1 in. Scale Mecc

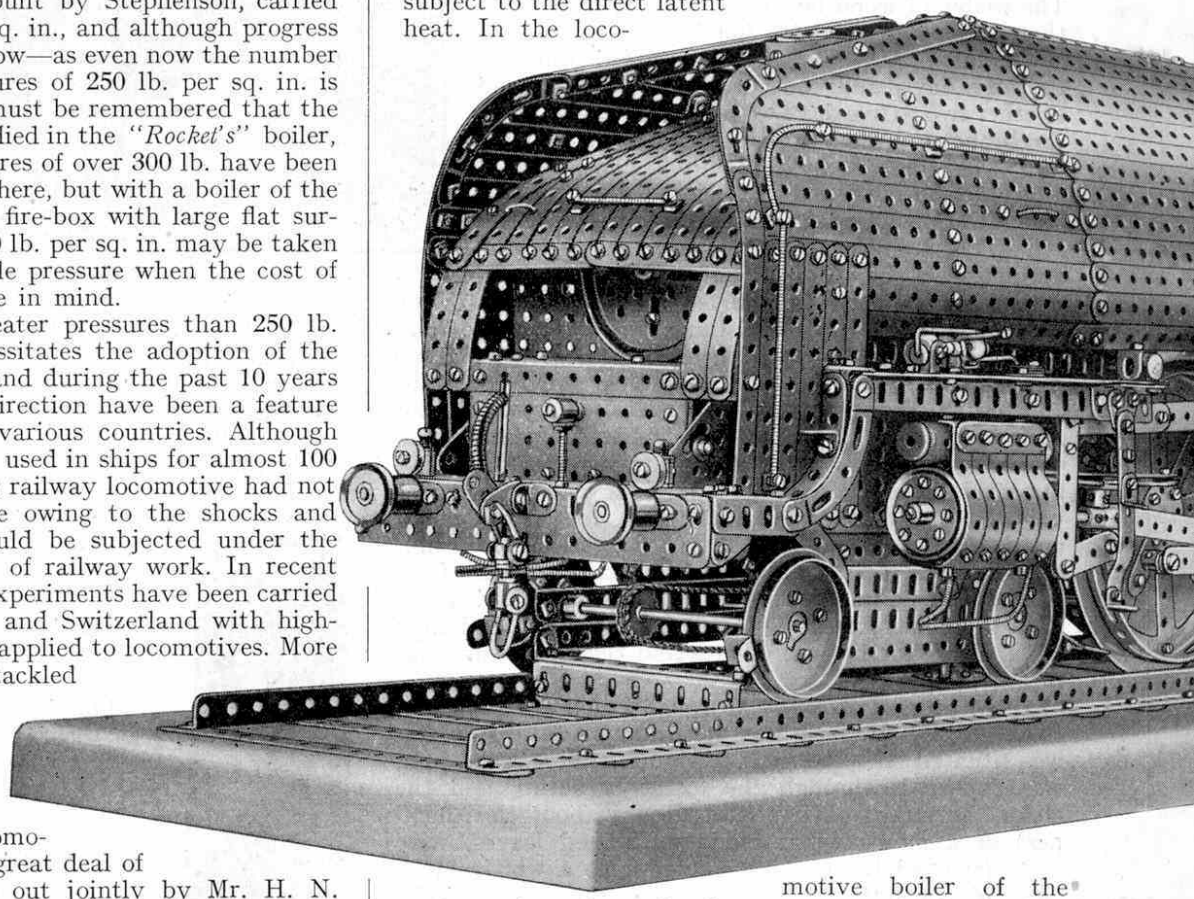
L.N.E.R. High-Pressure L

IN the comparatively early days of the locomotive it was recognised that, if the boiler pressure were increased, an economy in fuel consumption would be effected. With the ordinary type of locomotive boiler, however, such increases of pressure have generally resulted in increasing the cost of boiler maintenance. The boiler of the *"Rocket,"* as built by Stephenson, carried a pressure of 50 lb. to the sq. in., and although progress may appear to have been slow—as even now the number of locomotives using pressures of 250 lb. per sq. in. is comparatively limited—it must be remembered that the fire-tube principle, as embodied in the *"Rocket's"* boiler, has been adhered to. Pressures of over 300 lb. have been tried in Germany and elsewhere, but with a boiler of the Stephenson type, having a fire-box with large flat surfaces that require stays, 250 lb. per sq. in. may be taken to be the highest practicable pressure when the cost of boiler maintenance is borne in mind.

