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VOL. XXXI. No. 9 SEPTEMBER 1946

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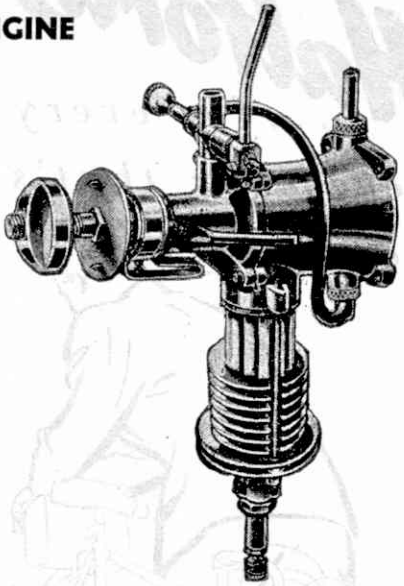

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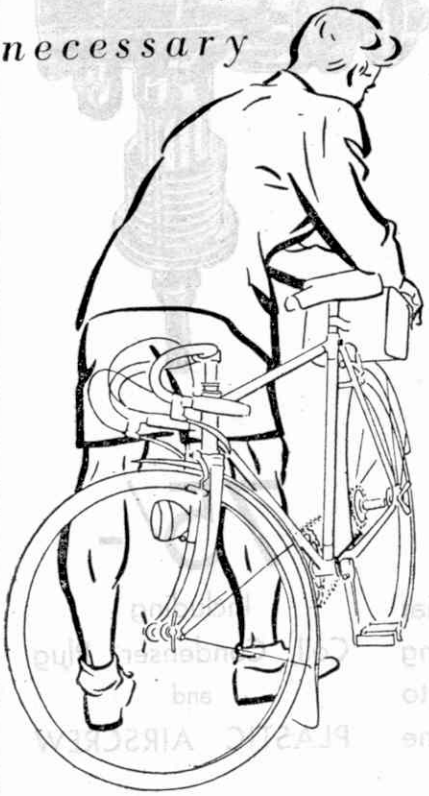

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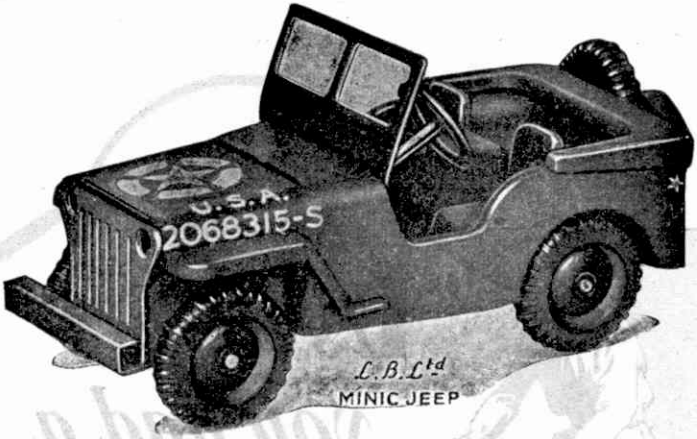

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Next Month: "BRITISH STEEL IN BRIDGE-BUILDING."

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With the Editor

Plastics

This month I publish the first of a series of four articles on Plastics. To-day the term Plastics covers a bewildering variety of products, differing so widely in appearance and purpose that a good deal of confusion has arisen as to what Plastics really are. The object of these articles is to explain the nature of Plastics and describe how they are made and used in everyday life.

In preparing the articles I set out to give a really accurate picture of the Plastics industry of to-day, and in order to do this I invoked the assistance of Birkbys Limited, makers of the well-known "Elo" Plastics. This firm's factory at Liversedge, Yorkshire, is self-contained in the sense that it makes not only finished mouldings, but also the resins, powders and moulds necessary for their production. The result of this collaboration is that I am able to state with confidence that the articles are not only accurate but also up to date in every respect. I feel that it is not too much to say that no series of equal interest and value has yet appeared.

Locomotive Liveries

In *"Railway Notes"* in this issue appear details of two locomotive surprises, in the respective decisions of the L.M.S. and the L.N.E.R. regarding the finish of their engines. In future all L.M.S. engines will be black, while those of the L.N.E.R., except the streamliners, will be green.

The disappearance of the well-known and distinctive Midland red will be widely regretted, particularly as under the new scheme only a few selected classes will have any lining out. However, well-kept black engines can look attractive, as those who remember the one-time finish of the L.N.W.R., L. and Y. and many Caledonian engines will know. On the other hand the L.N.E.R. decision will be welcome after the drabness of the war years. It will be quite a thrill to see the popular Doncaster uniform applied to engines that have not been so finished for years.

With the gradual elimination of wartime black for locomotives on the G.W.R. and S.R., the engines of three companies out of the four will thus wear green coats of varying shades. The G.W.R. green remains as it has been for so many years, while the S.R. have standardised a new and brighter shade.

This Month's Articles

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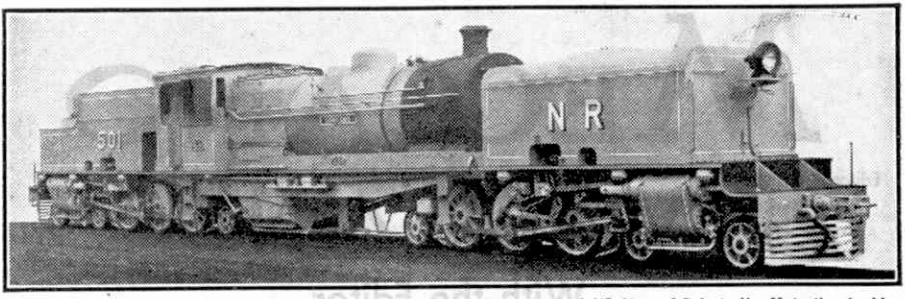

A 4-6-2 : 2-6-4 Beyer-Garratt Locomotive of the Nigerian Railway named "Sultan of Sokoto." Note the double cab roof and the louvred cab side shutters usually provided on locomotives working in the tropics. Photograph by courtesy of Beyer-Peacock & Co. Ltd., Manchester.

The *"Plateau Limited"*

On the Footplate in Tropical Africa

By Alan Kendall

ON Wednesdays the *"Plateau Limited,"* one of the Nigerian Railway's three main expresses, leaves Lagos on the coast for Jos, which is on the plateau of Northern Nigeria. I recently had the opportunity of travelling on this train, spending some 20 hours on the footplate. Although the trip lacked the high speed thrills of English and American expresses it was full of interest from start to finish. Everything was so different from my previous railway trips. Native train crews speaking pidgin English; almost naked pointsmen waving us on with huge grins; crowds of traders swarming alongside at every stop; small groups of warriors watching the train pass and fingering bows and arrows as though they thought we might be a tasty target; and animals of all kinds wandering on the unfenced tracks all helped to give the journey a spice of real adventure and romance in addition to the purely railway interest.

Eleven o'clock in the morning found me waiting at the end of the platform at Iddo station, Lagos, watching the engine backing on to the *"Plateau Limited."* A 4–6–2 type locomotive smartly painted in green and gold, No. 406 *"Emir of Ijebu-Ode,"* touched gently up to the leading coach, and the automatic couplings locked into place. By the time I had introduced myself to the driver and fireman and mounted the footplate, the guard was waving his flag. A slight movement of the regulator handle, and we began to move slowly and easily away on the first leg of our 700-mile journey to Jos. Although the track gauge is only 3 ft. 6 in., more than a foot less than on British railways, the cab was roomy and well protected, with seats for the driver and fireman, and large front and side windows giving a clear lookout.

We coasted gently along to Ebutte Metta Junction where we were held up for 11 min. waiting for a train to pass. The whole of the Nigerian Railway system is single track, and passing loops are provided at average distances of six or seven miles. In order that no two trains shall be on the same stretch of single track at the same time, traffic is controlled by means of the electric tablet system, and no driver is allowed to proceed unless in possession of a tablet. Visual guidance is also given to the drivers by English type semaphore signals, and by flags. Incidentally, the "all clear" flag is not green but black and amber striped. The reason for this is that green merges too readily into the backgrounds of jungle and bush, and cannot be easily distinguished.

When the train we were waiting for arrived, it proved to be a Sentinel-Cammell steam railcar, two of which are used for local services in the Lagos area. As soon as it was at rest, the staff clerk came hurrying up to us with the tablet, and we set off once more. After two more rather lengthy stops at Oshodi and Ikeja to pick up, we finally got clear of the latter station at 12.10 p.m., and I settled down to see what sort of performance the engine would put up on its 107-mile run to Ibadan, the first scheduled stop. No. 406 was built by Nasmyth Wilson of Manchester, and with tender weighs just over 100 tons. Her overall length is 61 ft. 5¾ inches, the driving wheels have a diameter of 5 ft., and the boiler pressure is 180 lb. per sq. in. The driver began to edge the regulator open wider, and I could feel the engine bounding forward in response. We soon reached 40 m.p.h., which owing to the light nature of the track and sharp curvature is the maximum permitted on this stretch. At this speed there was surprisingly little vibration in the cab, and the engine was riding as smoothly as a Rolls-Royce. The exhaust had become a steady purr, and the baffle plates were throwing it well clear of the cab, making it possible to look ahead without getting one's eyes filled with grit.

After 55 minutes running, we were again stopped to await the passing of a train, and the fireman took the opportunity to fill his water tanks, while the driver went round the working parts with his oil feeder. I must mention here that providing the section ahead is clear, it is not necessary to bring the train to a standstill to exchange the tablets. Speed is reduced to about 10 m.p.h., and the fireman hands out the old one and picks up the new one. As this operation is carried out every 20 min. or so, the constant reductions of speed have a very adverse effect on the overall timing of the train.

There now followed about 15 miles of almost continuous twists and turns, without a straight stretch of more than a few hundred yards, and speed was consequently kept around the 20 m.p.h. mark. The line from Lagos to Ibadan was the first to be built in Nigeria. It was begun in 1895 and opened to traffic on 4th March 1901, being then known as the Lagos Government Railway. As it was constructed as cheaply as possible, cuttings and embankments were kept down to a minimum, and

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this is the reason for the endless twists and turns to find the easiest grades. For the same reason there are no tunnels on the whole system. So far the steepest gradient had been 1 in 100, but it was obvious even at this stage that in this direction there were far more ups than downs.

Leaving Abeokuta at 3.40 p.m., No. 406 began to show her paces, and we reached and maintained the maximum of 40 m.p.h. for lengthy periods. The

Nigerian Railway "Pacific" No. 406, "Emir of Ijebu-Ode," on which the author of this article rode with the crew from Lagos to Ibadan.

train consisted of 11 passenger coaches and three vans, a load of 320 tons tare behind the tender. Some 20 miles out of Abeokuta, the climbs began to get more frequent and steeper, and the fireman was called upon to make prodigious efforts to maintain the steam pressure. With the tropical Sun outside and the heat of the open fire-box inside, the heat of the cab became almost unbearable. It was impossible to lean one's bare arms on the metal sides of the cab without a protection of cotton waste. In spite of this the fireman kept up a rate of 10 shovelsful of coal every minute with an easy rhythm, interspersed with copious draughts of water from a bucket. I doubt if any European fireman could have kept this up for long.

We came to a halt at Ibadan at exactly 5.30 p.m., the 62 miles from Abeokuta having taken 110 min., giving an average speed of 34 m.p.h. As this timing included two tablet stops and several 1 in 80 gradients, it represented quite a good performance. The 119¼ miles from the Lagos start had taken 6 hrs. 20 min. Here No. 406 was uncoupled, and disappeared in the direction of the engine sheds.

The Nigerian Railway has at present 198 main line engines and 48 shunting engines, and the one that shortly came forward to take the train on the next lap of 182¼ miles to Jebba was No. 410 "*Mary Slessor*," of the same class as No. 406. Leaving Ibadan at five minutes to six, we ran for nearly an hour without further check, although no great speed was attained. When it got dark, the powerful searchlight mounted on the front of the engine was switched on, lighting up the track very plainly for some 50 yds. ahead. The cab itself was also well lighted by electricity.

At the first stop, I left the engine and went to my compartment in the train. The first class sleeping coach, which was built by the Gloucester Carriage and Wagon Co., England, was exceptionally comfortable, well sprung and smooth riding. I had no difficulty in getting to sleep and was only half conscious of the arrival at and departure from Jebba, about 4 a.m. When I woke at seven we were halted at a place called Woabi, about 40 miles beyond Jebba.

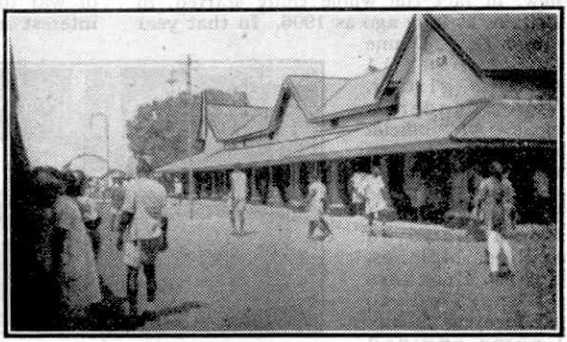
At the first stop after breakfast I went forward and found that the train was now being hauled by a 2-8-2 American "Austerity" locomotive, No. 652. This engine was built by the American Locomotive Co. at their Schenectady works in 1942, being one of 26 obtained during the war with similar specifications to No. 406, except that the boiler pressure is 200 lb. per sq. in. We set off at 9.20 a.m. on a stretch of track that has been recently relaid, and rapidly got up to 40 m.p.h. The American engine put up a very fine performance. We made steady progress and did not stop again until it became necessary to refill the water tanks at Kuntunku, reached at 11.51. This spell was the longest non-stop run made on the whole trip. A further 45 miles of climbs and twists brought us to Minna at 2.52 p.m., the 160 miles from Jebba having taken 11 hrs., so that the average speed was a little over 14 m.p.h. We were now 462¼ miles out of Lagos, 27 hrs. 42 mins. running time.

At Minna the line from Lagos forms a junction with the line from Baro, on the banks of the Niger, to Kano, capital of the Northern Provinces. The Baro-Kano railway, as it was then known, was begun in 1907 and completed in 1911, and the junction with the Lagos Government Railway was effected later the same year. On 3rd October 1912 the two were amalgamated under the title "The Nigerian Railway." On the platform at Minna stands the first locomotive to run in Northern Nigeria, an 0-4-0 tank engine by the Hunslet Engine Co. of Leeds. It ran on the Wishishi tramway, a 12-mile length of 2 ft. 6 in. gauge which connected Zungaru, then administrative H.Q. of Northern Nigeria, with Wishishi, highest point of navigation on the Kaduna river. With the opening of the Baro-Kano Railway, the tramway became obsolete.

Leaving Minna at 3.40 p.m. aboard No. 654, another "Austerity" locomotive, we ran over easy grades and newly relaid track and enjoyed a spell of comparatively fast running. The driver gave the engine her head, and No. 654 responded beautifully, covering several long straight stretches at 50 m.p.h. Between mileposts 472 to 473 60 sec. exactly were clocked, and this short burst at 60 m.p.h. was the fastest recorded on the trip.

After 20 miles or so the twists and climbs began again and speed

(*Continued on page 392*)



A typical scene outside the railway station at Lagos. Initials of the original Lagos Government Railway appear on the end building.

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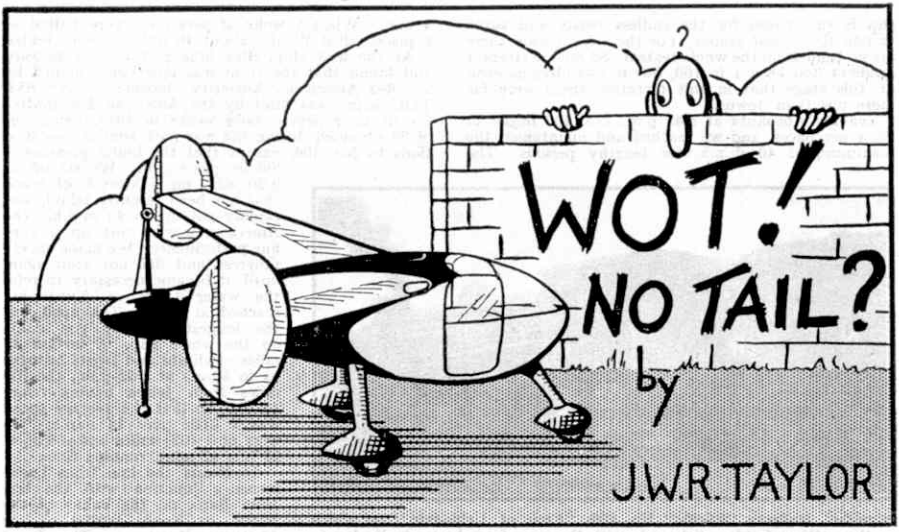
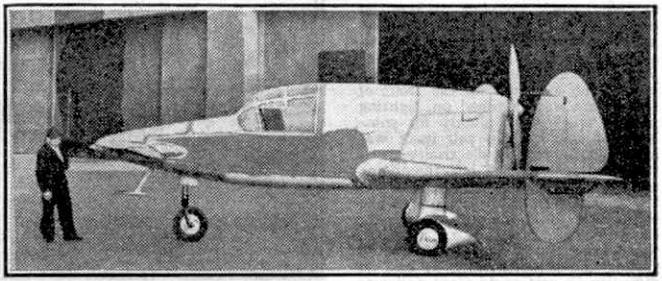


"IT'S all wrong" said my friend, looking at a picture of the Handley Page "Manx" tailless aircraft. "The only bird that flew without a tail was the pterodactyl, and because of the omission he is extinct now!" That may be true as far as birds are concerned, but it certainly does not mean that there is no future for tailless aircraft. On the contrary, several of the most famous and technically advanced firms in the aircraft industry are showing a great deal of interest in tailless designs at the present moment. After all, motor cars do not run about on legs, ships do not move through the water by wagging their tail ends, so why should an aeroplane have a tail just because a bird has one?

Tailless aeroplanes are by no means new; in fact the whole thing started, in Britain, as long ago as 1906. In that year Major J. W. Dunne built his D.1 tailless glider. Veiled under a cloak of official secrecy, his experiments continued and by 1908 he had successfully flown powered tailless biplanes. Short Brothers co-operated to produce the 50 h.p. Gnome-engined D.6 and then the D.7 monoplane, which was exhibited at Olympia. There are many good arguments in favour of tailless design, but the thing that most interested Dunne was the inherent stability characteristics that he felt sure his swept-back wing design would possess. He demonstrated the stability of the D.6 to Orville Wright by locking its controls in the air and writing a letter, which was quite an achievement in those days of "stick and string" aircraft when every flight was an adventure. In addition, of course, the saving in weight gained by dispensing with tail structure was jolly useful when there was only 50 h.p. to get the machine off the ground.

Dunne's experiments were unfortunately brought to an end by the outbreak of war in 1914, and not until 1922 was interest in tailless design revived—rather



The De Havilland Technical School's T.K.5, which has a small "tail" control forward of the cockpit. Photograph "The Aeroplane" copyright.

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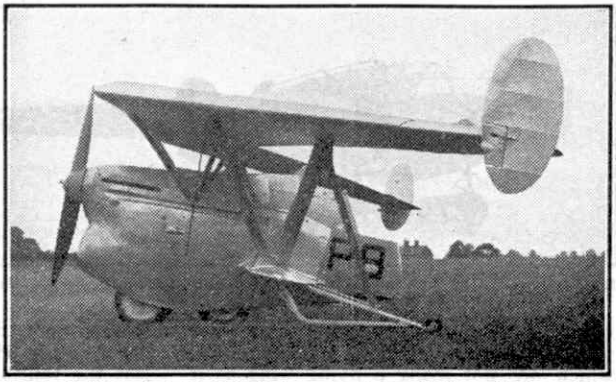
strangely in Germany. In that year Alexander Lippisch designed his first glider with swept-back wings and so began the research that has led up to to-day's most advanced theories on tailless design. Within ten years he had made a lot of progress and built the Delta 1—a little cabin monoplane with a 30 h.p. Bristol "Cherub" "pusher" engine. This was followed by the "Delta" 2 and 3, and the "Wespe" which had two Pobjoy engines, one arranged as a pusher, the other tractor. That seemed to end the series, but Lippisch worked on quietly and methodically and eventually joined Willi Messerschmitt—a most significant step as later events proved.



Westland "Pterodactyl," Mk. V two-seat biplane fighter. Photograph by courtesy of Westland Aircraft Ltd.

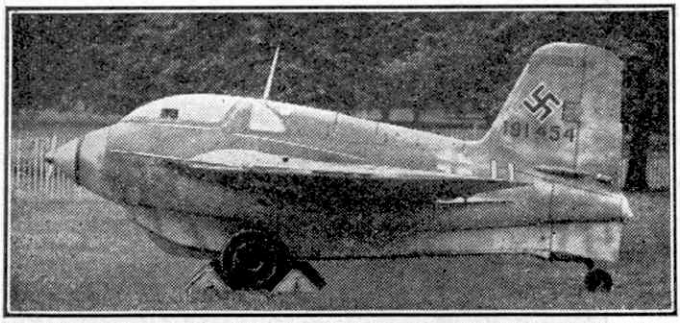
Meanwhile another Englishman had been hitting the headlines with his tailless aircraft—Captain G. T. R. Hill. He had designed and built his "Pterodactyl" I in 1926, in co-operation with the Westland Aircraft Company. It was a small two-seat monoplane with a "Cherub" engine, and its performance was so good that the Air Ministry was persuaded to help with the financial side of its construction. The wing was swept back at an angle of 30 deg. and the incidence decreased by 6 deg. towards the tips. This kept the centre of pressure stationary, and it was obvious that Hill really "had something" in his Pterodactyl.

By 1934 it had been developed into the "Pterodactyl" V two-seat biplane fighter, which had a tractor 660 h.p. Rolls-Royce "Goshawk" motor and a top speed of 200 m.p.h. As the gunner's cockpit was behind the wings he had a completely unobstructed hemisphere of fire. The idea was to build two versions, one like the prototype, the other a pusher with the gunner in the nose. A mixed Vee formation of these fighters, with the pusher type in front, would then be able to set up an unobstructed field of fire in every direction.

