discs, 5½″ diam.	,,	1	3
119.	Channel Segments (8 to circle), 11½″ diam.	,,	0	4
120.	Buffers	,,	0	2
120A.	Spring Buffers	per pair	0	8
123.	Cone Pulleys	each	1	3
*124.	Revsd. Angle Brackets, 1″	½ doz.	0	10
*125.	Revsd. Angle Brackets, ½″	,,	0	6
126.	Trunnions	each	0	3
126A.	Flat Trunnions	,,	0	2
127.	Simple Bell Cranks	,,	0	3
128.	Boss Bell Cranks	,,	0	4
*129.	Rack Segments, 3″ diam.	,,	0	6
*130.	Triple Throw Eccentrics	,,	1	3
131.	Dredger Buckets	,,	0	2
132.	Flywheels, 2¾″ diam.	,,	2	3
133.	Corner Brackets	,,	0	3
136.	Handrail Supports	,,	0	3
137.	Wheel Flanges	,,	0	4
138.	Ship's Funnels	,,	0	4
139.	Flanged Brackets, Right	,,	0	2
139A.	,, ,, Left	,,	0	2
140.	Universal Couplings	,,	0	9
144.	Dog Clutch	,,	0	6

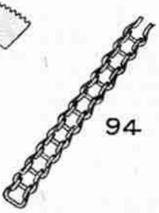
* These parts are supplied with nickel finish only.

You may obtain Meccano Parts from your Dealer

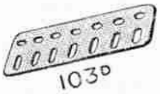

124


116

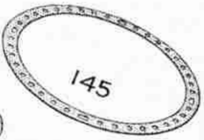

129


94


45


103D

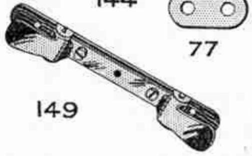

17

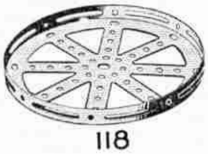

145


10


144


77


149

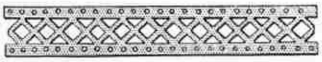

118


122


22A

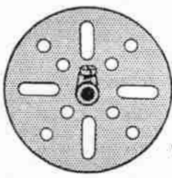

72


90

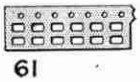

99


90A

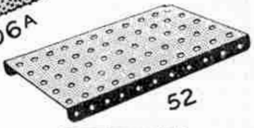

106A

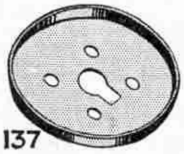

109

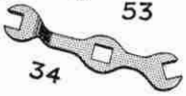

53

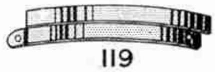

61

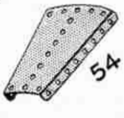

142


52


137


34


119


54


104

"Mystery Model" Competition

OVERSEAS RESULTS

It will be recalled that the "Mystery Model" Competition centred about the unusual movements of the Meccano reversing gear illustrated in the October (1926) "*M.M.*" The results in the "Home" Section of the contest, together with the correct solution to the problem, were published in the February 1927 "Suggestions Section." We are now able to give the names of the prize-winners in the "Overseas" Section.

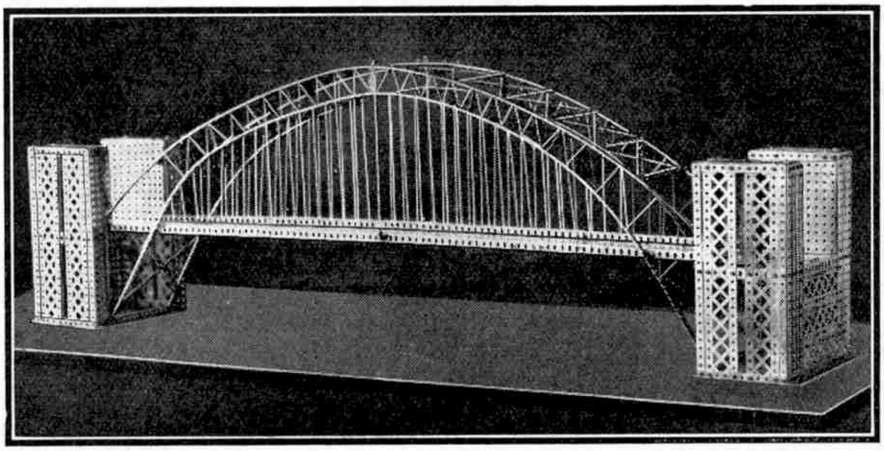
No competitor in this section succeeded in reproducing correctly the mechanism shown in the last mentioned Magazine and, incidentally, our own solution, which was based upon H. Dunhill's suggestion, still appears to represent the simplest possible method by which the required result can be obtained effectively. The First Prize, consisting of Meccano products to the value of 10/6, has been awarded therefore to Norman F. Joly (c/o Olivier & Co., Mitylene, Greece), who is the contributor of the best entry received.

Joly's solution to the mystery is based on a form of Pawl and Ratchet gear similar to that described on page 147 of the February "*M.M.*" except that only a single driving belt is used. The opposite rotational movement of the 3″ Pulleys is obtained by passing the driving belt over a 1½″ Pulley on the operating shaft, thence partially round the circumference of the two large pulleys, and round two Flanged Wheels bolted together to form an idle pulley.

Interesting Entries

Two other competitors submitted particularly ingenious solutions of the mystery, and we decided to award each with a special prize consisting of Meccano products to the value of 5/-. They are J. Fisher, Glenunga, S. Australia, and Thomas Aberdein, Claremont, Cape, S. Africa. The first mentioned competitor employs the Pawl and Ratchet method but transmits the drive through ordinary gear trains. T. Aberdein favours a mechanism similar in principle to the double pawl and rocking lever transmission used in the Meccano demonstration model of the Constantinesco Torque Converter (see page 427, May 1927 "*M.M.*"; also Standard Mechanism No. 254).

The following readers, who submitted particularly good solutions, will each receive a special Certificate of Merit and a complimentary copy of the Meccano Standard Mechanisms Manual; T. Nicholson, New Plymouth, N.Z.; Harold Spall, Brisbane, Queensland; Edward Holder, Port-of-Spain, Trinidad, B.W.I.; George P. Harris, Buenos Ayres; and S. Campbell, Johannesburg.



This realistic model of the arch in the Sydney Harbour Bridge was built by R. O. Jukes (age 14) of South Canterbury, New Zealand, and was awarded Third Prize (Overseas Section) in one of our recent model-building competitions

Suggestions Section

(*Continued from page* 635)

distance from the frame by means of a Collar or Washers placed on the shank of the ½″ Bolt.

It will now be seen that when the operating lever 1 is moved, the Coupling 3 is partially rotated, thereby forcing apart the Curved Strips 5. This causes the heads of the ⅜″ Bolts 6, which represent the brake shoes, to engage the inner periphery of a Flanged Wheel secured to the shaft that is to be controlled, and thereby applies a powerful retarding effect to the shaft.

It should be noted that one of the 1½″ strips 4 is spaced away from the Coupling 3 by a Washer, so that it will clear the second strip when the Coupling is moved. When the lever is released the brake is returned to the normal, or "off" position by means of a length of Spring Cord 7 stretched between the Curved Strips 5. In the illustration the Flanged Wheel is shown removed some distance from the bolts 6, but in practice it must be placed against the brake mechanism, of course, so that the heads of the bolts 6 fit inside its flange.

A particularly good suggestion for an internal-expanding brake of this type was received from P. W. Bedale, of Cambridge.

Miscellaneous Suggestions

(M.4). **Egg Whisk.**—Your model egg whisk would prove extremely serviceable in the home, we feel sure, and the use that you make of Propeller Blades as beaters is quite ingenious. Nevertheless we fear your model is scarcely suitable for detailed description in this Section. (*Reply to Leonard Matthews, Upper Horfield, Bristol*).

(M.5). **Spur-Gear Differential.**— Your novel differential gear possesses several interesting features, but it does not conform strictly to actual requirements. Although it provides for a difference in speed between the two road wheels, one of these wheels is driven constantly from the engine and therefore it is impossible for this wheel to slow down or become stationary as required when the car turns in a certain direction. We think you will be interested in the Meccano "spur" type differential gear described in the April "*M.M.*" (*Reply to R. W. Rush, Accrington*).

"No. 4 Outfit" Model-Building Competition

In this contest, as first announced last month, we are offering prizes for models built entirely from a "No. 4" Meccano Outfit. Entries from "home" readers must be received by the 30th of this month and from Overseas readers not later than 31st October next. Readers who intend to compete and have not yet sent in their work should do so without delay.

Models comprising parts that do not appear in the "No. 4" Outfit will be disqualified, but it is not necessary to use all the parts contained in the Outfit. An interesting feature of the contest lies in the fact that all competitors will have at their disposal an equal number of parts. Any type of model may be submitted provided that it is the competitor's own unaided work, both in design and construction.

Four Separate Sections

Entries will be divided into the following sections: Section A, for competitors over 16 years of age. Section B, for competitors under 16 and over 12 years of age. Section C, for competitors under 12 years of age. Section D, for competitors residing outside Great Britain.

Prizes will be awarded for the best entries from each Section as follows:—

First Prize: Meccano products to value £3-3s.

Second Prize: Meccano products to value £2-2s.

Third prize: Meccano products to value £1-1s.

Six Prizes, each consisting of Meccano products to the value of 10/6.

The following instructions must be followed closely:—The competitor's name and address must appear on the back of each photograph or sheet of paper used, together with his age, name of the competition (No. 4), and the Section in which the model is entered. Envelopes should be addressed "No. 4" Competition, Meccano Ltd., Binns Road, Liverpool.

Photograph or Drawing

Actual models should not be sent. A clear photograph or drawing is all that is necessary. Photographs or drawings of unsuccessful entries will be returned if a stamped addressed envelope of the necessary size is enclosed with the entry. It should be noted, however, that photographs of prize-winning models become the property of Meccano Limited.

A list of the contents of Outfit No. 4 will be found at the end of the latest complete Instruction Manuals; this list was reprinted in last month's "*M.M.*" Another new Model-building Contest is announced on page 643 of this issue.

Results of
Meccano Model-Building Contests

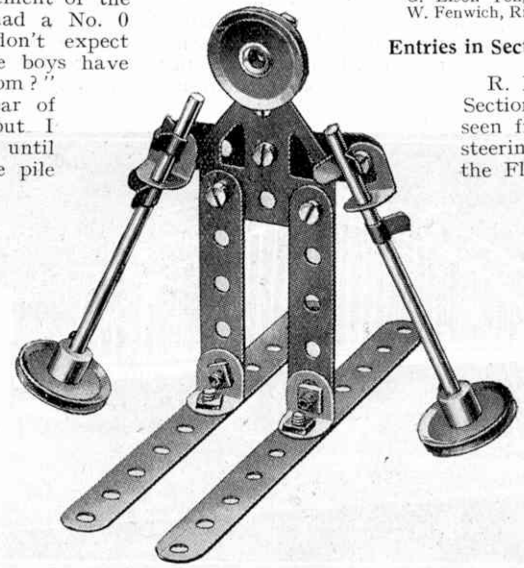
By Frank Hornby

"No. 0 Outfit" Competition, Home Sections

THERE can be few more exacting tests of our readers' model-building skill than that presented by the No. 0 Outfit Competition. The number of entirely new models that Meccano boys are able to devise from so few parts is truly surprising—at least, to the non-Meccanoite.

This reminds me of a remark made by an engineer friend of mine on reading the preliminary announcement of the contest. "Why," he exclaimed, "you had a No. 0 Outfit contest last year. Surely you don't expect many new entries in this one, when the boys have only five shillings' worth of parts to work from?" I tried to explain that there was no fear of Meccano boys' ideas "running dry," but I believe he remained somewhat sceptical until I showed him, some time later, the huge pile of entries lying on my desk.

If anything, the standard of merit displayed in the entries is higher than ever and I hope to include many of the models in future editions of the Instruction Manual. The names of the principal prize-winners in Sections A and B (for home readers) are as follows:—



The ingenious model of a ski-runner with which David G. Trevor secured First Prize in Section B

SECTION A (boys under 12 years of age):—

FIRST PRIZE (Meccano products to value £3-3s.): R. Lundie Shearer, Hillhead Park, Bonnyrigg, Midlothian. SECOND PRIZE (Meccano products to value £2-2s.): Jack Vernon Grindon, 19, Victoria Road, Whalley Range, Manchester. THIRD PRIZE (Meccano products to value £1 1s.): Ronald West, 24, Station Road, Beccles, Suffolk.

SIX PRIZES, each of Meccano products to the value of 10/6: Ernest Hall, Withington, Manchester; John Warren Davis, St. Ishmael, Milford Haven; G. Livock, Beccles, Suffolk; Albert Nichols, Darlington; W. Heaps, Market Drayton, Salop; G. C. Ackroyd, Woodhall Spa, Lincs.

SPECIAL COMMENDATION (Certificates of Merit): R. Rawkins, Hanwell, London, W.7; W. E. Blundell, Bromley-by-Bow, London, E.3; E. R. Webb, Exeter; G. Hindle, Hull; Norman Archer, Withernsea; G. R. Folson, Wembley; Edward Morgan, Westcliff-on-Sea; H. H. Lewis, Pontypool Road, Mon.; H. Martineau, Poplar, London, E.14; H. Hiscott, Ilford; R. Robinson, Doncaster; W. P. E. Beer, Roundhay, Leeds; G. Kitson, Hounslow; F. Nicholls, Dawlish; A. T. Fowler, London, S.E.15; R. Denton, London, N.11.

SECTION B (boys over 12 and under 16 years of age):—

FIRST PRIZE (Meccano products to value £3-3s.): David G. Trevor, 66, Petty France, Westminster, S.W.1. SECOND PRIZE (Meccano products to value £2-2s.): Olaf Hammerbeck, 30, Beehive Lane, Cranbrook Park, Ilford. THIRD PRIZE (Meccano products to value £1-1s.): John Smith, Melville E. Lodge, Lasswade, Midlothian.

SIX PRIZES each of Meccano products to the value of 10/6:—Jack Wheatley, Claygate, Surrey; H. C. Ackroyd, Woodhall Spa, Lincs.; G. J. Sageman, Highgate, London, N.6; E. W. Sellar, Winslow, Bucks.; Albert Tutty, Castle End, Cambridge; H. Tetlow, Manchester.

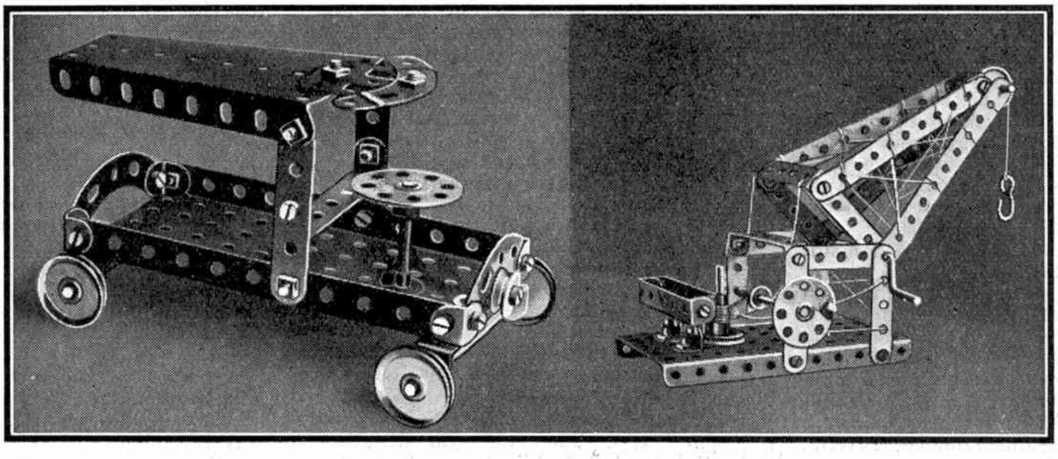
SPECIAL COMMENDATION (Certificate of Merit): John Evans, Salford; Albert Holmes, Gorton, Manchester; T. Hopper, High Wycombe; J. Conroy, Everard; R. H. Darton, Hitchin; G. Slaymaker, Westerham; J. Thompson, Scotstoun, Glasgow; S. G. Herrington, Swindon; G. Effemey, Christchurch; Edward Jones, London, S.W.1; G. Lesson, Derby; E. L. Philbin, West Hartlepool; E. Slaymaker, Westerham; S. Reed, Bridgwater; A. M. Johnston, Dunstable; S. Hawkins, Southampton; H. Pooss, Weymouth, Dorset; P. Baughan, Erdington, Birmingham; Carnegie Brown, Edinburgh; R. H. Mann, Mytholmroyd, Yorks.; G. Elson Tonge, Farnworth, Lancs.; E. R. Pedley, Willenhall W. Fenwich, Riccall, near York; L. W. S. James, Longside, Glasgow.

Entries in Section A

R. L. Shearer's First Prize-winning model in Section A represents a motor lorry, as will be seen from the illustration below. The vertical steering column in this model is fitted below the Flanged Plate with a Double Bracket that is caused to turn with the Rod by means of a Spring Clip placed so that its wings press against the sides of the Bracket. The latter is connected by cords to the ends of a 2½" × ½" Double Angle Strip, which is pivoted at its centre and carries the front axle. This is a very neat little model and looks remarkably well when built with the new coloured parts. It will be noted that a ½" loose Pulley is secured to an Angle Bracket in the front of the car to represent a head lamp.

The Second Prize in this Section was awarded for a model of the "Wee Bee I." monoplane, in which J. V. Grindon obtains an excellent representation of the fusilage by means of 5½" Strips coupled by Flat and Double Brackets. Curved Strips are used to reproduce the extended "nose" of the machine and two Flat Trunnions represent the tail. The main wing consists of two 5½" Braced Girders overlapped three holes and a 2½" Strip serves as a propeller.

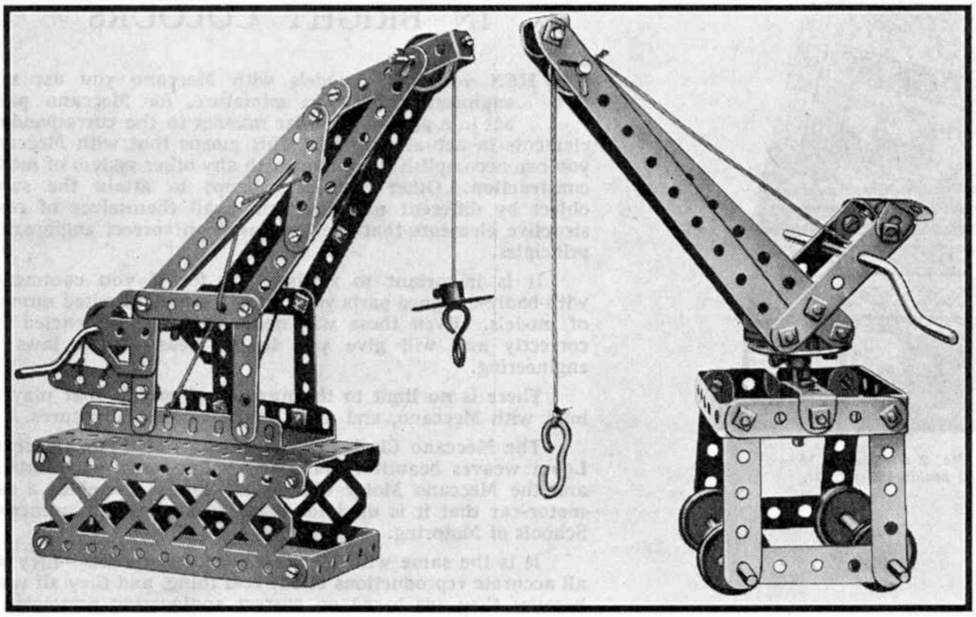
R. West submitted a particularly good model of a mortising machine, the original of which he was able to study in his father's workshop. The mortising tool in the model may be raised or lowered by a hand lever pivoted to the main upright of the machine. This lever is fitted with two 1" Fast Pulleys and a Bush Wheel to counterbalance the weight of the tool. The only point that I can criticise in this model is the somewhat unreliable method of joining two 3½" Rods end to end in the boss of a 1" fixed Pulley.



These two models are typical of the excellent work submitted in both sections of the "No. 0 Outfit" Contest. The Motor Lorry (left) was built by R. L. Shearer (First Prize, Section A), and the Luffing Jib Crane (right) secured a prize in Section B for H. Tetlow

"Off to Market"

A. Nichols sent in no less than three models. These were all equally interesting, but perhaps the most novel is the one entitled "Off to Market," and representing an old-fashioned farmer's cart complete with driver and horse. The latter, I must add, looks decidedly ill-fed, for he boasts only a single 5½" Strip for his body! Nevertheless, the model has an extraordinarily realistic appearance and is certainly most amusing. The other two models are also of the humorous type and are described as "Travelling Acrobat" and "Chairoplane." The former comprises a quaint Meccano figure pivotally attached to a Bush Wheel, which is mounted on a shaft and rotated by a belt drive from one of the wheels on which the model rests. The acrobat performs some astounding evolutions when the model is pushed along the table. A "chairoplane" is no doubt a familiar device to most of our readers, for it is found in pleasure fairs and other similar places of amusement. The chairs, which in the Meccano model consist of Double and Flat Brackets suspended from revolving arms by lengths of cord, are whirled round at a giddy pace and gradually rise higher from the ground as the speed of the apparatus increases.