The use of steam at greater pressures than 250 lb. per sq. in., therefore, necessitates the adoption of the water-tube type of boiler, and during the past 10 years or so experiments in this direction have been a feature of locomotive practice in various countries. Although this type of boiler has been used in ships for almost 100 years, its application to the railway locomotive had not been considered practicable owing to the shocks and vibrations to which it would be subjected under the relatively rough conditions of railway work. In recent years, however, numerous experiments have been carried out in America, Germany, and Switzerland with high-pressure water-tube boilers applied to locomotives. More recently the problem was tackled seriously in this country, and the first practical results took the form of the L.N.E.R. locomotive "No. 10000," which was completed in 1929. This locomotive was the outcome of a great deal of experimental work carried out jointly by Mr. H. N. Gresley, the Chief Mechanical Engineer of the L.N.E.R. and Mr. H. Yarrow of Glasgow, whose firm are famous as specialists in the design and building of water-tube boilers.

In "No. 10000" no revolutionary changes in design are embodied. The engine is of the four-cylinder compound type, the adoption of the compound principle being a necessity in order to take the fullest advantage of the high-pressure steam. The steam is supplied to the cylinders by a specially-constructed water-tube boiler designed jointly by Mr. Gresley and Mr. Yarrow, and built by the latter's firm. This boiler has given complete satisfaction, and it is interesting to note that at no point where the 768 tubes are expanded into the various drums has any sign of leakage occurred. In order to reduce scale formation in the boiler the feed-water is introduced at a temperature of over 400 deg. F. Boiler steam, before entering the high-pressure cylinders, is passed through superheating elements in the central flue that raise the temperature to approximately 700 deg. F.

It is remarkable that the boiler, although at no point in direct contact with the fire, is capable of supplying 20,000 lb. of steam per hour at a pressure of 450 lb. per sq. in. This notable rate of evaporation is possible owing to the large proportion of the heating surface that is subject to the direct latent heat. In the locomotive boiler of the ordinary fire-tube or Stephenson type, only the fire-box is subject to latent heat, and the rate of evaporation in the neighbourhood of the tubes is much below that near the fire-box sides. All the vital parts of the boiler and superheater are protected from direct heat by brick columns, thus ensuring a long life for these portions of the locomotive.



In order to avoid unnecessary complications, the steam used for auxiliary purposes is first passed through a reducing valve, which delivers it to a manifold in the cab at a pressure of 200 lb. per sq. in. It has thus been possible to retain standard fittings for all purposes except the main safety valve, regulators and the water gauges, which naturally are in direct communication with the boiler.

The most noticeable external difference between this locomotive and one of normal design lies in the shape of the boiler and the cab, and in the apparent absence of a chimney. The latter point, indeed, has been the cause

eccano Model of Locomotive "No. 10000"

of more popular comment than any other feature of the engine. In designing the boiler it was found necessary to provide extremely long water-tubes, which resulted in a boiler of high pitch, so that it was impossible to mount a chimney in the usual position. The difficulty was overcome by sinking the chimney within casing plates, the front end of the engine generally being so designed that the smoke and exhaust steam would be thrown upward for some distance and thus allow a clear view at all times for the driver.