Unfortunately this scheme was a little ahead of its time, and the "Pterodactyl" was regarded chiefly as a novelty to be demonstrated at air displays. But it had started the ball rolling, and in several countries designers foresaw the potential usefulness of the tailless warplane. So, although a few more peaceful tailless aircraft flew before 1939, the trend was more towards military types.

Russia was first with the Kalinin tailless bomber, in 1937. It was a twin-engined four-seat monoplane but was never built in quantity.

War came again in 1939, but this time tailless aircraft were not ignored. Instead, the advantages they had to offer acted as an incentive to further development. In America, Northrops continued



The first of the many. Alexander Lippisch's Me. 163 "Komet" jet] fighter. Photograph by courtesy of Aircraft (Technical) Publications Ltd.

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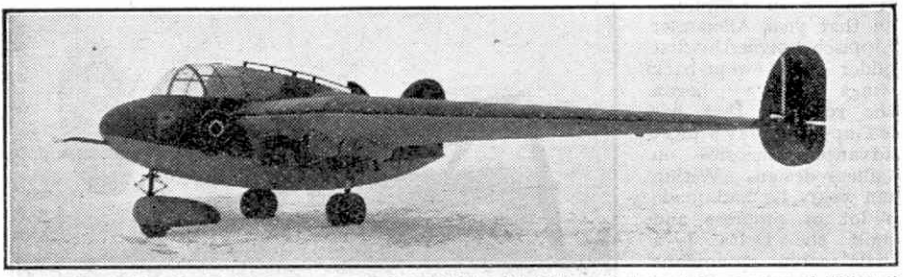

Handley Page "Manx," probable forerunner of a British tailless jet fighter. Photograph by courtesy of "Flight."

their experiments that had started with the little Northrop "Flying Wing" in 1929, which was not really a flying wing as it had thin tail booms. Throughout the war years they produced a number of interesting prototypes, including a neat scaled-down flying mock-up of a projected fighter design. This was a twin-engined "pusher" with its engines in the wings, and performed very well on its flight trials. Subsequently Northrops had a run of bad luck with their tailless aircraft, but this did not deter them and they have now built a giant 90-ton 4-engined flying-wing bomber. The fact that they have a contract for this aircraft shows that the U.S.A.A.F. have faith in the possibilities of this type of machine. It is a true flying-wing, as it has no fuselage, tailplane or even fin. Engines, crew, bombs and fuel are all housed in the wing. This prototype XB-35 has four 3,000 h.p. Pratt and Whitney engines, but subsequent machines will be fitted with jet or gas turbine engines. The Northrop XB-35 is designed to carry up to 60 tons of bombs and to fly at about 400 miles per hour.

But, due to the efforts of Alexander Lippisch, it is in Germany that most progress has been made in the development of tailless warplanes. There was a rocket-propelled German flying-wing as early as 1936 and, as soon as the efficient high-powered Walter rocket-motors became available, Lippisch designed a tiny fighter round one of these motors. The result was the Messerschmitt 163 "Komet," with its formidable armament of two 30 mm. cannons, top speed of 558 m.p.h. and 10,000 ft./min. climb. At last the tailless design had come into its own. Admittedly the Me.163 has its faults—any aircraft designed quickly in wartime and then mass-produced by unskilled labour under appalling conditions is bound to have its "bugs"—but it represents a tremendous achievement in design. Indeed it seems probable that now aircraft are reaching sonic speeds, tailless designs with extreme sweep-back are inevitable for aerodynamic reasons.

Nor does the Me.163 represent the peak of Lippisch's achievement. He had even more unorthodox tailless fighters under development, including the Jaeger P-13. The pilot was intended to lie prone in the machine, which was to be powered by a Lorin turbo-jet engine and to fly at 1,500 m.p.h.

The end of the war has ended this phase of Lippisch's work. But Handley Page have already flown their little "Manx," which may well be the prototype for a jet-fighter, and Armstrong-Whitworth are

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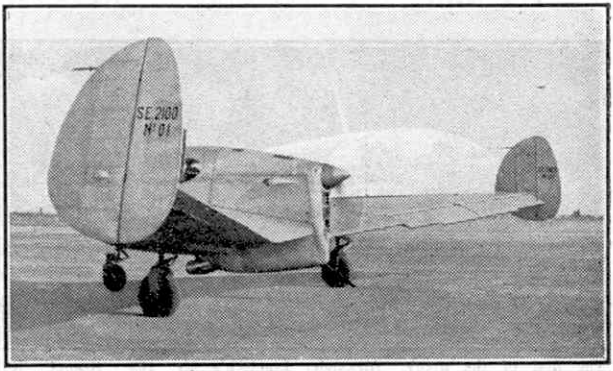

French tailless design. The little S.N.C.A. du Sud-Est 2100 "Sans Queue."

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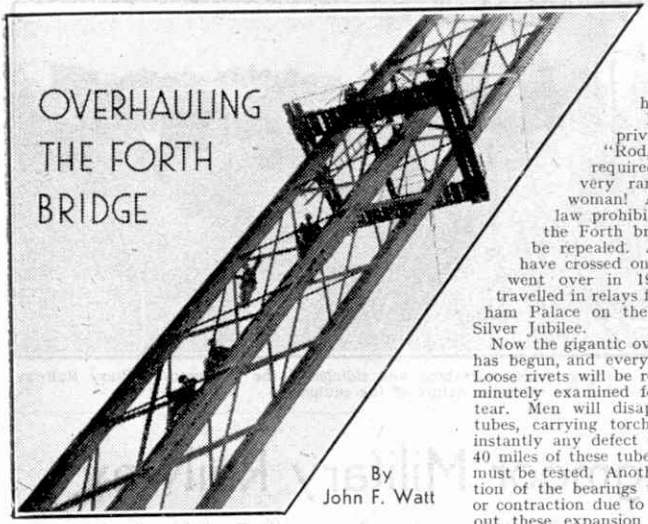


OVERHAULING THE FORTH BRIDGE

By John F. Watt

Amid the bracing of the Forth Bridge. Photograph by courtesy of the L.N.E.R.

MAJOR repair work on the Forth Bridge began on Sunday, 28th April, and will continue for some time. This is only the second time since the opening of the bridge that repairs have been undertaken. The previous occasion was during the period 1915 to 1919, when work was carried out to the floor of the bridge. This time the ends of all the main girders of the approach viaducts are being given attention.

The work that has been begun consists of reconditioning the girder bearings and strengthening them in accordance with modern practice, as well as replacing the cast iron bedplates on the tops of the piers with cast steel bedplates of modern design. It is hoped that the work will be completed before the end of 1947. The southern approach is being dealt with this year, and it will be the turn of the northern approach next year.

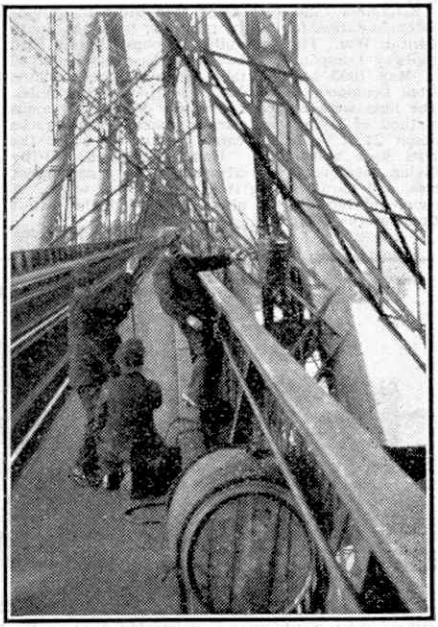
When the time came a small army of workmen began to swarm over the "Rod," as railwaymen invariably call this engineering masterpiece spanning the Forth at Queensferry. The work is dangerous. Men are often working at a height of nearly 400 ft. above the water, clinging to scaffolding suspended from the huge girders. The least slip and they would plunge into the water, and boats are kept at the ready for any such accidents while the men are working. During one big overhaul of the structure, eight lives were saved by rescue craft, which also recovered many caps and jackets that had fallen into the river. A special danger to be guarded against is stormy weather, and work on the higher parts of the bridge is suspended when the wind rises.

Painting the huge structure is a never-ending job. A squad of 30 men is normally employed, and it takes them three years to go over the 150 acres of the steelwork. When they finish, it is time to go back and begin all over again! To complete their task requires 50 tons of paint.

Welders, blacksmiths, riveters, plumbers, joiners, riggers and other tradesmen are all employed in the periodical overhaul of the bridge. It is an amazing structure they work on. It was completed 56 years ago and cost £4,000,000; the steelwork weighs 50,000 tons, and 8,000,000 rivets hold it together. Allowance is made for expansion or contraction due to changes in temperature, to the extent of one inch for every 100 ft. of steelwork. The length of the bridge is 2,765 yds., a little over a mile and a half, and it takes half an hour to walk across it. Few people are allowed the privilege of walking over the "Rod," however. A special pass is required, which is granted only on very rare occasions, and never to a woman! A strictly-enforced railway by-law prohibits a woman from walking over the Forth bridge, and this is not likely to be repealed. Among the privileged few who have crossed on foot are two Boy Scouts who went over in 1935, carrying a message that travelled in relays from John o' Groats to Buckingham Palace on the occasion of King George V's Silver Jubilee.

Now the gigantic overhaul of this massive structure has begun, and every inch of it will be gone over. Loose rivets will be replaced, and supporting girders minutely examined for the least sign of wear and tear. Men will disappear into the massive hollow tubes, carrying torches with which they will spot instantly any defect that has developed. There are 40 miles of these tubes in the structure, all of which must be tested. Another important job is the lubrication of the bearings that provide for the expansion or contraction due to changes in temperature. Without these expansion bearings, the whole structure would be liable to crumple up on a very warm day.

Despite the extent of the repair task, rail traffic will be normal over the bridge, except from 12.1 a.m. to 10.0 a.m. on Sundays, and for two periods of four hours each in midweek when trains are diverted to other routes. At all hours trains pass at greatly reduced speed over the portion under repair.



Repair work in progress on the Bridge.

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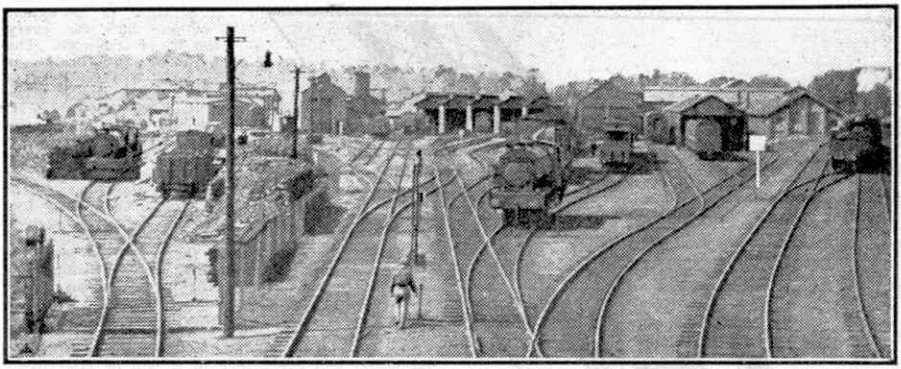


General view of the locomotive running sheds, workshops and sidings of the Longmoor Military Railway, showing the extensive nature of the equipment.

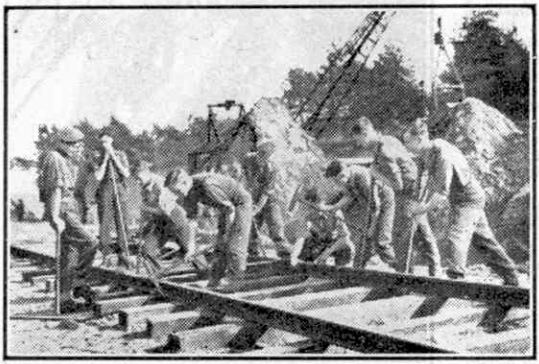
The Longmoor Military Railway

THE Longmoor Military Railway is in Hampshire, connecting Bordon, on the branch line of the S.R. from Bentley on the Guildford and Alton route, and Liss, which is on the Portsmouth line of the S.R. It is run by the Transportation Branch of the Corps of Royal Engineers, and serves as a training centre, producing staff to construct, repair and operate railways of all types and in any country for military purposes.

Longmoor came into being as a camp to provide accommodation for troops returning from the South African War. The first railway troops, the old 53rd Railway Company of the Royal Engineers, arrived in May 1903 to undertake the movement of huts from Longmoor to Bordon, a journey of five miles. The huts were hauled by railway by the ingenious method of laying two parallel narrow-gauge tracks about 24 ft. apart to carry trolleys on which the huts were transported. Haulage was effected by laying out a cable and attaching it to a convenient tree, and then winding it in on a steam winch. A couple of farm horses also helped, and the fastest time for the journey was one day.

From this somewhat unusual beginning Longmoor developed as a permanent home for the railway troops, and a standard gauge line between Bordon and Longmoor was completed in 1909. Longmoor was taken over by the Railway Operating Department in the 1914 War to form a depot and establishment for the training of all railway troops, and in the years between the Wars, with the co-operation of the British railway companies, it became the training centre for a small nucleus of regular troops and for the Supplementary Reserve units that formed the core of the huge Transportation organisation developed during the recent War.

The Longmoor Military Railway had by now developed into a complete system, with its own engines and rolling stock, with running shed and workshops for their servicing and repair, and yards for traffic purposes at different points. During the recent War a loop known as the Hollywater line was added to the existing main stem joining Bordon with Liss and important depots were located at various points. By September 1942 the usual peacetime strength had expanded from a total of approximately 500 to a peak of 7,000. During the War some 7,000 officers passed through Longmoor for training, and of other ranks over 27,000 had training in technical trades, and 24,000 in fieldworks. In addition over 80,000 men passed through the depot to form drafts for new units or reinforcements.



Officer cadets working as a platelaying gang on the L.M.R. The flat-bottomed rails are being spiked to the sleepers.

The character and scope of the training at Longmoor is remarkable and more than 40 trades are taught. Thus the surveyors, draughtsmen, platelayers and others required in railway construction are trained, and there are courses for enginemen, signalmen and traffic control staff as well as workshop staff, including boilermakers, locomotive fitters, welders and so on. In addition a variety of general Corps trades are taught, while railway clerical work, checking and storekeeping also are dealt with.

Men posted to the Transportation Branch are for the most part specially selected for their aptitude or previous experience, and their courses are designed to give intensive instruction in the

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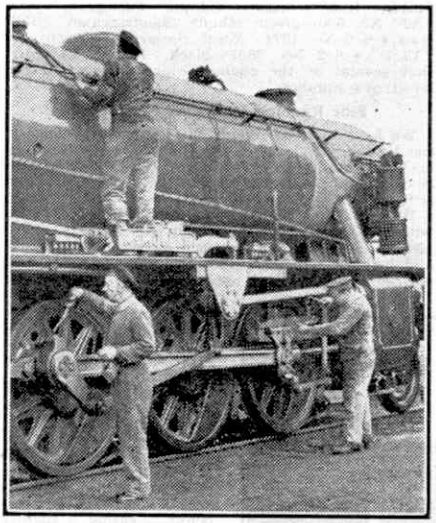


Engine preparation at Longmoor. The engine is a W.D. 2-8-0 No. 79250, "Major-General McMullen."

military aspect of their particular trades. Technical training is supervised by the Chief Instructor. Three departments deal respectively with railway construction, including surveying and bridging, railway operating, and railway workshop practice. The instructional staff has been drawn from every branch of civil transport, and is responsible for the technical instruction of all officers, cadets and other ranks and for maintaining the Longmoor Military Railway, which is regarded as a "training machine."

The railway began purely as an instructional line with a very small amount of domestic traffic. During the War, however, with the establishment of the stores depots referred to previously at different points, the line became of vital importance in the acceptance and despatch of large quantities of strategic stores. Thus the student operators found themselves obtaining practical experience with tangible results. This increased traffic made necessary more attention to the maintenance of the permanent way. Heavier locomotives than usual began to appear and to cope with these on the light permanent way special attention had to be given to the formation and ballasting. This kept platelayers busy and gave them excellent training.

The Construction Department also had to strengthen many of the bridges to carry the increased axle loadings. The longest bridge, of 98 ft. span over the east end of Longmoor Yard, was reconstructed, and most of the others were strengthened by introducing deeper joists and adjusting the abutments and piers to suit. A 300-ft. timber bridge on the main line was replaced by an embankment, work that was carried out by trainees without interruption to operations.

Naturally the increase in traffic had its effect on the workshops. Increased overhaul of locomotives and stock became necessary and in spite of the fact that the workshops site at Longmoor is not so well laid out as might be desired, due to its somewhat elementary beginnings, the plant and machinery is fairly comprehensive. It is not possible to undertake all major repair work on locomotives, but most of the normal maintenance work resulting from heavy work on the Longmoor line can be covered.

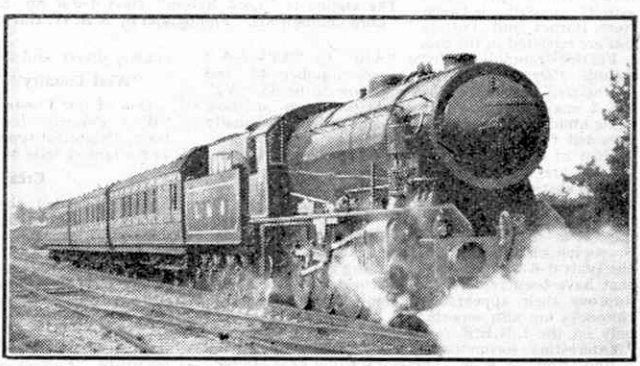
A feature of the railway is the variety of signalling equipment, from the simplest form of flag board to modern double line block working appliances. Certain sections of the railway are to be provided with colour light signals and experimental work with these has recently been undertaken. The object of this variety of equipment is to demonstrate the various methods of signalling that can be used on a military railway. Even before the war experiments were carried out in the control of rail movements by wireless. There is also a Signal School with a very completely equipped electrically operated miniature railway.

Steam locomotives in use before the war were all of the tank type, some the products of locomotive building firms and others obtained second-hand from various British railways. Then came the first W.D. standard locomotives of the recent war in the shape of the 2-8-0s of the L.M.S. Stanier type. These were followed by the appearance of British and then American "Austerity" 2-8-0s and the Ministry of Supply 2-10-0 type. Standard Ministry of Supply 0-6-0 saddle tanks also are used, and various other types have appeared on the line or have been accommodated at the depot from time to time. The illustrations on this page show a British "Austerity" 2-8-0 W.D. No. 79250, named "*Major-General McMullen*"— after a former Longmoor Commandant, and appropriately painted in colours of the Royal Engineers, dark blue and red with bright red lining.

Diesel-powered units of various kinds have been used on the line, while the coaching stock has originated from various British systems. The long hauls associated with lines of communication cannot be reproduced on the Longmoor Railway because of its geographical limits. It is possible however to give train crews some experience in handling freight trains of 1,000 tons by working the Hollywater loop line and a section of the main line as a continuous track.

Altogether the thoroughness of Longmoor training is aptly summed up in the remark, often expressed by field commanders: "*You can tell a Longmoor trained sapper anywhere; but you can't tell him much.*"

The information in this article is based on an address by Brigadier C. A. Langley, C.B.E., M.C., Commandant, Transportation Training Centre, R.E., to whom we are indebted for permission to reproduce the accompanying photographs.



A passenger train on the Longmoor Military Railway, hauled by 2-8-0 No. 79250. This engine is finished in the colours of the Royal Engineers.

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Railway Notes

L.N.E.R. Locomotive News

The L.N.E.R. have made a striking contribution towards more cheerful travel by deciding to paint all their locomotives, numbering 6,400, in bright colours. The streamlined "Pacifics" that before the war hauled such crack trains as the "*Coronation*" and the "*Silver Jubilee*" will be painted "Garter" blue; all the remaining engines will be painted in the pre-war standard L.N.E.R. green. Thus even goods and shunting locomotives will now appear resplendent in the green livery that was previously reserved for passenger train locomotives.

New construction recently has included "06" L.M.S. type 2-8-0 engines numbered 3135-41, at Darlington Works, and 3159-67, at Doncaster.

The second "A2" 4-6-2 is No. 511, named "*Airborne*," and carries Works No. 2002.

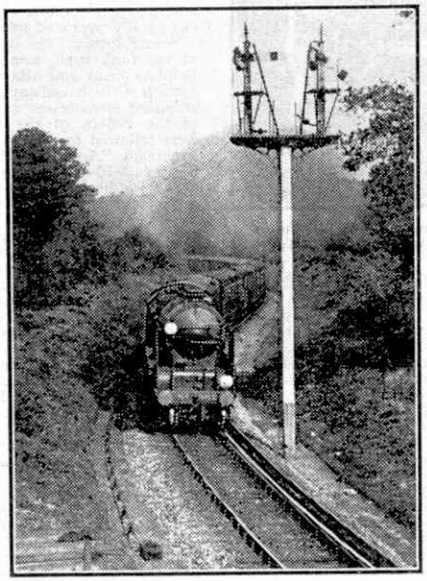
More of the standard "B1" 2-cyl. mixed traffic 4-6-0s constructed by the North British Locomotive Co. Ltd. are in service on the Great Eastern section, numbered 104x. With the exception of No. 1040 "*Roedeer*" they are so far unnamed. They are painted black with red lining.

"N2" 0-6-2T No. 4727, renumbered 9506, is now back at King's Cross, but Nos. 2583 and 2588 of the same type were lately allocated to Nottingham, as more of the ex-Metropolitan passenger tank engines are being withdrawn. "C1" G.N. type 4-4-2 express locomotive No. 3293, shedded at King's Cross, is fitted with experimental automatic train control apparatus by means of which colour-light signal aspects passed between New Barnet and Potters Bar are repeated in the cab.

Further rebuildings from "A10" to "A3" 4-6-2 include "*Doncaster*" with a new number 48, and "*Isinglass*," previously 2562 and now to be 63. "V2" 2-6-2 engines of the "Green Arrow" type are now being numbered 800-983 in the same order as originally intended to be 700-883.