Two Prize-winning Cranes from Section B. Left: Swivelling Crane by E. W. Sellar
Right: Swivelling and Travelling Crane by A. F. Tutty

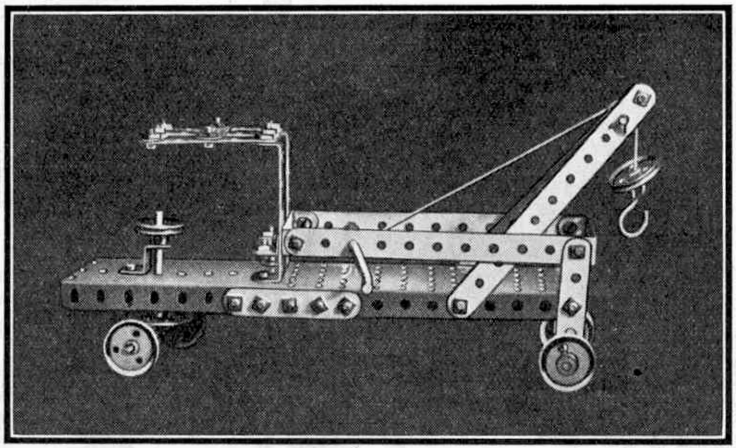
Amongst the other prize-winning entries in this section I should like to mention particularly a model plough submitted by E. Hall. Although an ordinary one-horse plough is a simple device, it is not an easy one to reproduce with great realism by means of a No. 0 Outfit. Nevertheless, Ernest Hall has done so with considerable success. G. Livock's hand printing press is also very good. The base of this machine consists of a 5½"×2½" Flanged Plate supported on 5½" Braced Girders, and the press itself consists of a Sector Plate that may be raised or lowered on operation of a hand lever. W. Heaps sent in a model beam engine and J. W. Davis chose as the subject for his model a swivelling jib crane.

G. C. Ackroyd submitted a novelty described as the Meccano "Bang-bang" game. This appears to me to be somewhat similar to the well-known "tiddleywinks" and I have little doubt that it provides many hours of indoor fun.

Entries in Section B

Some idea of the excellence of the models submitted in this section will be obtained from the accompanying illustrations of five of the principal prize-winning entries. The Meccano Ski-runner shown on the preceding page secured First Prize for David E. Trevor. This model is perfectly simple to construct but it presents a striking and most amusing appearance. The head of the runner consists of a 1" loose Pulley bolted to a Flat Bracket forming his neck, and his arms are also constructed from Flat Brackets.

O. Hammerbeck's Second Prize-winning entry, a motor breakdown lorry, is well constructed. Its efficiency would be improved, however, if the jib of the crane was provided with some additional support, such as two lengths of cord secured so as to act as ties between the top of the jib and the chassis frame.



Motor Breakdown Lorry, by Olaf Hammerbeck. Awarded Second Prize, Section B

J. Smith secured Third Prize with a model of a "pedal Fairykar." The frame of this model is constructed from a Sector Plate extended by a Flat Trunnion, the end hole of which forms a bearing for the steering column. The latter is attached by means of Spring Clips to a Double Bracket bolted between 2½" Strips which form the front wheel forks. A Bush Wheel serves as the front wheel and the Rod to which it is secured carries at each end a pedal composed of an Angle and a Flat Bracket bolted together. The handle-bars are represented by a 2½" Strip carrying two Flat Brackets.

An excellent model of a luffing jib crane, with which H. Tetlow secured a prize, is included in another illustration. The crane, although of small dimensions, presents an appearance of massive strength, and its design is not unlike that of the famous "Mammoth" 200-ton floating crane in the River Mersey. The jib is luffed by cords winding on a 3½" Rod fitted with a Bush Wheel to serve as an operating handle. In order to prevent the jib overhauling, a frictional brake is applied to this rod by means of a piece of cord stretched tightly round a ½" Pulley. An interesting example of economical construction is shown in the method by which the hoisting handle is used to form the pivot bearing for the jib.

More Meccano Cranes

Two other model cranes, each of which secured a prize for its designer, are illustrated. The first of these, by E. W. Sellar, represents a swivelling crane and is mounted on a substantial base constructed from a 5½"×2½" Flanged Plate supported on 5½" Braced Girders. The crane swivels about a 2" Rod passed through the Flanged and Sector Plates and held in position by 1" Fast Pulleys secured above and below the plates. The second model, by A. F. Tutty, is of a swivelling and travelling crane. This is of very neat construction, the crane being mounted on a travelling base built up from 2½" Strips and 2½"×½" Double Angle Strips. The crane itself is secured by Angle Brackets to a Bush Wheel that is mounted on a 2" Rod forming the swivel bearing. The Rod passes through a Double Angle Strip secured in the base and is further supported by two ½" Reversed Angle Brackets.

G. J. Sageman's model is in the form of a lathe, in which excellent use is made of the contents of No. 0 Outfit. The mandrel shaft is rotated by a belt drive from a Crank Handle journalled in the base of the model. A very original and effective representation of a revolving office chair gained a prize for J. Wheatley.

The subject of H. C. Ackroyd's model is a derricking crane. The model is exceptionally well designed and separate winding shafts, each controlled by a friction brake, are provided for the hoisting and luffing movements. I have already had occasion to mention the work of this competitor's brother, G. C. Ackroyd, who obtained a high place in Section A.

THE NEW MECCANO

REAL ENGINEERING PARTS IN BRIGHT COLOURS

The No. 2 Outfit costs 15/- and builds 163 models.

WHEN you build models with Meccano you use real engineering parts in miniature, for Meccano parts act in a precisely similar manner to the corresponding elements in actual practice. This means that with Meccano you can accomplish more than with any other system of model construction. Other systems attempt to attain the same object by different methods, and avail themselves of constructive elements that are not based on correct engineering principles.

It is important to realise this, for if you commence with badly-designed parts you can only build a limited number of models. Even these will necessarily be constructed incorrectly and will give you faulty ideas of the laws of engineering.

There is no limit to the number of models that may be built with Meccano, and all are real working structures.

The Meccano Clock keeps accurate time ; the Meccano Loom weaves beautiful material for hat-bands or neckties ; and the Meccano Motor Chassis so closely resembles a real motor-car that it is used for teaching students at numerous Schools of Motoring.

It is the same with all other Meccano models—they are all accurate reproductions of the real thing, and they all work because they are based on correct engineering principles.

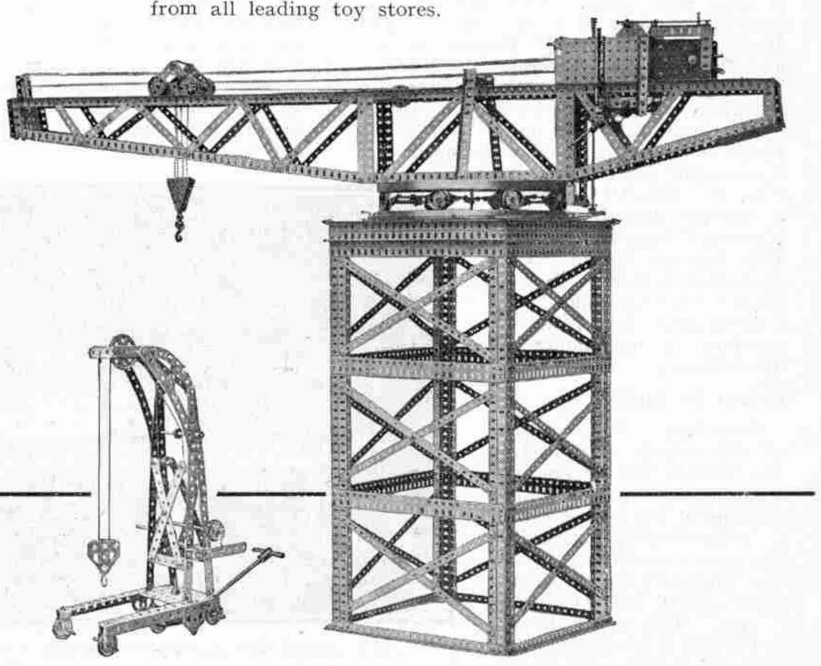
PRICES OF NEW MECCANO OUTFITS

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

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

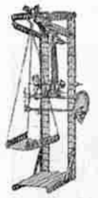
Meccano Outfits may be obtained from all leading toy stores.

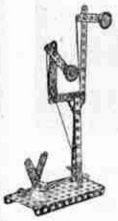
Compare these two fine models of cranes—one, a small hand-operated portable hoist, and the other, a giant "hammer-head" crane. Both are constructed on the same principles, and work in a most realistic manner. Any Meccano boy may build the big crane just as easily as he builds the small one.

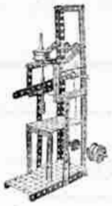


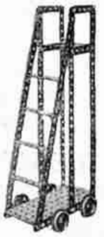
Special Summer
Model-Building Competition

FOR ANY TYPE OF MODEL









Holiday Subjects

During the sunny months of July and August few Meccano boys can spare much time thinking out how to construct a particular kind of Meccano model or how to use a specified number of Meccano parts to the best possible advantage. On the other hand during their holiday travels or country rambles they are bound to run across innumerable objects that will at once suggest themselves as suitable subjects for Meccano models. For these two months, therefore, we are arranging special model-building competitions in which any type of model may be submitted and any number of Meccano parts may be used. Full particulars of this month's contest appear below.

How to Compete

All models submitted in the competition must be the competitors' own unaided work, both in design and construction. Although any size of Outfit or quantity of parts may be used, it is important to remember that it is not necessarily the most intricate or elaborately-constructed models that will carry off the prizes.

As in every previous contest the most telling point will be originality—either with regard to the type of apparatus selected as the subject of the model, or to the novel uses of Meccano parts or movements employed in its construction.

Entries will be divided into the following Sections: Section A, for competitors over 14 years of age. Section B, for competitors under 14 and over 12 years of age. Section C, for competitors under 12 years of age. Section D, for competitors residing outside Great Britain.

List of Prizes

Prizes will be awarded for the best entries FROM EACH SECTION as follows:—

First Prize: Meccano products to the value of two guineas.

Second Prize: Meccano products to the value of one guinea.

Third Prize: Meccano products to the value of half-a-guinea.

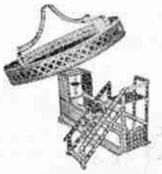
Six Prizes, each consisting of Meccano products to the value of 5/–.

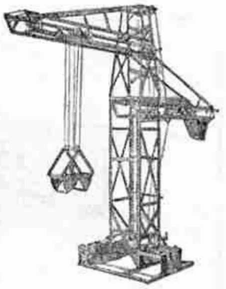
A Limited Number of Certificates of Merit.

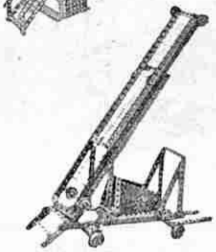
The first prize in each section will be awarded to the competitor who builds the model that the judges decide to be the best entered in that section, and the second and third prizes will be awarded to the second and third best models, and so on. Models possessing points of exceptional interest will be described in the Magazine and if suitable they will also be included in forthcoming Instruction Manuals.

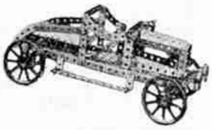
Closing Dates

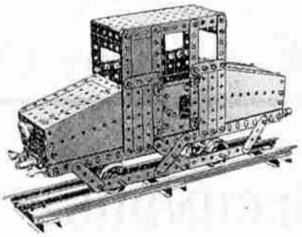
For Sections A, B and C: 31st August.
Section D: 30th November, 1927.

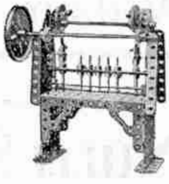


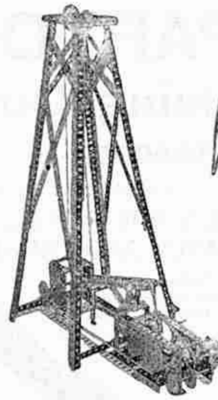


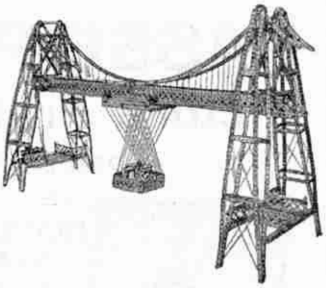


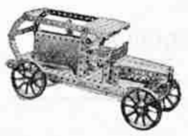


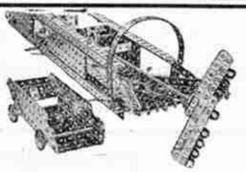








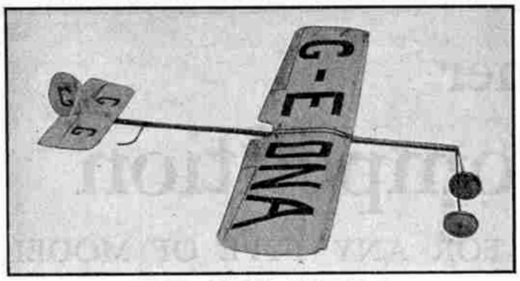




Important Instructions

Readers should send in clear photographs or good drawings of their models together with any explanations that may be necessary. The following instructions must be followed closely:—The competitor's name and address must appear on the back of each photograph or sheet of paper used, together with his age, name of the competition (Summer Model-building Competition) and the Section in which the model is entered. Envelopes should be addressed "Summer Model-building Competition," Meccano Ltd., Binns Road, Liverpool.

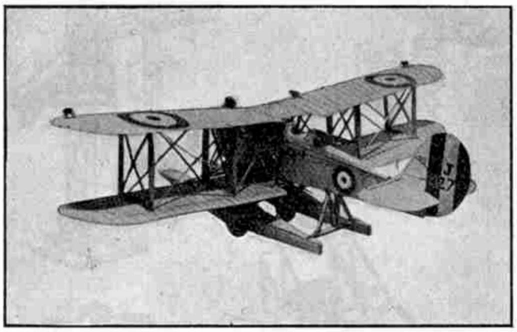
Actual models should not be sent. A clear photograph or drawing is all that is necessary. Photographs or drawings of unsuccessful entries will be returned if a stamped addressed envelope of the necessary size is enclosed with the entry. It should be noted, however, that photographs of prize-winning models become the property of Meccano Limited.



MODEL GLIDER "G-EDNA"

These models will soar to a height of 30 ft.

G-EDNA	24" Model, set of parts	**2/6**	Post 6d.
G-EDNB	18" " "	**1/9**	" 6d.
G-EDNC	12" " "	**1/-**	" 4d.



BLACKBURN "VELOS" SEAPLANE

A 24" model with elastic motor inside the fuselage, four aluminium disc wheels, two floats and finished torpedo. Set of parts and instructions ... **3/6** Post Paid.

APPLEBY'S FAMOUS MODEL AEROPLANES

These models are wonderfully realistic, having all the parts and fittings of the originals faithfully reproduced in miniature.

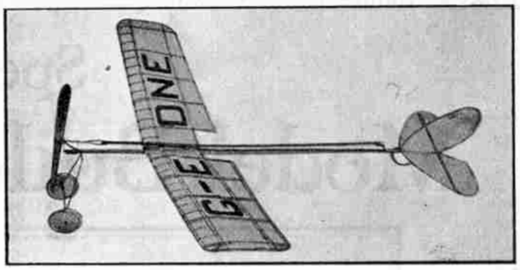
The illustrations are actual photographs of the finished models, and the sets which you buy will make up exactly similar without any further parts being required.

The model Gliders (types G-EBNA/B/C) are our latest productions. They have a new type of double surfaced mainplane, aluminium disc wheels and will soar to a height of 20 or 30 feet. The largest model G-EBNA if launched in an upward direction will climb to a great height, flatten out and then gracefully glide down to the ground in either a straight or circular course.

ORDERS OVER 3/- Post Paid.

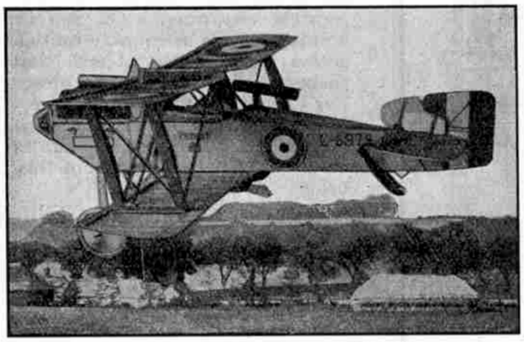
Colonial customers should remit 9d. per model extra to cover extra postage.

SEND YOUR ORDER NOW



TRACTOR MONOPLANE G-EDNE

This model will rise off the ground and fly for 20 seconds. Span 20". Length 21". Propeller 6". Weight 18 drams. Set of parts and blue print, **3/9** post free.



MILITARY BIPLANE, TYPE E-6879

A model Glider complete in all detail. Will perform almost any evolution of the original. Set of Parts and Instructions **1/-**. Post 4d.

William E. Appleby (N/C) & Co., (Dept. K) 217, 219, JESMOND ROAD,
NEWCASTLE-ON-TYNE

NULLI SECUNDUS BRITISH AND BEST

PASSE PARTOUT

Picture Framing Outfits

and Accessories

FRAME YOUR OWN PICTURES NEATLY AND CHEAPLY

Passe Partout is easy to do and enables you to decorate your own home

All Accessories Sold Separately

Complete Outfits at £1, 10/-, 5/- & 2/-

Bindings at 6d. per coil of 12 yards

Send for our free instruction booklet to-day

From all Stationers and Photographic Dealers

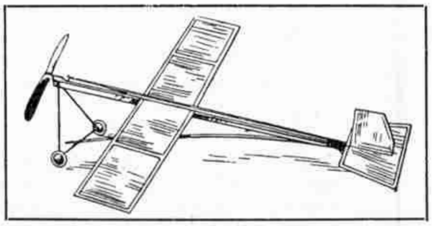
SAMUEL JONES & CO. LTD.
Passe Partout Makers, Bridewell Place, E.C.4

Our Air Supremacy

The "WARNEFORD" MODEL AEROPLANE

A Guaranteed Flying Model.

Soundly Constructed of the Finest Possible Materials.



No. 4 TRACTOR 4/6

The No. 0 "PUSHER" MONOPLANE selling at 5/6, can be adjusted for all manner of flights, i.e., Elevator can be flattened out for long distance flying, or adjusted for sharp rising, or again for turning left or right. This Machine is practically unbreakable.

Prices: PUSHER TYPE 5/6 to 14/6

TRACTOR TYPE 4/6 to 21/-

THE WARNEFORD MODEL AEROPLANE can be obtained from any London Store, or Messrs. Hamley Bros. Ltd. or Branches, and from all the leading Stores throughout the world.

Sole Manufacturer:
F. J. MEE, Greenwich Road, London, S.E.10

TRADE ONLY. LEAFLETS FREE.

Famous Trains—(*continued from page* 607)

drop to Shortlands, after which the line rises again at 1 in 95 past Bromley to Bickley Junction, where we are braked in order to pass round the spur line to where the main line from Charing Cross is joined at Orpington Junction. Still climbing, on rather less than "half regulator" and 30 per cent. cut-off, we breast Orpington, Chelsfield and Knockholt, the last three miles, to a point just south of Knockholt Station, being up at 1 in 120. At last we are at the summit, but this 17½ miles of toilsome ascent from Victoria has taken us 31 minutes. For the remaining distance of just over 60 miles we are to average round about 55 miles an hour.

Checks on the Line

Swiftly gathering speed down through Polhill Tunnel, we dash through Dunton Green at just over 60 an hour and take the sharp rise from there to the mouth of Sevenoaks Tunnel "at the double," so to speak. The two miles through the tunnel fall at 1 in 144, and the five miles on to Tonbridge Junction at 1 in 122, and the good alignment of the track here permits of speeds—frequently attained—up to 75 miles an hour or so. Soon after leaving the tunnel, however, we notice in front of us the green warning board indicating engineering works in progress, and the "C" sign, showing where they commence, brings us down to 15 miles an hour at Hildenborough. Shortly after regaining speed we have to slow yet again for the curve through the junction at Tonbridge. Over the first 30½ miles of our journey we have taken 47½ minutes.