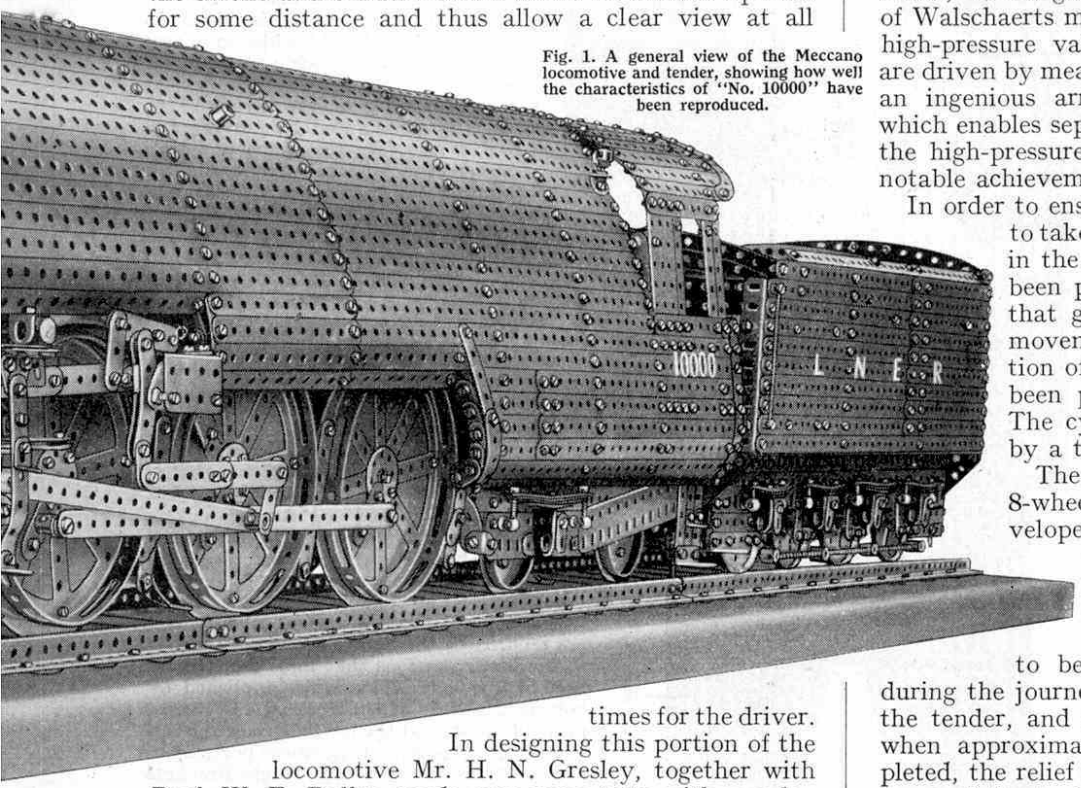


Fig. 1. A general view of the Meccano locomotive and tender, showing how well the characteristics of "No. 10000" have been reproduced.

In designing this portion of the locomotive Mr. H. N. Gresley, together with Prof. W. E. Dalby, made numerous tests with wooden models of proposed designs. These were placed in a wind tunnel, and powdered chalk was projected through the chimney in place of smoke. The action of the chalk was noted with speeds up to 50 m.p.h., the observations being carried out through glass windows in the side of the tunnel. These tests ultimately resulted in the present design, where the streamlined chimney protrudes through a leading-up surface, which deflects the air stream in an upward direction. The air stream is further concentrated by means of the curved casing plates mentioned previously. The design has given complete satisfaction in actual service, sufficient upward deflection of the exhaust being obtained at all speeds without hindrance to the driver's view.

When the engine was originally built it was fitted with two high-pressure cylinders 12 in. in diameter, and two low-pressure cylinders 20 in. in diameter. After a period of running, however, it was decided that the work would be more equally distributed between the high-pressure and low-pressure units if a reduction in the diameter in the high-pressure cylinders were effected. This alteration was therefore carried out, and as was expected resulted in a more evenly balanced engine as a whole.

In order to secure the best results from compound locomotives it is desirable that separate control for the valve gears of the high-pressure and low-pressure cylinders should be afforded. Ordinarily in a 4-cylinder compound this would involve the provision of four separate sets of valve gear. It is interesting, however, that "No. 10000," although a 4-cylinder engine, has only two sets of Walschaerts motion operating directly on the outside high-pressure valve spindles. The low-pressure valves are driven by means of a special connection incorporating an ingenious arrangement patented by Mr. Gresley, which enables separate points of cut-off to be reached in the high-pressure and low-pressure cylinders, and is a notable achievement in design.