Most of the "03" 2-cyl. G.N. type 2-8-0 mineral engines are now at Frodingham depot, Lincs., and a large share of the mineral or heavy freight haulage from Peterborough (New England) shed is in the hands of W.D. "Austerity" 2-8-0s. More "Atlantics" of classes "C1" and "C7" have been withdrawn. Stovepipe chimneys have been fitted to several of the Ivatt 0-6-0 saddle tank shunting tank locomotives that have been repaired at Stratford, which does not improve their appearance. Many other changes in chimneys are also reported on other older types, not only on the L.N.E.R.

Interesting locomotive variety was provided on a July afternoon when expresses passing near Hatfield within two hours were hauled, among other engines, by "A4" No. 14, "*Silver Link*"—blue; "A1" No. 4470, "*Great Northern*"—a darker blue; "A3" No. 105, "*Victor Wild*"—black; "*Edward Thompson*," new "A2" No. 500—green; rebuilt "Sandringham" "B2" class 4-6-0 No. 1671 "*Royal Sovereign*"—green; and "A2/1" 4-6-2 No. 3697—black. It will be noted that several of the engines concerned carried the latest new numbers.



A pre-war Continental Boat Express to Dover, S.R. The engine is "Lord Nelson" class 4-6-0 No. 862 "Lord Collingwood." Photograph by S. A. W. Harvey.

Fine Running by Stanier "Jubilees"

We have received reports of two excellent runs on the Midland Division of the L.M.S. with substantial loads by "5XP" 3-cyl. "Jubilee" class 4-6-0 express locomotives. One was short, the other long and arduous.

When working the 8.52 a.m. Bristol-Bradford train, with 360 tons behind the tender, No. 5605 "*Cyprus*" had no assistance up the steep ascent out of Bristol and had to stop at Mangotsfield to pick up a considerable complement of passengers. Restarting 3 min. late, a grand run was made over the 31¾ miles of moderate grading on to Gloucester, the total time start to stop being only just over 31¾ min., reminiscent of some of the fastest trips of 1939 with lighter trains; 16¼ miles were covered in 13½ min., at an average of 74 m.p.h., and 84 was touched at the foot of a long 1 in 270 descent just before easing slightly through Berkeley Road station and junction.

On the 9.5 a.m. St. Pancras to Leeds, with 13 coaches weighing nearly 400 tons full, No. 5654 "*Hood*" was stopped for 2 min. by signals 2½ miles from the start, but reached the first stop at Kettering 4 min. early, covering 72 miles in 87 min. actual. Some time was gained on each subsequent stage between stops at Leicester, Trent, Chesterfield and Sheffield, so recouping some overtime at stations as well as time lost by relaying or other special slacks. The arrival at Sheffield was only 1½ min. behind time, although total delays had amounted to about 19 min., which was a praiseworthy effort indeed on the part of engine, driver and fireman.

"West Country" Locomotives on Kent Routes

One of our illustrations this month shows an S.R. "West Country" of 1946 on an Eastern Section train. This latest type has replaced the "Lord Nelsons" as the largest class on the Kent routes.

Great Western Tidings

New "Castle" class green express engines have been put into traffic and allocated as follows: No. 5098 "*Clifford Castle*," Salop; No. 5099 "*Compton Castle*," Paddington; No. 7000 "*Lord Portal*," Newton Abbot; No. 7001 "*Denbigh Castle*," Cardiff; and No. 7002 "*Devizes Castle*," Landore, Swansea. No. 7003 "*Elmley Castle*" is also there. It has been announced that 25 "Castles" are to be converted to oil burning at Swindon.

At the time of writing Nos. 7004-6, named respectively "*Eastnor Castle*," "*Lamphey Castle*" and "*Lydford Castle*," had also just come into service; they are stationed at Gloucester, Worcester and

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L.M.S. train from the Midland Division entering Carlisle. Photograph by H. C. Casserley.

Salop respectively. Further new 0–6–0 pannier tanks reported in July were Nos. 9646–51, shedded at Exeter or in South Wales. Named "Halls" not previously reported include No. 6920 *"Barningham Hall,"* No. 6930 *"Aldersey Hall,"* and No. 6966 *"Witchingham Hall."*

Not many of the new "County" 4–6–0s appear to have been named yet and their construction has stopped for the time being at No. 1019. Nos. 2832, 2839, 2849 and 2863, of the 2–8–0 type, have been converted to oil burning. No. 4014 *"Knight of the Bath,"* of the once famous pioneer 4-cyl. "Star" 4–6–0 class, has been withdrawn; it has been stationed lately at Stafford Road shed, Wolverhampton.

More New Standard L.M.S. Locomotives

The L.M.S. Company announce that additional class "5" 6 ft. 4–6–0 mixed traffic engines placed in service are numbered and shedded as follows: Nos. 4931, 4953–4 and 4967 at 5A, Crewe North; Nos. 4955 and 4968 at 2A, Rugby; No. 4962 at 17A, Derby; Nos. 4969–70 at 9A, Longsight (Manchester); No. 4971 at 7A, Llandudno Junction; Nos. 4958–61 and 4972–7 at 29A, Perth; Nos. 4956–7 at 31A, St. Rollox, Glasgow; and No. 4978 at 27A, Polmadie, Glasgow. New class "4" 2–6–4Ts added to stock were Nos. 2223–7, 13A, Plaistow; No. 2228–9, 26A, Newton Heath, Manchester; and Nos. 2230–2, 23C, Southport.

New Rolling Stock on the S.R.

Passengers in the London suburban area are becoming familiar with the new style, wide four-coach sets now coming into traffic at the rate of one unit per week. Each unit seats 420 passengers in 35 compartments. The body-work is of steel and provides the maximum seating room, six a side, while keeping the total width within the loading gauge of all present electrified routes. Two of these units coupled together at peak hours provide seating for 840 passengers. Third class trailer carriages to the number of 116 also are being built for incorporation in the older three-car sets, converting them to four-car units with motor coaches at each end, fitted with current pick-up and driving compartments.

Ashford Works have been busy with the construction of 500 12-ton covered goods wagons with steel underframes, mass-produced at the rate of one per hour. They are then mounted on their wheels and fitted with steel skeleton upperworks. In the body shop plywood panels are built on, roof and timber-sheeting completed. The finish is in standard wagon brown with small white lettering.

New Standard L.M.S. Colour Scheme

After experiments to determine durability, economy and appearance of various styles of painting or lettering, all L.M.S. locomotives are to be painted black, so the red as well as the "Coronation Scot" blue are not to reappear. "Pacific," "Royal Scot," "Patriot" and "Jubilee" express classes only will be lined-out in maroon and straw colour.

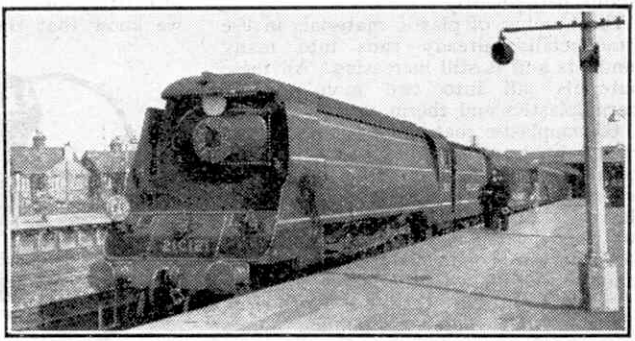
Carriage stock will continue to be red, of a shade officially styled maroon, with straw coloured lining. Neat Gill Sans lettering will become standard. The basic colours for passenger station buildings will be maroon and straw, with various shades of grey for certain roof and bridge work.

As materials become available station nameboards are in future to be of the enamelled iron type; those at the departure ends of platforms will consist of two boards set in a V-shape, so that the name will be prominently visible from the windows of trains. Boards of this kind are already in use at certain Midland Division stations.

A Long Non-Stop Goods Train Run

The huge holiday traffic of the present summer has necessitated many more long distance passenger trains, some of which are running at higher speeds than has been possible during the past six years. The importance of effecting next-day deliveries of foodstuffs and other valuable freight by goods train has not been overlooked, however, and the L.M.S.R. introduced eight additional express freight trains in July last, making 102 daily in the two fastest classes, wholly or partially vacuum-braked.

The longest non-stop run made by an L.M.S. freight train is scheduled for the 2.55 p.m. express goods from London (Camden) to Glasgow. The train is booked without a halt from Camden to Crewe, nearly 156 miles, in 3½ hours at an average of 44½ m.p.h.



S.R. "West Country" class No. 21C 121 on an up train at Tonbridge. Photograph by A. C. M. Clements, Tunbridge Wells.

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Plastics in Everyday Life

I—What are Plastics?

THE dictionaries tell us that the word "plastic" indicates something that is capable of being moulded into a required shape. This suggests a substance of a dough-like nature, but the plastic products with which most of us are familiar are anything but dough-like. Their most obvious feature indeed is their hardness and toughness. Yet the substance of which the ash tray or other article we have in front of us is made was at one time in a really plastic state, in which it was moulded by a combination of heat and pressure into its present shape. A plastic thus may be described as a substance which, at one time in its career, is capable of being moulded by the application of heat and pressure into a required shape, which it retains permanently.

This is the first of four articles on Plastics that have been prepared with the assistance of Birkbys Limited of Liversedge, Yorks., makers of the well-known "Elo" Plastics. The photographs that illustrate the articles were all taken at the "Elo" Works.

The number of plastic materials in use commercially already runs into many hundreds and is still increasing. All these materials fall into two main classes, thermoplastics and thermosetting plastics. A thermoplastic material becomes plastic when heated and solidifies on cooling, and the process of softening and setting can be repeated indefinitely. A thermosetting plastic is plastic in its unheated form, but when heated it sets finally, and cannot afterwards be made plastic again. Among well-known thermoplastics are "Xylonite," "Bexoid," "Erinoid," "Diakon" and "Perspex"; familiar names among thermosetting plastics are "Bakelite," "Elo," "Beetle," and "Rockite." The thermoplastic is the older of the two, but the great plastics industry of to-day has developed mainly from the appearance of the thermosetting materials.

What are plastics made of, and why are they plastic? For the answers to these questions we shall have to plunge into chemistry, but fortunately it is not necessary to plunge very deeply, and the start is made with something familiar to readers generally—the atom. Atoms are the smallest particles of different elements that can exist, far too small to be seen in even the most powerful microscope, and the picture of elements built up of them we owe to John Dalton, a Manchester scientist of last century. Dalton thought of them as solid pieces of matter, something like shot. Nowadays we know that they are by no means as

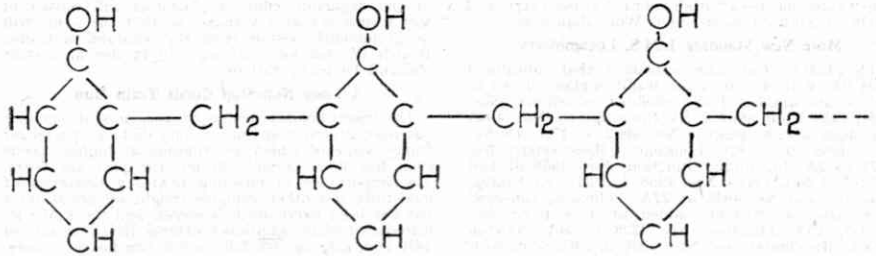

Fig. 1. The chain molecule formed when phenol and formaldehyde are heated with a catalyst. The ring portions are from the phenol, which contains the benzene ring, and the connecting CH2s from the formaldehyde.

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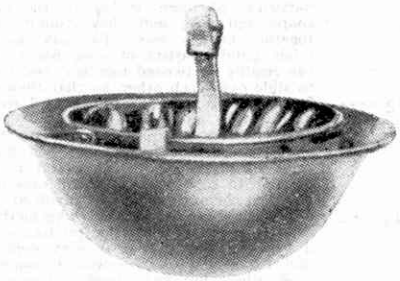


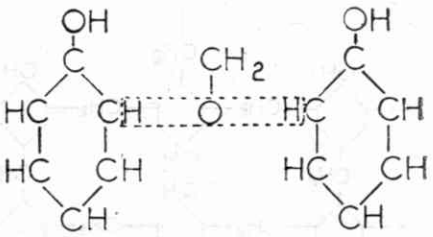
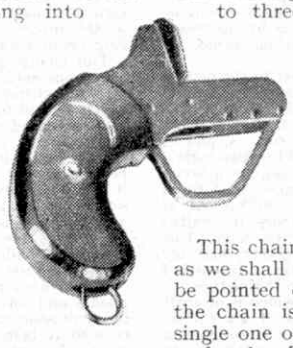


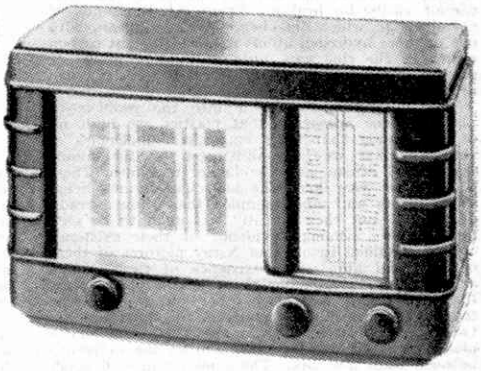
Fig. 2. How phenol, which contains the benzene ring of six carbon atoms, combines with formaldehyde to form a plastic. The atoms within the dotted line are split off to form water, and the two benzene rings are united by the carbon atoms of the formaldehyde.

solid as this, and that they are indeed built up of still smaller electrically-charged particles known to us as protons, electrons and so on. The nature of atoms does not concern us at the moment, however. It is sufficient to think of them as particles of different elements, of which there are 92 altogether. Those with which we are chiefly concerned in looking into the make-up of plastics are carbon, hydrogen, oxygen and nitrogen, and of these the most important, the centre of the whole business, is carbon. We know it best in the form of charcoal, but a diamond is crystalline carbon, and in combination with the other elements named it gives rise to hundreds of thousands of compounds, of all colours and consistencies, and with many widely differing properties.



Now the reason for the existence of so many carbon, or organic compounds, as they are called, is the ability of carbon atoms to link up with each other. An example will show what is meant. The elements present in the well-known gas methane, which is found in the form of firedamp in "gassy" coal mines, are carbon and hydrogen, and each carbon atom present is united with four hydrogen atoms. The capacity to unite with four hydrogen atoms is a characteristic of a carbon atom. Putting C for an atom of carbon and H for one of hydrogen, the chemist would write CH_4 for methane, this representing the smallest particle of the compound, or what he calls a molecule. Now if one hydrogen atom was supposed to be missing, the residue CH_3 would have one of the four combining capacities of its carbon atom unsatisfied; and two such residues combined with each other form a molecule of a gas called ethane, represented by $CH_3.CH_3$, or C_2H_6. Another carbon atom added gives propane, the formula for which is C_3H_8, and so the process can go on, longer and longer chains of carbon atoms being formed, the end ones united to three hydrogen atoms each, and those in between to two hydrogen atoms each. The compounds built up in this way are called paraffins. As the number of carbon atoms in the chain increases the boiling point rises, and we pass from gases to liquids and then to waxy solids.

This chain formation is very important, as we shall see. In the meantime it must be pointed out that each carbon atom in the chain is connected to the next by a single one of its four combining capacities or bonds. This is seen at a glance from the formula of pentane, the chain compound of this type with five carbon atoms in it. This is $CH_3.CH_2.CH_2.CH_2.CH_3$. There are also compounds in which two bonds appear to unite the carbon atoms in



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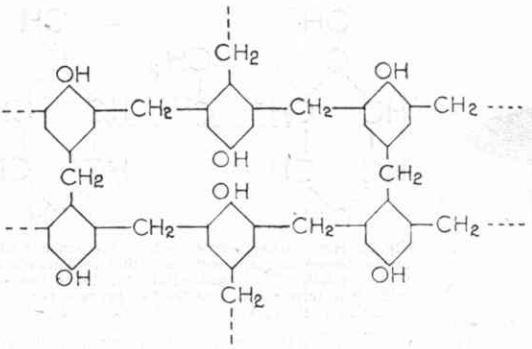


Fig. 3. This diagram explains what happens when the phenol-formaldehyde plastics set. The chains are linked up to form a network. In this drawing the benzene ring is represented by the six-sided figure.

association with each other, while in certain cases there appear to be even three bonds; the well-known gas acetylene is an example of a compound in which there is a triple bond. Contrary to what would be expected, double and triple bonding is by no means as firm as single bonding where carbon atoms are concerned.

These and many other facts have led to the picture of the four bonds of carbon pointing in definite directions. It is usual to picture the atom at the centre of a pyramid standing on a triangular base, with the bonds pointing to the four corners, and so at angles of 120 deg. to each other. When two carbon atoms are connected by a single bond, or a series of them are connected in this manner to form a chain, none of the bonds has to be pulled out of position. But when two carbon atoms are united by two bonds each it is clear that these have to be strained somehow to bring them together, and the result is a weakness, which of course is intensified when three bonds each are drawn into the picture.

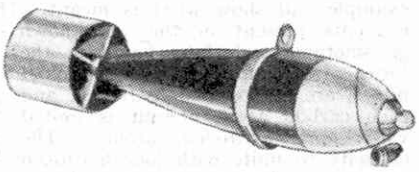
There is one special form of chain which is of great interest and importance. It consists of six carbon atoms, and although some of the bonds connecting these must apparently be double, the chain is not at all weak, but indeed really strong, for the compound represented by it is very stable. This is benzene, in which the molecule has six atoms of carbon and six of hydrogen. The directions of the bonds of the carbon atoms explains why this is the case. These are at angles of 120 deg. to each other, and it is possible to arrange six carbon atoms in a chain that returns on itself and actually forms a ring that cannot easily be broken. There are thousands of chemicals in which this benzene ring appears with one or more hydrogen atoms removed so that carbon atoms in the ring can unite with other atoms or groups of atoms, and many of them are concerned in the making of plastics.

Now how does this come into the problem of plastics? The answer is that plastics are built up of compounds that have long chain molecules of the kind that we have illustrated by the simple example of ethane and the higher paraffins. These chains grow very long, the molecules formed being much bigger and more complex than those already dealt with, but they are still too small to be seen by the eye, although evidence of their existence can be obtained by making X-ray pictures of them of a special kind. The existence of these chains accounts for the peculiar properties of plastics, for they slide easily over each other and at the same time give cohesion to the mass. The difference between a non-plastic chemical, such as salt, and a plastic one can best be compared to the difference between sand and silk. The sand consists of small particles, all more or less of the same shape and size, and they cannot stick together in any way. The silk on the other hand consists of long fibres that can readily be twisted together, and made to slide over each other, so that they can be spun into long threads, wound round narrow rods and woven together.

Next comes the question, how are these chains formed? The chemist has many ways of producing them, and it is impossible to go into all of them, especially as the chemical changes involved are often very complicated. One of his methods can be illustrated by the production of a type of plastic that is very common and for which an astonishing range of applications has been found. Two compounds are involved in its production. One is carbolic acid, or phenol, to give it its chemical name; the other is formaldehyde, a simpler chemical that is present in formalin, well known as a disinfectant and steriliser. When these two chemicals are heated together in the presence of an acid or alkali they join up with each other, a phenol molecule linking up with a formaldehyde molecule that itself, on the opposite side, so to speak, hooks on to another phenol molecule. The second phenol molecule in turn joins on to another formaldehyde molecule, and so the process goes on with the formation of the long chain molecule seen in Fig. 1.

This change is made evident in the production of a resinous mass. Chemists were used to the tendency of many chemicals of this kind to form such resins, which seemed to be useless, and indeed were regarded as a waste of material and a nuisance. But early this century a chemist named Baekeland looked more closely into the resinous mass obtained on heating phenol with formaldehyde. He found that it could readily be moulded to any shape before setting on heating, while the finished product was an electrical insulator. He saw that there could be many uses for this material and he patented its production under the now familiar name of Bakelite. It was the first of the thermosetting plastics.

It has been noted that in making a plastic from phenol and formaldehyde, these are heated together in the presence of an acid or alkali. Whichever of these is used it helps along the action between the two chemicals, but itself remains unaltered at the end. The chemist calls a substance that acts in this way a catalyst. The exact nature of the product formed in this instance depends on the acid or alkali employed, and in producing Bakelite an alkaline catalyst was used.



Plastics formed from formaldehyde and phenol and other chemicals of the same kind are dark in colour. If the phenol is replaced by another chemical known as urea, or by others of the same class as urea, a lighter product is the result, and plastics made from these materials can therefore be given a very large range of bright colours in many shades by introducing colouring matters into them. Some of these plastics indeed are transparent, and generally they are attractive and decorative in appearance.

These plastics are built up by what the chemist calls condensation. The bonds of the carbon atoms in their constituents are fully occupied, but under the influence of the catalyst certain atoms are broken

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away to form water, and the carbon atoms then unite by means of the bonds thus set free. Fig. 2 shows this graphically.

Another way in which long chain molecules are built up is described by the long word polymerisation, which only means multiplying. In this a number of molecules simply hook on to each other to form a very much larger single molecule. A good example is provided by a gas called ethylene, in the molecule of which there are two carbon atoms and two hydrogen atoms. When this is liquefied and heated in certain conditions it forms polyethylene, the molecule of which contains carbon and hydrogen in the same relative proportions as in that of ethylene, but is about a thousand times as heavy. This new molecule takes the form of a long chain and the material is a well-known plastic.

The existence of these long chains accounts for both kinds of plastics, those that soften when heated, that is the thermoplastics, and those that set when heated above a certain temperature and cannot again be softened, that is the thermosetting plastics. The latter act in this way because heating them above a certain temperature sets them off forming chains sideways and upwards, as suggested in Fig. 3. The result is that the long chains formed are tangled inextricably together, and are no longer able to slide over each other.

The great interest that is taken nowadays in plastics has been stimulated by many wonderful discoveries of artificial plastics built up in the ways that have been indicated. At the same time it is well to bear in mind that plastics are not all new. Resins and waxes of various kinds, together with various pitches and bitumens, have all been well-known natural products for ages, and rubber is another plastic that has been familiar for a long time. Yet another natural plastic is shellac, an eastern product formed on the branches and twigs of trees by a tiny insect. This material is treated with various fillers to give it substance, and the mixture on heating forms a plastic mass to which any required shape can be given by pressing. Gramophone records are made of shellac.