We have now before us one of the straightest lengths of line in the British Isles, with only the gentlest of undulations, and of this "*Lord Nelson*" will take the fullest advantage. The driver opens the regulator to one-half, while keeping his cut-off still at 30 per cent. Rapidly we gather speed. Sixty-six miles an hour at Paddock Wood, 69 just beyond, 62½ at Marden, 70½ at Staplehurst, 61½ beyond Headcorn, 67 at Pluckley, 62½ at the top of the rise to Chart Siding, 66 through Ashford Junction and past the lines of engines outside the locomotive works there—these are typical speeds over the ups and downs of this section. So we have covered the 26½ miles from Tonbridge to Ashford, with our 470-ton train, in 26 minutes, despite the necessity of recovering speed after the Tonbridge slack.

Another permanent way warning board ahead! It is renewal of track this time, near Smeeth, and once again our proud progress must be stayed until the welcome "T" sign indicates that normal speed may be resumed. So on past Westenhanger to Sandling Junction; 66½ miles from Victoria in 85 minutes, and 13 minutes left in which to cover the last 11½ miles. It is easily done; from here to Dover is an unbroken falling grade of 1 in 264. We get up to 66 miles an hour just before Shorncliffe, and then have to be eased down for the curves through Folkestone. The sea bears into sight on our right as we swing over the high viaduct across the centre of the town.

The Last Stage

On through Folkestone Junction and the tunnel we speed; then through the Warren, with its marked evidences of constant falls of the cliff face, and the trouble and expense that they have given to the railway company. Abbott's Cliff Tunnel is threaded, and we espy on our right all that remains of the beginning that was once made to bore under the English Channel. At last the peculiar tunnels under Shakespeare's Cliff are in view, and we take the "left-hand window," slacken speed to a walking pace over the timber viaduct beyond, as we approach the junction at Dover, and bear round a very sharp curve into the Marine Station at Dover. Yes, we have done it; the time is 12.23 p.m., to the very "tick."

A shunting engine comes and hitches the vans and the two trucks off the rear, carrying them round on to the Quay and we regretfully say goodbye to driver and fireman, who run back to the locomotive depot to get ready for working the 3.30 p.m. boat express back to Victoria. Such is a day in the life of the "*Lord Nelson*."

Meccano in Turkey

بويوك ملت مجلسى حكومتى
معارف وكالتى

اورتا تدريسات دائرەسى
٢١٥٥ عمومى
٨٠٣ خصوصى
٣٥ تعميم

آنقره
٢-٢-١٩٢٧

منطقەسى معارف امينلكنه

برچوق غرب مملكتلرينك ايلك واورتا مكتبلر ايچون فنى آلات تدريسيه اولمق اوزره قبول ايتديكى «مەقانو» ماكينەلرى مكتبلريمز ايچونده موافق كورولمشدر . منطقەكزدەكى ايلك واورتا مكتبلردن آرزو ايدنلرك بر طاقم تدارك ايتمەلرينك معارف ومكتب مديرلكلرينه توصيەسى لزومى تعميماً تبليغ اولونور افندم .

معارف وكالتى وكيلى
دقتور

The above is a copy of a letter from the Ministry of Education at Angora addressed to the District School Inspectors in Turkey. It is of particular interest to readers of the "*Meccano Magazine*," and we give below a literal translation of it.

It is interesting to remark, in passing, that the Meccano Manual will shortly be available printed in Turkish. As most of our readers know, Meccano is used in every civilised country in the world, and our literature is already printed in some 16 languages, including even Chinese. We have not, however, so far printed the Instruction Manual in Turkish, but this is now about to be done.

Angora, 2nd February, 1927.

To District School Inspectors,

It has been found useful to adopt for our schools the Meccano Outfits, which have been accepted as part of the material for science lessons in western elementary and secondary schools. I would ask you therefore to recommend by circular that the elementary and secondary schools in your district should procure these outfits.

For the Ministry of Education,
Dr. Refik.


SUNNY JIM


H-O
MADE IN CANADA
THE WHOLE WHEAT COOKED WITH MALT
FORCE
TOASTED WHEAT FLAKES

Competition Page

A MYSTERY STORY COMPETITION

"What on earth is the use of sending a boy out shopping," grumbled Jack to himself as he walked slowly down the road toward the town and shops, "how can Mother expect me to know the difference between frozen and English mutton ? How can I be expected to know just when two colours are perfectly matched ? And—oh ! dear, now I've forgotten what else I had to get ! I would ever so much rather that Mother had sent Millie. And just when I had got my Hornby track fixed up."

As Jack walked, he cudgelled his brains to remember the remaining part of his commission, and ever at the back of his mind there lurked that threat of punishment that his Mother had made when last he had been sent shopping and had returned home with an electric flash lamp instead of 1 lb. lamb chops ! Oh ! dear, was life worth living ?

Suddenly a brain wave struck him. "Why, here's the station. Perhaps the advertisement sign boards will remind me. And anyway I've plenty of time and can watch the trains for a bit. Why, perhaps a driver will even let me have a peep into the engine cab."

Thus talking to himself, Jack dashed into the station and .... disappeared !

Time passed and Jack's Mother became anxious. When his Father returned from the office he organised a search party but no trace of the missing boy could be found. All that night and far into the morning the search continued but still there was no result.

What happened to Jack ?

* * * *

In the preceding sentences we give the opening scenes of a fascinating short story. Here is a situation full of interesting possibilities, and we invite our readers to submit their version of Jack's adventures after entering the station.

Solutions to the mystery can be as short as the entrants desire but in any case must not exceed 1,000 words in length. Only the competitor's name, address and age, is to appear on the back of each sheet of paper used. Prizes of Meccano or Hornby trains to the value of £1/1–, 15/–, 10/6 and 5/– will be awarded to the best solutions, and in addition there will be a number of consolation prizes.

Entries must be addressed to "Jack's Adventures, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than 30th July. Overseas closing date, 30th October.

23rd Drawing Contest

It has been a remarkable feature of many of our past drawing competitions that very many competitors do better work when called upon to exercise their imaginations than when required to make what is in effect, a straight copy of some transport vehicle, either from memory or a picture. We are rather interested to see what sort of a job our artist readers can make of a humorous sketch, in which the imagination can be given full play, and below we print a funny story, for which an illustration is wanted.

HE DIDN'T AUTO!

"He's quite a motor fiend, isn't he? Never seen without his car."

"But I saw him yesterday without it !"

"Is that so ? Where ?"

"He was clinging to the front of a locomotive with a steering wheel around his neck !"

The picture need not necessarily show the motorist perched upon the engine ; competitors may prefer to illustrate the means by which he got there. All that is necessary is to make a picture of that portion of the imagined incident that seems to offer the most scope for fun. The sketch may be in black or white or colours.

Drawings may be any size up to 10 in. by 8 in. and prizes of Drawing Materials or Meccano products (to be chosen by the winners) to the value of 10/6 and 5/– will be awarded to the competitors who submit the best sketches in each of the usual two sections ; A for readers of 16 and over and B for those under. Each competitor must give his name, address and age, on the back of his entry.

Entries must be addressed to "Auto Sketch, Meccano Magazine, Binns Road, Liverpool," and sent to reach this office not later than 30th July. Overseas closing date, 31st October.

31st Photo Contest

It is now some months since we announced a photo contest, and we are sure that those readers who take an interest in this hobby will welcome the announcement that one of these interesting contests will be held each month during the summer. It is intended to make the subjects comprehensive, in order that every one may have an equal opportunity of taking part.

The subjects for this month are "A Summer Scene" or "Three Railway Photographs."

Prizes of photographic or Meccano goods (to be chosen by the winners) to the value of 10/6 and 5/– will be awarded to the best entries in each of the usual two sections ; A for readers of 16 and over, B for those under. Intending competitors should note that their name, address and age, must appear on the back of each photo submitted, and that photographs can only be returned if a stamped and addressed envelope is sent with the entry, which must be addressed to the "31st Photo Contest, Meccano Magazine, Binns Road, Liverpool."

Closing date, 30th July ; Overseas, 30th October.

Home Results

Crossword Puzzle No. 1

As we anticipated, there was a bumper entry for this contest, and as a result it has been decided to set this form of puzzle more frequently in the future. Strangely enough, although we set out with the intention of disregarding the "alternative" trap as a means of arriving at the prize-winning entries, there proved to be two or three instances in which alternative words could be employed. Every solution containing alternatives covered by the given clues has been admitted as correct in so far as those words are concerned.

There was a trap, however, for the unwary and we must confess we were staggered by the number of readers who fell into it. To use the words of one entrant, "It was not until I was reading about the Eclipse that I found him out. That is what comes of not reading the 'Mag' properly at the time." The correct solution will appear next month and in the meantime we append the list of winners.

1. A. Ramsay (Birkenhead) ; 2. L. T. Edwards (Evesham) ; 3. S. F. J. Bracker (Walsall).

Consolation prizes : F. Ashton Hill (Liverpool) ; H. R. Foden (Chalfont St. Peter, Bucks.) ; J. W. Shepherd (Eastbourne) ; E. Day (London, W.12) ; F. Herriot (Peebles) ; J. W. Chapman (Beaconsfield, Bucks.)

May Essay

Opinion among our readers seems to be very strongly in favour of cricket as the ideal summer pastime, for rather more than 50 per cent. of the competitors wrote in praise of England's national summer sport. Tennis, photography, swimming, fishing, cycling and rambling also received very strong support.

The prize awards are as follows :—First prizes, Section A : F. W. Skinner (Winchester) ; Section B : K. Osbourne (Darlington). Second prizes, Section A : F. J. Bracher (Walsall) ; Section B : H. Beats (Dundee). Consolation prizes : E. Langton (Bramhall, Ches.) ; W. Newall (Sale).

Overseas Results

Feature Voting Contest

The outcome of the poll in this contest proved how diverse are the interests of magazine readers and how widely the tastes of various sections of readers differ. It will be remembered that the feature "Famous Trains" was easily on top in the Home Section. In this it proved a poor third.

The final order was as follows :—Model Building Contests ; Competition Page ; Famous Trains ; Conquest of the Air ; Famous Engineers ; Suggestions Section. Standard Mechanisms and Electricity tied for the seventh place and therefore fill the seventh and eighth places jointly.

No competitor succeeded in giving a completely accurate forecast and the prizes are awarded to the following entrants whose lists were most nearly correct:

1. J. Morris (S/Lausanne, Switzerland) ; 2. A. Kumar (Delhi) ; 3. J. A. Gomes (Bombay) ; L. Secluna (Moulmein, Lower Burma).

OBJECTS *of the* GUILD

To make every boy's life brighter and happier.

To foster clean-mindedness, truthfulness, ambition and initiative in boys.

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

The Meccano Guild

With the Secretary

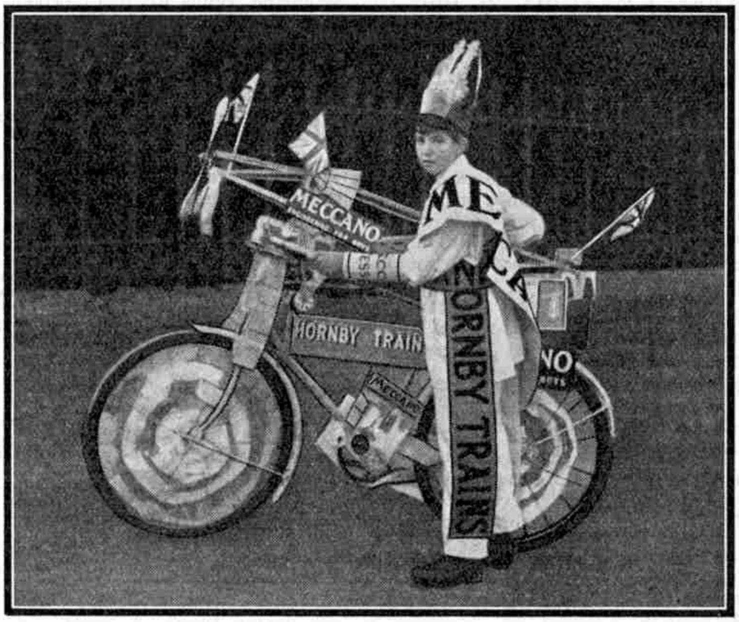
Clubs Throughout The World

One of the most gratifying features of the past two or three years has been the steady growth of the Guild throughout the Empire and in various foreign countries. This affords further proof—if any be necessary—of the fact that the spirit of the Meccano boy is the same whatever his nationality may be.

In Australia there are now several flourishing clubs with steadily growing memberships, and many other clubs are proposed and likely to come into being shortly. A notable feature of the programmes of the Australian clubs is their great variety, and although model-building takes first place, meetings are never allowed to become too serious and there is always some fun in the background. This feature applies also to the New Zealand clubs, one of which, Wiseman's M.C., still has the honour of being the largest Meccano club in the world.

The South African clubs are obviously full of vitality, for they have succeeded in attracting and maintaining the interest of civic and other authorities and in obtaining the patronage of many gentlemen holding important positions in scientific, educational or engineering spheres. It is also a frequent occurrence for prizes of various kinds to be presented by some firm to the local club for model-building contests. This success must be attributed to keen enthusiasm on the part of all concerned, and it is also a striking example of the results that may be obtained by wise publicity methods. Members of these South African clubs are having a thoroughly good time and they let everybody know it!

A Carnival Costume Hint



Guild members who intend to take part in Fancy Dress Contests in local Carnivals frequently write to ask for advice in regard to the design and construction of suitable costumes to represent Meccano. The above photograph shows a particularly clever effort by A. J. Huckell of Willingham, Cambs., from which many useful ideas may be gained

India, too, has a number of well-established clubs running on sound lines. In many respects the organisation and methods of these clubs differ from those of Australasia or South Africa, but the successful results obtained show that matters are being conducted on the best lines to suit local conditions. There are good prospects of other clubs being formed before long and the future of the Guild movement in India seems assured.

Canada, after apparently hesitating a good deal, has now broken the ice, and club development is only a matter of time. It is probable that no Meccano club in the world has greater enthusiasm for model-building than the Manitoba M.C. Members of this club take their model-building very seriously, and in consequence obtain really first-class results.

I have not space this month to refer individually to clubs in other parts of the world, including South America and Egypt, but I hope to deal with these on a future occasion.

Coming nearer home, France has a steadily increasing number of flourishing clubs to which I intend to refer later. There are also clubs in Belgium and Italy, and prospects of others being formed in various countries, including Norway, where enthusiasm for Meccano is steadily growing.

Lone Members

I still receive a considerable number of letters from boys living in remote places expressing regret that they are unable to join the Guild because there is no club in their vicinity. This idea is, of course, entirely without foundation, for any boy who possesses a Meccano Outfit or a Hornby Train Set may join the Guild, even though he may be living hundreds of miles away from the nearest Meccano Club, as is the case with many overseas members. Such boys are known as "lone members," but they are just as much members of the Guild as if they belonged to a Meccano Club.

I should also like to make it clear that the Special Merit Medallion is not confined to members of clubs but may be won by lone members who do work of real value for the Guild.

Proposed Clubs

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

WEST HARTLEPOOL—E. Dickinson, 70, Arncliffe Gardens, West Hartlepool.

HAMILTON, NEW ZEALAND—B. C. F. Haverbier, Mahoe Street, Hamilton, N.Z.

WEALDSTONE—J. Skoyles, 28, Aberdeen Road, Wealdstone Middx.

ENDCLIFFE—Kenneth Stacey, 157, Rustlings Road, Endcliffe, Sheffield.

WINCHCOMBE—Charles V. Heath, North Street, Winchcombe, Glos.

GRANGETOWN—Eddie Pezzack, 11, Sevenoak Street, Grangetown, Cardiff.

NORTHENDEN—Frank Leigh, Myrtle Croft, Sale Road, Northenden.

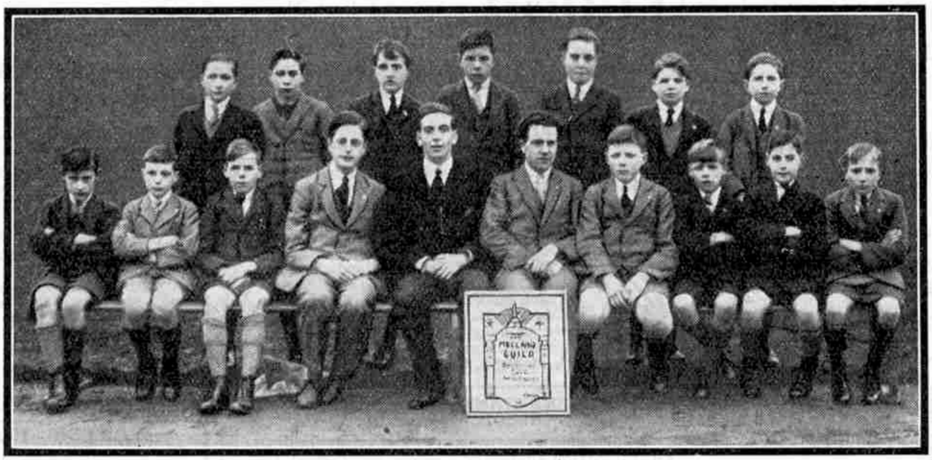
CLUB NOTES

Ilfracombe M.C.—Model-building continues to be very popular. Marks are given for each model and the member who has the highest total of marks for attendance and model-building is awarded a prize at the end of the session. Mr. Annear gave a very interesting Lecture on "*Canals and Waterways*" which was greatly enjoyed. Members have been practising for a concert. Club roll: 35. *Secretary*: R. Trawin, 33, Victoria Road, Ilfracombe.

Annan M.C.—A Cycling Section has been formed and now consists of eight members. Meetings continue to be well attended and there is no falling off in enthusiasm for Model-building. An interesting Lecture was given recently by Mr. Lusk on "*The Eclipse of the Sun.*" Club roll: 18. *Secretary*: Oswald Gibbs, 6, Addison Place, Annan.

Royal Grammar School (High Wycombe) M.C.—A lecture on "*Travel*" by Mr. A. S. Watts was greatly enjoyed. Mr. Watts has travelled to Central Africa, Palestine and Egypt, and his collection of slides is very fine. One slide that aroused particular enthusiasm depicted a tiger prowling around the camp! A Concert organised by several members was noteworthy for a band composed of piano, drums, violin, jazz outfit and paper and combs, together with the energetic assistance of about 70 voices! A party of 30 paid a visit to the Natural History Museum, South Kensington, and it has been proposed to visit the Science Museum next term. Interesting Lectures have been given by Mr. R. C. Rolph on "*Norway*," illustrated by about 50 slides made by himself; by the secretary on "*Bees*;" by — Chapman on "*The Microscope*" and by F. W. Kemp on "*Electricity*." Club roll: 120. *Secretary*: H. R. Foden, "Taviuni," Copthall Lane, Chalfont St. Peter, Bucks.

Harrogate and District M.C.



The above photograph shows a group of members of the Harrogate and District Meccano Club. This club was formed in January 1925 by Mr. C. Crausaz, under whose enthusiastic Leadership it has made steady progress. Exhibitions of models have been a feature of the club syllabus and have attracted many visitors and raised quite useful sums for club funds

Rhos-on-SeaCollege M.C.—This recently affiliated club is making good progress and has now been divided into two sections. The club is on friendly terms with Rhos M.C. and it is hoped to arrange many meetings in the future. A football match has already been played between the two clubs, Rhos beating the College. It is hoped to introduce a club Magazine shortly, and Nature Rambles are to be arranged. This club is for boarders only. Club roll: 14. *Secretary*: B. G. Woodcliffe, Rhos-on-Sea College, Colwyn Bay.

Pendleton M.C.—The attendance continues to be good and new members are enrolled at almost every meeting. Many excellent models have been built recently, including the Eiffel Tower and a Funicular Railway. Meetings will be continued during the summer but a definite programme has not yet been arranged. Club roll: 62. *Secretary*: E. Gibson, 20, Grosvenor Place, Cross Lane, Salford.

Hessle M.C.—The old club room has now been repaired and members are glad to be back again in their old quarters. A meeting is to be held shortly to make arrangements for the summer Camp. Stamp Collecting is a very popular feature and the Library is in constant use. Chapel officials are taking a practical and increasing interest in the work of the club. Club roll: 19. *Secretary*: T. A. Fillingham, "Red Lea," Marlbro' Avenue, Hessle.

Selkirk M.C.—Meetings are held fortnightly and good progress is reported. The secretary recently exhibited and explained a model crane fitted with an electro-magnet for lifting purposes, and his demonstration aroused keen interest. On a recent Hornby Night a large model railway was laid down, incorporating many good models of a Foot-bridge, Signals, etc. Club roll: 14. *Secretary*: W. Lake, 29, South Port, Selkirk.

Marsh Street, Conway M.C.—A Musical Evening proved an outstanding success. The programme included piano, violin and flute solos, and the secretary recited a humorous poem entitled "*My Word, You Do Look Queer!*" An interesting and novel evening consisted of an imaginary tour of the world made by all the members, during which at each port of call members related all they knew about that particular place. Club roll: 65. *Secretary*: W. O. Knight, 22, Howard Road, Walthamstow, London, E.17.