In order to ensure as delicate control as possible, and to take the fullest advantage of this refinement in the design of the motion, telemotors have been provided to operate the steam reverser that governs the reversing and notching-up movements. The reliability and ease in operation of control by telemotors have long since been proved in the steering gears of ships. The cylinder drain cocks are also controlled by a telemotor.

The locomotive is fitted with an L.N.E.R. 8-wheeled corridor tender of the type developed for the London to Edinburgh non-stop runs of *"The Flying Scotsman."* This carries sufficient coal for journeys of this length, and is provided with a scoop that enables the water supply to be replenished from the track troughs during the journey. The corridor runs down one side of the tender, and enables the enginemen to be changed when approximately half the journey has been completed, the relief crew travelling in the leading compartment of the train. The total weight of the engine and tender in working order is 166 tons so that "No. 10000" is one of the heaviest locomotives in this country.

Since its construction the engine has been used extensively on a number of long runs, taking its turn with the standard "Pacific" locomotives in the working of important expresses, including *"The Flying Scotsman."* The results obtained as regards reliability and economical fuel consumption appear to have been quite satisfactory, but a prolonged period of use will be necessary before economies in maintenance costs will become fully apparent.

With regard to the initial expense of construction, the forged steel drums in the boiler are the most expensive components. As these are not in any way subjected to the action of the fire, however, they may be expected to have a long life. The cost of this water-tube boiler is not greatly in excess of that of the usual "Pacific" type of boiler with wide fire-box. The fire-box of a normal locomotive is the most costly section, its life being short and its renewal expensive. The water-tube boiler, however, requires no copper fire-box or fire-box stays, so that

the costly maintenance and continual anxiety caused by fire-box stays are abolished. Again, the tubes are more effectively secured, and are not subjected to variation of temperature or stress where they enter the drums. With the reasonably high pressure adopted in this engine therefore, and the great care with which every part has been designed, the ultimate results should be favourable.

The Meccano Model

The model is built to a scale of slightly less than 1 in. to the foot, and is intended primarily as a model of instruction for demonstrating the general characteristics of this locomotive. For this purpose it has been raised slightly above a section of railway track, and matters have been so arranged that a Motor carried in the Tender drives all wheels at their correct speeds through Sprocket Chain. Thus it is possible to study the Walschaerts valve motion and to vary the valve travel, the latter operation being carried out from a lever in the cab. It is also possible to control the brakes from the tender platform, and to receive an excellent idea of the controls and method of operating the locomotive from the fittings in the cab.

Construction of the Boiler and Cab

Owing to the peculiar shape of the boiler, it is necessary to build it up in a rather unorthodox manner, the lack of a rigid and symmetrical framework making the construction far simpler than that of a standard locomotive boiler, if built in the following manner. Fig. 2 gives an excellent idea of the shape of the boiler and cab before being bent to shape.

The model is begun at the cab end. Three sets of three 12½″ Strips, laid side by side and bolted to suitable cross members 1, 2, 3, form what ultimately will be the top portion of the boiler. The three Strips at the cab end overlap the centre three Strips three holes, and the remaining three are overlapped two holes. Three more cross-members 4, 5, 6, are now bolted to the top of the boiler in the positions shown, and thirteen 4½″ Strips are secured to the member 4 on each side of the centre 12½″ Strips, in order to span the space between the members 4 and 1. Each 4½″ Strip, with the exception of the last one on each side, is now continued by two 12½″ Strips from member 1 across members 5, 2 and 6 to 3, and from here Strips of varying lengths are utilised to mould the front portion of the boiler.

A symmetrical finish is given to the ends of the Strips by clamping them between two 7½″ Strips, secured to the Flat Brackets 7, and two 3″ Curved Strips. A 7½″ Strip 12, overlapping the 12½″ Strip 13 two holes, is now fitted, and to this are bolted two further 7½″ Strips 14 by means of a Flat Bracket and 1½″ Strip. Each of the two extremities of the smoke deflector, built up from five 4½″ Strips and one 5½″ Strip, are bolted at their upper ends to the lower edge of the deflector proper, and at their lower ends to a 3½″ Angle Girder. A 1½″ Angle Girder 8 is bolted to one of the 4½″ Strips; the purpose of this will be described later.