The chemist seems to have stepped definitely into the plastics field about 80 years ago, when the first artificial plastic was introduced. This was called Parkesite, after its discoverer, Alexander Parkes of Birmingham, and it is the material that has since been known under the names of xylonite and celluloid. The starting point for this historic material was cellulose, the basic chemical of vegetable tissues such as cotton and wood. This is itself a long chain compound built up from "bricks" that are molecules of glucose, but is too brittle to be a plastic itself. Parkes made his plastic from it by acting on it with nitric acid and adding camphor and alcohol, the result being the now well-known hard horny-like material, which can readily be softened by heating and then moulded into any shape desired.

Celluloid has been used for many purposes, but suffers from the drawback that it is very easily inflammable. Efforts have been made to produce a similar plastic that did not burn easily by using acetic acid instead of nitric, but they were not very successful. There was one unexpected result, however, which illustrates the fact that one never knows what uses may be found for chemicals hitherto disregarded. The cellulose acetate produced in these experiments was discovered many years later to be an ideal dope for aircraft fabrics, protecting them from the effects of damp and exposure. It has been used since then in immense quantities, not only for this purpose, but also for making artificial silk and plastics of various kinds.

In the meantime casein too has become important because of its plastic nature. It is made from milk by curdling it with rennet, a ferment or coagulant, the casein settling out in fine granular particles that are washed and dried. Casein plastics include Erinoid and Lactoid. In making them the chemist used another trick—the introduction of plasticisers, which act like internal lubricants, allowing the chains of the basic chemical to slide freely over each other. Camphor is a typical plasticiser, and the use of these aids is necessary for cellulose plastics as well as those made from casein. It has already been pointed out that Parkes used camphor in making celluloid from cellulose.

With the introduction of scientific methods the plastics chemist is becoming more or less master of a field that is daily growing larger. He has discovered so much about the make up of the long chain molecules of which plastics consist that to-day he can practically design a plastic to meet any required need, for he knows the effect of introducing various groups of atoms in different positions in the chains.

Next Month:

"Preparing the materials"

Finding Buried Metal

Not long ago the only way of finding buried metal pipes, cables or conduits of which there was no record was by digging. Now they can be traced without difficulty by the "Cintel" Metal Detector, which in its general form and performance is a reminder of the mine and bomb detectors used by the services during the war years.

The device is electrical in operation, and there are three parts to it, all of which are shown well in the illustration on this page, in which the detector is seen in use. One is a search head, to which a handle is fitted, then comes the amplifier box, which carries a battery, and finally there are the headphones. Control is very simple, one knob being sufficient to adjust the instrument to working condition, and the presence of metal underground is indicated by a distinctive note in the headphones.

Tracing underground pipes with the "Cintel" Metal Detector. Photograph by courtesy of Cinema Television Ltd.

In average conditions the detector will find 6 in. pipes buried as much as 2 ft. 9 in. below the surface of the ground, showing their actual position to within an inch or two. Small pieces of magnetic and non-magnetic metal embedded in timber or otherwise concealed can be detected at depths up to about 9 in.

With the aid of an oscillator the "Cintel" Metal Detector can trace buried pipes for considerable distances even when they are as much as 30 ft. below the surface of the ground, provided that they are exposed at any one point.

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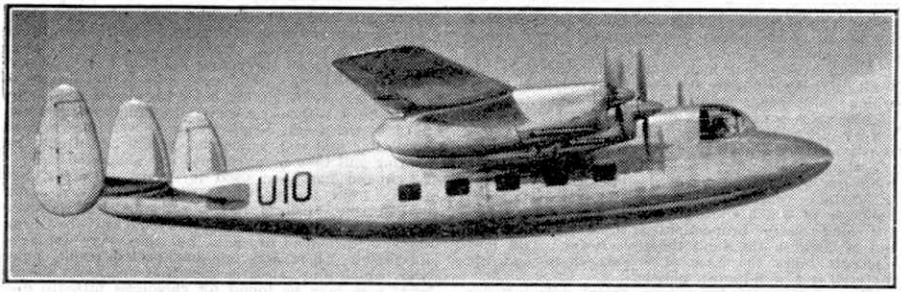


Miles "Marathon" transport. It seats 18 passengers and is intended for feeder-line and charter service.

Air News

Miles "Marathon" Air Liner

Yet another outstanding British air transport has successfully completed its prototype flight trials. It is the Miles "Marathon," which flew for the first time on 19th May last, piloted by Ken Waller, the company's chief test pilot, and is illustrated above.

The all-metal "Marathon" seems to be the answer to the prayers of all feeder-line and charter service operators, as it carries a large payload at comparatively high speeds and yet is very economical. Careful design, fine streamlining and surface finish are combined with the provision of four engines of proved efficiency, D.H. "Gipsy Queen" 71s, each developing 330 h.p. The Miles design staff decided to use four low-powered engines rather than two high-powered ones, in order to combine the greatest possible margin of safety in the event of engine failure, with maximum simplicity, economy and ease of maintenance.

The high wing arrangement ensures a good view of the ground for the passengers, and facilitates entry into and exit from the cabin, which has a total capacity of 774 cu. ft. and a minimum head-room of 6 ft. Normally 14 to 18 comfortable seats are provided, with plenty of leg room and luggage space. The floor has been made strong enough to support the weight of concentrated loads of freight, but the "Marathon" is intended chiefly as a passenger transport and, as such, it offers a higher standard of comfort than any other medium-sized aircraft in the world.

For those who like statistics, the "Marathon" has a wing span of 65 ft., is 52 ft. 1 in. long and, fully loaded, weighs 16,240 lb. It has a top speed of 230 m.p.h., and will carry 18 passengers and 540 lb. of luggage for 500 miles at a cruising speed of 175 m.p.h. The "Marathon" is the transport of to-morrow as well as to-day, for next year it will be flying with Armstrong-Siddeley "Mamba" gas turbine engines.

J.W.R.T.

The Canadian-Built D.H. "Chipmunk"

A new trainer aircraft designed and built in Canada since the war ended recently made its first flight at Toronto. It is the DHC-1 "Chipmunk," shown in the lower photograph on this page, and is the first machine designed in the Canadian factory of the de Havilland Enterprise, where more than 1,100 "Mosquitoes" were built during the war.

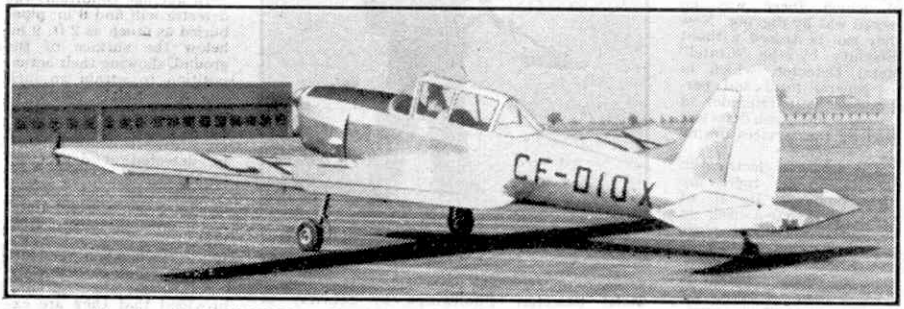
The "Chipmunk" is intended as a replacement for the well-known D.H. "Tiger Moth," the machine in which almost all the pilots of the British Empire were trained in the war years. It has the same 140 h.p. "Gipsy Major" I C engine as its predecessor, and while offering the modern monoplane characteristics and the durability of all-metal construction it is lighter than the "Tiger Moth" and about 40 m.p.h. faster, with a top speed of 152 m.p.h. Later DHC-1s will have 160 h.p. "Gipsy Major" 30 engines and a correspondingly higher performance.

The crew of two are seated in tandem under a Perspex hood. A side-by-side two-seater cabin version, designated the DHC-2, is also under development.

J.W.R.T.

Crop Spraying by Helicopter

The helicopter is excellent for spraying crops from the air with special dust or liquid to destroy agricultural pests. A demonstration of its efficiency in this respect was given recently at Harston, Cambridge, by a firm called Pest Control Ltd. A Sikorsky "Hoverfly" helicopter, fitted with a 185 h.p. engine, was used. The pest-destroying liquid was carried in a small chemical tank and pumped out through a row of nozzles in front of the fuselage as the machine flew slowly and very low over the crops.



The Canadian-built DHC-1 "Chipmunk," a new trainer aircraft with enclosed cockpits.

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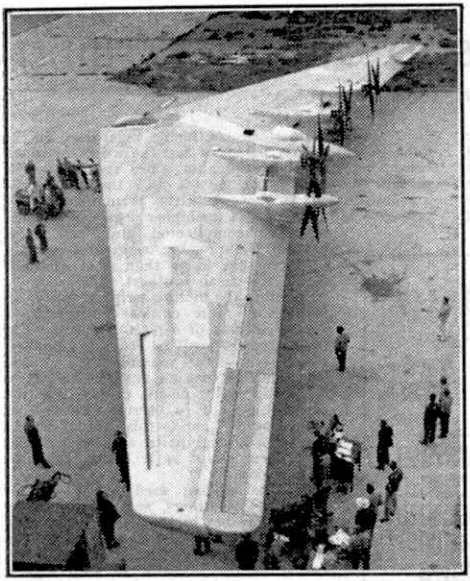


Tractors pulling the huge Northrop XB-35 all-wing bomber into position for its first taxying tests. Photograph by courtesy of Northrop Aircraft, Inc., U.S.A.

Crop-spraying on a larger scale than is possible with the "Hoverfly" can be done with the Cierva W.10 "Air Horse" helicopter designed by the Cierva Autogiro Company to a specification drawn up by Pest Control Ltd. A mock-up of this machine was displayed at the Harston demonstration and attracted much attention. The W.10 is a weird looking aircraft, with three 3-bladed rotors each mounted at the end of its own long tapering arm or boom, and measures 50 ft. from rotor hub to rotor hub. The 3 tons or so of chemicals for spraying are carried in a tank attached to the underside of the fuselage, and when the machine is in operation they are pumped to 100 nozzles that spray them upon the crops. The machine is fitted with a Rolls-Royce "Merlin" 32 engine and has a crew of two, the pilot and the spray operator.

New American Bombers

The two largest bombers in the world are now being test-flown in the United States. They are the Northrop XB-35 and the Consolidated-Vultee XB-36, illustrated on this page. Both machines are unorthodox in design, but the Northrop is particularly interesting as it is a true flying wing, with its crew, engines, bombs and undercarriage all buried inside the wing contours. It is referred to briefly on page 358, in the article on tailless aircraft, but more details have become available since that reference was written.

The Northrop XB-35 has been under construction since 1943 and, although designed as a long-range bomber, may be adapted as a cargo plane to meet changing post-war requirements. This flying wing has a span of 172 ft., with an area of 4,000 sq. ft., and is capable of operating under overload conditions at a gross weight of 209,000 lb. or over 93 tons. It is fitted with four Pratt and Whitney "Wasp Major" engines giving a total of 12,000 h.p. and driving 8-bladed Hamilton Standard contra-rotating propellers. The normal crew of nine is carried in a pressurised nacelle, the gun turrets being remotely controlled. Cabin space is also available for six additional men to relieve the crew members on long-range flights, and there are folding bunks for the off-duty men. The prototype XB-35 cost about £3,250,000 to build, and Northrops have a contract for 14 more B-35s.

The Consolidated-Vultee XB-36 is even bigger than the XB-35, with a wing span of 230 ft. and a length of 163 ft. It is more orthodox than the Northrop machine, but utilises a sharply swept-back wing, a feature that is likely to become almost inevitable as aircraft speeds approach the speed of sound. Its six "Wasp Major" engines are faired neatly into the wings and drive pusher propellers. This increases the efficiency of the wing as airflow over it is not broken up by the propellers. The XB-36 carries a crew of 15, like the XB-35.

A commercial version, the Consolidated Model 37, is under construction for Pan American World Airways. It has been designed to carry 204 passengers for 1,500 miles at speeds up to 350 m.p.h.

J.W.R.T.

First Bristol "Wayfarer" in Service

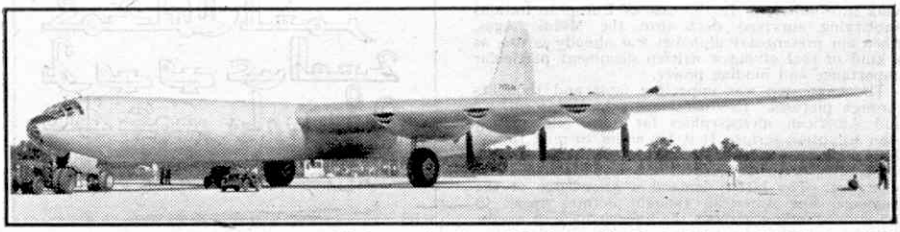
The first post-war British air liner to begin commercial service was the Bristol "Wayfarer" delivered to Channel Islands Airways in June last. This machine was the second prototype Bristol 170. It began work on 1st July last on the company's London-Jersey air service, a 186-mile trip accomplished in 75 min. The machine has a crew of four and carries up to 32 passengers.

British Aircraft for Export

During the war years British fighters and bombers proved themselves second-to-none in the world. All the skill and experience that turned out these famous warplanes is now being utilised in the production of civil aircraft, and it is becoming increasingly obvious that foreign airline operators appreciate this fact.

Argentine is going in for British air liners in a big way, and has already taken delivery of three Short "Sandringham" flying boats and the first of 20 Vickers "Viking" air liners. More "Sandringhams" and an unspecified number of Avro "Yorks" and "Tudors" have been ordered by Argentinian airlines for transatlantic air routes.

J.W.R.T.



The Consolidated-Vultee XB-36, the world's largest bomber. U.S. Army Air Forces Photo., Washington, D.C.

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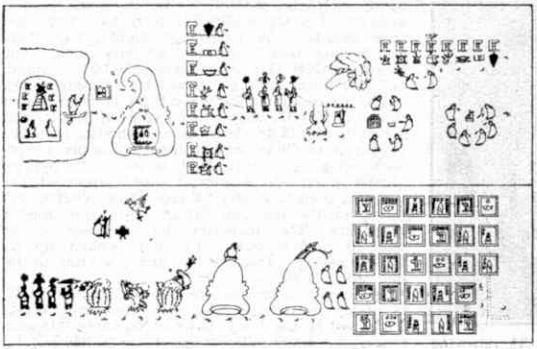
From Hieroglyphs to Sound Writing

By M. Lorant

IT is said that the 26 characters of our alphabet are too much for the modern child to learn. What should the Chinese child say when he has to master several thousand characters, not to mention the children of a bygone age in ancient Egypt, or the children of such forgotten civilisations as that of Mexico, or Yucatan, who had to master an infinite variety of hieroglyphic signs in order to be able to say that they could read or write? No wonder that to be literate in those days, in the early development of writing, was a privilege of the few, whereas reading and writing in our days have to be simplified as far as possible in order to make them accessible to every child on the face of the Earth.



Mexican picture writing telling a long story of conquest and travel between the years 1038 and 1223.

The most primitive means of imparting messages in prehistoric days was "knot-writing," which in Mexico and in Peru, at the time of the Incas, was developed to a scientific accomplishment. The hundred-and-one intricate ways of tieing a knot or of looping a loop all had their special significance, and a whole letter or document of "binding" importance could be "written" or tied on a piece of rope. Such rope letters were sent on journeys of many months to reach the person addressed, who on receiving it would call his knot expert, or scribe, to read it. The intricate knotted, plaited, netted "Quipos" of Mexico and Peru were knotted and unravelled, or "read," by professional "knotters" or scribes.

The art of tying intricate knots is still discernible in the weaving craftsmanship of Mexicans, but of course the significance of the knots has long since sunk into oblivion. In the case of European nations knot-tying survived deep into the Middle Ages, when our present-day alphabet was already in use, as a kind of seal giving a written document particular importance and binding power.

The next step was imparting facts and thoughts through pictures. In their more primitive form, we find American hieroglyphics far more enlightening than Egyptian script. It is far easier to read Indian hieroglyphs, as preserved on bits of bark, smooth rocks, etc., than to unravel the mysteries of those of Egypt. The latter demand a knowledge of the language, but American thought-pictures speak to the understanding without the intermediary of words. Pictures referring to hunting, fishing, battles, etc., were similarly conceived by Indian scribes over the entire North American continent, regardless of the tribe to which they belonged and the words in which they expressed their thoughts when speaking. The picture writing of the Aztecs and the Toltecs of ancient Mexico, in whose countries permanent landed property had developed a far higher degree of culture, is more complicated and variegated, evidently expressing a greater variety of facts and ideas than that of their North American brothers.

Reading the picture script of American Indians is more or less guesswork, a sort of solving of a picture puzzle. The next step towards a regular alphabet, which admits of reading without the possibility of making any mistake as to what the writer meant to say, was the establishing of a script known as "ideography," and this leads us to Egyptian hieroglyphics, and beyond that to Chinese script as it has come down to this day.

Chinese writing used to be picture script like all others, and the traces are still discernible in the Chinese alphabet to-day, in about 200 characters of the early "idea picture" still in use. It is said that the inventor of the Chinese alphabet as it has come down to posterity was the great Emperor Fohi, who ruled about the year 2,940 B.C. The traces of birds' claws in the sand inspired him to design the shapes of word signs, and he thus created the "niso tri wan," the "Bird's Trace Script," one of the many types of script in use in China in the course of thousands of years. In the ninth century B.C. a court historian, Tcheu by name, collected the different

(*Continued on page 392*)

An ancient Arabian inscription.

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BOOKS TO READ

Here we review books of interest and of use to readers of the "M.M." With the exception of those issued by the Scientific and Children's Book Clubs, which are available only to members, and certain others that will be indicated, these should be ordered through a bookseller.

"THE L.M.S. AT WAR"

By G. C. NASH (L.M.S. 5/-)

It was clear from the very outbreak of the late war that railways would play a vital part in it, in the transport of men and material, and how splendidly they did their work is well shown by Mr. Nash's record of the war activities of the L.M.S. The coming of the war had been foreseen and the tasks in front of the railways carefully considered in advance, so that in the first four days of September 1939 the L.M.S. was able to carry about half a million children from London to other parts of the country while continuing the ordinary peacetime services. Then the railway adjusted itself to wartime conditions. How it did this and how it performed its tremendous tasks throughout the war years, interrupted and delayed but never brought to a standstill by the most ferocious air attack, can well be realised from the author's racy and often moving account. This never loses interest. The human side of the story is kept well in the foreground, but sufficient figures and other details are given to enable the reader to grasp the immense scale of the work in every single section of the railway's activity.

There is so much in the book that it is impossible to give even a complete summary of its contents. It deals with transport work for the Services, in itself a herculean task; with the battle of the railways, when there were nightly bombing raids, and heroic deeds by railwaymen frustrated the desperate efforts to bring their work to a standstill; with the wonderful story of the L.M.S. fleet in the narrow waters; and with the tremendous concentration that brought armies and equipment on an unprecedented scale to the ports for the final invasion of Europe. All these stories, and those of the railwaymen and railway-women who did the work, and of the shops in which railway equipment was maintained while tanks and other special material also were being produced in immense quantity, are well told.

In addition to many half-tone illustrations the book includes eight splendid full-page reproductions in colour from originals by Norman Wilkinson, O.B.E., P.R.I. The book is available at 5/- net from the L.M.S. Advertising and Publicity Department, Central Offices, Euston Station, London N.W.1, or through any station bookstall on the L.M.S.

"TRAINS ILLUSTRATED"

(Ian Allan Ltd. Price 1/-)

"*Trains Illustrated*" is the second booklet of a series that is to be produced as conditions permit; paper restrictions prevent it from appearing as a regular periodical. The present number lives up to its title in including reproductions of photographs of many locomotives and trains, some of them in colour, beginning with "*Enterprise*" at the head of the L.N.E.R. "*Scarborough Flier*" on the cover. The well-varied articles include one on the "*Golden Arrow*," now happily restored, another on the unique 15 in. gauge Romney, Hythe and Dymchurch Railway, and a fine contribution from Mr. H. C. Casserley, well known as a photographer of railway subjects. Mr. Cecil J. Allen tells an enlivening story of speed records on the L.M.S., and for technically-minded readers there is a section on boiler pressure by Mr. O. J. Morris, illustrated by the author's own sketches. A "Spotters' Page" is devoted specially to items of interest to members of the "Spotters' Club."

Copies of booklets of this series can be obtained from the A.B.C. Locomotive Books, Mail Order Department, 33, Knollys Road, Streatham, London S.W.16, price 1/2 post free.

"THE HISTORY OF MODEL AIRCRAFT"

By Lt.-Col. C. E. BOWDEN, A.I.Mech.E.
(The Harborough Publishing Co. Ltd. 8/6)

Here is the first comprehensive survey that has been made of the development of the model aeroplane. The author is well qualified to write on this topic as he is one of the most experienced model aircraft designers in the world.

The subject is dealt with in four parts. The first covers the period 1874–1921 and, after referring briefly to the beginning of flight and in some detail to the experiments of Cayley, Stringfellow, Langley and others of the early days of flying, passes on to the historic triumphs of the Wright brothers and the early work of Sir A. V. Roe. An interesting fact brought out is that from the very beginning of attempts to fly men have experimented first with models.

The second part of the book covers the period 1921–1935, aptly described as "The Middle Ages of Aeromodelling." In it we see how the Society of Model Aircraft Engineers came into being. By 1936 there were many model aircraft contests sponsored by the S.M.A.E., and in the third section of this book, covering the years 1936–1941, the author deals extensively with them in addition to Wakefield Cup contests during that period. The final section reviews the post-war situation as regards model aeronautics, and the National Exhibition of Model Aircraft held in London last year.

An outstanding feature of the book is the lavish use of splendid half-tone photographs of the many model aircraft mentioned in it, and there are also many diagrams of particular machines.

"ON SAFARI"

By THEODORE J. WALDECK
(Harrap. 6/- net)

Mr. Waldeck was fortunate enough to be able to gratify his ambition to become an explorer and traveller at the early age of 18, when he accompanied the Duke of Meckenburg on a trip to East Africa to obtain zoological specimens. His start was almost a disaster, but after a period of stern discipline and training he proved capable of holding his own in the work of the expedition.

Since that early effort Mr. Waldeck has returned to Africa time and again hunting for specimens, taking part in explorations and on one occasion photographing wild animals in their natural surroundings. On these expeditions he has met with many interesting adventures, the stories of which make very exciting reading.