Westbury M.C.—Interesting papers have been written by various members. A Lantern Lecture entitled "*One Hundred Years of Railways*" was greatly enjoyed and members were keenly interested in all they saw on the occasion of a visit to the Phœnix Motor Works. Club roll: 19. *Secretary*: Eric Moye, 24, Burnell Rise, Letchworth, Herts.

Northwood M.C.—Good progress is reported, but new members are required. A small club-room has been secured. Any boys in the district interested in the club should communicate with W. T. Carey, 30, Chester Road, Northwood, Middlesex.

Crowle M.C.—Meetings are held in North Street on Friday evenings and steady progress is being made. The programme at present is mainly devoted to Model-building, various Competitions, Radio and Games. Preparations are being made fora Dramatic Evening. Cycle Tours and Rambles are arranged for the summer months and the question of holding a Camp is being discussed. Club roll: 14. *Secretary*: Morris Boardman, North Street, Crowle, Scunthorpe.

Sittingbourne Baptist M.C.—A Hornby train purchased out of club funds has aroused great interest. A Contractors' Night proved extremely successful, the task being to build a bridge between two tables. Games Nights are very popular and Cycle Tours are being arranged. *Secretary*: D. L. G. Thorne, "The Anchorage," Addington Road, Sittingbourne, Kent.

Haslingden Secondary School M.C.—Some of the members of Holy Trinity (Blackburn) M.C. visited this club and a debate was held on the subject "*Will Electricity be of Greater Service than Gas to the Civilisation of the Future?*" Refreshments were served afterwards and a most enjoyable evening was spent. It is hoped to arrange Draughts and Table Tennis matches between the two clubs. On another occasion "*The Story of our Ships,*" loaned from Headquarters, was read and was greatly enjoyed. A Mammoth Crane was the winning model in a recent Model-building Competition. Club roll: 36. *Secretary*: Kenneth Tupling, 16, Alexandra Terrace, Haslingden, Rossendale, Lancs.

Kettering M.C.—Rapid progress is being made and the membership has increased to fourteen. An adult Leader has not yet been appointed. An Exhibition is under consideration. Most of the club members are joining the Guild. *Secretary*: A. Taverner, 39, Broadway, Kettering.

Central Hackney M.C.—Recruiting has been carried on vigorously and with good results. Hornby Trains are a popular feature on Club Nights and some portion of the meeting is always devoted to them. The recent Exhibition was very successful. Many good models were on show and a Motor Chassis loaned from Headquarters drew a large number of admirers. Saturday afternoon outings are a great attraction and the summer programme includes also Swimming and Cycling. New members will be made very welcome. Club roll: 36. *Secretary*: H. Michel, 49, Middleton Road, Dalston, London, E.8.

Australia

Hampton M.C.—A suitable club room has now been found and the club is now divided into two sections named respectively "Locos" and "Tenders," and marks are given in each section for attendance. A Drawing Night proved a great success, drawings of engines, motor cars, aeroplanes and ships being shown. At a Visitor's Night recently organised Games were played and Blindfold Boxing caused great amusement. Blindfold Model-building also aroused great interest. It is hoped shortly to visit the Victorian Railways Workshop at Newport and a FootballTeam is under consideration. Club Roll: 15. *Secretary*: F. G. Wallis, 9, Kereford Street, Hampton, Victoria, Australia.

Italy

Siena M.C.—Members have been building a large model of a Switchback Railway and photographs of it are to be sent to Headquarters shortly. A play is now being rehearsed and promises to be successful. A Cycling Section is to be opened shortly and the Cricket Section is full of enthusiasm. *Secretary*: Valentino Bruchi, 39, Via Ricasoli, Siena.

Clubs not yet Affiliated

Worthing M.C.—The secretary reports that good headway is being made. A recent Social Evening proved very successful. Every member was invited to bring a friend, and refreshments were provided by Mrs. Knowles, who is the club treasurer. The summer programme is under consideration. *Secretary*: R. Knowles, "Shanklin," St. Thomas' Road, Worthing.

Wick M.C.—Meetings are largely devoted to Model-building. In a recent competition each member had to build a Swivelling Crane, the time allowed being 1½ hours and the prize a Fretwork Set given by the secretary. It is proposed to hold a summer camp, and Cycle Runs and visits to places of interest have been arranged. *Secretary*: Dan. Sutherland, 5, Lower Dunbar Street, Wick, N.B.

Bolton M.C.—Progress is being seriously hampered by failure to obtain a suitable club room. A Leader also is urgently needed and members would be glad of any assistance in either of these directions. *Secretary*: Hubert Henshaw, 149, Clarence Street, Bolton, Lancs.

Stoke and Newcastle M.C.—Has been formed by Mr. E. O. Wayte, and considerable progress has been made. A club room has been kindly provided by Messrs. Wayte Bros., and meetings are to be held weekly during the summer. Intending members should write to the Secretary, P. L. Taylor, 5, Poolfield Avenue, Newcastle, Staffs.

FINE PACKETS

The best way of adding to your collection is to BUY GOOD PACKETS.

Gibbons Packets are best of all.

WHOLE WORLD

100 diff. 6d.	300 diff. 1/6	600 diff. 4/6
200 diff. 1/-	500 diff. 3/6	750 diff. 7/-
	1,000 diff. 10/6	

BR. EMPIRE ONLY (No. G.B.)

100 diff. 1/3	300 diff. 8/6	600 diff. 30/-
200 diff. 3/6	400 diff. 14/-	750 diff. 45/-
250 diff. 6/-	500 diff. 21/-	1000 diff. 80/-

Ask for a Gibbons Approval Sheet—THE BEST.

STANLEY GIBBONS LTD.
DEPT. S.15., 391 STRAND, LONDON, W.C.2.

FREE Set of 12

FRENCH COLONIES

For 30 days (Colonies 60 days) we present this gift **Gratis** to every Stamp Collector sending **1½d.** (the cost of postage)—Abroad **2½d.** Only one gift allowed to each applicant, and cost of postage must be sent.

☞ **Important. Now Ready. 43rd Edition, 1927. Illustrated Catalogue and Guide to Stamp Collecting.**

Over 100 pages. Full of information and bargains.

Post Free, 6d. We present free with our Catalogue a set of 10 new Mozambique stamps (all pictorial).

ESTABLISHED 1880.

ERRINGTON & MARTIN LTD.
LONDON, E.9.

PACKETS (Postage extra)

25 N. America	3d.	100 S. America	1/6
50 ,,	7d.	125 ,,	2/6
75 ,,	1/-	150 ,,	4/-
100 ,,	1/6	25 W. Indies	6d.
125 ,,	2/6	50 ,,	1/2
150 ,,	4/-	75 ,,	2/-
25 C. America	1/3	100 ,,	3/-
50 ,,	2/3	125 ,,	4/6
75 ,,	2/3	150 ,,	7/-
100 ,,	3/6	14 French Col.	2d.
125 ,,	5/-	20 ,,	3d.
150 ,,	7/-	25 ,,	4d.
25 S. America	3d.	30 ,,	5d.
50 ,,	7d.	35 ,,	6d.
75 ,,	1/-	50 ,,	9d.

Sheets of Postage or Fiscal in separate countries.

J. RUSSELL
Chetwynd, Shanklin Drive, Westcliff-on-Sea.

13 Mozambique Company Free.

To all sending 2d. (Overseas 3d.) for postage of my new 64-page Price List of Packets and Sets from 1d. up, Albums from 1/- to £4, Books about stamps from 6d. up, Outfits and Accessories of all kinds, fully illustrated, will be sent the above 13 different Mozambique Company stamps. This is a beautiful set, mostly in two colours, and depicts East African Natives, Ivory, Tobacco, Cotton, Coffee and Maize crops, View of the Port of Beira, Native Village, Coat of Arms with Elephant Supporters, etc. Ask for the No. 2 Packet, and don't forget the Postage. In addition, for RESPONSIBLE approval applicants only, 2 TRINIDAD (large stamps) FREE.

THIS IS A SNIP—ONLY ONE PACKET TO EACH APPLICANT.

If you don't want the Packet, send a postcard for the Price List.—You want that.

EDWARD SANDELL, 10-11, FETTER LANE, LONDON, E.C.4.

100 DIFFERENT STAMPS SET 20 DIFFERENT BRITISH COLONIALS AND SET 100 GUMMED ALBUM HEADINGS FREE!!

EXTRAORDINARY STAMP OFFER 100 different stamps, which include many War, over 40 fine unused. Peace and interesting overprinted stamps. A further fine set of 20 different British Colonials, and the used set 100 printed and gummed album headings. The whole parcel absolutely free. (Collections purchased). Just send P.C. requesting our famous approvals.

LISBURN & TOWNSEND, LONDON ROAD, LIVERPOOL

"1000 PACKET" A Wonderful Offer for 4½D.

The "1000 Packet" contains 500 excellently assorted stamps, a **COMPLETE SHEET OF 100 UNUSED** (very useful for exchanging), a neat booklet (12 pages) for holding duplicates, **25 British Colonials,** usually sold at ½d.—1d. each, including new and obsolete issues, 375 Magic "Strip" Mounts which are three times as quick as the old-fashioned single ones, and my price list of stamp bargains. In addition FREE Sets will be sent to those who send names and addresses of stamp collecting friends.

Postage 2½d. extra.
Abroad 6d. ex.

WATKINS (M. Dept.), GRANVILLE ROAD, BARNET, HERTS.

Free! 50 Different British Colonials

This wonderful **gift** packet contains 2 Jamaica (pictorial), 5 Australia, 1 Malay (tiger), 10 Canada, 1 Cochin (rajah), 1 Deccan, 4 Ceylon, 1 Gold Coast, 1 Nigeria, 1 Travencore, 4 New Zealand, 1 Queensland, 1 Straits, 5 Union South Africa (including new issue), 9 Irish (set with high values). ABSOLUTELY FREE TO GENUINE COLLECTORS REQUESTING APPROVALS. Also those sending 3d. for postage, etc., receive fine set of 100 unused German, all different.

SPECIAL OFFERS.—50 diff. French Colonials, 7d.; 100 diff. 1/6; 50 diff. Portuguese Colonials, 7d.

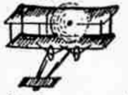
J. BURTON, 31, Onslow Road, Fairfield, LIVERPOOL

FOUND in a "DIAMOND" PACKET: FRANCE 1870, 80c., catalogued by Stanley Gibbons at £2

Many Rare Stamps have been found by purchasers of **THE "DIAMOND" PACKET** which is guaranteed to contain **1,000 Unsorted Stamps** from Convents abroad. 1 packet 1/3, 2 packets 2/5, 3 packets 3/6, 4 packets 4/6, 5 packets 5/6. All post free. (Abroad 3d. per packet extra.)

O. NERUSH, IMPORTER (DEPT. E), 2-22, CATHCART HILL, LONDON, N.19

The "AERO" PACKET 4½d. Post Free



18 Airpost and Triangular Stamps FREE to purchasers of the Aero Packet who ask to see approval sheets. Packet contains good class stamps only. New issues of **Liban, Syria, Niger, Poland, China** (famine stamp), Pictorials of **Newfoundland, Ecuador and Mozambique, etc.** FREE with each packet 18 AIRPOST aeroplane design and triangular stamps. Satisfaction guaranteed or money returned. Send names of stamp collecting friends and receive an extra set free.

H. C. WATKINS, M. Dept., Granville Road, BARNET.

---

500 DIFFERENT STAMPS, 1/6; 1,000, 3/6.—F. Gibbins, 6, Montpellier Road, Exmouth, Devon.

FREE. Stamp Album and Stamps. Just request Approvals.—Mercer, 1, Sweden Grove, Waterloo, Liverpool.

---

50 CLEANED STAMPS FREE. Send for 1d. and ½d. Approvals.—Miss Williamson, 18, Victoria Park, Dover.

---

20 Different Free including German Airpost Stamp. Request approvals.—R. Laven, Bank House, Bailieboro.

---

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

STAMP Bonus with my ½d. approvals.—S. R. Catt, 20, Brunswick Road, Ipswich.

CLEARING STAMPS, 50 for 1/-. Enclose stamped envelope. Strand Album, 500 Stamps. 10/-.—Fogg, Mottram Old Road, Stalybridge.

EASTERN PACKET FREE.—Containing stamps from **China, Japan, Hong Kong, Malay, Ceylon, India.** In all 100 different stamps to all applicants for my famous ½d. stamps on approval. Without approvals this packet may be had for 6d.—S. H. Fleming, St. Winifreds, Christleton Road, Chester.

---

1 AFGHANISTAN

or 50 different British Colonials, sent FREE to all applicants applying for approval sheets, and sending 2½d. for postage, etc. 50 French Colonial, 7d.; 10 Trinidad, 10d.—Harcourt, 70, Clifton Road, Darlington.

100 DIFFERENT STAMPS FREE

to applicants for approvals who enclose 1½d. postage. Many Stamps at 1/12th Catalogue Price.

E. J. DAVIES,
3, Clapton Road, Meadows, Nottingham.

SHANGHAI PACKET FREE

A grand packet of **25 Different Stamps** containing **Shanghai** 1893, 5c unused, a very fine stamp, **Soruth** Indian Native State, 1923, 3 pies unused, **Morocco** King George 5c unused, **Albania 1926,** 1 qind, **Japan Earthquake** 1924, **Ruanda-Urundi** surcharged on **Belgian Congo,** a fine **set of 4 French Equatorial Africa** surcharged on **Gaboon, Middle Congo, Oubangui** and **Tchad, Monaco** 1925, **Angola** 1914 unused, **New Caledonia** pictorial, **Madagascar** pictorial, **Niger Territory,** pictorial, etc., etc., free to all asking to see my famous approval sheets and enclosing **2d. for postage and packing** (**abroad 3d**).

S. HAMMOND, 2, Chesham Fields, BURY.
Stamp Collections Purchased.

WANTED—1000 APPLICANTS

For my **outstanding** Approval Books and Sets of Fine Stamps. **Every** genuine applicant will receive **Free** (abroad 4d.) a **superior gift** of the **NEW CANBERRA** (**Australia**) **STAMP,** celebrating the opening of the Federal Parliament. I have a fine list of long sets by countries, also packets. **Steal a march** on your friends in the summer. **Write Now** and **Reap Rightly.**

H. LINDSEY (**Dept. M.**),
27a, The Square, P.O. Box 10, St. Annes-on-Sea.

105 Free

incl. rare **LUXEMBURG** (new issue) mint, Venezuela, Saare, Portuguese Cols., etc. 40 unused. Magnificent gift to *genuine* applicants for my *cheap* high-class appros.

PORTER, 20, Sydner Road, Stoke Newington, N.

Scarce War Stamps Free

The **War** Packet contains scarce set **4 Canada War Tax,** scarce unused **Ceylon** overprinted **War Stamp, Malta** overprinted **War Tax,** scarce **Jamaica 1/- Queen Victoria,** also further **War, Surcharged** and other interesting stamps. In all **57 different.** Offered **Free** and **Post Free** to genuine applicants for **Half Price** approvals (Abroad 4d.) Mention **War** Packet.

HORACE MILLER & CO., Whitstable, Kent.

1,111 Try the Cheapest and Best 1,111

Method of adding to your collection. When you buy PACKETS you buy DUPLICATES. I will send you a book of 1,111 different stamps from which you may select any 100 for 3/-.

BUY ONLY THOSE YOU REQUIRE.

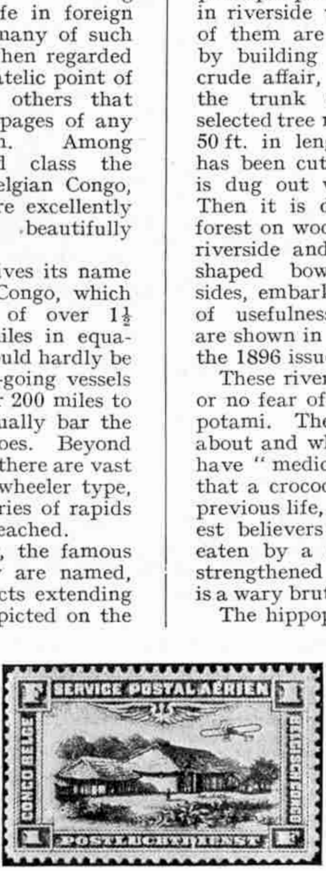
1,111 **H. HARDY,**
285, Archway Road, London, N.6. 1,111

THE BELGIAN CONGO AND ITS STAMPS

YOUNG collectors in their novitiate days almost invariably show a marked preference for stamps of exotic colouring and mysterious design. Scenes depicting life in foreign lands exercise a wonderful fascination, and while many of such stamps can only be deemed " common rubbish " when regarded from a strict philatelic point of view, there are others that would grace the pages of any collector's album. Among these we would class the stamps of the Belgian Congo, most of which are excellently engraved and beautifully printed.

The Congo derives its name from the River Congo, which drains an area of over 1½ million square miles in equatorial Africa, and is some 3,000 miles in length. It could hardly be termed a mighty river, for it is navigable to ocean-going vessels for only 100 miles from the sea. Above this for over 200 miles to Stanley Pool there are numerous rapids that effectually bar the progress of any save very small craft, such as canoes. Beyond Stanley Pool, up what is known as the Middle Congo, there are vast stretches, navigable to small steamers of the stern-wheeler type, which are separated from one another by further series of rapids until, 1,000 miles up, the famous Stanley Falls are reached.

These falls were first discovered by Dr. Stanley, the famous British explorer and missionary, after whom they are named, and they really consist of a series of falls or cataracts extending over a distance of 60 miles. These are the falls depicted on the 10c. stamp of the 1895 issue, which we illustrate here. The actual falls shown have a drop of only 6ft., the river at this point being slightly wider than the Thames at London Bridge. We also show the 50c. stamp of the same issue, in which the principal feature is the River M'pozo, a tributary of the Congo, which is crossed at the point illustrated by a railway bridge.



The Congo, or to give it its proper name, the Congo Free State, is a territory some 900,000 square miles in extent lying to the north of the River Congo. The inhabitants—and there are nearly 30,000,000 of them—are commonly termed savages, but, if the reports of many explorers are to be accepted, although their customs and habits are primitive there is little else that is savage in their make up. The population is split up into a large number of tribes, but no one tribe is predominant and none gives allegiance to another. There is thus no political unity, and in fact the chief who bears the name " King of the Congo " has very little more prestige than a dozen other local chieftains.

Each town or village has its own " headman " who, in our own country, would be ranked as an hereditary mayor, for the office descends from father to son. He possesses no despotic power and with his assembly of " *macotas,*" or counsellors, manages the local affairs. The number of villages is very considerable, and these usually are composed of collections of ordinary flimsy huts built chiefly of mats woven from a reedy grass or the fibres of plants. The chief's house is a slightly more substantial construction but rarely possesses more than two apartments.

The natives are a comparatively peaceful people, chiefly distinguished by their indolence. Agriculture is the principal pursuit of those who do work, although the men residing in riverside villages are expert watermen and fishermen. Many of them are experts in " shipbuilding " and make their living by building canoes for other villages. The native canoe is a crude affair, being built from the trunk of a tree. The selected tree may be as much as 50 ft. in length, and after it has been cut down the centre is dug out with small adzes. Then it is dragged from the forest on wooden rollers to the riverside and, with a slightly shaped bow and flattened sides, embarks upon its career of usefulness. These canoes are shown in the 40c. stamp of the 1896 issue, and it will be seen that they are quite large boats.

These riverside natives are simple in their faith and have little or no fear of such denizens of the water as crocodiles and hippopotami. They will enter the water fearlessly when crocodiles are about and when questioned on the subject will declare that they have " medicine " against them ! Others quite stoutly maintain that a crocodile will never attack a man unless the beast, in its previous life, was a witch ! It is on record that one of the staunchest believers in this superstition was subsequently caught and eaten by a crocodile. His theory, strangely enough, was only strengthened among his comrades ! Nevertheless, the crocodile is a wary brute and will very rarely attack unless his victim is alone.

The hippopotamus is feared much more greatly, although hippo shooting is considered among the least dangerous of sports by big game hunters. Usually the hippo is hunted from a canoe and the crews are carefully selected men who are accustomed to this clumsy animal's manœuvres. A hippo when wounded becomes vicious and will sink and make for the canoe under water with the idea of coming up underneath and capsizing the craft. Consequently the crew watch closely for the trail of bubbles that indicates the animal's movements, and draw slowly ahead. Then, as the hippo comes up and throws itself out of the water in its efforts to capsize its assailants, it almost invariably presents an exceedingly good target.

On one occasion when a canoe was making for a sand bank on which some hippos were basking in the sun, it ran over one that had been under water and was just coming up for air. Catching the canoe with its head the hippo sent it flying into the air, throwing the steerer and two of the paddlers into the water. The animal must have been considerably more scared than its victims, however, for it promptly made off to safety !