Two 5½″ Strips 11, overlapping two holes at the member 2, are secured at one end to the member 6 and at the other by means of a Flat Bracket to the boiler. The edge of the member 6 is made to appear broader by fitting it with two Flat Brackets fixed in place by means of two ½″ × ½″ Angle Brackets.

The lower portion of the rear end of the boiler and the cab is now built. Two 9½″ Strips 9 are bolted between members 4 and 1 so that they overhang the member 4 ten holes. The inner ends of these Strips are extended to the member 6 by means of two 12½″ and two 5½″ Strips, and Strips of varying lengths are laid against 9 so that their ends form a slope at 5. The appearance of this slope is improved by fitting a 4½″ Strip and eight Flat Brackets, as shown in Fig. 1.

The cab roof and sides are built out from the three centre 12½″ Strips, mentioned earlier, on two sets of two 5½″ Strips. The roof consists of fifteen 4½″ and two 5½″ Strips 10, eleven of the centre 4½″ Strips being extended by 3″ Strips and the remaining four by 2½″ Strips. A roof edging effect is given by fitting a 5½″ Strip and two 2½″ small radius Curved Strips round the edge of the finished roof.

The cab window surroundings consist of a number of 4½″ Strips bolted together as shown in the illustration. A finished appearance is given to these windows by the addition of two Flat Brackets, one being fitted across each upper corner.

The bending of the structure to shape is commenced by curving the roof of the cab, the shape of which must be that of a wide angle, slightly rounded at the apex, rather than a continuous curve. The boiler is now curved, a good idea of the correct shape being gained from Fig. 1. It will be found advisable to bend the lower edges of the boiler and cab before finally drawing them together, as this method reduces possible damage to coloured parts to a minimum. The shape of the boiler is preserved by bolting two 4½″ × 2½″ Flat Plates, overlapping five holes, between the 1½″ Angle Girders 8, and by connecting together the two ½″ × ½″ Angle Brackets 15 by means of two 4½″ Strips, overlapping two holes. Two further 4½″ Strips, overlapping five holes, are bolted to the ½″ × ½″ Angle Brackets 16 to aid in strengthening the structure. The smoke-box door (Fig. 1) is represented by a 3″ Pulley Wheel secured by ⅜″ Bolts to the 4½″ × 2½″ Flat Plates mentioned earlier.

The upper portions of the cab sides, which are secured to the cab roof, are now bolted to the lower portions that form a continuation of the boiler. This is accomplished by bolting the ends of the vertical 4½″ Strips, protruding beyond the lower edge of the cab windows, to the top of the lower portions of the cab sides. Three ½″ × ½″ Angle Brackets bent to an angle of 45 degrees are fixed to each of the rear edges of the cab and these carry a 2½″ Strip and three Flat Brackets. The 2½″ Strip is attached to the Angle Brackets by Handrail Supports, and the three Flat Brackets are arranged to follow the curve of the lower portion of the cab. The Handrail Supports are fitted with handrails consisting of Spring Cord, down the centre of which has been passed 22 S.W.G. bare copper wire. The wire strengthens the rail and allows a firm grip to be obtained in the Handrail Support.

The whistle is built up from a Threaded Pin carried on a ½″ × ½″ Angle Bracket. The Threaded Pin carries a Compression Spring and three Washers held in place by a Collar. (*To be continued.*)