The book is illustrated by excellent drawings.

"HOME PHOTOGRAPHY"

By DAVID CHARLES, F.R.P.S.

This booklet, issued by Johnsons, is a completely re-written version of an earlier one that before the war proved of the greatest value to beginners in photography. The many useful hints and tips given in it are intended for those who are just starting to do their own developing and printing, and every detail of this absorbing work is fully and clearly explained. At the same time the booklet will be found interesting by more experienced photographers.

Copies can be obtained from Johnson and Sons, Manufacturing Chemists Ltd., Hendon, London N.W.4, by any reader of the "*M.M.*" who sends 3d. in stamps to cover the postage. Those who apply will be given the opportunity of having their names added to the list of enthusiasts to whom new leaflets and booklets published by the firm will be sent.

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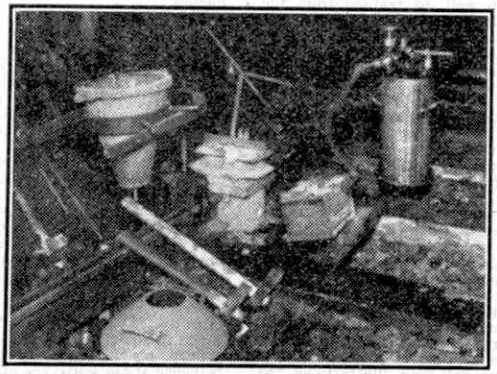
Repairing Tramway Lines

A Fascinating Night Scene

By Eric N. Simons

ONE of the interesting, unexpected sights of pre-war days that disappeared during the war was the repairing of tramway rails without taking them out of the track. Readers who happened to be out late after all the trams had gone back to the depot for the night, would sometimes see a group of workmen very busy and intent in the middle of the road. There were fascinating glimpses of white-hot metal and bluish flame, and mysterious movements. As a boy myself, watching this sight as I went by, I often wondered what it was that was being done.

Such brilliance of light could not be allowed in blackout days, but now that we are again able to leave our windows unscreened on the darkest night, this method of mending the lines is coming back again. In Sheffield, for instance, there are four gangs of men regularly repairing the track in this way.



Pre-heating rail ends in a mould before pouring the thermit steel required to join them. This illustration and those on the opposite page show thermit welding of rails on the Glasgow Corporation subway and are reproduced by courtesy of Murex Ltd.

I am going to try to tell you what I did not know when I was a boy—what the men are doing and how they do it. The method of repairing used is known as *alumino-thermic* welding, which, because it is rather longwinded and hard to say, has wisely been shortened to thermit welding. Its great advantage is that the worn or damaged rail can be mended without having to be taken out of the track, which would be a long and expensive process, involving the laying of a new rail in place until the old one was ready.

The thermit welding process was first discovered in Germany by Dr. Hans Goldschmidt, about 46 years ago. He found that if he mixed together iron oxide (one form of which we know as rust) and aluminium in the form of a very fine powder, and ignited the mixture with a special kind of powder, a chemical reaction took place that produced intense heat. This reaction went right through the entire mixture, and eventually two completely new substances were found to have been produced—a superheated mass of iron, freed from the iron oxide, and occurring in the form of steel (which, as readers of my earlier contributions will know, is a mixture of iron and carbon); and a slag or dross composed of molten alumina (aluminium oxide). The steel contained a little manganese, a little silicon and a little aluminium, in addition to about 0.1 per cent. of carbon.

So far so good, says the reader, but what was the good of this? In the first place, the vital fact was that this reaction, producing steel and slag from iron oxide and aluminium, occurred with very great rapidity. Moreover—though this is not important as far as tramway rails are concerned—other metals besides iron could be used in the thermit process. In short, a ton of whatever metallic mixture of the right type was made could be turned into iron (or other metal) and slag in 50 seconds, without any preliminary heating. What is more, the heat generated raised the temperature to the region of 2,750 deg.C., which is terrific.

After experiment, it was found that a particular form of iron oxide was the most effective, and if this was used in the finest particles or flakes, steel could be deposited where required as a means of welding two parts or pieces together. Another useful feature was that additional

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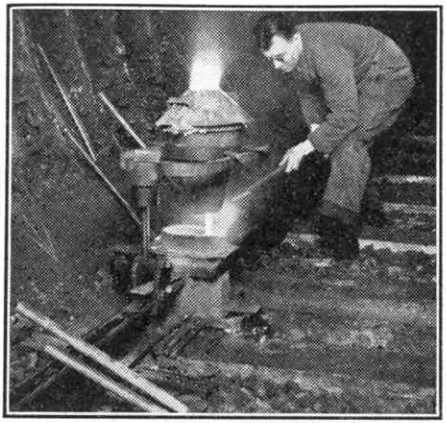

Pouring thermit steel from the crucible into the mould.

elements such as chromium, nickel, vanadium, manganese, and so forth, could be added to the mixture so as to give the weld metal whatever particular properties were thought necessary. The molten steel deposited was so hot that it melted any metal it was brought into contact with, mingled with it, and as a result produced a mass of metal which, when it had cooled down, was solid and uniform in composition and structure.

This then is the basic principle of the welding of tramway rails. The rails to be welded are placed in position with their ends a little way apart, but in perfect alignment. How far they are apart depends on their size. If a tramway rail to be repaired is cracked, a portion of the metal is cut out along the line of the crack. How much metal is removed in this way depends on the size and cross-sectional area of the rail.

Next, the surfaces of the rail to be joined together are carefully rubbed with emery paper for a distance of about five inches on each side of the crack or break. This is to make them perfectly clean.

It will be realised that if the liquid steel created by the chemical reaction is poured on to or round the rail ends to be united, these ends will be melted by its intense heat, and will fuse or mingle with it. Before the steel is poured, however, the rail ends are brought to a red heat, and a ring or collar of surplus steel is deposited round the fractured parts or ends, so as to make the weld stronger than it would be if only the gap between them were filled.

The important point is that the gap between the ends must be big enough to allow the molten steel to flow without restraint. It may happen that the crack or fracture in the rail runs diagonally across it. The metal must then be cut away so as to produce a nearly vertical gap. The cleaning of the surfaces to be joined ceases when all dirt and grease have been cleaned off.

This all sounds very easy so far, but there is one serious matter that has not yet been mentioned. When a metal cools, it contracts or shrinks. The shrinkage approximates to from $\frac{3}{16}$ in. to $\frac{5}{16}$ in. per inch, according to the size of the weld and how long the rail ends have been preheated before welding. It will be seen that, if care is not taken, when the weld cools the contraction will cause the metal to pull away, reopening the gap.

It is not the steel actually deposited between the two ends of the rail that shrinks to any great extent; it is the entire weld that shrinks, sometimes by as much as $\frac{1}{4}$ in. The reader will recall that the rail ends are heated red hot before welding is carried out. This heating causes the ends to expand, which narrows the gap between them slightly. The longer the preheating goes on, the greater the expansion, and the narrower the gap becomes. If then the metal is poured without any adjustment of the gap, when the rail-ends and the weld metal cool all together the shrinkage becomes too severe, and something has to give.

The remedy adopted is to widen the gap a little before the welding begins, just enough to allow for the expansion of the red hot rail-ends.

Yes, says the reader, I see this—with a little difficulty—but I don't understand

Trimming off excess of thermit steel.

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how the metal when poured into the gap is prevented from spilling all over the place. How is it kept from going elsewhere than just in the narrow gap? The answer is that the molten metal is poured into a mould, made from a pattern. A quantity of yellow wax is heated in a pan until it is soft and plastic. It is then moulded or formed about the rail ends to form a collar. The gap between the ends is also stuffed with wax, and a hole is made in this wax to allow any gases to escape when the welding begins. This hole is normally made by forming the wax round a cord of ¼ in. diameter, and taking out the cord when the pattern has been made.

The wax constitutes the pattern, and from this a mould must be made. A moulding box to contain the mould is first taken. This has holes in its sides, and must be placed exactly to suit the position of the weld. It is secured to the rail-ends and filled with well-rammed heat-resistant moulding sand mixture. The sand must be rammed hard, because if it is left soft or loose there is risk of injury to the workman from molten steel spurting out when the weld metal is poured.

Certain wooden patterns are also used and must be placed carefully in position, afterwards being withdrawn. Their impressions remain behind in the moulding sand, and these are then examined to see if any broken surfaces or obstructions of channels for the flow of steel appear. These must be patched and removed respectively if they exist.

Preheating of the rail ends follows, and this is done by placing the nozzle of a petrol burner or torch at the opening of the mould, and, by means of an air blast, causing the hot flame to play upon the rails. As they become hot, the wax pattern round them melts and trickles away, leaving behind only the formed hollow where it was.

Meantime a crucible for the thermit mixture is being got ready. It is cone-shaped and is lined with magnesia tar. On its floor is laid some hard burnt magnesia stone with an opening of special shape in it into which a hollow cone, also of magnesia stone, is placed to make a nozzle by means of which the molten steel can be poured into the mould. A fresh cone is used for each lot of steel.

The crucible is now filled with the thermit powder, which is smoothed off at the top. The powder cannot catch fire until it has reached a temperature of about 1,500 deg. C. That is why a special powder has to be used to ignite it. This powder is placed on the top of the thermit powder, and kindled by means of a red-hot wire, or sometimes by a simple match. The chemical reaction takes about 25 to 35 seconds, unless the weld is very big, when as long as 50 seconds may be necessary. The reaction is so noisy that the welder knows when it is over by the cessation of noise, and he can then begin to pour the steel.

This steel is at a temperature twice as high as that of ordinary molten steel, and this is what is meant by "superheated." It is teemed into the mould, and its fierce heat melts the rail-ends and causes them to mingle as liquid with the liquid steel from the pot. The mould must not be broken open too soon, as if the weld metal cools too quickly, fresh cracks or distortion may result. At least two or three hours are needed, but if it is possible to leave the mould a longer period, this is an advantage.

As soon as the mould has been taken away, all the feeding heads and runners are cut off, either by oxy-acetylene burning or by simple hammer and chisel. These heads and runners are merely the openings through which the steel has flowed, which, because some steel is left behind in them, emerge after the mould is broken open as bristling projections of stumps and hollow shells of metal all round the weld.

The amount of thermit mixture necessary to make the weld is calculated from the weight of wax employed in forming the pattern on the basis of one pound of wax (including feeders and runners) to one bag of thermit. There are also tables that give the right amounts for rectangular welds, but these are not always reliable. A bag of thermit mixture weighs about 30 lb. and this will produce approximately 17 lb. of steel. Specially prepared thermit mixtures are used for complicated alloy and other steels.

Filing a welded rail joint on the Townsend Avenue Light Railway, Liverpool. Photograph by courtesy of the City Engineer, Liverpool.

The heat necessary for melting the steel is all produced by the chemical reaction, and this means that no expensive heat-providing equipment is required, which is one of the great advantages of the thermit process. But for this it would probably be impossible to repair the rails without removing them from the track. The only external heat required is that for drying the mould and preheating the rail-ends. Such equipment is relatively inexpensive and quite easily transported from point to point as required. The thermit process is thus extremely useful for emergency welding when the breakdown of vital parts may mean a complete stoppage.

This type of welding is applicable to many other kinds of work besides welding tramway rails. New necks can be welded on to the rolls of steel rolling mills; broken gear teeth can be replaced; pipes can be joined together; railway rails and frogs can be mended. Cast iron also can be welded, and stern posts, davits, anchors and rudder posts of ships have frequently been repaired by thermit methods.

There is one point that may have puzzled the reader. I referred earlier to the formation of *two* substances by the chemical reaction—steel and slag. You have explained what becomes of the steel, says the reader, but what happens to the slag? The answer is that, when the steel is poured, the slag it contains, together with any particles of sand or dirt that may be picked up from (*Continued on page 392*)

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Engineering Notes

A Big Lift

The Metropolitan - Vickers Electrical Company recently had the biggest lifting problem in the history of their great works at Trafford Park, Manchester. This was to lift a large rotor body, forming the field system of a large vertical type water-driven generator, on to its hub and supporting bracket. The total weight of the rotor was 136 tons, and as this was too great for any single crane in the workshop it was slung on a beam between two of the largest cranes. In order to bring the load within the capacity of the lifting-gear, four of the 36 pole pieces of the rotor had to be removed from each side. In the illustration on this page the workers can be seen clambering on to the pedestal, thus showing their confidence that the simultaneous operations of the two cranes would be perfect, as indeed it was.

In the illustration the rotor, which has a diameter of 22 ft., is seen in position ready for lowering on to its hub and shaft, which are already in place below it. Below these again is seen the supporting bearing bracket, in which the total combined weight of the rotating parts and the hydraulic thrust of the water, more than 700 tons, is carried on a bearing of spring-supported white metal faced segmental pads. These pads and the thrust block on the shaft are given an extremely high finish.

Three of these machines are being built for New Zealand, and they are rated at 33,333 kW, 11,000 V. Each machine is designed for a maximum speed of 410 r.p.m., or a peripheral speed of over 320 miles an hour.

New Lamp of Intense Brilliancy

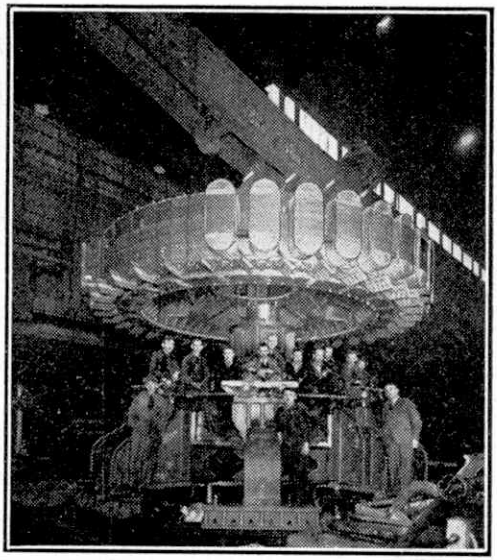
A single 1,000-watt electric lamp that has a light output equal to the light cast by a canopy of 125 ordinary 40-watt lamps has been developed in the United States. This is probably the most brilliant lamp ever produced for commercial use. It is only 14 in. long, and rather less than 4 in. in diameter.

The new lamp is intended for illuminating indoor games areas and similar places where very good lighting is required with as few reflectors as possible. It is also specially suitable for installing in industrial buildings having very high ceilings.

The lamp is of the Mercury vapour type with special pressure boosting arrangements and can be burned in any position.

New Life-Boat for Douglas

The Royal National Life-Boat Institution has provided a new motor life-boat for Douglas, Isle of Man. The new vessel is a Watson cabin-type boat 46 ft. long, and weighs 20 tons. Two watertight 40 h.p. Diesel engines are fitted, giving a speed of over eight knots, and the range without refuelling is 200 miles at full speed.



A heavy lift at Trafford Park works, Manchester. The illustration shows a 136-ton rotor body for a 33,333 kVA generator on the crane hooks. Photograph by courtesy of Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester.

The new vessel replaces another motor life-boat, the *"Manchester and Salford,"* which has been at Douglas for 22 years and will now go into the reserve fleet. She has been built out of legacies from the late Mrs. M. E. Walton, of Derby, after whom the boat is named *"Millie Walton,"* and from her husband, Mr. Charles Walton. The Institution requires many new life-boats to make up for losses and delays of the war.

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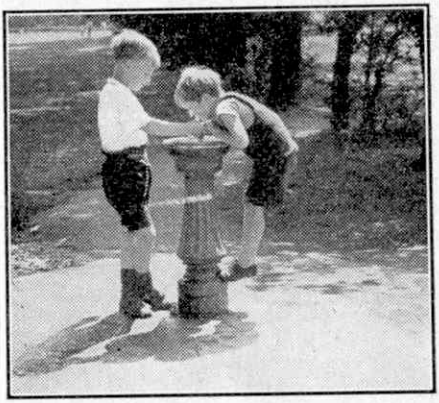
Photography

September Days

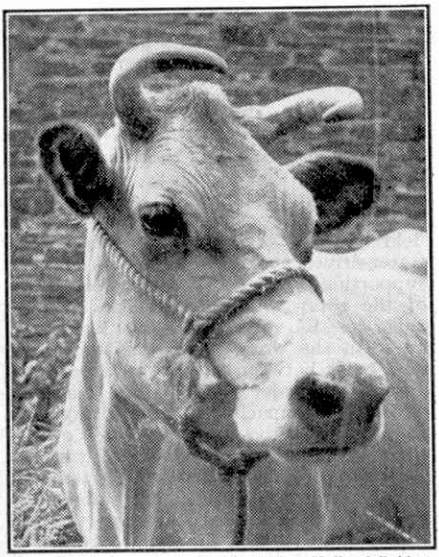
FOR most of us September brings the holidays to a close. It is a wonderful month for cloud effects, and it gives us a chance to carry out at last the good resolutions we have so often made—to take pictures with real skies instead of blank paper. There is a special satisfaction in producing a landscape picture with a good sky, and a panchromatic film with a medium light filter will work wonders in these September days.



"Thirst Quenching." Photograph by E. Davies, Nottingham S.E.9.

Exposures need to be considered more carefully now than in the height of summer. The light value is apt to be deceptive, and it changes rapidly from hour to hour. So now is the time to make good use of the meter or calculator that we probably have not bothered about much in the past two or three months. The increase in exposure made necessary by the filter must not be overlooked in the excitement of the moment.

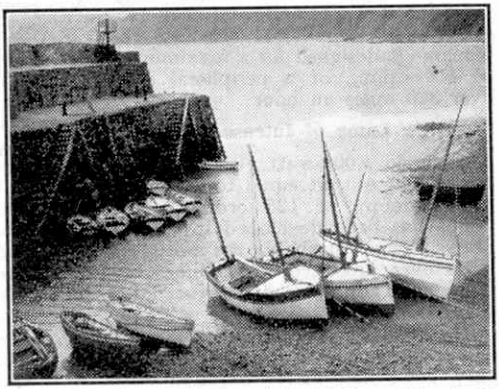
Next month many of us will be thinking of making an album of our holiday pictures to provide pleasant recollections during the winter evenings. It is a good plan now to run over in our mind the photographs we have already taken, and try to fill in some of the gaps that always seem to occur. The interest of the album can often be increased very greatly by a few pictures made specially to complete a series, or to provide a record of something we overlooked earlier in the year.



"Tesa." Photograph by B. Chulindra, Helland Bridge.

Finally, pictures of groups of summer friends who will be separating soon should not be forgotten. These are good to look at in the album in later days, recalling many a pleasant adventure or raising a smile at the thought of some hilarious escapade.

Light-hearted holiday snapshots win many prizes in the "*M.M.*" photographic competitions. It is well worth while to enter two or three of the most attractive pictures. Good luck to them!



Breakwater, Clovelly. Photograph by W. Barr, Birkenhead.

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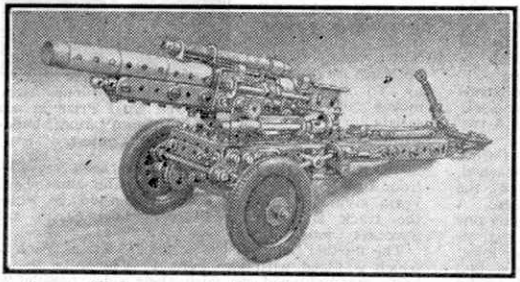
Model-Building Competition Results

April "General" Contest (Home Section)

By "Spanner"

THE April General Model-building Competition attracted a very fine collection of entries, among which were some of the best-built models that I have seen since wartime evacuation and National Service demands so disrupted Meccano model-building activities for many keen enthusiasts. Now that things are becoming gradually more normal it is very good indeed to find many of my pre-war friends resuming their efforts in the monthly competitions. Hundreds of newcomers to the Meccano hobby also are now sending in entries, and I am looking forward to a steady improvement in both the total number of entries in each contest, and the standard of model-building. Later on Meccano parts will become available, and with gradually increasing stocks of parts at their disposal these younger boys will be able to attempt the construction of larger and more elaborate models.



A fine model Army gun built by Gnr. Siddons, Woodbridge. It formed part of a group of models that earned the First Prize in our April "General" Contest.

The prize-winners in the "April" Contest range in age from 11 to more than 20, and each competitor's age was taken into consideration in assessing the merits of his work.

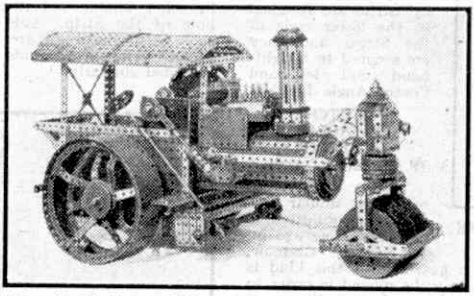
The full list of prize-winners is as follows: 1st Prize, Cheque for £2/2/-: Gnr. Siddons, Woodbridge; 2nd, Cheque for £1/1/-: J. E. Meggitt, Ipswich; 3rd, P.O. for 10/6: J. E. Matthews, Fillongley.

Consolation Prizes of 5/-: P. D. Hancock, Edinburgh 9; A. Reeve, Melton Mowbray; C. R. Hayles, Seaford; A. Picken, Gainsborough; S. Twycross, Nottingham; R. A. and V. J. Taylor, London N.10.

The most outstanding entry was a group of models consisting of a heavy German gun, limber and half-track tractor. The gun and the tractor are illustrated on this page, and they are two of the most realistic examples of their subjects that I have seen. They were built by Gnr. K. A. Siddons, Woodbridge. The gun is fully equipped, including elevating and traversing gear, wheel brakes, recoil spade, working breech block, loading tray and sighting equipment. Study of the illustrations will reveal several fine constructional details.

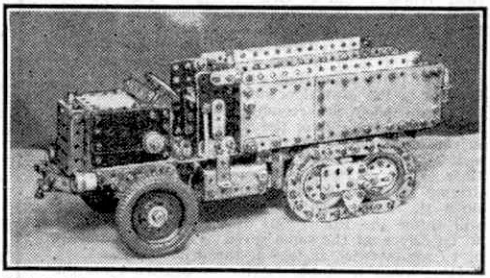
Another excellent model was a U.S.A. "Austerity" locomotive, which was submitted by J. E. Meggitt, Ipswich. Unfortunately it is not possible to illustrate this model, but I can assure readers that it is a really fine piece of work.