As is to be expected in a land that still remains in a very primitive condition, really big game abounds. Elephants, lions, tigers and gorillas are common, and the Congo is one of the only two African territories in which the white rhinoceros can be found. The whale-headed stork and the giraffe are also found here. The natives themselves for some hundreds of years past have realised the value of ivory, and elephant hunting is one of their principal operations. The 1 franc stamp of the 1894 issue shows an elephant hunt in progress. The most popular form of hunt adopted by the natives is to form a large half-circle round a herd of the beasts

(*Continued on page* 653)

GAMAGES

THE STORE THAT SPECIALISES IN BOYS' WANTS

Now that July is here, and the approach of the Holidays, the question of "How to Spend My Holiday" is very quickly solved by Gamages. There are thousands of suggestions from this famous Holborn Boys' Store, but the main subjects of interest for the modern boy are featured on this page; if it is impossible to call at Gamages, write and tell us about your requirements and we will send you full particulars of your wants.

TAKE UP CHEMISTRY

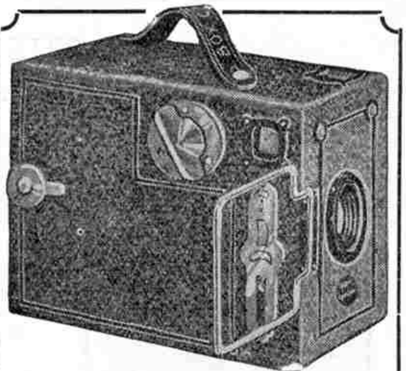
A fine Hobby for the wet evenings and one of which you will not quickly tire. It is amusing, interesting, and very educational. The modern schoolboy will find it extremely useful for improving his knowledge. You have a choice of a large range of outfits if you come to GAMAGES. Post 6d. **5/6**

Other Sets **3/3, 14/6, 32/6, 52/-**

TRY A CAMPING HOLIDAY THIS YEAR

and you can't do better than to get this Tent. Made of Green Rotproof Special Lightweight Material, absolutely waterproof, Jointed Poles, Packed complete in valise including ropes, pegs, mallet, etc. Size 6×5×4 Price **30/-**

Will sleep 2 adults or 3 to 4 boys.



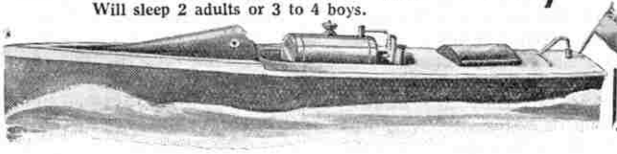
PHOTOGRAPHY IS A SPLENDID HOBBY

This is the most popular of all Roll Film Cameras. Simple in operation and certain in results. These cameras are fitted with the direct vision wire view-finder, which very greatly simplifies accurate picture making.

CONSTRUCTIONAL DETAILS.

Solid constructed body, covered with black leatherette, fixed focus, nickel-plated and black fittings, silent winder, easy loading, Reflex and direct view-finders. Real Periscopic lens, 3 stops. Everset Time and Instantaneous shutter, leather handle. Instruction book. No. 2¼B, for pictures 2¼ × 3¼ (6×9 cm.) Price **12/6**

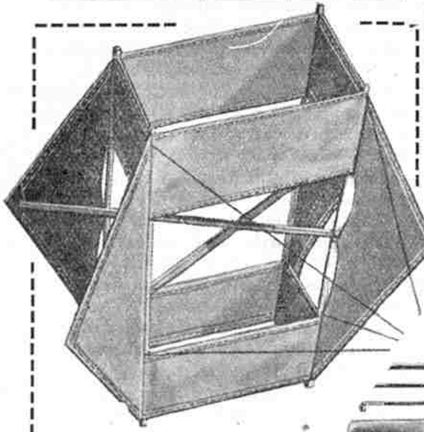
Films **1/2** each. Any make. Post free.



THE FAMOUS MOTOR HYDROPLANE "MAPLE LEAF V."

The hull is constructed of selected yellow pine and has mahogany spray hood and deck fittings, brass rudder, tiller and rack, and strong wire guard to protect the brass propeller. Enamelled in a beautiful shade of green, the hood, deck and fittings being varnished. 26 in. long. Fitted steam engine and boiler. "Maple Leaf V." will run for 30 minutes and cover a long distance. Post free. Price **22/6**

WE STOCK ALL "MECCANO" AND HORNBY TRAIN PARTS



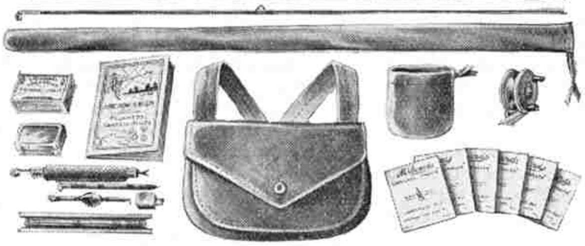
KITE FLYING IS NO CHILD'S PLAY

Try your skill with the famous

QUADROPLANE

The finest of all Kites for attaining great heights. It is well and strongly made and stands 29" high. Post 6d. Price **3/6**

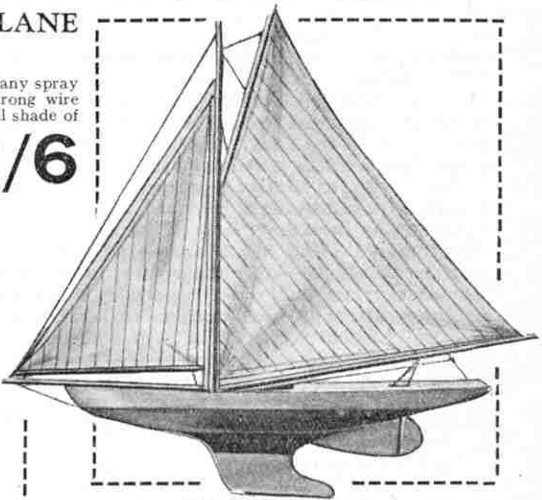
32" high ... ... Price **4/6**
35" high ... ... " **5/11**
Post 6d.
38" high ... ... Price **7/6**
Post free.



FOR THE BUDDING ANGLER

GAMAGES COMPLETE FISHING OUTFIT

Fishing's a splendid sport. With the set illustrated above. Complete in box. Each box contains 8 ft. 3 joint rod with rings and reel fittings. Reel, Lines, Floats, Gut Casts, Ledger, 7 Hooks to Gut, Plummet, Split Shot, Disgorger, Haversack, Worm Bag, Bait, and Book on "How to Begin." Price complete **21/-**



Get THIS Splendid

MODEL RACING YACHT

(4-Rater Type)

These Yachts are beautifully finished, and the Rigging, Sails, etc., are arranged so that they may be adjusted as speedily as possible, which is very necessary when racing. The 30 ins. and upwards are painted in two colours, and have Automatic Steering Gear.

15 ins. **19/9** 18 ins. **27/6** 21 ins. **35/-** 24 ins. long **48/6**
27 in. **62/-** 30 ins. **92/6** 38 ins. **£6/17/6** 46 ins. long **£10/-/-**

A. W. GAMAGE LTD., HOLBORN, LONDON, E.C. 1

CITY BRANCH:—107, CHEAPSIDE, LONDON, E.C. 2.

Stamp Collecting—*(continued from page 651)*

and, by the creation of a lot of noise, to drive them gradually toward prepared pits and stockades where they are captured with comparative ease.

The African elephant is not easy to track and in fact proves one of the most elusive of victims. Even when it is traced it is not an easy matter to bring it down with a gun, for its skull is extremely bony and has only one vital spot—between the eyes. When the beast is charging, as often it will when attacked, the aim must be at the heart and chest, and woe betide the unfortunate hunter who does not move very quickly after shooting at an infuriated elephant as it bears down upon him. The trunk of a stout tree is the only safe refuge.

The natives prize the hairs of an elephant's tail very highly and weave them into necklaces and girdles. Four hundred years ago 50 such hairs were considered worth 1,000 Portuguese reis (£10), while a complete tail was worth two or three slaves. The native hunter's modus operandi is to drive the elephant up a narrow and steep defile in which the animal becomes so placed that it can no longer go forward, neither can it turn back. Then it is a comparatively simple matter to pick out the required spoils.

In many parts of the Congo the natives are highly superstitious and some exceedingly queer customs still prevail. One of these, a "trial by ordeal," known as *molomba*, still persists in trials where the evidence is insufficient to justify a straightforward conviction. The trial consists of the heating of a kind of hatchet in a fire until it is red hot, then the *gangamokisso*, or priest, draws it across the skin of the accused without touching. If there are two prisoners, their legs are tied close together and the instrument is drawn between them. Should either be burnt he is condemned, but otherwise he goes free.

Despite the general laziness of the natives, many old industries still thrive in remote villages and our illustrations show two examples of this. The 75c. and 1 franc stamps of the 1923 issue show respectively a weaver and a potter at work, and one really must marvel at the extraordinarily fine quality of the work produced. Particularly in pottery are the workmen adept and some of their wares are exceedingly handsome. It is hard to realise sometimes that the articles have not been turned on the wheel, so round and even are they. Suitable clay is fairly common in all parts of the Congo and in some districts an almost pure pipeclay is found.

The natives have no idea of a potter's wheel, but instead they place a piece of calabash under the lump of clay to make it turn freely, and slowly but deftly turn it by hand. The process roughly is as follows. Having roughly moulded a vessel with the calabash, it is put in the sun to dry while another piece of clay is shaped. When the second article is ready for drying, the first one is further worked, and so on until all the articles are so far dry that the stalk on the stand with which they are made can be cut off and the bottom finished. The articles then remain in the sun for a further drying and when a sufficient number is ready the vessels are grouped around a fire and baked red hot. It is true that a lot of the heat is wasted, but the pots turned out are extremely serviceable.

The weaving process is equally crude, although a loom of sorts is used. The raw cotton grows in a semi-wild state in the jungle in bushes running to a height of 10 ft. or 12 ft. When the seed capsule bursts at maturity, white fluffy cotton hangs until it is gathered. The black seeds are picked out and swept to the edge of the jungle, there to grow again, while the cotton, after loosening, is spun on a distaff. A piece of wood a span long with a potato or a piece of manioc stuck on the end of a stick serves as a spindle, and in this manner the cotton is spun and sold in the market places as spun yarn. The yarn is woven on a frame, clearly shown on the stamp, and the principal articles made are hammocks, which are largely used by mothers to carry their children about. Elaborate and neat patterns are turned out, lines and squares, checks and triangles being done in black, white and yellow.

In a short article such as this it is impossible to deal with all the interesting features that are displayed upon the country's stamps. For example, on the 1923 issue, from which we have selected the weaver and the potter, there are shown also an archer, a basket-maker, a rope worker and a palm oil extractor.

There is much in the arts, customs and beliefs of Northern Congoland that recalls ancient Egypt. The elaborateness of the pottery and the beauty of tone of the musical instruments—features unknown to the rest of negroid Africa—are strangely suggestive of the glories of the Pharoahs, so much so, in fact, as to suggest that there was some kind of connection between the two countries in bygone ages.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with this article have been prepared.

The Inverted Swan

A reader recently wrote us asking the price of the Western Australian stamp on which the swan is shown upside down. The reader evidently referred to the famous 4d. blue of the 1854 issue and it was more in hope than faith that we suggested the stamp be sent to us for examination. Our reader, it transpired, was merely curious, but, as it happens, a copy of this stamp was put up for auction recently in London. This specimen had a minute tear under one letter, the blemish affecting its value to some degree. Unfortunately we are unable to state at the moment at what figure the stamp changed hands. Only nine copies are known to exist and the £1,000 mark was passed some years ago.

Seventh Stamp Contest

"My Favourite Stamp Countries"

In recent stamp contests readers have been asked to identify certain whole stamps, fragments of stamps, and inscriptions on stamps; they have been required to detect minute differences between various stamps that are to the casual eye precisely similar, and there has been one feature of the many thousands of entries to the contests that has particularly compelled our attention. The majority of the entrants to these contests compete regularly month by month and it is possible to detect from the ready facility with which many competitors have set about the task of telling what they know of certain stamps in a given competition, while at the same time displaying hesitancy in dealing with other stamps in the same contest, that those competitors have specialised in certain countries and have paid little attention to other countries. In short, those competitors have their favourite countries.

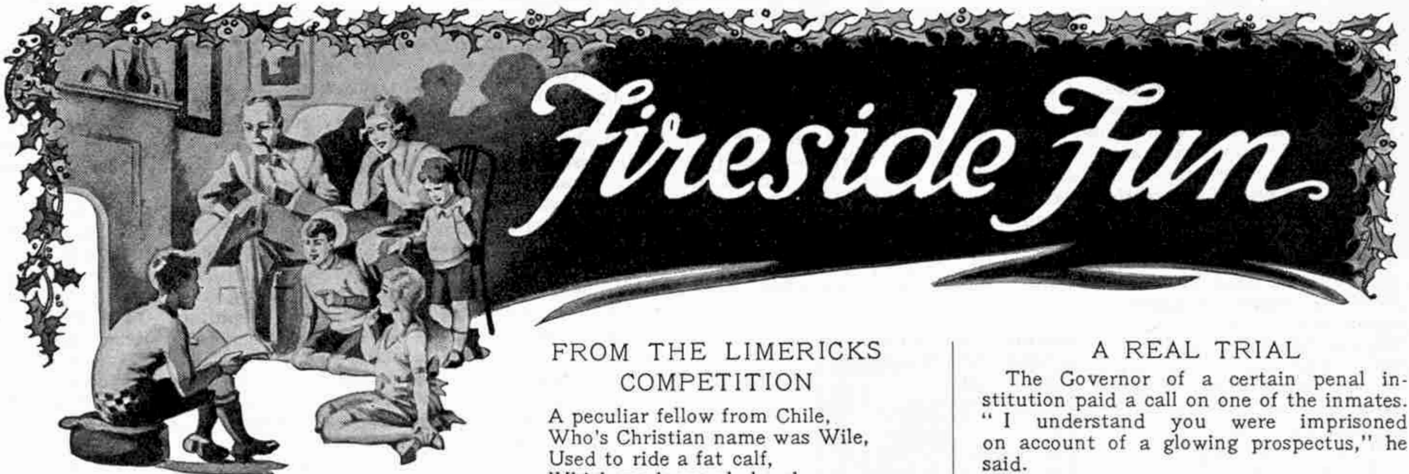
The study of the issues of a favourite country is one of the most fascinating branches of stamp collecting and it is with the object of discovering something of the stamps and countries in which our readers take special interest, that we entitle our stamp contest this month, "My Favourite Stamp Countries."

The majority of our readers probably come within the category "general collector" and, as such, have no special favourite. Nevertheless there must be some group of countries to which the general collector gives at least a small degree of special attention. It is for that reason that the title of the contest refers to "countries." No reader may deal with more than five countries in his entry, but in any event, to attempt more would be to court disaster, for all entries to the competition are limited to five hundred words. In that space readers are asked to give brief details of the stamp-issuing countries they specially favour, and their reasons for favouring those countries. The reason for selecting particular countries for special attention should be given in detail.

It is obvious that it is rarely mere chance that leads one to pay detailed attention to one of the many hundreds of countries that issue stamps. Possibly the first acquaintanceship was casual.

We know of one collector who took up collecting only a year ago and to-day possesses a collection of Dutch stamps that would be a credit to a collector of many years' standing. Pressed for a reason for specialising in the stamps of Holland, he diffidently explained that he was so impressed by the beauty of the engraving of a stamp of the Dutch 1924 issue that he determined to possess at least the complete set of that issue. Having achieved that, he has passed to a keen study of Dutch issues generally, and his case probably is typical of many.

Prizes of stamps value 10/6, 5/– and 2/6 will be awarded respectively to the entrants submitting the three best efforts and competitors must state on their entries the stamps they would wish to receive in the event of their being awarded a prize. The stamps selected must be chosen from the advertisements appearing in this issue. Entries must be written on one side of the paper only and sent to reach this office not later than 31st May, addressed to "7th Stamp Contest, Meccano Magazine, Binns Road, Liverpool."



Fireside Fun

ALL-ROUND SCHOLAR

He wanted to enlist. He was asked to read, but failed.

"What school did you attend," asked the recruiting officer.

"Sir," replied the recruit cheerfully. "I was three years—now and then—in the infants; six years—off and on—in the first standard, and two years—in and out—in the truant school."

* * * *

"Oi'll not work for that man Brown any more, on account of a remark he made to me to-day."

"What did he say to you?"

"He says: 'McBrady you're discharged.'"

* * * *

Weary Walker: "No, ma'am, I ain't dirty from choice. I'm bound by honour. I wrote a testimonial for a soapmaker once, and promised 'to use no other.'"

Mrs. Housekeep: "Well, why don't you use that?"

"Because, ma'am, that firm failed about five years ago!"

* * * *

HER MISTAKE

Old lady: "You can't be poor, my good man, if you wear spats."

Tramp: "Ma'am, these are suede boots with the bottoms worn off."

* * * *

Teacher (in grammar class): "Willie, please tell me what it is when I say 'I love, you love, he loves—'"

Willie: "That's one of them triangles where somebody gets shot."

FROM THE LIMERICKS COMPETITION

A peculiar fellow from Chile,
Who's Christian name was Wile,
Used to ride a fat calf,
Which made people laugh,
So decided to ride a small file.

* * * *

Ensign: "And you say you lost control of your car?"

Chief: "Yes. I couldn't keep up the instalments."

* * * *

Farmer (using telephone for first time): "Send me a bushel of oats."

Voice over the Wire: "Who are they for?"

Farmer: "Don't you be funny with me, my lad. They are for my horse."

* * * *

A MISUNDERSTANDING

A Scotsman paid his taxicab fare, and gave the driver a penny for a tip.

"What's this?" growled the driver, poising the penny and glaring at it in disgust.

"Ye're a sportsman," said the Scotsman, beaming at him—"Tails!"

* * * *

A TALL ONE

Soldier: "Yes, this knocker is a souvenir. One day I was knocking at a door in a French village, when a shell came along and blew the house away, leaving me this knocker in my hand."

* * * *

"Well, Charlie, did you enjoy your visit to the Isle of Wight last Easter?" said a young man to his acquaintance.

"Yes, thank you," was the reply, "I enjoyed myself very much, but it's a peculiar place."

"How is that?"

"Why, Tom, it has Needles you can't thread, Freshwater you can't drink, Cowes you can't milk, and Newport you can't bottle."

A REAL TRIAL

The Governor of a certain penal institution paid a call on one of the inmates. "I understand you were imprisoned on account of a glowing prospectus," he said.

"Yes," admitted the prisoner. "I was too optimistic."

"Well," continued the other, "the Home Office wants a report on conditions in this gaol, and I want you to write it."

* * * *

A party of tourists were motoring in Scotland and lost their way. Presently they found themselves on the outskirts of a good-sized city. Stopping the car, one of the party asked a boy the name of the town.

"I'll tell ye if ye gie me saxpence," replied the boy.

"Ah!" said the tourist, as he stepped back into the car. "Carry on, it's Aberdeen."

* * * *

Discerning child (who has heard some remarks by father): "Are you our new nurse?"

Nurse: "Yes, dear."

Child: "Well, then, I am one of those boys who can only be managed by kindness, so you had better get some sponge cakes and oranges at once."

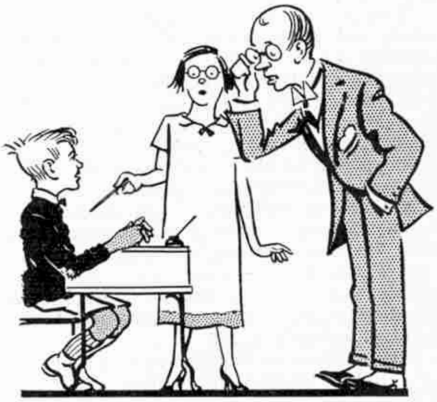
* * * *

Tramp: "Please, mum, I haven't a friend or relative in the world."

Housekeeper: "Well, I'm glad there's no one to worry over you in case you get hurt. Here, Tiger!"

* * * *

FULL OF HIS SUBJECT



The inspector was looking round the class, when the teacher called his attention to a rather grubby youngster.

"This boy," she said, "has an excellent knowledge of geography."

The inspector regarded the dingy one's nails for a space, and then remarked: "I see that. At least, he has a good deal of this country at his fingers' ends."

NO ROOM FOR TWO

A Scot went abroad on the chance of picking up a job, and in the course of his wanderings called at some works and interviewed the man in charge. After quite a satisfactory talk the latter inquired if his visitor was a Scot.

"Ay, and I am," was the proud reply.

"Ah, then I am sorry I cannot take you on."

"Michtie me!" demanded the Scot indignantly.

"Well, you see, some years ago the then manager engaged a Scot and within a year he got the manager's place."

"Then all I can say," came the disappointed rejoinder, "I wish that Scot was here yet."

"He is here, I'm him."

* *

First irate passenger (in crowded excursion train): "Do you mind taking your foot off mine?"

Second: "Certainly, if you'll take your pipe out of my mouth."

* *

Little Tommy, after his first visit to the village church, was asked how he enjoyed the service.