John E. Matthews, Fillongley, has had many of his models illustrated in the "*M.M.*" but none more worthy of reproduction than the fine steam road roller shown on this page. This model earned for Matthews the Third Prize, and its success is due very largely to the remarkably neat workmanship and realistic proportioning of the entire structure. Note particularly the construction of the chimney and boiler and the yoke that joins the front of the boiler to the superstructure of the front roller mounting. These are details that display a very sound knowledge of the Meccano parts and their many applications, and they have been assembled to produce a most realistic effect. There is also a fine touch of the "real thing" in the stay-rods at the back of the cab and in the structure of the large rear wheels.



John E. Matthews, Fillongley, built this fine steam road roller, and was rewarded with Third Prize for his remarkably neat workmanship.

A studio easel model won a prize for P. D. Hancock, Edinburgh, a keen painter in oils, and a neat model of a modern semi-detached house was entered by A. Picken, Gainsborough, who also was awarded a consolation prize.



This half-track tractor was submitted by Gnr. Siddons, in conjunction with the Army gun shown in the upper illustration.

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Among the Model-Builders

By "Spanner"

R. W. Roddick, Buenos Aires, who won First Prize in our 1945 "Autumn" Model-building Contest.

A NOVEL SLING FOR CRANES
(K. N. Pritchard, Brook's Green)

Fig. 1 shows a novel and interesting type of sling that can be used on model cranes. It is based on an actual sling used for picking up steel girders without the use of a crowbar to place the sling in position, as is necessary with ordinary steel or rope slings. The sling illustrated consists of two 2½" Triangular Plates spaced apart by ½" Bolts, the upper Bolt being pivotally secured to a Hook. Two 2½" Cranked Curved Strips are bolted to one side of the Plates and two Simple Bell Cranks, to which 1" Corner Brackets are attached, are secured to the opposite corners. A ½" Pinion, forming one jaw of the sling, is bolted to the lower ends of the Boss Bell Cranks and spaced by a Washer. The second jaw of the sling is built up of three 4½" Strips that are pivoted on a ½" Bolt. Four 2½" Strips are attached to the lower ends of the Strips and they are secured to a right-hand and left-hand Corner Angle Bracket.

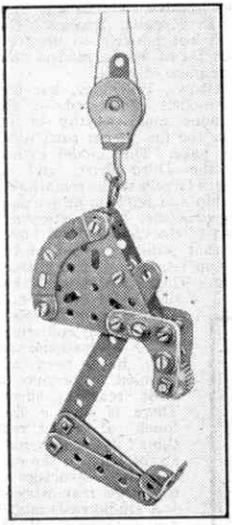

Fig. 1. A novel lifting sling for cranes.

CLUTCH CONTROLLED GEAR-BOX
(F. Rowson, Glasgow)

This is based on a somewhat similar construction submitted to me some time ago by F. Rowson, Glasgow. The great advantage of a gear-box of this kind is that the shafts do not have to be moved in order to change gear; hence the driving connections are simplified and wear and tear on gears is minimised.

The driving shaft has two 1" fast Pulleys fitted with Rubber Rings 3 and 4 fixed to it. Placed against these Pulleys, but loose on the shaft, are a 50-teeth Gear Wheel 1 and 1" Gear Wheel 2. Also on the shaft are two Compression Springs mounted between Washers and placed one on each side of a Collar 6, which is also free on the shaft. The Collar is connected to a lever 5 that is attached pivotally to the base plate by a Bolt and lock-Nuts. When the lever is in the central or normal position, no power is transmitted to the secondary Rod 7, but on moving the lever to one side or the other, one of the Springs is caused to press its respective gear wheel firmly against a rubber-shod Pulley, and consequently, the Gear Wheel commences to revolve "solid" with the driving shaft, while the other gear wheel rides idly upon it. Hence slight movements of the lever 5 will throw the Rod 7 out of engagement, cause it to be driven at the same speed as the driving shaft or to rotate twice as fast as the driving shaft.

It is quite a simple matter to construct on the lines suggested above an efficient and interesting gear-box, which can be incorporated in several different kinds of models.

CREEPER TRACK FOR MODEL EXCAVATORS
("Spanner")

Many types of excavating machines and tractors, as well as army tanks, are mounted on creeper tracks, and I find that some model-builders are puzzled as to the best means of making satisfactory creepers without using too many parts. Several methods of constructing creepers have been described from time to time on these pages, and this month I am giving details of a further method, in which the track is constructed from short Strips and Sprocket Chain.

The flexible belt consists of 28 2½" Strips, each of which is fitted with two bolts 1. The nuts on the bolts are tightened up with their sides parallel to the edges of the Strip. The Strips are then laid side by side, with the nuts upward, and a length of Sprocket Chain 2 is laid over the end holes of the Strips. Cord 3 is then passed through a hole in the first Strip, round one of the links in the Sprocket Chain, and then back through the same hole of the Strip. This process is repeated with each Strip, until all are threaded to the Sprocket Chain. The other ends of the Strips are then threaded similarly.

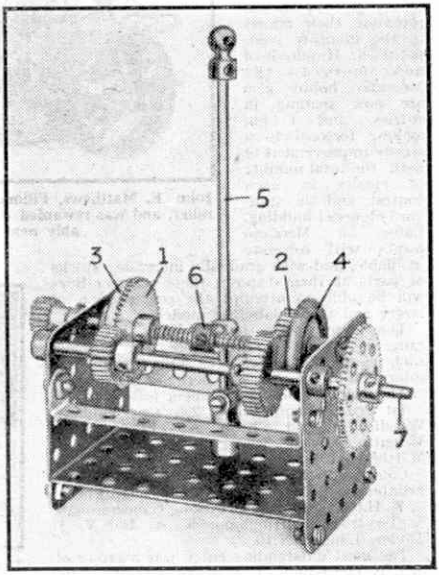

Fig. 2. A useful clutch-controlled gear-box.

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The ends of the Sprocket Chain are then joined together in the normal way, and the free ends of the cord are tied together.

The band is carried on eight 1½" Flanged Wheels, four on each side, and is driven by two Bush Wheels mounted on Rod 4. Each Bush Wheel carries eight bolts, the shanks of which are on the same side as the boss and act as teeth, to engage the bolts in the 2½" Strips. The four centre flanged wheels are mounted on a bogie consisting of two 2½" Angle Girders bolted to a 2½" × 1½" Flexible Plate. The Flanged Wheels are fastened on 3" Rods journalled in the elongated holes of the Angle Girders. A 4" Rod 5 passes through the centre holes of the Angle Girders and is journalled in the 5½" Strips as shown.

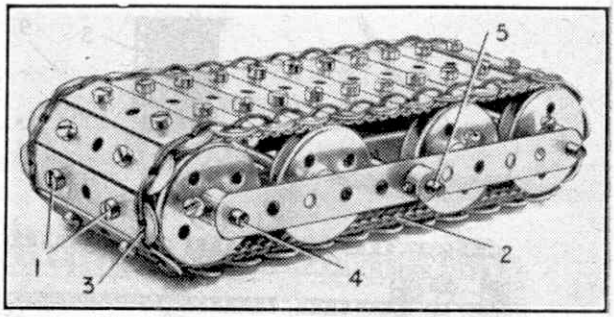


Fig. 3. A good example of Meccano creeper track.

To mount the track in a model long Rods are journalled in the base or chassis of the model, and on them are fastened the front and rear pairs of Flanged Wheels. These Rods are driven from the gear-box of the model. In some cases the bogie can be pivoted to the chassis, and the 5½" Strips can then be dispensed with.

The track illustrated is intended for use with shafts 5 in. apart, but tracks of other lengths can be built if desired.

An alternative and equally satisfactory method of construction is as follows. The track can be formed from Strips attached to Sprocket Chain by means of paper clips of the split pin type. These are passed through the Strips and Chain, after which the shanks of the clips are bent outward to prevent the clips from slipping out. It is possible to vary these methods of construction considerably to suit the particular parts available and the model for which the tracks are required.

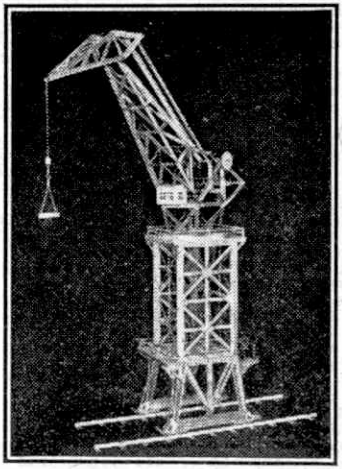
Grand Autumn Model-Building Contest

Fine Prizes for "M.M." Readers

This month's competition gives every Meccano boy a chance to win one of the fine cash prizes offered for the best models received. All a competitor has to do is to build a Meccano model of any kind based on his own ideas. Any number of parts may be used and any type of model is suitable. The competition is open to readers of all ages living in any part of the world, and the only condition is that models entered must be the competitor's own work, both in regard to design and construction.

In preparing their entries competitors should try and think of something original, that is, some subject that they have never seen in the form of a Meccano model. Once the subject has been chosen the next thing is to make a neat model of it using only Meccano parts.

Please note that it is not necessary to send the actual model. A photograph or a good sketch is all that is required. The sender's age, name and address must be written on the back of each photograph or drawing, and these must be forwarded to *"September Meccano Competition, Meccano Ltd., Binns Road, Liverpool 13."* A short description of the main features of the model should be sent with the illustrations.



A fine level-luffing crane built by J. Willems, Antwerp, Belgium.

Entries will be divided into two sections. Section A is for competitors living in the British Isles, and will close on 31st October; Section B is for competitors living outside the British Isles, and in order to give readers in distant lands time to prepare and forward their entries this Section will remain open until 28th February, 1947.

The following prizes will be awarded in each Section. First, Cheque for £2/2/–; Second, Cheque for £1/1/–; Third, P.O. for 10/6. There will be also 10 other prizes each consisting of a P.O. for 5/–, and certificates of Merit also will be awarded to competitors whose entries just fail to reach prize-winning standard.

All prize-winners will be notified by letter as soon as possible after the closing dates. Photographs or drawings of prize-winning models become the property of Meccano Ltd. Unsuccessful entries will be returned to senders only when a correctly stamped and addressed envelope is enclosed with the entry for that purpose.

If they wish competitors may enter more than one model in the Competition, but no single competitor can win more than one prize.

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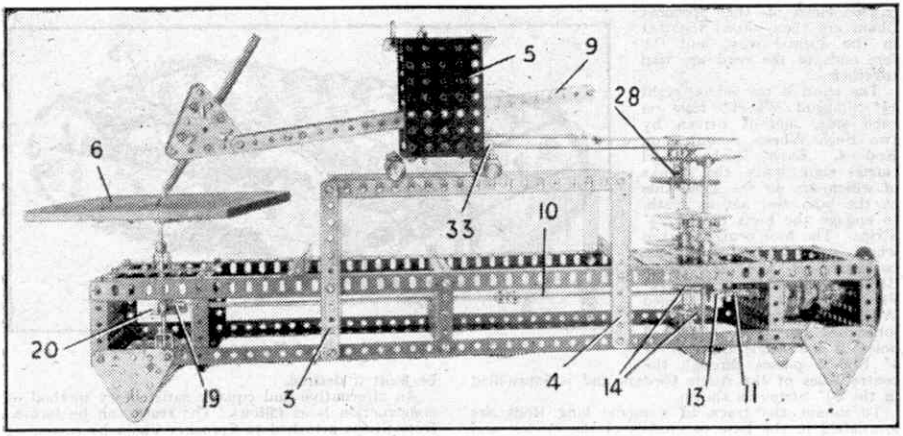


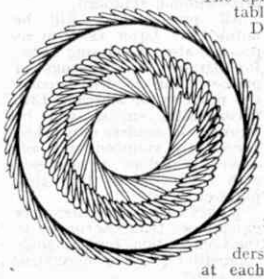
Fig. 1. A general view of the new Meccanograph. This fine machine produces hundreds of fascinating designs, examples of which are shown at the foot of this page.

A New Meccanograph

Fascinating Designs Produced Automatically

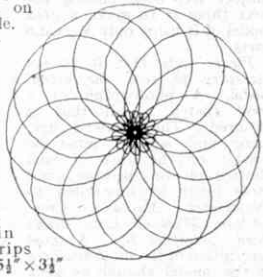
THE Meccanograph continues to be one of the most popular among the limitless number of models that can be built from Meccano. For the benefit of new readers we may explain that a Meccanograph is a designing machine by means of which it is possible to produce hundreds of fascinating and beautiful symmetrical patterns such as those shown at the foot of this page, which are actual productions of the Meccanograph described in this article. Several different forms of Meccanograph have been described in the "*M.M.*" in the past, and this month we are able to give details of yet another that possesses several unique features and is capable of producing an even greater variety of beautiful patterns than any of the machines dealt with previously.

The model is built entirely from Meccano parts and is constructed as follows. The frame consists of four 18½" Angle Girders bolted to the corners of five 5½" × 2½" Flanged Plates which are spaced in the frame as shown. Another 5½" × 2½" Flanged Plate 1, Fig. 2, is bolted at the upper side of the frame to provide bearings for the Rods of the operating heads. A 5½" Angle Girder 2 serves a similar purpose for the lower ends of these Rods.



The spindle of the drawing table 6 is journalled in Double Bent Strips bolted to 2½" Strips, which in turn are fixed to the two 5½" × 2½" Flanged Plates at the front end of the model. Four 2½" Triangular Plates bolted to the lower 18½" Angle Girders of the frame serve as legs. Two 5½" Angle Girders 3 and 4 are bolted at each side of the frame in the positions shown, and at their upper ends are bridged by two 9½" Angle Girders that form running rails for the travelling carriage 5.

The drives to the table 6 and the crown heads 7 and 8, which operate the carriage 5 and pen arm 9, are arranged as follows. Referring to Fig. 2 a compound rod 10 which runs the full length of the model carries a 57-teeth Gear, a 50-teeth Gear, 1" Gear, ¾" Pinion and ½" Pinion in that order. These are arranged to mesh with the following gears on a Rod 11, which are arranged in the following order, commencing from the rear end of the model; ½" Pinion, ¾" Pinion, 1" Gear, 50-teeth Gear and 57-teeth Gear. Outside the frame of the model Rod 11 is fitted with a Sprocket 12, and on its inner end is a ½" Pinion 13 that engages either of two 1½" Contrates 14 fixed on a shaft 15. Rod 15 carries also above the Flanged Plate a ½" Pinion, a 57-teeth Gear and a 2½" Gear in that order. The Rods of Crown heads 7 and 8 each carry a ½" Pinion 16, a 57-teeth Gear 17 and a 2½" Gear 18. These gears are all fixed on their Rods, but those on the centre Rod 15 are normally free, only one of them being fixed as desired, when operating the model. The Rod 10 drives the drawing table through a Worm 19, Fig. 1, which engages a 57-teeth Gear fixed on the shaft of the table.



The travelling carriage and the pen arm are constructed as follows. The framework of the carriage consists of two 3½" × 2½" Flanged Plates to which two 5½" × 3½" Flat Plates are bolted. The axles are journalled in Double Angle Strips fixed to the lower 5½" × 3½"

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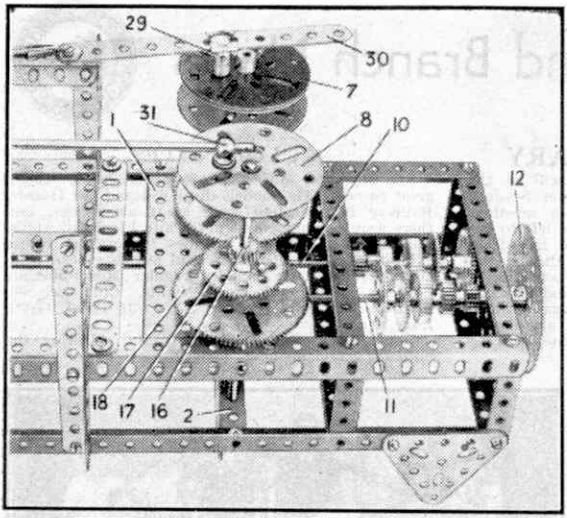

Fig. 2. The "crown heads" and main driving gears of the new Meccanograph.

Flat Plate and they each carry two ½" loose Pulleys as shown. Washers are used to space the Pulleys the correct distance apart to run freely on the flanges of the Angle Girders as seen in Fig. 3.

A Channel Bearing 21, Fig. 3, is bolted to a Bush Wheel 22 and it carries two Slide Pieces (Part No. 50) which pivot freely on Bolts locked in their bosses. A Large Fork Piece 23 is also bolted to the Channel Bearing, and to the Bush Wheel 22 is fixed a Handrail Support 24. The whole of this unit is mounted freely on a 4½" Rod 25, which can be journalled in any of the holes in the upper and lower Flat Plates of the carriage. A Crank 26 is fixed to the upper end of Rod 25 and a Threaded Pin 27 is provided to lock the crank to the frame of the carriage, which is necessary in producing some types of designs. The crownhead 7, Fig. 2, which operates the side to side movement of the pen arm, consists of four Face Plates bolted in pairs back to back and mounted on a Rod about 1" apart as shown. The holes in the two pairs of Face Plates must be opposite to each other, so that a 1½" Rod 28 Fig. 1 can be passed through any of them. This Rod carries a Slide Piece 29 Fig. 2, and in this slides a 5½" Strip 30, which is joined by a Rod and Strip Connector to a Rod fixed in the Handrail Support 24 of the pen arm pivot (see Fig. 3).

The crown head 8 is a single Face Plate in which is pivoted freely a Handrail Support 31. This holds a Rod 32, the other end of which passes through and is gripped in a further Handrail Support 33 fixed to the lower Flat Plate of the carriage as seen in Fig. 1.

The pen arm consists of two 12½" Strips carrying at their front ends two 1½" Triangular Plates between which the tracing pen is gripped. The Strips pass through Slide Pieces pivoted to the Channel Bearing, and their rear ends are drawn together by a long Bolt and nut. This completes the constructional details of the model and when the Sprocket 12 is connected to a Motor it is ready for working.

The infinite variety of designs that can be produced on this machine are made possible by the wide range of alternative gearing that can be employed in the drives to the crown heads and the table. Any one of the gears on Rod 11 can be selected as the driver, and this should be fixed to the shaft, the other gears on this shaft being allowed to run freely. All the gears on Rod 10 should be fixed to the shaft. Further variations in design can be produced by using either of the two Contrates 14 in mesh with Pinion 13. Only one Contrate must be meshed at one time. The gears on the shafts of the crownheads 7 and 8 should all be fixed permanently to their Rods, but two of the three Gears on Rod 15 should be left free, only one of the three being fixed to the shaft at any time. The one to be fixed can, of course, be selected and varied as desired. Considerable variation is also possible by altering the holes in which the Rod 25 of the pen arm pivot is journalled.

It will also be found that great differences in the designs are produced by altering the length of the pen arm merely by sliding the 12½" Strips in the Slide Pieces, and by varying the lengths of the coupling rods 32 between the crown head 8 and the travelling carriage, and of the Rod connecting the crown head 7 with the pen arm pivot.

The designs are best drawn with a fountain pen or a special pen made from a piece of glass tube about ½" dia. and 6" long. The tube is gripped by pliers at each end and the centre portion is held over a gas flame until it softens, when it is stretched until it becomes a very fine tube. This is broken at the centre to form two drawing pens, the ends of which are rounded off by holding them in the flame. The pen is loaded with ink by means of a fountain pen filler.

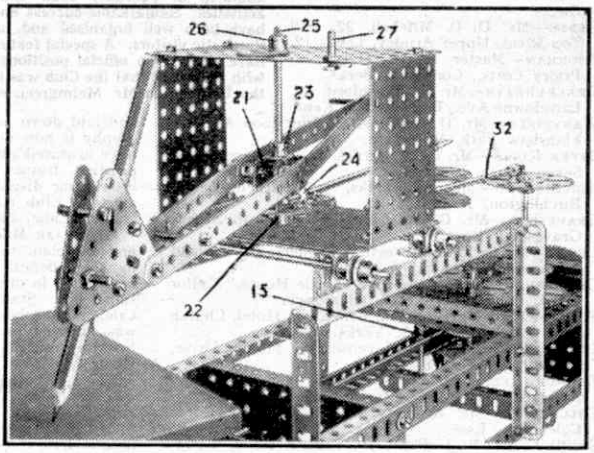

Fig. 3. A "close-up" view of the travelling carriage and the pen arm pivots.

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Club and Branch News

WITH THE SECRETARY

Very soon Club and Branch Nights will be the great events of the week, for the Winter Sessions are at hand and preparations for indoor meetings are now in progress. These can safely be left to the Leader and officials, who will be guided by wishes expressed by members themselves at the general meeting that in most cases marks the opening of the indoor season. A meeting of this kind is really essential to ensure that the activities planned shall be those in which members generally are keenly interested, for only when this is the case will the work of a Club be really successful.

An important point that must be kept clearly in mind is that new members are essential if progress is to be made. All newcomers to the Meccano and Hornby Trains hobbies are possible Club or Branch members, and they are best reached by personal efforts. Every member of a Club or Branch should be asked to bring along a friend in order to introduce him to the delights of Club work, or to look further afield for at least one recruit each, and if this is done faithfully there will be no fear of lack of new members. The support of parents of existing members and of newcomers also should be enlisted. Where possible the Leader should get in touch with them, either by paying a visit to them, or by arranging an Open Night at which they can see what the Club is doing.

PROPOSED BRANCHES

LONDON—Mr. R. Oldring, 46, Wetherden Street, Leyton, London E.17

EASTLEIGH—Master L. Currell, 132, The Crescent, Eastleigh, Hants.

BEACONSFIELD—Master B. Leslie, 1a, Burckers, Parade, Beaconsfield, Bucks.

LEEDS—Mr. D. C. Mitchell, 22, Hill Top Road, Upper Armley, Leeds 12.

COOKHAM—Master P. W. Harris, 4, Priory Cotts., Cookham, Berks.

BEXLEYHEATH—Mr. D. Washford, 24, Lansdowne Ave., Bexleyheath, Kent.

WAKEFIELD—Mr. D. Griffiths, 17, Pinewood Avenue, Flanshaw Park, Wakefield.

SEVEN KINGS—Mr. R. M. Barnes, 14, Elmstead Road, Seven Kings, Essex.

BIRCHINGTON—Mr. L. Brooks, 1, Westfield Road, Birchington, Kent.

GRAVESEND—Mr. G. W. Churchill, 1, South Street, Gravesend, Kent.

LEEDS—Mr. C. P. Hainsworth, Delamere, 4, Westfield Avenue, Upper Armley, Leeds 12.

GLAMORGAN—Mr. D. Walters, "Leslie House," Culfor Road, Loughor, Swansea, Glamorgan.

PONTEFRACT—Mr. G. Atkin, Grove Lea Hotel, Church Balk Lane, Pontefract, Yorks.

LEEDS—Mr. C. Semple, "Ravenscroft," 11, The Drive, Roundhay, Leeds 8.

BOGNOR REGIS—Mr. J. S. Evans, "Two Orchard," Aldwick Bay, Bognor Regis, Sussex.

COLCHESTER—Mr. R. Putman, 39, Wellesley Road, Colchester, Essex.

SYDNEY—Mr. B. J. Parle, 10, Karuck Road, Turramurra, Sydney, N.S.W., Australia.

PENARTH—R. Hersee, 72, Westbourne Road, Penarth, Glam., S. Wales.

CLUB NOTES

ST. OSWALDS M.C.—The May Exhibition was a great success. The models displayed and the Hornby Railway in operation were great attractions, and there were refreshments and "White Elephant" stalls. A discussion at which schemes for making future exhibitions even more successful also has been held. Other events have included regular Model-building Contests, Talks and Track Nights. Club roll: 60. *Secretary:* D. R. C. Pavey, 37, Croft Road, Green Lane, Norbury.

CAER URFA (SOUTH SHIELDS) M.C.—During the outdoor season members levelled a stretch of ground and laid down an excellent outdoor railway. Photography is now one of the interests of members, who have acquired photographic material and are making printing frames. A Collector's Night led to an interesting display. A Chemistry Section has been started. Club roll: 30. *Secretary:* G. Burrows, 118, Quarry Lane, Cleadon, South Shields.

Members of the Maylands, Perth, Western Australia, M.C., with Mr. V. Malmgreen, Leader, in the centre of the front row. This Club was affiliated in February 1936 and has a splendid record of general activities. Remarkable success has been attained in Exhibitions, which have been well organised and have attracted large numbers of enthusiastic visitors. A special feature of the Club's work is that members have been given official positions of responsibility as soon as possible, with the result that the Club was kept in good working trim throughout the War, when Mr. Malmgreen was serving in the Australian Forces.

HENLEAZE M.C.—On Meccano Nights "Simplicity" and aeroplane models have been built. Competitions in which definite models have to be built also have been held; in one of these the subject was a working signal box. Stamp Nights, Debates, Cycle Rides and Cricket have been arranged, and interesting running was enjoyed on an outdoor track. Club roll: 18. *Secretary:* M. E. Frost, 32, Oakwood Road, Henleaze, Bristol.

BRANCH NEWS

WIDNES AND DISTRICT—Constructional work has included a model of an S.R. electric locomotive and a signal box, work being carried out under the direction of the Chief Designer. The Branch layout is making good progress and operations will be started soon. *Secretary:* R. Gribben, 210, Liverpool Road, Widnes.

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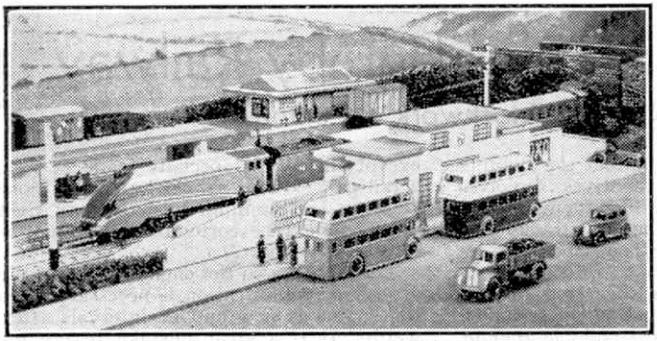
Dinky Toys on Dublo Layouts

LINESIDE effects play an important part in miniature railway work, and even on a temporary railway it is possible to provide a few additions that improve the general realism. Apart from the items of a definite railway character such as stations and miniature figures, lineside features generally take the form of buildings, roads and so on. Now that certain Meccano Dinky Toys are again available many readers will be anxious to develop road traffic and effects in conjunction with their Hornby Dublo railway systems. In this article therefore we deal with Dinky Toys motor vehicles that are specially suited to the scale of Dublo Trains and give a few suggestions for their use on or about a layout.

The amount of attention given to actual roads, pavements and so on will depend on the space available and the ideas of the individual Dublo owner. Whatever the degree of development, however, the Dinky Toys motor vehicles shown in the accompanying illustration can be employed very effectively. The proportions of the smallest Dinky Toy cars such as No. 35a Saloon Car, 35b Racer, 35c M.G. Sports Car and 35d Austin Seven Car make them ideal for use on the roads around and about the station, or at times on the platform as if being loaded or unloaded.



The realistic effect produced by the use of various Dinky Toys on a Dublo layout is well shown in this illustration. Note particularly the Double Deck Buses halted at the station entrance.

The transport of motor cars by rail is often carried out on a large scale. As a rule covered railway vans are used, and often these are of special construction. For Dublo purposes the ordinary 12-ton Goods Vans are the best representatives of the motor car vans of actual practice, unless we care to use an open wagon. Strictly speaking cars conveyed by rail in open wagons should be covered over, but they certainly look more interesting in miniature when they are not.

There are many possible uses for No. 22c Motor Truck, a typical commercial vehicle. It always looks well on the road or in the goods yard, where it can appear standing alongside a Coal Wagon or backed up to the road side of the deck of the Goods Depot as if for loading or unloading. It can be supposed to be privately owned or it can be considered as one of the railway fleet of road vehicles used for local collection and distribution services.

The scheme of having a railway-owned "Road Motor Department" is one that can be developed in an interesting manner and it certainly does add to the completeness of the system. As a rule the younger operators on any layout normally need no persuading to undertake the job of "driving." A special garage or depot for the accommodation of the "Company's" road vehicles can be made at home if required, or possibly an existing building can be adapted. Most Hornby Dublo railway enthusiasts will not find any great difficulty in this or in adding various touches to give a realistic effect to the depot and vehicles. As is well known road motor services play a prominent part in real railway work nowadays.

Coming to passenger transport, good use can be made of both No. 29b, Streamlined Bus, and No. 29c, Double Deck Bus. The former is particularly suitable for independent operation, to provide services connecting with the regular trains, and also to cater for any special "combined trips" that the Dublo "General Manager" may wish to run. The running of special works buses meeting certain trains in the morning or evening is another idea, while if the lineside effects include an airport, as is frequently the case nowadays, these buses are just the thing to provide road transport between the port and the railway station. A further scheme is to use such vehicles to provide alternative road services in the event of there being a stoppage of the trains for any reason, although this of course should not happen on a Dublo railway!

The Double Deck Bus No. 29c is excellent for local running and in fact a bus terminus can be worked into the road approach of the railway station if there is sufficient space. A scheme of this kind can be quite effective, even if carried out on fairly simple lines with one or perhaps two vehicles. The illustration on this page shows the realistic effect of a couple of buses halted outside the station. Additional vehicles can be used at "rush hours," and the running of different services will add considerably to the fun. A little touch that helps the realistic effect is to place a Dublo figure on the bus platform. A Ticket Collector of the D1 set of railwaymen makes quite a good conductor. Other ideas on these lines will no doubt occur to readers. "Stop" signs and other roadside details connected with road traffic operations also can be fixed up without much trouble, and will help greatly in producing the right effect.

Among other Dinky Toys that can be used quite successfully are the Petrol Tank Wagon No. 25d and the Royal Mail Van No. 34b. The road tanker can be used in conjunction with the rail Tank Wagon and it is necessary for the supply of "fuel" to any garage or motor depot that we may establish on the layout as suggested previously.

In real life the Royal Mail van is a familiar sight at most railway stations and the Dinky Toys vehicle will be found specially useful. A great deal of postal traffic is conveyed by ordinary express trains so that we can make a feature of this on our Dublo layouts; the Dinky Toy Royal Mail Van can make regular calls at the station in order to connect with our trains.

Of the military vehicles available the Medium and Light Tanks, Nos. 151a and 152a respectively, look effective in the goods yard as if waiting to be entrained. The Transport Wagon, No. 151b, can be used in the yard or anywhere on the road.

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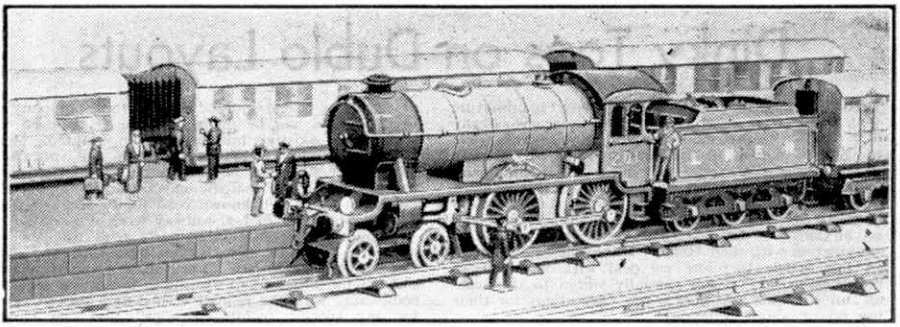

"Hornby Junction," an intermediate station with the E220 Special L.N.E.R. Locomotive "The Bramham Moor" at the platform. Note the head code discs as used on the L.N.E.R. Eastern section.

Fun With Your Hornby Railway

Running Clockwork Locomotives

IT is sometimes thought that the running of clockwork locomotives involves nothing more than winding them up and letting them speed along the track until they stop. Actually their operation is remarkably simple, but with a little attention on the lines suggested in this article Hornby Clockwork engines can be made to give the greatest possible amount of enjoyment to their owners by working their trains efficiently and by keeping on doing so.

The instructions that are always included with Hornby Locomotives should be followed, and the instruction leaflet should be kept for future reference. Too many miniature railway owners neglect this point; they are too anxious to get on with the business of running a new engine! It does no harm for even the experienced operator to read up the instructions relating to a new engine.

The first necessity for good running is a track that is sound. A firm level foundation is essential, and particular care should always be taken when laying down the rails to see that they are properly connected throughout. Another point is that the correct number of rails should be used so that they join up fairly without any forcing. The rail connecting clips should be used at each joint so that there cannot be any possibility of the rails coming apart. It is also important to see that the gauge of the rails is correct and to check this, the back of the handle of the winding key of all Hornby Locomotives except the MO is specially made to form a rail gauge. This should be passed along between the running rails and any tight places should be corrected by easing the rails gently apart.

Turning now to the engine itself, a little attention to lubrication is necessary when the engine is new and at intervals afterwards. It is a great mistake to use too much oil; a very small quantity on each spindle, gear wheel and axle bearing will last quite a long time. Other working parts such as the piston rods and coupling rod pins also should have their drops of oil. Any excess of this is a nuisance, for it finds its way on to the wheels and the rails and causes the driving wheels to slip so that the engine loses power and speed. Once any oil has reached the rails it is picked up and rolled round the wheels of the rolling stock with the result that ultimately a deposit of oily "mud" forms on the wheels. This causes sluggish, "woolly" running and in extreme cases can even bring about derailments.

Thick oil should never be used for clockwork mechanisms, as this has a clogging effect. A fine machine oil of good quality such as is used for sewing machines will do nicely, and this can be obtained fairly easily. It can be applied successfully to most moving parts by means of a wire dipper. An ordinary oil can is not advisable as it delivers too much at once, although it can be used to put a few drops between the coils of the mainspring. If in the course of oiling

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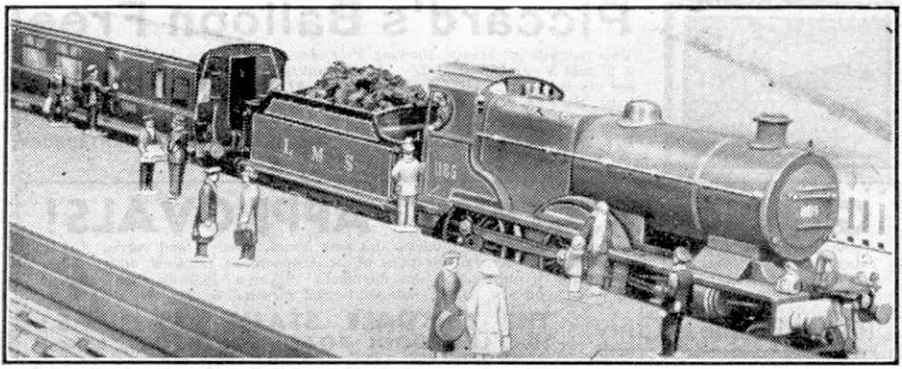


Waiting for the "Right Away." The Hornby L.M.S. Standard Compound No. 1185 is ready to leave with an express train.

a drop or two does get where it is not wanted it should be wiped off, or it will collect dust and result in an untidy appearance.

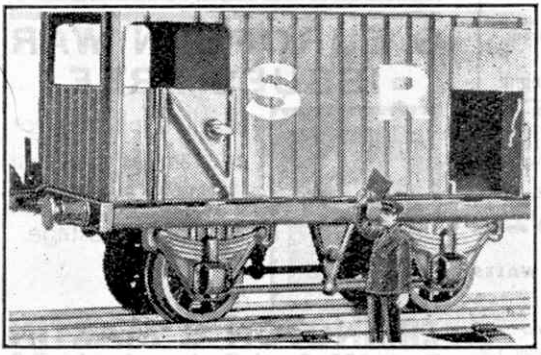
When winding a clockwork engine we should make sure that the correct size of key is used; where several engines are in traffic there may be an assortment of keys in use, with the result that they can get mixed up. In addition the key should always be pressed home as far as it will go on the winding shaft. This makes winding easier and avoids any unnecessary wear of the key or shaft. Before winding the brake should be applied and in a reversing engine the reversing rod should always be fully in forward or backward gear.

Overwinding the spring is the "bogey" of many owners of clockwork engines, especially those who are using a locomotive for the first time. As a matter of fact one can feel when the spring has reached its limit and if we count the number of half-turns of the key required to reach this point and make a practice of using several half turns less we shall be on the safe side. Half-turns are suggested rather than full turns because in using the key we usually wind it half a turn at a time and the counting is easy and becomes almost automatic.

The control of clockwork locomotives for braking and reversing is quite simple and one soon becomes accustomed to the "feel" of the control rods in the cab by means of which the brake or reversing movements can be operated by hand. There are in addition special rails fitted with movable stops between the running rails that can be set to engage the brake trip lever, which is suspended from the mechanism underneath the engine. The larger engines from the No. 1 type upwards have in addition a reverse trip that can be worked from the track by means of a suitable rail.

Although Hornby clockwork locomotives will haul quite a satisfactory load, in running trains it is wise not to assemble more vehicles than the engine can comfortably handle. The nature of the layout will have some bearing on this, as track formations that include a good proportion of straight run will favour the engine.

A point to remember here is that the performance of an engine improves with use, so long as a little care on the lines suggested in this article has been taken.



"Right." The guard of a Hornby freight train gives the signal to start to the driver.

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Piccard's Balloon Free!

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For other Stamp Advertisements see also pages 388 and vii.

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Stamp Collecting

Stamps of an Island Continent

By F. Riley, B.Sc.

FROM New Zealand, our last place of call in our Empire tour, we now go westward to Australia, a little more than 1,200 miles away. Books could be written about the stamps of the island continent, which makes a strong appeal to all collectors, from specialists who are keen on varieties and philatelic history and details to the beginner.

There was no Australian Commonwealth when stamps were introduced on the continent, and to begin with each State had its own issues. The earliest of these appeared in New South Wales and Victoria in January 1850. Tasmania followed in 1853, and then came Western Australia in 1854, South Australia in 1855 and Queensland in 1860. Many of these early efforts have attained special distinction in the stamp world, notably those of New South Wales and Western Australia, the first issues of which are now famous for the rarity and value of the stamps themselves or of striking varieties. New South Wales began with the "Sydney Views," a name that suggests the chief feature of their design. These stamps were engraved in Sydney and bring very high prices to-day. The earliest stamps of Western Australia in general are not so highly priced, but they have become even more famous because of a remarkable variety, a stamp with a romantic story. Every reader of the "*M.M.*" will be familiar with the swan that is the characteristic feature of the design of a great range of Western Australian stamps. This appeared on the very earliest stamps of 1854, which were lithographed, and on a few examples of the 4d. blue value issued in that year the swan appears to be upside down, giving a variety usually known as the "Inverted Swan." Actually it is not the swan that is inverted, but the framework round it. This was not discovered until a damaged strip of three stamps was brought to light, and showed that on the sheet the swan itself appeared right way up.

The number of examples of this star turn in stamp varieties is very small, and famous collectors have given high prices for them when they have come on the market. One of them was sold for the equivalent of £1,060 in Paris in 1923, but when it was sold again several years later in London it brought only £350. Other examples have realised as much as £680 and £850, but one specimen has been sold for as low as £50. It is difficult to explain these ups and downs in price. A good deal of course depends on condition, a good stamp with wide margins naturally being more valuable than one that is cut close to the design and is in poor condition.

With the "Sydney Views" and the earlier "Swans" outstanding in rarity and special interest, there is a very fine range of stamps from all of the Australian States prior to 1913. At first portrait stamps were the order of the day. The earliest stamp of Victoria was a portrait stamp, and New South Wales produced one in 1851. Victoria later produced designs showing the Queen on her throne. The earliest Tasmanian stamps, all portraits, bore the name "*Van Diemens Land*," the modern name of the State appearing for the first time two years after the issue of the earliest stamps in it.

Variations from the portrait type first made their appearance in New South Wales in 1888. Australia in general provides wonderful scope for pictorial stamps of the modern type, with designs illustrating its interesting history, splendid scenery and a wild life that is unique in interest, as the article "*Wild Life Down Under*" in last month's "*M.M.*" showed. The New South Wales issue of 1888 made an excellent start, for the kangaroo, the emu and the lyre bird figure on its designs. All these creatures are typically Australian, particularly the kangaroo, and the white kangaroos recently presented to Mr. Churchill are almost symbolic of the Commonwealth.

In the same year there came the first commemoratives, marking the centenary of New South Wales, an event that was distinguished by the issue of two stamps of 5/- and 20/- value.

The kangaroo made its first appearance on South Australian stamps in 1894, and five years later Tasmania issued its first pictorials, an excellent set showing mountains, lakes, waterfalls and other attractive scenes on the island. In the meantime Victoria had begun the issue of charity stamps, the first of which bore portraits, but were followed in 1900 by a stamp with the Victoria Cross as the chief feature of its design and another showing a South African war scene. These two stamps were sold at prices considerably above their postal value, and the difference was devoted to a patriotic fund. New South Wales and Queensland also issued stamps of this kind, funds raised in this manner being devoted to various good causes.

Australia became a Commonwealth on 1st January 1901, but it was 12 years before a design for a Commonwealth stamp was agreed upon, and in the meantime each State continued to print and issue its own stamps. In 1911 a world-wide competition was organised. This attracted more than 1,000 entries, and the first Commonwealth stamp, which appeared in January 1913 in values from ½d. to £2, was based on winning entries. The design shows an outline map of the continent with a kangaroo posed on it.

This kangaroo issue was the beginning of a fine series, with which I will deal next month.

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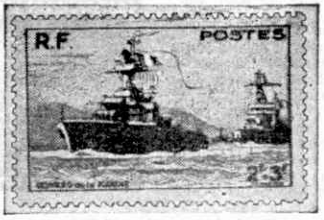

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This fine stamp as illustrated has just been issued by **FRANCE** in honour of the French Navy. Its handsome design shows two of the latest French Battleships at sea on manœuvres. It is a most attractive stamp which every philatelist will want for his collection, and is already scarce. We have managed to obtain a number of these stamps and offer one to **YOU—ABSOLUTELY FREE,** to add to **your** collection. We will also send you a nice selection of stamps on approval. You must write to us and ask for Warships Stamp Free and approvals, and must send 3d. in stamps for our postage. Write now and obtain this magnificent stamp **FREE.**

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For other Stamp Advertisements see also pages 386 and vii.

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Stamp Gossip

and Notes on New Issues

By F. E. Metcalfe

THERE was a time when collectors used to put their collections away during the summer months, when they were able to indulge in outdoor rather than indoor pastimes, but your collector of to-day seems to be able to manage both his collecting of stamps and whatever other sports he may like to indulge in. The result is that the poor dealer finds it very difficult to get a summer holiday at all. Does he mind? Maybe not, but at any rate collectors can hardly expect the same service as they get in winter time.

Whilst there has been little outright condemnation few people have expressed satisfaction with the two British "Peace" Stamps. The designs are "doodles" pure and simple, and savour more of the lower class-room than efforts of mature designers. The Editor of *"Gibbon's Stamp Monthly,"* who is no mean judge of such things, sums them up when he dubs them "Peace Puerilities." And quite evidently the Post Office is as amateurish in its ideas about commemorative stamps as are the designers of the particular stamps in question, for according to newspaper reports the Postmaster General was afraid that the stamps were being hoarded by speculators. Such an idea is absurd. Our peace stamps were issued by the million, so that everybody could get all they could possibly buy or afford; if they had not been bought up, the issue would have been a flop, as the designs merited.

Whatever may be the "methods" of our own Post Office, those abroad continue to turn out stamps, good and bad. As far as France is concerned they are generally good. The latest is one we are illustrating, and an attractive design it is.

Another interesting stamp is one of a set of three issued by Belgium to commemorate the Dover-Ostend steamship service. The stamps are not up to the usual Belgium standard, but they are interesting enough to British collectors. The set can be bought for about 1/6.

Some readers may not have seen the stamps, said to have been printed in Germany in photogravure, which the Japanese were to have issued had they been able to overrun India. The word *"Azadhind"* means Free India, and nine values of the stamps are known.