"It was very nice but you have no kneeling pads. Still, the old gentleman who sat in front of me was very kind, for he pushed his hat under the seat for me to use."

* *

Mike: "Sure and begorra, but I can't halt right."

Pat: "It's easy. All you've got to do is when the sergeant says 'Halt!' you bring the foot that's on the ground to the side of the foot that's in the air, and then remain motionless."

* * * *

SAFETY LAST

Some American Motoring Epitaphs.

Lies slumbering here one William Lake; he heard the bell but had no brake.

At 50 miles drove Allie Pidd; he thought he wouldn't skid, but did.

At 90 miles drove Eddie Shawn; the motor stopt; but "Ed" kept on.

Here he sleeps, one Johnny Fonker; he rounded a turn without a honker.

Down in the creek sleeps Jerry Bass; the bridge was narrow; he tried to pass.

Here lies the body of William Jay, who died maintaining his right-of-way.

Here's all what's left of Harry; at the railroad crossing he did not tarry.

John William Jones lies under this thistle; he didn't heed the choo-choo's whistle.

* * * *

Irish Physician (after examining injured man): "Two of the wounds are fatal, but you may recover from the other three!"

THAT SETTLED IT

A traveller rushed on to the platform and accosted the station-master: "When does the half-past five train leave?"

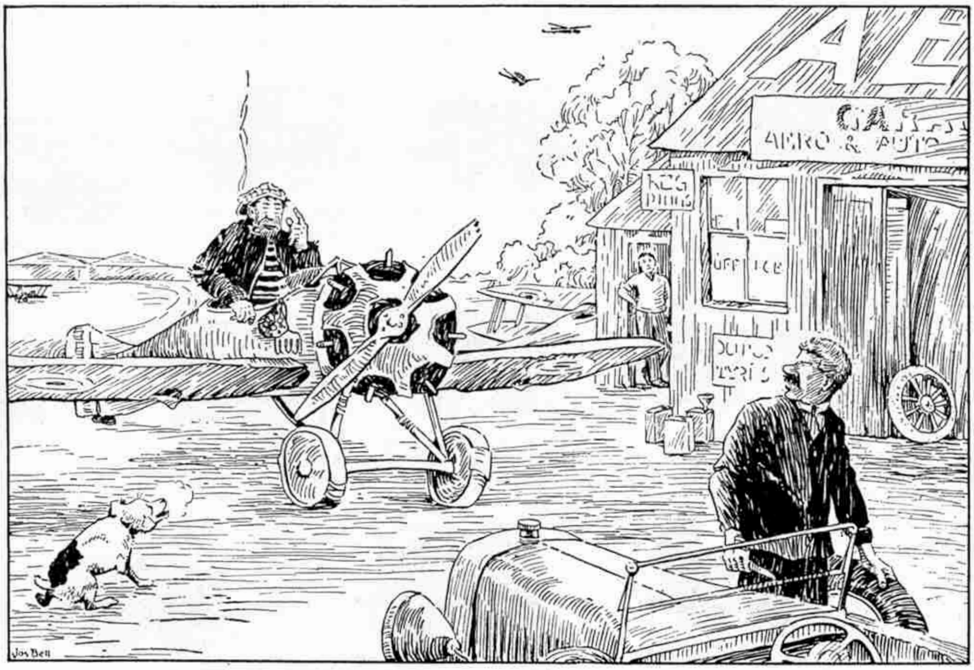
Station-master: "Five-thirty."

Passenger: "Well, the new church clock is twenty-seven minutes past, the post-office is twenty-five minutes past, and your clock is thirty-two minutes past. Now, in the name of goodness, what clock am I to go by?"

Station-master: "You can go by any clock you like, sir, but the train's gone."

* * * *

Q. What is the best form for a soldier?
A. A uniform.



Courtesy] [*Gloster Aircraft Co. Ltd.*

Will it come to this? Spare a bloke a drop of petrol, guvnor!

"Tommy," said his mother, "grandmother is very sick. Can't you go in and cheer her up?"

"Yes," said Tommy, and he went into the sick room. But in a few moments he came out disconsolate. "Couldn't, mother," he said, "she seemed to get worse."

"What did you say, dear?" asked the mother.

"Why, I asked her if she would like soldiers at her funeral."

* * * *

Elderly Movie Patron: "No, my dear, I never can remember what pictures I have seen. They go in one eye and out the other."

* * * *

"Albert," said the teacher to a pupil, "do you know what wind is?"

"Yes, ma'am," was the reply; "wind is air that's in a hurry."

* * * *

NOT QUITE

"Has he ever been on Government work before?" the manager asked the clerk about an applicant for a situation.

"Very nearly," was the answer.

"What do you mean?"

"Oh," said the clerk, "there wasn't enough evidence!"

"DOING" THE LODGER

The class had been having a lesson on laundry-work, and the teacher was questioning the girls concerning it. "What is the first thing to be done when the washing is finished?" she asked, but there was no response.

"Now come along," she said, "surely you know what your mother does when she has finished washing!"

There was a pause, then up spoke a bright-eyed youngster: "Please, teacher, she takes the handle off the wringer so as the lodger can't use it."

* * * *

While the Captain was taking kit inspection he noticed Private Brown had no toothbrush.

"Where's your toothbrush?" he demanded.

"Here, sir," said Private Brown, producing a large scrubbing brush.

"You don't mean to tell me you can get that thing into your mouth?"

"No sir," replied Brown without changing his expression. "I take my teeth out."

* *

Pat's letter to a friend: "I am sending you an overcoat, and I have taken off the heavy buttons to save postage. You will find them in the inner pocket!"

* * * *

BULLS

A clergyman took occasion to reprove some of his congregation for sleeping in church, and observed that it was one of those sins that people committed with their eyes open.

After a crowded service an old lady in church was heard to say: "If everybody else would only do as I do, and stay quietly in their seats till everyone had gone out, there would be no crush at the door."

An Irish Methodist clergyman, in an outburst against the Devil and all his works, consigned his Satanic majesty to "the bottom of the bottomless pit."

An Irish servant girl wrote home to her sister that the people she was with were so rich that their flannel petticoats were made of silk.

Here is another domestic "bull" worthy of a place in any collection: Mistress: "Why don't you keep the baby quiet, Kate?"

"I can't keep him quiet, ma'am, unless I let him make a noise."

The old churchyard notice must also find a place in this collection:

"No one buried here but those living in the parish."

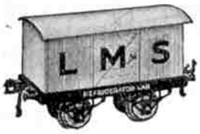
ROLLING STOCK AND ACCESSORIES

(HORNBY SERIES)

There are now 60 different train accessories—Stations, Signal-Cabins, Lamps, Wagons, Level-Crossings, Foot-Bridges, Turntables, etc. Further accessories will be added to the system from time to time, and will be announced in the pages of the *"M.M."*

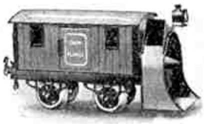
All Hornby Rolling Stock and Accessories are built in correct proportion to the size, gauge, method of coupling, etc., of the Hornby Trains and all have the uniformly beautiful finish that is the great feature of these trains. With these accessories you can build up a most realistic railway system, and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

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

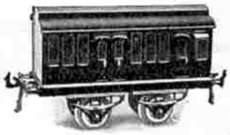


***REFRIGERATOR VAN**
Enamelled in white, with opening doors. Price **4/-**

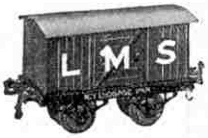
BRAKE VAN
Finished in grey, with opening doors. Price **4/-**



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



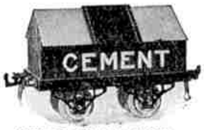
***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **3/6**



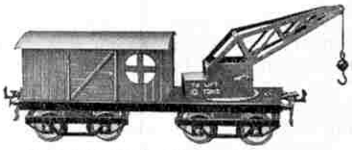
***No. 1 LUGGAGE VAN**
With opening doors. Price **4/-**

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

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

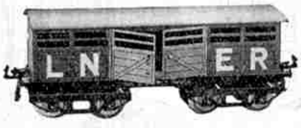


CEMENT WAGON
Finished in grey and black. Price **4/-**



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

SECCOTINE WAGON
Beautifully finished in blue, with opening doors. Price **4/-**

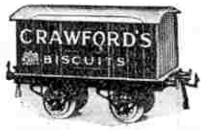


***No. 2 CATTLE TRUCK**
Splendid model fitted with double doors. Suitable for 2-ft. radius rails only ... ... Price **6/6**

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

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

ROTARY TIPPING WAGON
Finished in grey and green. Price **4/-**



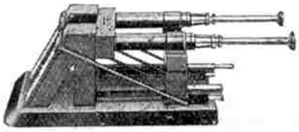
CRAWFORD'S BISCUIT-VAN
Finished in red, with opening doors ... Price **4/-**

CARR'S BISCUIT VAN
Finished in dark blue, with opening doors. Price **4/-**

JACOB'S BISCUIT VAN
Finished in crimson lake, with opening doors. Price **4/-**

***GUNPOWDER VAN**
Finished in red, with opening doors. Price **4/-**

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

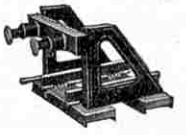


HYDRAULIC BUFFER STOP
Price **5/-**

PETROL TANK WAGON "SHELL"
Finished in red. Price **3/-**

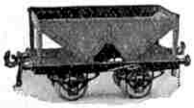
PETROL TANK WAGON "PRATTS"
Finished in green. Price **3/-**

MOTOR SPIRIT TANK WAGON "B.P."
Price **3/-**



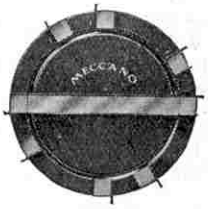
SPRING BUFFER STOP
Price **1/6**

***CRANE TRUCK**
Finished in grey and black ... Price **4/6**



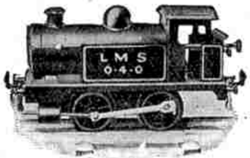
***HOPPER WAGON**
Mechanically unloaded. Finished in grey and black ... Price **4/-**

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

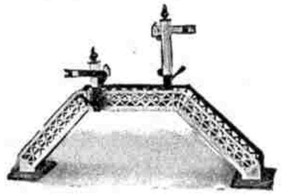


TURNTABLE
Price **5/-**

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



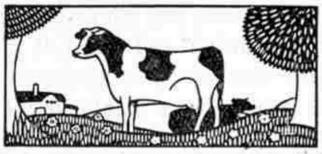
HORNBY No. 1 TANK LOCO
Gauge 0, in colours to represent L.M.S., L.N.E. or G.W. Railway Companies' locos. Price **12/6**



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

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

**Lettered L.M.S., L.N.E.R. or G.W.*



Oh, Look at the Lovely Cow!

When Dick got his new camera the first photograph he took was of a cow, which happened to be in his line of vision. The next was of an evening sunset. The third was of Baby Jane playing in the garden. The remainder even more ambitious still. When the spool was developed all the six negatives were perfect, in spite of the fact that cows have a habit of turning the head just as the shutter is being clicked; sunsets require a colour-sensitive film, and babies never do stop moving, anyway. But Dick was wise. He'd been advised to use Ilford Roll Film and he had done so! As you can see by the subjects he had chosen, it's the film which suits any picture you like to take.

The Film that never disappoints!

ILFORD ROLL FILM

The British Made Film in the Red Carton. In sizes to fit all Roll-Film Cameras. *From Photographic Dealers Everywhere.*

*Write for free booklet (illustrated) entitled "*The Lure of the Camera, or Timely Tips for Snapshots*" to Dept. M.M.

ILFORD, Limited, ILFORD, London, England.

Wormar Steam Engines for Meccano

NEW SUPERHEATED MODELS

Specially designed for Meccano, with standard drilled base (by kind permission of Messrs. Meccano Ltd.) the new improved Wormar engines offer the following advantages which are shared completely by no others, *regardless of price.*

BRITISH MADE

1. Meccano drilling. The only engine really suitable for building into any Meccano model.
2. The only seamless *brazed* boiler at the price. The usual soldered boilers leak if water boils dry.
3. Separate engine with solid steel frame—detachable steam union. Can be taken to pieces and re-assembled or run some distance from boiler (by adding extra steam tubing).
4. Superheated steam giving great power and speed. Double power of foreign engines and more than most British ones, even at higher prices.
5. Mods. E & C will take Meccano chain drive.

EXPERIENCE COUNTS

We have concentrated on Meccano steam engines. We know your needs. This unapproachable **5/11** *model is the result.*

Interesting booklet free

Three Models of Solid Brass and Steel only

Mod. D. Single Cyl. as illustrated. With filler. **5/11** Post 7d. extra.

Mod. E. Single Cyl. with geared drive and nickel plated finish. Post 9d. **10/6**

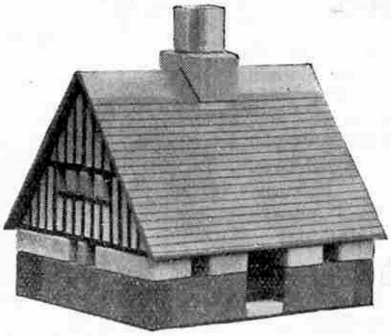
Mod. C. Twin Cyl. with geared drive and super finish. Post 9d. **15/6**

Of all Meccano Dealers or

WORBOYS & SMART
183, King St., LUTON

LOTT'S BRICKS

SOLID STONE BUILDING BRICKS



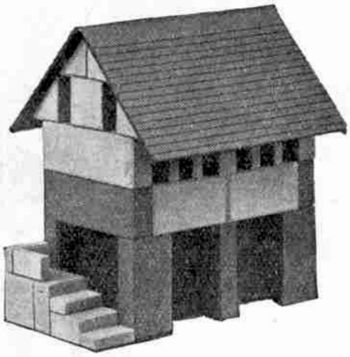
COTTAGE. Built with Box 1 Tudor Blocks, Price 3/6

Every boy can build Houses, Bridges, Railway Stations, Signal Boxes, Farm Buildings, etc., with a box of Lott's Bricks or Tudor Blocks. Buildings made with these bricks are ideal for use in every kind of model display. The cost too is moderate when compared with that of other methods of model building, and like real structures they are built in solid stone. Ask your dealer for particulars, to-day, or write for illustrated list to Lott's Bricks Ltd., Watford.

PRICES:

LOTT'S BRICKS. 30 models, 5/-; 48 models, 10/-; 70 models, 17/6; 100 models, 42/-

TUDOR BLOCKS at 3/6, 7/6, 21/- and 42/- per box.



SIGNAL BOX. Built with Box Oa. Price 3/3

SOME PROVINCIAL STOCKISTS:

Bexhill	Barker's Library & Stores Ltd.
Burslem	Wm. Shaw Ltd.
Bridgwater	W. Kitch.
Cardiff	Cross Bros. Ltd.
Dewsbury	Wigglesworth & Co.
Hove	M. & E. Bench.
Kettering	Lee & Co.
Leith	J. & W. Coltart.
Leeds	The Dolls' Hospital.
Manchester	H. Wiles Ltd.
Reading	Hill & Sons Ltd.
Ramsgate	Banwell & Young.
Reigate	J. W. Payne.
St. Leonards	Daniels & Co.
Wellingboro	Hordern & Sons.

SOME LONDON STOCKISTS:

John Barker & Co. Ltd., Selfridge & Co. Ltd., A. W. Gamage Ltd., Harrods Ltd., Hamleys Ltd. (Al Branches).

Palmers Stores Ltd., Hammersmith.
Grant Bros., Croydon.
Allders Ltd., Croydon.
Cuff & Co. Ltd. Woolwich.
A. J. Cornish, Thornton Heath.
Arding & Hobbs Ltd., Clapham Junction.
Bon Marche Ltd., Brixton.
Bentalls Ltd., Kingston-on-Thames.
Cyril Gardner, Golders Green.

LOTT'S BRICKS LTD., WATFORD, ENGLAND

Gwen—" What is he saying, Tom ?—I can't make it out."
Tom—"He says, 'S-E-C-C-O-T-I-N-E—S-T-I-C-K-S—E-V-E-R-Y-T-H-I-N-G.' "
Gwen—" Oh, the silly !—sure everybody knows that."

OF COURSE every Meccano boy who can use his hands knows all about Seccotine and what it can do but, beginning with the children, it is interesting to learn what faith other people have in the great Adhesive.

Two ladies occupied a seat on a Cambridge lawn, in sight of the great Chapel of King's College. One told to the other how she had taken a little boy into the Chapel, and as she pointed out to him the great height of the building—its walls so old, so high, and yet so strong,—the little fellow, impressed, said, "I wonder did they use Seccotine."

This is not an invented story. A third adult, stranger to the others, sitting on the same seat, knew something about Seccotine and its home, and reported the incident. It is an example of the grip that Seccotine has on the national mind, that, when a child is shown something remarkable for firmness of jointing, it associates Seccotine with the good work.

King's College Chapel, Cambridge, was not built with Seccotine, but its proved reliability in a wonderful variety of uses is sufficiently remarkable. It is not possible here to enumerate these uses,—mention can be made of only a few, widely differing.

Lord Kelvin, the great scientist, wrote of Seccotine : " I am glad to say I find it very useful for many ordinary purposes and for scientific models."

Messrs. Yarrow & Co. Ltd., Scotstoun, Glasgow, wrote : " We are pleased to say that we have used your Seccotine for lining steel lockers with canvas . . . and find it very satisfactory."

In yacht-building, also, Seccotine has been used successfully. Many will remember that, years ago, in one of the earlier races for the America Cup, Shamrock III. had her spinnaker boom broken in a severe gale. Seccotine was used to repair the damage. We give here a copy of letter sent us on the subject by Messrs. Cosens & Co. Ltd., Weymouth : " We are in receipt of your letter of 22nd inst. . . . We used Seccotine in the repairs to spinnaker boom of Shamrock III., the results being, as far as we can judge, quite satisfactory."

Here is the testimony of a well-known firm of opticians in Bristol : " We find Seccotine one of the most excellent adhesives we have ever tried."

Sold everywhere in pin-stoppered tubes at 4½d. (vest pocket size) 6d. and 9d. per tube

Sticks Everything

SECCOTINE

Requires no heating

Regd. Trade Mark

In the Workshop—in the Laboratory—in the Home—Seccotine is—AT HOME

JAEGER

Pure Wool

The New "Meccano" Jersey

The New "Meccano" Jersey

This Jaeger "Meccano" Jersey is made in the special "Meccano" pattern. It wears splendidly and prevents chill when a boy gets hot, as every boy will sooner or later. The "Meccano" Jersey appeals to every boy at once as well as to the "grown-ups" who study the health, happiness and appearance of children.

22"	24"	26"	28"	30" Chest
7/-	7/9	8/6	9/3	10/-

Colours :—Navy body with Light and Dark Saxe dice effect.
Mid Grey body with Black and White ,,
Fawn body with Brown and Saxe ,,
Brown body with Fawn and Red ,,
Saxe body with Navy and Dark Saxe ,,
French Grey body with Lt. and Dk. Saxe ,,

Three-quarter Hose, Turnover Tops to match

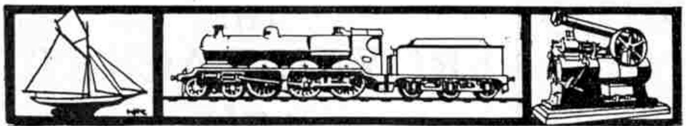
3, 4	5, 6, 7	8, 9, 10
2/9	3/3	3/9

Obtainable only from Jaeger Depots and Agents.
(Write for the address of your Local Agent).

JAEGER **HEAD RETAIL DEPOT : 352/54, OXFORD ST., LONDON, W.1.**
WHOLESALE & SHIPPING : 95, MILTON ST., LONDON, E.C.2.

BRANCHES : AUSTRALIA—Melbourne, 234/236, Flinders Lane. Sydney, 38/44, York Street.
CANADA—Montreal, 1187, Bleury Street.

meccanoindex.co.uk



Choose your Hobby boys!

Model Railways—Motor Boats, Yachts and Ships—Stationary Engines— Which shall it be?

FIRST make up your mind that nothing but a "Bassett-Lowke" model will do, and then write for catalogue:

RAILWAYS—ENGINES—SHIPS

The Real Thing in Miniature

SECTION A/17.—Model Railways and their equipment. Locomotives, Rolling Stock, Stations, and everything for the complete Model Railway. Over 180 pages. Post free **6d**

SECTION B/17.—Stationary Engines, Boilers, Dynamos, Motors, Boiler and Engine Fittings, Accessories for Stationary and Railway Models. 176 pages. Post free **1/-**.