Believe it or not, we have no new commemorative stamp of the United States to illustrate, and it is just as well perhaps, for latterly the interminable purple or puce shades have been getting a bit monotonous. The United States has turned out many more commemorative stamps than the whole of the British Empire put together, and yet one American paper has the temerity to criticise Bechuanaland and Swaziland for having modest "Victory" sets! Incidentally several months ago we advised the purchase of the South African overprinted "Victory" sets. Then they were available at 1/3 a set. Now they are bringing over three times that figure, particularly the Bechuanaland issue, and they will probably go higher yet.

It is hard just not to get away from "Victory" stamps, for however the rest of the world is viewing the matter collectors are going in for peace in a big way. Shortly after these lines appear in print the Crown Colony "Victory" stamps will be putting in an appearance; in the meanwhile Bahawalpur has brought out an attractive stamp, a line engraved production of Messrs. De La Rue. The only drawback of this stamp is the grey background, which looks for all the world as though the stamp has got a grease smudge; however, seen in a good light the stamp is quite attractive.

The Argentine Republic provides our fifth illustration, with a good portrait in grey of that great American President, Franklin D. Roosevelt. Naturally this stamp has had a great reception in the U.S.A., but one cannot help but wonder what political object President Peron of Argentina had in view when he sanctioned the issue. Unfortunately the stamp has a rather shoddy appearance, a common fault of all modern Argentine stamps. A similar design in recess would have provided a beautiful stamp.

Many collectors are excited about the varieties they have discovered in the British "Peace" stamps. The most notable of these is the stamp showing 7 olives instead of 6. This is No. 115 of cylinder number 4. The cylinder number by the way, is the small number under the larger letter and figures. Another variety is the stamp with three portholes, a variety of the 2½d. stamp. Both these varieties are interesting to the specialists, but are not likely to be catalogued and are not likely to have much value.

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From Our Readers

This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

THE CANADIAN PRAIRIES

Many folk travelling across the Canadian prairies for the first time are apt to find them very monotonous, but even now that they are tilled and fenced these great grasslands have a beauty all their own. When

Grain elevators at a wayside station in the Canadian prairies. Photograph by N. V. Salt, Didsbury.

the wheat is ripe and golden, and a gentle breeze blows down from the mountains, they have the beauty of the sea, a seemingly boundless expanse of freedom.

A train travelling west from Winnipeg crosses a rolling plain, almost treeless except in an occasional river valley. The journey of 800 miles takes nearly two days and although one has occasional glimpses of homesteads, with their wooden farmhouses and big barns, and there are a few stops at small villages, it is difficult to realise that the prairie belts near to the railway are thickly populated as compared with half a century ago.

One feature that the traveller cannot help but identify with this prairie scene is the grain elevator, gaunt examples of which stand alongside the railway in even the smallest village. In these country elevators the grain collected from outlying farms is conveyed to the top of the building by endless belts to which scoops are attached. The scoops throw the grain into huge bins, where it is stored until it can be transported by rail to the enormous terminal elevators at one of the great grain ports, such as Fort William on Lake Superior. There the grain is stored once again until it can be shipped east by the Great Lakes route for distribution to the countries of the World.

The grain elevators that are dotted about on the prairies are living monuments to the courage and determination of the early pioneers who developed this great wheat producing area.

T. F. Salt (Didsbury).

AN INDUSTRY FROM SEAWEED

Last summer I spent a holiday in Co. Donegal, where seaweed is still gathered along some parts of the coast for commercial use. The long stalks of certain types of seaweed are selected and dried in the Sun before being placed in shallow trenches, covered with earth and stones, and burned slowly at a very low temperature. The calcined ashes, which are usually black or dark blue in colour, contain a proportion of an alkaline substance called "kelp." This kelp can be refined and made to yield a very small quantity of iodine, the most commonly used household antiseptic.

It was from burnt seaweed that iodine was first obtained in 1811 by the French chemist Courtois, its discoverer. Since then it has been discovered that many things contain iodine besides sea water and it is now mainly produced from saltpetre found in Chile. Actually about 8 lb. of iodine can be extracted from a ton of kelp, the proportion of kelp in seaweed being approximately 5 per cent., but the yield of iodine varies considerably.

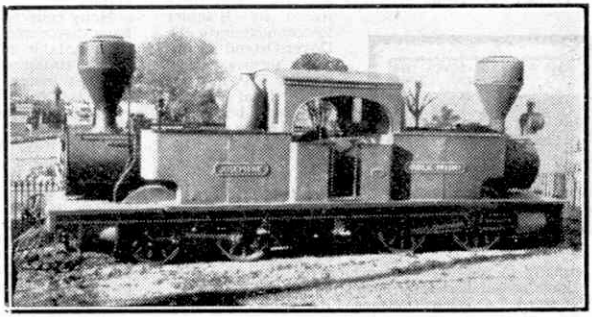
Much of the element is lost when seaweed is simply burned, and for this reason efforts have been made to extract the iodine by heating the seaweed in retorts. This not only prevented waste of iodine, but also gave such other products as ammonia, naphtha and tar. Even then the industry did not prove a success, however, and the process was abandoned in favour of the older method.

A. Stewart (Belfast).

"A PIONEER LOCOMOTIVE"

In the "*M.M.*" for April of this year there was a description of the "*Josephine*," one of the first locomotives to work in New Zealand. I have now been able to obtain photographs of the engine from the Otago Early Settlers Association, who have kindly agreed to its reproduction. This pioneer engine is of the Fairlie type, with a boiler at each end and a cab in the centre. It saw service on the Dunedin-Port Chalmers Line, and eventually found its way into the Otago Early Settlers Museum.

G. Ditchfield (Dunedin, N.Z.).



"Josephine" the first engine of the Dunedin-Port Chalmers Railway, New Zealand, now preserved in the Otago Early Settlers Museum.

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Competitions! Open To All Readers

What is Your "Pointword" Score?

The idea of our chief competition this month is simple. All that readers have to do is to pick out in this issue of the *"M.M."* a phrase or sentence containing exactly 25 letters, and to re-arrange these letters to form a square in which there are as many complete words as possible in the vertical and horizontal lines. In order to make this clear we give an example based on the phrase "Enormous terminal elevators," which readers will find on lines 26 and 27 in the first column on page 390 of this issue.

	10	5	5	—	10
10	S	T	O	R	E
2	T	M	O	U	R
—	E	O	M	L	A
3	A	R	E	I	S
—	L	N	N	V	E

TOTAL 45

The aim in the contest is to get as large a score as possible, marking 10 points for each word of five letters, five for each word of four letters, two for a word of three letters and one for a word of two letters. A line containing two words of three and two letters respectively scores three points. Letters may appear in the square only as many times as they occur in the original sentence, and short words forming part of a longer word in the same line do not count. Only English words in ordinary current use may be used; names, slang and made up words are ineligible.

It will be seen that the maximum score is 100. Such a score actually would be miraculous, and in general a score of 60 points can be considered good. The example on this page gives a total of 45, and we are sure that readers can improve very greatly upon this effort. On their entries competitors must state the page and line from which the words are taken. We will give them a hint; they will find it an advantage to choose a phrase that contains a fair sprinkling of the letters T, R, S and E.

There are two sections, for Home and Overseas readers respectively, and in each prizes of 21/–, 15/– and 10/6 will be awarded for the best efforts. In the case of a tie for any prize the neatness and originality of the entries will be taken into account.

Entries should be addressed *"September Pointwords, Meccano Magazine, Binns Road, Liverpool 13."* Closing dates: Home Section, 31st October; Overseas Section, 30th April, 1947.

A Signalling Story

For our second competition this month we turn to railway signalling. Below we give a passage dealing with the general history of signalling on railways, which has been developed in order to ensure on the one hand the correct running of trains to time-tables and on the other safety in operation. In this account we have missed out certain words, and readers are asked to fill in the blanks.

Here is the passage, with a dash for each of the 16 words that have been omitted.

In the earliest days of British railways there was practically no system of — as we understand it to-day. Even after signals of various kinds were installed at the lineside there was no — system. Trains were operated on a — — system and there was practically no — between individual signalmen, who were referred to on certain lines as —.

Telegraphic communication improved methods of working, while signals and points began to be — so that they could not conflict. Apparatus generally was improved and the — system gradually adopted, by which an interval of — rather than time is preserved between successive trains. More recent developments have included — circuiting, — operation and — signalling, and the use of — signals. One British railway, the G.W.R., has an extensive system of automatic — — of its own design installed on all its principal — routes.

It is not necessary to re-write the entire passage. All that competitors have to do is to give a list of the 16 words required in order and to forward this to *"Signalling Story Contest, Meccano Magazine, Binns Road, Liverpool 13."*

As usual there will be two sections in this competition, for Home and Overseas readers respectively, and in each there will be prizes of 21/–, 15/– and 10/6 for the best efforts in order of merit. In addition consolation prizes will be awarded to other deserving entries. In the event of a tie for any prize the judges will take neatness and novelty into account.

Competitors should take care that their full names and addresses are written on their entries. Closing dates: Home Section, 31st October; Overseas Section, 30th April, 1947.

September Photographic Contest

This month's contest is the 9th of our 1946 series, and in it, as usual, prizes are offered for the best photographs of any kind submitted. There are two conditions: 1, that the photograph must have been taken by the competitor, and 2, that on the back of the print must be stated exactly what the photograph represents. A fancy title may be added if desired.

Entries will be divided into two sections: A, for readers aged 16 and over, and B for those under 16. They should be addressed: *"September Photographic Contest, Meccano Magazine, Binns Road, Liverpool 13."* There will be separate sections for Overseas readers, and in each section prizes of 15/– and 7/6 will be awarded. Closing dates: Home Section, 30th September, Overseas Section, 31st March, 1947.

Prize-winning entries become the property of Meccano Ltd. Unsuccessful efforts will be returned if they are accompanied by a stamped addressed envelope or wrapper.

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The "Plateau Limited"—(*Continued from page 355*)

dropped back into the twenties and often below. After dark we suffered three very lengthy checks for passing trains, and this completely offset the fine start from Minna. Kaduna junction was reached at 8.45 p.m., the 120 miles from Minna having taken 4 hrs. 55 min., an average of 24 m.p.h.

We left Kaduna just before midnight, and reached Kafanchan next morning. Then came the section to Jos, undoubtedly the titbit of the whole trip. The line climbs almost without a break for 50 miles, much of it at 1 in 60. The engine was driven hard, the exhaust becoming a continuous roar, and the fireman working unceasingly.

Fifty miles from Kafanchan we reached the highest point on the Nigerian Railway, 4,324 ft. above sea level. This is 800 ft. higher than the summit of Snowdon. From this point to Jos is mostly downhill, and we coasted gently down, while the fireman had a well-earned rest from his herculean labours. We came to rest at Jos exactly five hours after leaving Kafanchan, 61 miles away, an average of 12¼ m.p.h.

The 725 miles from Lagos had taken 50 hrs., which gives an average start to stop speed of 14½ m.p.h. Not a very impressive performance, you may think, compared with British or American standards. But when one considers the light track, the narrow gauge, the difficulties of terrain and water supply, and the climb to over 4,000 ft., it must be admitted that the running of a through train across 700 miles of wildest Africa which only 60 years ago was largely unexplored, is indeed a worthy achievement.

Wot! No Tail!—(*Continued from page 358*)

reported to be working on a flying-wing air liner design. They have built a 53 ft. 10 in. span all-wing glider, with which to carry out preliminary flight research trials and in extensive tests this glider has reached speeds of 250 m.p.h. de Havillands too are developing a high-speed tailless air transport—the D.H.106—which will probably have a gas-turbine engine and fly mail across the Atlantic at over 500 m.p.h. The little D.H.108 "Swallow," illustrated on this page, is more or less a small-scale version of the D.H.106 and was designed and built in seven months, using a standard "Vampire" fuselage and "Goblin" jet engine. It has proved highly successful and shows that British designers are well aware of the possibilities of jet-propelled tailless aircraft.

In France, the little S.E.2100 light plane has demonstrated that tailless design has advantages to offer for the private owner too. Finally, just to prove that jet-propulsion has its uses in small machines, the American NACA Laboratory is building a small tailless cabin monoplane, driven by a "pusher" propeller with a small jet-outlet at each blade tip. If this aircraft, which is shown in the title drawing to this article, is as good as its designers hope, there is a good chance that aeroplanes *with* tails may become as dead as the proverbial Dodo—or Pterodactyl!

From Hieroglyphs to Sound Writing—

(*Continued from page 370*)

types of script in use in various parts of the empire, made a selection of the most suitable characters, and designed new ones where it was necessary. This is the Chinese alphabet as it has come down even to modern China.

Egyptian hieroglyphs had their origin in a picture script similar to those of the American continent and of China. But the recurring word pictures were repeated and simplified until they became symbols of certain sounds. A square with an opening in the bottom line came to signify a house; the same square containing the symbol of a deity was recognised at a glance as a temple. Gradually, however, the simplification and repetition of signs developed into symbols for syllables, into an ideographic writing which it has taken Egyptologists centuries to unravel.

From Babylonia came the arrow-head or cuneiform writing, in which every character was formed of a wedge-like sign, either singly, placed horizontally, vertically or slanting in some direction, or in twos or threes. The arrow-head writing spread from Babylonia to Assyria, to the Medes and the Armenians, and became the foundation of Semitic and of Aryan writings, undergoing many changes, but retaining the original principle.

Somewhere between the Euphrates and the Nile, among some of those Mediterranean peoples who were the bearers of an ancient civilisation, the sound alphabet that we still use to this day, had its origin. The Greeks attributed it to the Phœnicians, but the Phœnicians themselves denied the authorship, and their legends tell of an Egyptian, Thoth, who had imparted to them the signs of "sound writing." This is the course that led up to the development of the simple alphabets of the present day.

D.H.108 "Swallow" jet-propelled tailless aircraft. Photograph by courtesy of The de Havilland Aircraft Co. Ltd.

Repairing Tramway Lines—(*Cont. from page 374*)

the mould, being lighter than the steel, rises to the top of the feeding heads, runners, etc., and is thus removed when the heads and runners are cut off. It would not do to leave them behind in the steel, because they would then constitute points of weakness.

If you can find out from your local tramways manager when and where thermit repair of the track is being carried out, go and watch it, and you will spend an enjoyable and interesting hour.

"THE B.S.M.E. BULLETIN"

The July issue of this publication, the official organ of the Bombay Society of Model Engineers, has just reached us. Its interesting articles deal with model railway work, the construction of ship models, the use of measuring instruments, electric relays and the care of batteries and accumulators, and the career of Richard Trevithick. The editor is N. P. Vevaina, Scindia House, Dougall Road, Ballard Estate, Bombay. Subscriptions are open to non-members of the Society.

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Fireside Fun

Mrs. Smith: "Don't those bells sound nice and peaceful?"
Mr. Smith: "What do you say?"
Mrs. Smith (loudly): "I say those bells sound nice, don't they?"
Mr. Smith: "Sorry, I can't hear you for those awful bells."

* * * *

"Caught anything?"
"Yes, two."
"What were they?"
"The 7.30 there and the 5.15 back."

* * * *

"I say, your American places have queer names, Oshkosh, Poughkeepsie, Cherokee, Weehawken, Kenosha."
"I suppose they seem strange to your English ears. Do you come from London?"
"No. I come from Leighton Buzzard, but I was born at Puddletrenthide and lived most of my life in Chipping Norton."

* * * *

"Is that man a friend of yours, daddy?"
"Who? The waiter? No, I've never seen him before. Why do you ask?"
"Well, he was so polite, daddy."

* * * *

"Can you swim?"
"Yes, at times."
"That's funny. How do account for it?"
"Well, I can only swim when I'm in the water."

* * * *

"Why does a chicken cross the road?"
"Oh, trying that old thing on me. To get to the other side, of course."
"Well, some such fowl reason, I suppose."

* * * *

"Our driver backed a jeep into a circular saw the other day."
"Ruined it, I suppose."
"Well, not exactly. We've got two motor bikes now."

* * * *

THIS MONTH'S HOWLER

Gladiators give out a strong heat.

BRAIN TEASERS

NET THESE TEN WORDS

Here is a rather unusual word rectangle puzzle that is double-barrelled, the idea of this being of course to make it harder! Can you find words to complete the rectangles shown below, in which missing letters are marked by asterisks?

*	*	*	*	N	E	T		1	T	E	N	*	*	*
*	*	*	N	E	T	*		2	*	T	E	N	*	*
*	*	N	E	T	*	*		3	*	*	T	E	N	*
*	N	E	T	*	*	*		4	*	*	*	T	E	N
N	E	T	*	*	*	*		5	*	*	*	*	T	E

The words must also fit the following clues, the first word in each clue referring to the rectangle on the left, and the second to that on the right: 1. Title; Strain. 2. Musical instruments; Drawing instrument. 3. Concerning creation; Is present at. 4. Former; Satisfied. 5. Stung; Reduce length. T.K.C.

* * * *

COUNTRIES PUT IN ORDER

In the past we have gaily jumbled up the names of countries, aeroplanes, motor cars, etc., and one reader apparently thinks the time has come to reduce this jumbling business to order. He has taken the names of 10 countries and carefully arranged the letters in their names in alphabetical order. Here they are:

AACCEHIKLOOSVZ; AAGILOSUVY; AGLOPRTU; AAHIILNTU; AEINOST; ADEILNRSTWZ; AAABILN; AABGILRU; AAIMNRU; AAILTV

The effect seems to us more bewildering than the usual jumble, but there it is. Can you say what countries are represented in this remarkable list? G.F.

* * * *

"Do you think they're safe?"
"Oh, yes. They're both locked."

* * * *

SOLUTIONS TO LAST MONTH'S PUZZLES

The divisor in the first puzzle in the August "*M.M.*" is 215, the dividend 37,195, and the quotient 173.

A little "eesy" work with S as the initial letter for the five words required gives the following as a solution to our second puzzle: Sever, Seems, Speck, Steel and Seven. With B as the initial letter we can get Bevel, Beets, Blend, Breed and Bezel. There are other solutions and it would be interesting to learn if any reader has made a record score of these.

The message in our third puzzle, a code one, is read by taking first the initial letters in order, then the second letters, then the third, and so on until the letters have been used up. The message disguised here actually gave the solution to the code.

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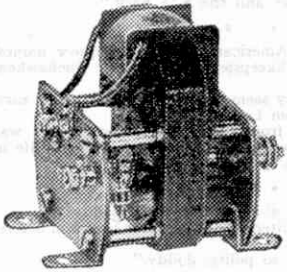

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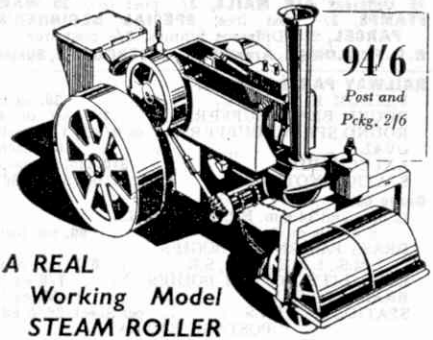

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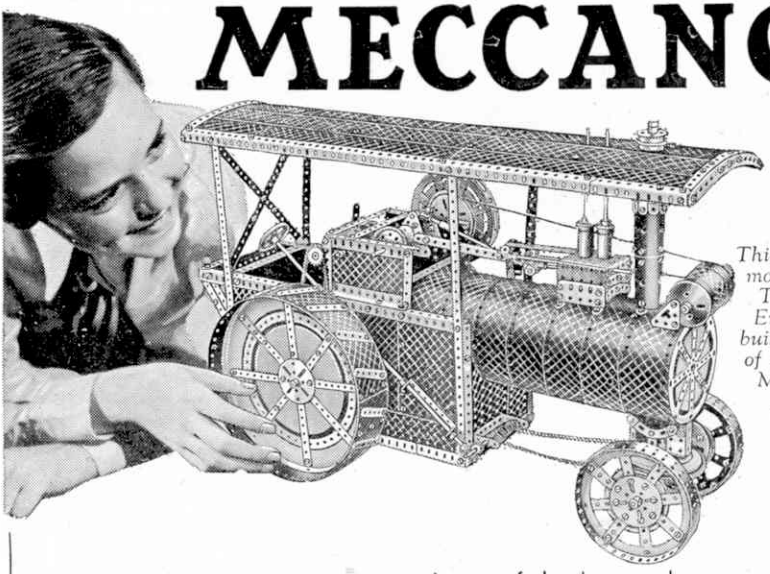

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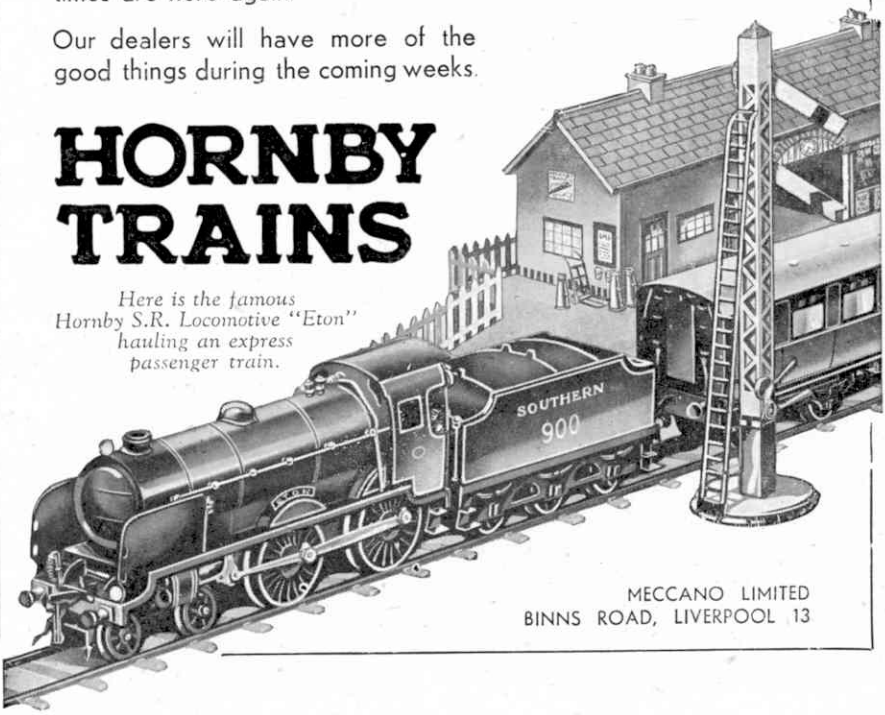

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