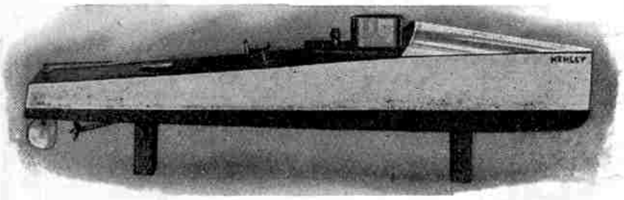
SECTION S/17.—Model Sailing Yachts, Motor Boats, Ships' Fittings and Accessories, Exhibition Ship Models, etc. Over 80 pages. Post free **6d.**

Eighth Edition of the Model Railway Handbook now ready. Price **2/6.** *Postage* **3d.**

BASSETT-LOWKE LTD.
NORTHAMPTON
LONDON BRANCH. 112, HIGH HOLBORN, W.C.1.
EDINBURGH BRANCH. 5, FREDERICK STREET

The "Henley" Steam Launch

An All-British Production



LENGTH OVERALL 24 in. **BEAM 4½ in.**
Absolutely safe **Practically unsinkable**

A fast and excellent steering craft

SPECIFICATION

HULL—Built of carefully selected mahogany. Strong, light weight, pleasing lines. High freeboard, polished spray hood. Hull enamelled green and white. Adjustable rudder with locking device.

ENGINE—Single cylinder, double acting, oscillating 7/16" × 7/16", solid gunmetal; crankshaft, disc and pin machined from solid steel.

BOILER—Solid copper, **brazed** throughout. **Absolutely safe.** Working pressure 20 lbs., but tested to 100 lbs. Will not damage if allowed to run dry. Efficient safety valve fitted. Non-spill lamp with no wicks to clean.

PROPELLER—Correctly designed 2 bladed propeller of gunmetal.

Price complete with filler, funnel and instructions. Post free **42/-**

Hamleys
Estd 1760

Illustrated list of steam, electric and clockwork boats and sailing yachts free on request.

Mail Order Dept. (M),
200/2, REGENT STREET, LONDON, W.1
and branches throughout London

All goods over 10/- sent post free unless otherwise stated.

Build it yourself!

Never before have you been able actually to construct your own steam engine, but after much experiment Hobbies now offer a box of parts which anyone can put together to make a strong and efficient power plant. The Hercules set is so planned that no soldering is required; simply a screwdriver and a pair of pliers, and the engine is complete within 20 minutes. When built it will drive your Meccano models under steam for a considerable period.

No Soldering or trouble.

HOBBIES "HERCULES" STEAM ENGINE SET

The engine is of brass with large capacity boiler and an enclosed firebox. A safety valve is fitted and a non-spill lamp is supplied. The steam pipe leads to a machined brass cylinder and geared drive, so that two speeds are provided. The whole unit is fitted to a metal base plate.

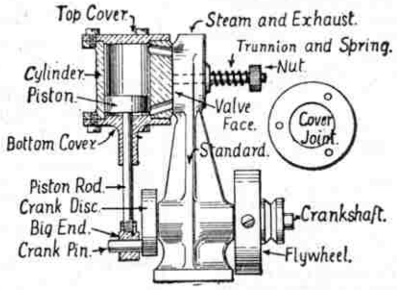
Complete with fully illustrated instructions **13/6** **Post 9d.**

A SPLENDID PASTIME ANY MECCANO BOY CAN UNDERTAKE

HOBBIES LTD. (Dept. 196), Dereham, Norfolk
Obtainable from Stores and Toyshops or Hobbies Branches in London, Glasgow, Manchester, Birmingham, Sheffield, Leeds, Southampton and Brighton.

You must have the S.T. ENGINE

to drive your Meccano Models.



This is the drawing which helps you to build the engine.

S.T. Engine Parts	**5/-**
Finished Boiler	**8/-**
Finished Plant on Base ...	**17/6**

Post Free.

It is utterly different from the ordinary Toy Shop model engine.

In the first place you have the pleasure of building it yourself.

You need have no fear, we **guarantee** it will work when you have built it.

Secondly, like all Stuart models it is made on correct engineering lines and therefore has **Power.**

The Boiler is of Copper, brazed throughout and tested.

Read what a customer writes:—

"Please send me a trunnion nut for the S.T Engine purchased from you 3 years ago. It is a grand little engine and is running splendidly. I am telling every Meccano boy I see about it. It drives models at an awful speed."

Send a stamp for list 12M which describes this and several other simple models, or better still a Postal Order for 6d. for our new 80 page Engine catalogue, fully illustrated and packed with interest from cover to cover.

Stuart Turner Ltd., Henley-on-Thames

meccanoindex.co.uk

FREE TO PHOTOGRAPHERS

A new booklet illustrated in colours

"SCIENTIFIC SIMPLICITY IN PHOTOGRAPHY"

36 pages of helpful hints and methods. Don't miss reading it

A postcard will bring your copy

BURROUGHS WELLCOME & Co
3, SNOW HILL BUILDINGS
LONDON, E.C. 1

.x.x 4912 COPYRIGHT

HOME PHOTOGRAPHY

BUY A "**LUXOL**" PATENTED DARK ROOM **LAMP**

Burns PARAFFIN. No Loose Oil. Special Absorbent Imperishable Wick. No Smoke. Absolute Safety. No Fogging. Ideal when travelling, at School, or on Holidays. Complete in metal case. Always ready. PRICE 3/- EXTRA RUBY or YELLOW GLASSES . . 1/6 (Post ex.)

From all Dealers or
'Luxol' Safety Light Co. Ltd.
57,SouthwarkSt.,London,S.E.

GREAT RECORD BARGAIN !!

THE NEW 1927 IMPROVED MODEL OF THE FAMOUS "MONARCH" *Regd.* **DE-LUXE LARGE CAMERA**

Fitted with genuine **GUARANTEED MENISCUS LENS, Reflex View-finder, Nickel-plated Spring Lever Shutter, Lever Guard, Flexible Leatherette Handle and absolutely GUARANTEED TO TAKE PERFECT LARGE PHOTOS** Size $3\frac{1}{2} \times 2\frac{1}{2}$ ins. **BRITISH MADE** and supplied complete with all Accessories:—**Best Quality Plate, Developing & Printing** OUTFIT with easy instructions for use. **Send P.O. 2/- to-day for complete Camera and Outfit !! Testimonials Galore !!!**

SALE PRICE **1/9** ONLY! Post 3d.

W.J.Thomas,Esq., writes: "Developed and printed photo, think it as good as if taken with a Camera which cost £3." Miss E. Le Cheminent writes: "Astonished to see result of my first effort. The picture is as good as that done by a proper photographer."

Sale Catalogue, 1,000 *Big Bargains, Post Free!* **THE LEEDS BARGAIN Co. (M.), 31, Kendal Lane, LEEDS.**

Patents, Trade Marks, Inventions Advice Handbook & Cons. free.—B. T. King, Regd. Patent Agent, 146a, Qn. Victoria St., London, E.C.4. 40 years' refs.

Mend your Punctures while you Ride

FORGET TYRE TROUBLE

and go care - free on your way. Tubes treated with our IMPERVO increase the joys of your Cycle.

"The Story of IMPERVO"

FREE

to Meccano Readers.
Write NOW for a Copy.
H. COLYER & CO.
(Dept. 31a),
5, Point Hill, Greenwich, S.E.10

Patent Model Mfrs.

THE SIGN OF QUALITY & EFFICIENCY

AIR SUPREMACY Boys of Our Empire

insist on flying the FAMOUS 1927 "SKISAIL" PATENT MODEL AEROPLANES, as no other type can compare for PRICE, DESIGN, PERFORMANCE, or all those points which make an excellent product.

British Manufacture. Patent No. 138210.

Guarantee. These models show perfect stability in flight, will rise from ground, and are excellent flyers.

Specification. Selected Silver Spruce Fuselage, Best Proof Silk covered Planes, Aluminium Wheels, Polished Propeller. Nos. 0, 1, 2 and 3 fitted with our **Famous Patent Safety Chassis.**

Flight from 150 to 450 yds. according to size, in straight or circular course.

No. 0	Price	18/6
,, 1	,,	14/6
,, 2	,,	10/6
,, 3	,,	8/6
,, 4	,,	6/6
,, 5	,,	4/6

Postage 6d. Two sent carriage paid.

A Purchaser Writes:

Your "Skisail" aeroplane showed such excellent flying features that a chum of mine has decided to buy one.

E.P.M., Blackburn.

No Holiday will be complete without a "Skisail" Monoplane, as the healthful pleasure of flying our world-famous models is most fascinating. **The "Skisail" Patent Models are still the best.** Our competitors know it—they *try* to copy them. Purchase direct from the **Pioneer Inventors.**

Send P.O. to:—

Patent Model Manufacturers,
159, Lymington Avenue,
WOOD GREEN, LONDON, N.22.

BOYS MAKE YOUR OWN LEAD SOLDIERS

Cowboys, Indians, Animals, Zulus, Model Station Staff, Rodeo, etc. Our CASTING MOULDS make thousands from any scrap lead WITHOUT PREVIOUS EXPERIENCE. Send stamp to-day for illustrated catalogue.

Complete mould ready for work **2/6.**
RODWAYS, 102, Long St., Birmingham
Mention "Meccano."

A **Veeder CYCLOMETER FITTED TO YOUR BICYCLE TELLS YOU:**

How far you have been. Distance from one place to another. Service your tyres give you. Number of miles to destination. Distance travelled, &c.

Make your riding doubly interesting. Its accuracy has been endorsed by all the best authorities and the experience of your fathers for 30 years.

Insist upon a genuine Veeder—see the name thereon.

Made in Two Models:
Regular 6/6, Trip 15/-.
F. E. DICKINSON, St. Andrew's House, Holborn Circus, LONDON, E.C. 1.

THE
ROYAL RACKET
17/6

A well-made Racket of smart appearance. English rent ash frame, shoulders bound two places, strung with reliable red and white gut. Guaranteed this Season's make.

All weights.

17/6 Post Paid.

18/- Cash on delivery.

This is a special line and cannot be repeated when stocks are exhausted.

RUSSELL HILLSDON,
CHICHESTER,
Sussex.

MAKE OR BUY A GRAMOPHONE 100% cheaper than others. Mechanical Parts of a 1st-class **RIFANCO-Phone:** Double Spring Motor, 12-in. Turntable, Swan Tonearm, Superior Sound Box, Internal Horn as fitted by other firms in £10, £20 Gramophones. All bar the wood. **£1 : 18 : 6 Nett Cash**

This set supplied with polished Oak or Mahogany 40 in. high Cabinet as shown. Pedestal **£5** Nett Cash. Carriage paid in U.K. **7** Days' trial. Money back if dissatisfied. Other sets from 18/-. Machines 30 models, Sideboards, Pedestals, Portables, etc., from **19/6.** Motors **9/-.** 64-page Catalogue of all Accessories FREE. Instructions *How to make Gramophones,* 3d. Est. 23 yrs. 1,000 Testimonials.

Regent Fittings Co., 78D, 120, Old St., London, E.C.1.

A REAL CINEMA SHOW in your own Home. Send for Bargain Lists of Cinematograph Machines and Films.—Lloyds, 48, Rupert St., Piccadilly Circus, W.1.

THE WORLD'S GREATEST CYCLE OFFER

8/- NOW

£10 FOR £6

The frame of the Graves **'Speed King'** Cycle is rust proofed, enamelled Black & Coach lined (or can be supplied all Black if desired) Fitted with

B.S.A. 3-SPEED GEAR
DUNLOP Roadster Cord Tyres
RENOLD CHAIN
MIDDLEMORE'S Three Coil Spring Saddle

10 YEARS WARRANTY

£6:0:0

Lady's or Gent's model same price, Carriage Paid Terms: **8/-** now, & **8/-** monthly. Complete Approval **Catalogue Post Free. J. G. Graves Ltd. Sheffield.**

HARBUTT'S
PLASTICINE

The indispensable adjunct to all users of "Meccano" Construction Sets and Miniature Railways: your little screws and small sections do not roll away and get lost the moment you put them down if you dab them on a slab of Plasticine, that alone is worth all the cost of the "Rainbow" which is only 1/- post free. There are dozens of other things you can use it for too!

Harbutt's Plasticine Ltd.,
99, Bathampton, Bath.

ROLLER SKATES

Like **Meccano** and **Hornby Trains** they are still as **popular** as ever with all **healthy boys and girls.**

Many years of wear can be got out of them as they are **adjustable** to any size.

We sell the **best make only,** yet our **Prices** are the **lowest** in the trade.

No. 3 with Threaded Clamps and Case-hardened Steel Wheels ... 5/- pair
No. 5 with Best Ball-Bearing Wheels 10/- „
No. 6 with Best Ball-Bearing Wheels and Block Heels, as illustrated 11/- „

Postage and Packing 1/-. Colonies and Abroad 5/-

Bateson's Sports Depôt, Blackpool

TORTOISES : GOLDFISH

LAND TORTOISES for your garden and greenhouses. Easily kept, and interesting, 2/- and 3/- each, carriage paid to your house.

GOLDFISH, all Colours, from 3d. each.
Fancy Fish also in stock.
Aquariums from 3/6 each.
Weed, Snails, Food, Instructional Books. All Accessories for most interesting hobby. Stamp for Illustrated Price List.

DE VON & CO.,
127, KING'S CROSS ROAD, LONDON, W.C. 1.
'Phone: Museum 0767.
Telegrams: "Oiseaux, London."

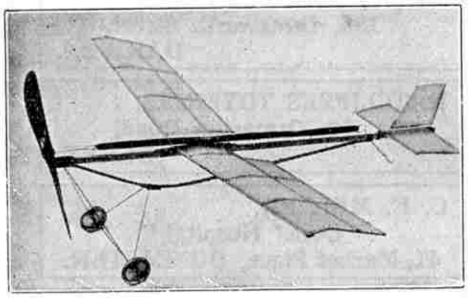
The Proof of Our Air Supremacy

In the Model Aeroplane World.

A **D.A.P. MODEL AEROPLANE**
was awarded
THE GAMAGE Silver Challenge **CUP**
For Longest Flight in Open Competition at Hendon Aerodrome, April 9th, 1927.

Awarded 1926
"Flight," "Model Engineer," "Sir John Shelley" and "Pilcher" Silver Challenge Cups. 3 Silver Medals. Prize Medal and 50 Dollars National Air Races, Philadelphia, U.S.A. Official Certificates for Record Flights.

The Proved
BEST BRITISH MODEL AEROPLANE



This is our No. 6 Tractor Monoplane. Length 24 ins. Span 22 ins. which will fly 150 yards. (Distance doubled under favourable conditions). Fitted with a D.A.P. Hand Carved Propeller (not Bentwood). This Model will rise from the ground. Price **10/6.** Carriage and Packing U.K. **1/-** extra.

Hand Launched Pusher Monoplane. Flies 200 yds. An all round good flyer. Price **5/-.** Carriage and Packing U.K. **9d.** extra.

Set of Materials, including Finished Carved Propeller, Drawing and Instructions to construct a fine Biplane Model. Length 24 in. Span 22 in. Price **8/6.** Post Free U.K.

We supply everything for the construction of Model Aeroplanes. Illustrated Catalogue 4d.

Our Guarantee. Cash refunded on any of our Models that will not fly the distance claimed.

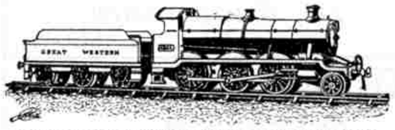
THE D.A.P. MODEL AERO CO. (Dept. M9),
187, Replingham Road, South Fields,
'Phone: Putney 0636. **London, S.W.18.**

Round the World

The pages of the "*M.M.*" offer you a world-wide market. For a small charge of 10/- per column inch (2¼ inches wide), your advertisement is brought to the notice of thousands of potential customers each month. An advertisement in the "*Meccano Magazine*" will be read by over 100,000 readers in all parts of the world.

Rates and Specimen Pages on request.

Advertisement Manager,
"Meccano Magazine"
BINNS ROAD LIVERPOOL



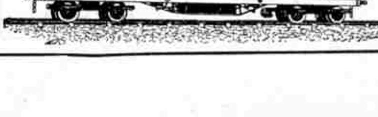
Our special Model of the G.W.R. "Mogul." Gauge 0. Electric or Clockwork.

This is only one of many beautiful Models which we offer. Parts and Fittings for Home Construction a speciality.

The LEEDS MODEL Co. Ltd.,
Dept. M., BALM ROAD, HUNSLET, LEEDS.

The Hall-mark of Quality. **L·M·C** *Accurate to Scale, Perfect in Detail*

CATALOGUE full of INFORMATION and ACCURATE ILLUSTRATIONS. New Edition, 1/- Post Free. 134 Pages.



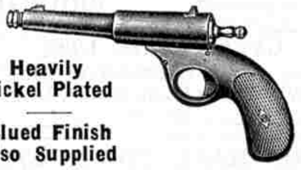
JENNERS
PRINCES STREET EDINBURGH
LIMITED

EDINBURGH AGENTS
for MECCANO and Hornby Trains

A complete stock of all Hornby Train Accessories and Meccano parts

JENNERS PAY CARRIAGE

DOLLA AIR PISTOL



Heavily Nickel Plated

Blued Finish also Supplied

An old Popular Model greatly improved making it the finest yet offered

PRICE 5/- Postage 7d.

Darts 4/6 per gross

H. H. PARSON (Pistol Dept.),
55, Northcote Rd., S.W.11

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this page carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

J. WOODHALL,
256, Grange Road,
'Phone: B'head 621 BIRKENHEAD.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
BLACKPOOL.

SELLEN'S BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

J. MORRIS, F.C.O.,
70, Knowsley Street,
Tel. 1074 BOLTON.

BROWN, MUFF & CO. LTD.,
BRADFORD.

JOHN TAYLOR,
28, Preston Street,
Tel.: Brighton 957 BRIGHTON.

GYLES BROS. LTD.,
Tel. 2888 24, Bridge Street, BRISTOL.
188, Whiteladies Road, Clifton, BRISTOL.
Tel. 143

JOHN HALL (TOOLS) LTD.,
BRISTOL. NEWPORT.
CARDIFF. SWANSEA.

SALANSON LTD.,
20, High Street, BRISTOL.
4, High Street, CARDIFF.

SAM TAYLOR,
Silver Street,
Tel. 320 BURY.

HAROLD HUNT,
38, Spring Gardens,
Tel. 202 BUXTON.

H. W. GILL,
23 & 24, Pittville Street,
CHELTENHAM SPA.

R. H. JEPSON,
1, Cross Cheaping,
COVENTRY.

PURSEY & MOCKRIDGE,
The Sports Outfitters,
Tel. Dartford 173 DARTFORD.

HENRY WHALLEY,
195, Duckworth Street,
DARWEN.

RATCLIFFES TOYERIES,
19, Osmaston Road,
DERBY.

C. E. MELLER,
"Dolls' Hospital,"
41, Market Place, DONCASTER.

JAMES L. DIXON,
14, Suffolk Street,
(off Grafton St.), DUBLIN.

DIXON'S,
41, High Street,
DUNDEE.

DRAFFEN & JARVIE LTD.,
Nethergate,
DUNDEE.

BASSETT-LOWKE LTD.,
5, Frederick Street,
EDINBURGH.

WRIGHT'S DOLLS' HOSPITAL,
14, High Street,
ERDINGTON.

ROBERT BALLANTINE,
103½, St. Vincent Street,
GLASGOW.

C. BELL (The Children's House),
320, Byres Road, Hillhead,
GLASGOW, W.2.

CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, the Railway Coys., etc.

The MARVEL MART (Wm. Ross & Co.),
110, West Nile Street,
GLASGOW.

WELTON & MESSENT,
5, Pond Street,
HAMPSTEAD, N.W.3.

FLETCHER'S TOYLAND,
77, Deardengate, HASLINGDEN.
Grand Building, RAWTENSTALL.

GAMLEYS,
The Hove Hornby Train Store,
78, Church Road, HOVE.

HAMMOND'S LTD.,
Paragon Square,
HULL.

W. J. S. CARPENTER,
13 & 15, Queen Victoria Street,
LEEDS.

PEARSON & DENHAM (PHOTO) LTD., 6, Bond Street,
LEEDS.

ROBOTHAM,
"Baby's Kingdom,"
Tel. 4809 LEICESTER.

BYCROFTS EMPORIUM,
366, High Street,
LINCOLN.

C. LUCAS, Hobbies Depôt,
35, Manchester Street,
LIVERPOOL.

Reliance Cycle & Motor Co.,
29/31, Manchester St., Liverpool.
Argyle & Conway Sts., Birkenhead.

The ARUNDEL CYCLE & SPORTS STORE, 52, Church Road,
Upper Norwood, LONDON, S.E.19.

F. R. POTTER & SON,
43, Market Place,
LOUGHBOROUGH.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

A. FRANKS LTD.,
95 & 97, Deansgate, MANCHESTER.
90, Bradshawgate, BOLTON.

A. INMAN, MANCHESTER.
105, Lapwing Lane, Didsbury. Tel. 1518.
179, Dickenson Rd., Rusholme. Tel. 2241.

EDWARD LLOYD,
268, Upper Chorlton Road,
Tel. 613 Chorlton MANCHESTER, S.W.

JOHN NESBITT LTD.,
42, Market Street,
MANCHESTER.

Meccano & Hornby Train Supplies

The fifteen dealers whose advertisements appear on this page carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

R. SCUPHAM & SONS,
35, Linthorpe Road,
MIDDLESBROUGH.

WILLIAM OLLIFF,
13, Grainger Street West,
NEWCASTLE-ON-TYNE.

JANES & ADAMS,
13, The Promenade,
And Branches. PALMERS GREEN.

R. MARSDEN & SON LTD.,
115, Church Street,
Tel. PRESTON 1314 PRESTON.

DEAN & HOLT,
78, Yorkshire Street,
ROCHDALE.

ROCHESTER.
GERALD MORRIS,
24, High St., ROCHESTER.

SHEFFIELD PHOTO COMPANY,
6, Norfolk Row (Fargate),
'Phone 3891 SHEFFIELD.

WILSON, GUMPERT & CO. LTD.,
57, Fargate,
Tel. 489 SHEFFIELD.

BIRMINGHAM & COVENTRY CYCLE CO., 140 & 151, Above Bar,
SOUTHAMPTON.

OSBORN & CO.,
9, High Street,
SOUTHAMPTON.

S. T. SIMPSON & SON,
589-595, Lord Street,
Tel. 999 SOUTHPORT.

H. W. GINN,
The London Motor, Cycle & Sports Co.,
Tel. 252 Staines 106, High St., STAINES.

SAXONS LTD.,
29/30, Holmeside,
SUNDERLAND.

SPORTS HOUSE
WOKING & WEYBRIDGE.

DISGUISE

Original and instructive pocket MAKE-UP OUTFIT for Actors, Detectives and others.

Price 3/- each complete (post free)

Overseas 6d. extra.

Milton, 24, Station Parade, Norbury, London, S.W.16.

NATURE STUDY

Obtain your supplies of Books, Collecting Apparatus and Specimens from

WATKINS & DONCASTER, Dept. M.,
36, Strand, London, W.C.2 (P.O. Box 126).
'Phone: Gerrard 9451. Full Catalogue Post Free.

50 SHOT AUTOMATIC PEA REPEATER

The Super Pea Pistol. New heavy model, best black finish, 50 shots at one loading, each in box with ammunition, post free 2/9.

The well-known 25-shot Automatic Pea Repeater, post free 2/3.

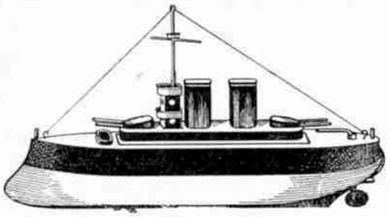
New Model 17-shot Pea Repeater, black finish, post free 1/3.

R. DILNOT, 125, Chiswick High Rd., London, W.4.

SUTCLIFFE'S

BRITISH MADE

MODEL WARSHIPS



Designed from **British Cruisers,** beautifully finished, and made to last a lifetime.

NO CLOCKWORK. NO ELECTRICITY.

A mysterious and most ingenious principle of propulsion is employed which will drive the boat at a nice speed up to 2 hours at a stretch.

NOTHING TO GET OUT OF ORDER.

Every model is tested to work satisfactorily under its own power, and as there is nothing to get out of order, it will last for years.

12" size **10/6** Postage 9d. extra.

Write for free folder giving full particulars, and for the address of the nearest toy dealer demonstrating these models.

16" size **15/-** Postage 9d. extra.

Sole Manufacturer: **J. W. SUTCLIFFE,**
ATLAS WORKS, HORSFORTH, near LEEDS.

A Windy Day
Hurray! Hurray!
A Lofty Kite for Me

Write for our 1927
KITE LIST
Post Free 1d.

We are Great on

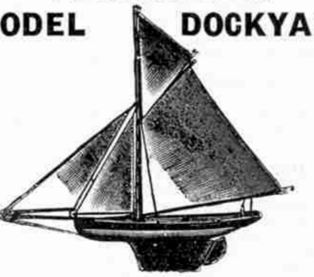
MODEL BOATS

Sailing Boats ...	... 2/6 to 10/6
Racing Yachts ...	... 12/6 to 60/-
Hobbies Steam Boats	... 11/9 to 30/-
Stuart Turner's Henley...	... £2-2s.
Bassett-Lowke's T.B.D.	... 50/-
Clockwork Boats	... 10/6 to 60/-

Boat Fittings in great variety.

C. LUCAS
35, Manchester St., Liverpool

KENSINGTON MODEL DOCKYARD



Sailing Yachts & Fittings

HOBBIES STEAM LAUNCHES
MOTOR BOATS
HORNBY TRAINS
MECCANO OUTFITS AND PARTS
WORMAR STEAM ENGINES

Requisites for
CRICKET, TENNIS,
FISHING, PHOTOGRAPHY

AIR GUNS AEROPLANES
Electric Motors & Accumulators

Send 1½d. Stamp for List "M."

C. H. LORBERG
185, Kensington High St., London, W.8

READERS' SALES

(Rate: 1d. per word, min. 1/–).

Wanted, 1923 copies of "M.M." for January, February, March, April, June, August, September, October, November and December issues. Write Master Jacobus Viljoen, Spitskrans, Dist Bethlehem, South Africa.

Sale. Wor-Mar Trojan Steam Engine, 3/6. Magic Lantern and Slides. Cost 7/–, 3/6.—R. Thompson, 15, Orford Hill, Norwich.

Sale. Miss Peggy Steam Launch, new, 15/–. Bargain.—Carswell, Follingworth House, Batley.

Model Railway, No. 1 Gauge, for sale, both indoor and outdoor sections. Apply photo—Ridehalgh, The Bungalow, Chapel-en-le-Frith.

Cigarette Cards, Lists Free. 1,000 Imperfect Cards, 1/9; postage 6d.—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Subscribers are wanted for "Every Boy's Magazine," No. 1 out to-day, 16 printed pages, two-colour cover. 40/– offered in competition. Send 1½d. now.—L. Blair-Hickman, First Tower, Jersey.

Tram and Omnibus Tickets bought or exchanged.—John M. Bilton, 40, Dinnington Road, Woodseats, Sheffield.

For Sale. Model Railway, Steam Furniture Van, other articles. Prices.—Nelson, 48, Uphill Park Road, Weston-Super-Mare.

Sale. Brand New Banjulele including Case. Guinea. Worth easily double.—"Homeleigh," Fillebrook Ave., Leigh, Essex.

Sale. Cinematograph and other toys. Particulars—Wm. Cleghorn, 10, School Brae, Peebles.

Wanted. No. 2 Gauge Rails and Points. Particulars to Wright, 38, Milton Road, Birkenhead.

For Sale. Meccano Magazines, March-April, 1921 to April 1927. Good condition. Apply—Bass, 14, St. Albans Crescent, Woodford Green, Essex.

Album containing 1,500 different stamps, £1 post free.—Hood, 67, Marine Parade, Sheerness.

Members Wanted for Correspondence and Exchange Club. Particulars from—The President (J.E. & C.C.), Brenanstown, Hoe Cabinteely, Co. Dublin.

70 Handicrafts' Fretwork Designs 2/6. Model Railway Station, 2 ft., 2/11. Loading Platform, 1 ft., 1/3. Tunnel, 9 in., 1/6. Engine Shed, 1 ft., 1/6. Made of 3-ply, etc.—J. Seymour, High Street, Tenterden.

Sale. Gauge 1 Rails, Wood Sleepers, Strong, good condition. Cost 30/–. Offers.—Scott, St. Paul's Vicarage, Morley, Leeds.

Sale. 1,200 Cigarette Cards, 1000 in 20 sets, 10/6.—Purnell, Barlows Lane, Andover.

SMALL ADVERTISEMENTS

REGATTA RACING YACHTS.—Before buying a yacht send for our coloured illustrated price list—free.—Pantoys Ltd., Promenade, Cheltenham.

NAME OUR TREES AT ONCE. Own a collection of Preserved Leaves carefully mounted on cards 6" × 4" and fully named. 36 specimens, 4/–; 24, 3/–; 48, 5/6. Any for 1½d. each. Send stamp for list.—Arborist, 8, Lindley Avenue, Southsea.

Miniature Wireless Set (Rosenthals Pat. No. 233564). Size of 3d. piece. Exhibited Inventions Exhibition. Results surprised experts. 1/2 post free (abroad 1/6).—Lumb, 28, Wilson St., Monkwearmouth, Sunderland.

"MECCANO MAGAZINE" BINDERS
Your Magazines may be kept clean and tidy by enclosing them in one of the special binders we supply. Two sizes, price 3/– and 3/6 post free, from Meccano Ltd., Binns Rd., Liverpool.

1/6 THE BULLY BOY 1/6

20-Shot Rapid Repeater Action Pea Pistol. Fires a pea 25 feet at the rate of 100 a minute. A regular Pocket Lewis Gun! Bright nickel finish; each in box with ammunition. A better shooter than you have ever had before! Send **1/6** and don't miss our latest quick-firer! Colonial Orders (Stamps not accepted) 9d. extra.
J. Bishop & Co., 41, Finsbury Square, London, E.C.

MAKE YOUR OWN ELECTRIC LIGHT

5/6

These wonderful Dynamos light brilliantly 4-6v. lamps, and are very easy to work. **5/6**, post 6d. Delivery by return of post.
GREENS (Dept. E.N.),
14, New Oxford Street, London.

This Month's Special Articles

Lives of Inventors—(*continued from page* 598)

engine, and ere long Murdock had invented the double D slide valve. Strangely enough Watt did not look favourably upon Murdock's inventive industry and ingenuity, and at first was very averse to recognising any advantage in the new valve over his own type. However, he ultimately agreed to Murdock's type of valve being adopted for double-acting engines, in place of the four poppet valves then being fitted. The improvement added greatly to the efficiency of the steam engine and effected further economy of steam.

A YACHT 30" HIGH 12/9
(Post Free)

Just the thing for the Holidays

"REGATTA" RACING YACHTS

This Yacht is 30" high with an 18" Deck and carries four white sewn sails which can be readily adjusted, like a real Yacht. There is a **Lead Keel** which makes for steady sailing. Mast and Rigging are removable for carrying. The Yacht is beautifully enamelled and lined in attractive colours; it is guaranteed to sail.

SEND for Fine Coloured Catalogue illustrating our series of Model Yachts

PANTOYS LIMITED
7, Promenade : Cheltenham
and 24, Westgate St., Gloucester

MECCANO MAGAZINE

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

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

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

Advertisements

Readers' Sales and Wants. Private advertisements (*i.e.*, not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper (see important notice below).

Small Advertisements. 1/– per line (average seven words to the line), or 10/– per inch (average 12 lines to the inch). Cash with order (see important notice below).

Display. Quotations for space bookings, and latest circulation figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 10th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking two inches or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Stamp Advertisers Please Note:—

The Readers' Sales and Wants column is reserved for advertisements dealing only with collections of stamps as a whole. A collection that is being disposed of on approval sheets, or by packets or sets, should be advertised in the small advertisement column, the rate for which is 1/– per line, average seven words to the line. Although the advertiser may not be actually conducting a stamp business, such advertisements are not to be classified under Readers' Sales and Wants.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Obtaining the "*M.M.*" Overseas

Readers Overseas and in foreign countries may order the *Meccano Magazine* from regular Meccano dealers, or direct from this office, the price and subscription rates being as above.

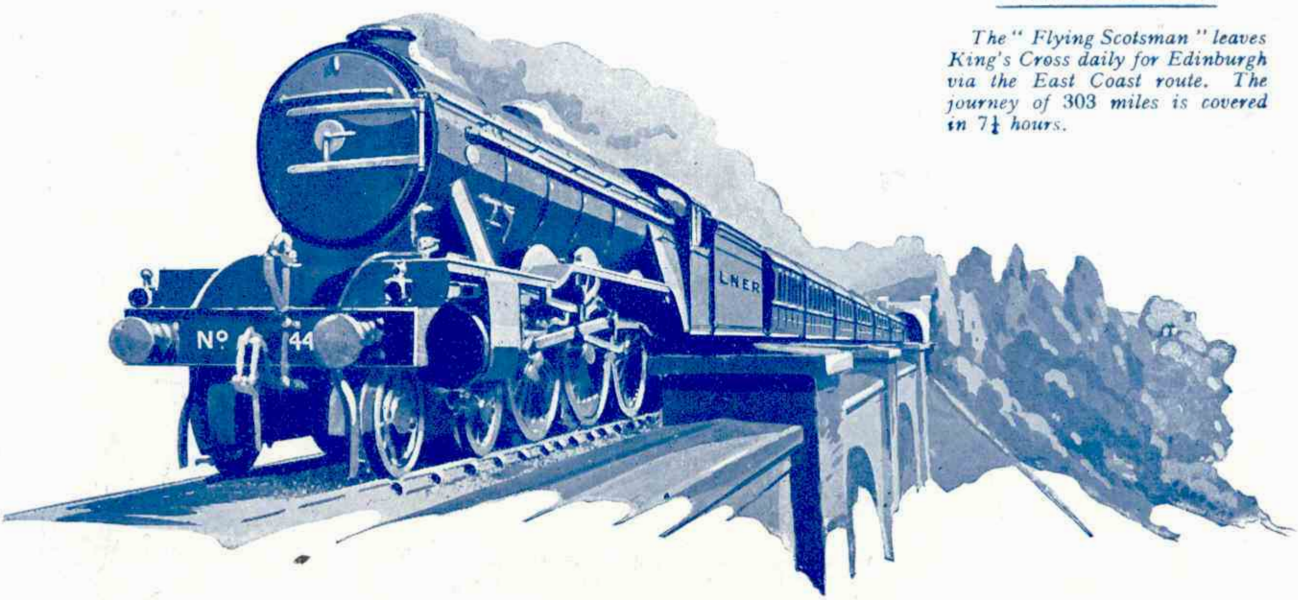
IMPORTANT.

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 45, Colborne Street, Toronto.
AUSTRALIA: Messrs. E. G. Page & Co.,
52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Messrs. Browning, Ifwersen Ltd.,
P.O. Box 129, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199),
Textile House, Von Brandis St., Johannesburg.

CUT THIS OUT

"MECCANO" PEN COUPON, VALUE 3d. Send 5 of these coupons with only **2/9** (and 2d. stamp) direct to the **FLEET PEN CO., 119, Fleet Street, E.C.4.** By return you will receive a handsome lever self-filling **FLEET S.F. PEN** with solid gold nib (fine, medium or broad), usually 10/6. Fleet price **4/–**, or with five coupons only **2/9**. De Luxe Model **2/–** extra.



FAMOUS TRAINS:

The "Flying Scotsman" leaves King's Cross daily for Edinburgh via the East Coast route. The journey of 303 miles is covered in 7½ hours.

HORNBY TRAINS

BRITISH AND GUARANTEED

Each Hornby Set is packed in a strong, handsome box and is supplied with a complete set of rails. The locos and various components are carefully examined and tested before leaving the factory, and they are guaranteed.

PRICES

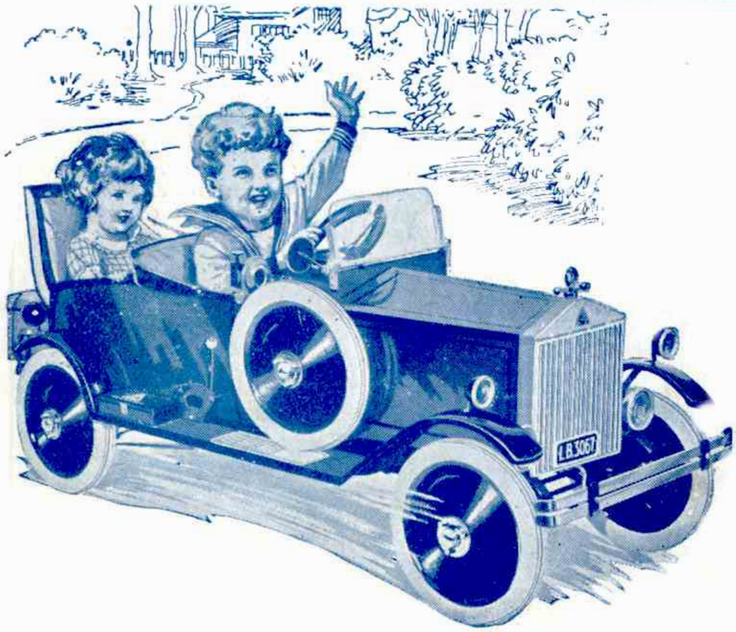
No. 0 Passenger Set ...	**24/–**
No. 0 Goods Set ...	**17/6**
No. 1 Passenger Set ...	**27/6**
No. 1 Goods Set ...	**21/–**
No. 2 Pullman Set ...	**60/–**
No. 2 Goods Set ...	**37/6**
No. 1 Tank Goods Set	**25/–**
No. 2 Tank Goods Set	**45/–**
No. 2 Tank Passenger Set	**45/–**

WHEN you own a Hornby, you can enjoy the fun of running your own complete railway system. It's the finest fun in the whole world, and you will find that even your father will want to help you when you've fixed up a Hornby Railway!

See how long a Hornby Loco runs without re-winding. See how it gets up speed with a heavy load behind it, and how smoothly it rides over the points and crossings. And how fine and sturdily built are Hornby Trains. How real they look. How beautifully they are enamelled in the correct colours. Every part of a Hornby Railway is like that—strong and beautifully finished. Ask your dealer to show you samples.

This is the No. 2 Pullman Express, one of the famous trains in the Hornby System. It consists of two handsome Pullman coaches hauled by a fine 4-4-0 loco of great power and speed, and it is running daily in hundreds of homes in all parts of the world.

Manufactured by
MECCANO LTD.,
BINNS ROAD,
LIVERPOOL.



A Splendid Gift for the Out-door Boy!

EVERY young motor enthusiast will long for one of these fine pedal motors constructed on real car lines.

The "ROLLS ROYCE" Model No. 9, as illustrated above, is quite a big model 66" long overall and has a curved body and dickey seat. Accessories include spare wheel, motometer, driving mirror, adjustable windscreen, spring bumper, brake, trunk, mechanical horn, starter buzzer, etc. Wheels are detachable like real ones. Cycle chain drive with tubular chassis is fitted. £10 : 10 : 0

OXFORD No. 5. A useful little runabout with polished radiator, patent balloon disc wheels, 5 lamps, bulb horn, dummy hood, driving mirror, etc., 42" overall. £4 : 1 : 0

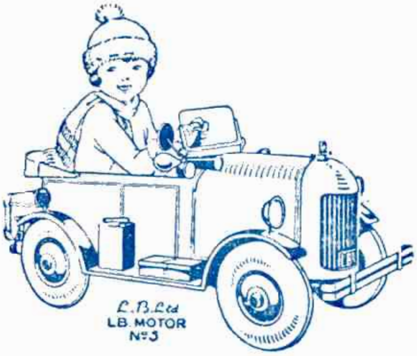
L.B. MOTOR. This is a really fine piece of work. It has a most realistic polished radiator and almost all the accessories you'll find on a real car—balloon tyres, etc., yet it onlycosts £4 : 13 : 9

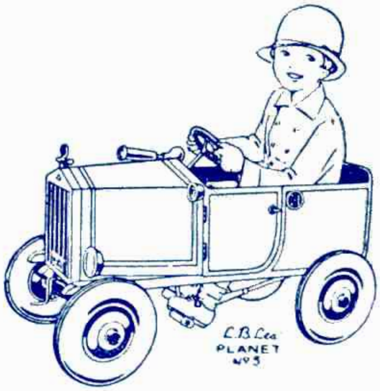
PEDAL FAIRYKAR (Regd. trade mark). A new model of this popular toy, fitted with patent balloon wheels with rubber tyres. Seat painted red. Handlebars plated and fitted with rubber grips. Models from 9/6. 4b as illustrated 13/6

ORB MOTOR. Inexpensive but strong and well finished in bright red paint. Easily pedalled by means of Lines Bros. double crank drive and suitable for boys or girls 2-5 years. 25/6

PLANET No. 5. The door on this model opens and has a plated handle. Patent balloon disc wheels are fitted and give the car a handsome appearance. Seat adjustable. As illustrated. £2 : 12 : 6

FAIRYCYCLE (Regd. Trade Mark). A fine little cycle at a low price. It is built to stand lots of hard wear and will give you hours of jolly good fun. Finished black with gold lines; models from 39/6





NEPTUNE
Swimming Bar

Quite a new idea for swimmers and learners. Easily supports even an adult in the water yet packs away into a small space. Rubber bladders fit wire frames which are fitted to a bar 36" long. Inexpensive but jolly good fun. Send for a free Illustrated folder. Bar as illustrated. 7/6

Lines Bros.
Tri-ang Toys

Regd. Trade Mark

British made by
LINES BROS. LTD.,
Tri-ang Works,
Merton, S.W.19.

Obtainable at all good toy shops and stores.

PUBLISHED BY MECCANO LTD., BINNS RD., LIVERPOOL.
Printed by Stembridge & Co. Ltd., Albion Street, Leeds.