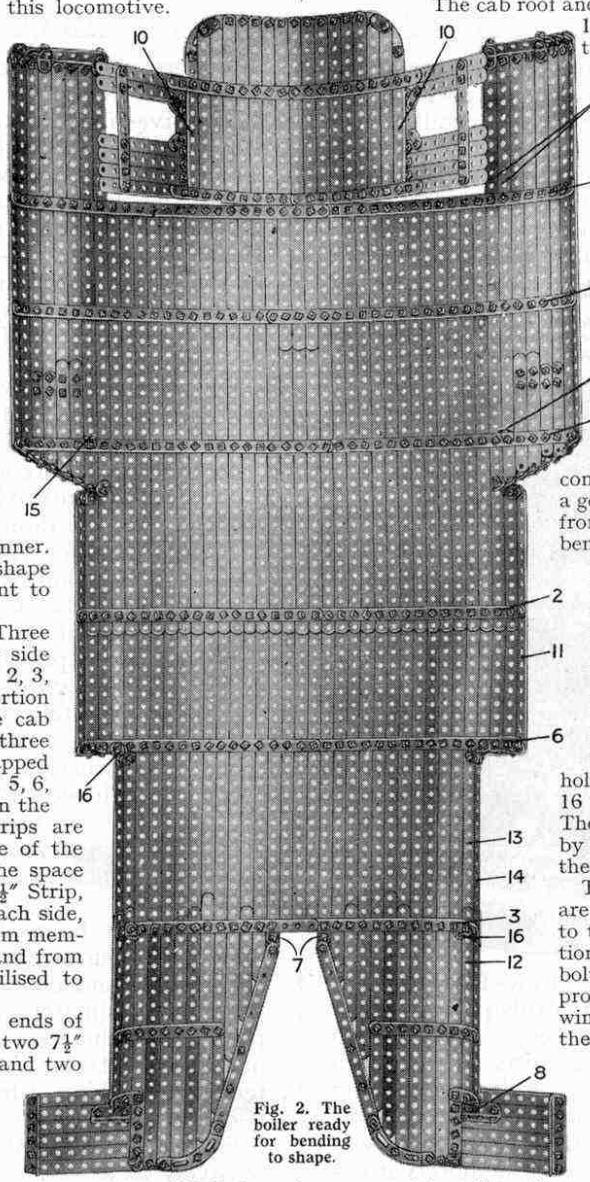
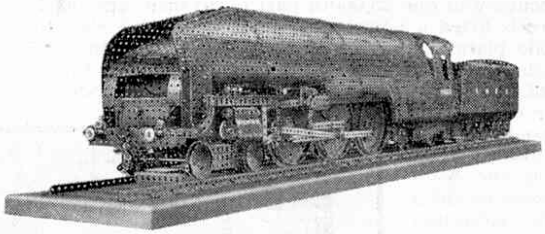


Fig. 2. The boiler ready for bending to shape.

LIST OF PARTS REQUIRED

89 of No.	1	1 of No.	8a	29 of No.	12b	4 of No.	21	4 of No.	48b	11 of No.	64	20 of No.	90	10 of No.	103k	2 of No.	128
41 „ „	1a	12 „ „	8b	8 „ „	13a	4 „ „	22	2 „ „	48c	2 „ „	67	4 „ „	90a	8 „ „	109	12 „ „	133
86 „ „	1b	13 „ „	9	8 „ „	14	2 „ „	22a	4 „ „	50a	72 „ „	68	4 „ „	94	18 „ „	111	26 „ „	136
76 „ „	2	16 „ „	9a	8 „ „	16	4 „ „	23	10 „ „	52c	40 „ „	69	3 „ „	95	21 „ „	111a	8 „ „	137
98 „ „	2a	5 „ „	9b	2 „ „	16a	8 „ „	24	9 „ „	53a	17 „ „	70	14 „ „	96	71 „ „	111c	6 „ „	146
47 „ „	3	4 „ „	9c	1 „ „	16b	74 „ „	25	2 „ „	58	3 „ „	72	8 „ „	103	2 „ „	114	11 „ „	147b
47 „ „	4	6 „ „	9d	1 „ „	17	2 „ „	35	33 „ „	59	6 „ „	77	2 „ „	103a	2 „ „	116a	2 „ „	161
72 „ „	5	8 „ „	9e	5 „ „	18a	1474 „ „	37	8 „ „	62	8 „ „	79	4 „ „	103b	6 „ „	118	1 „ „	162a
16 „ „	6	11 „ „	9f	6 „ „	18b	240 „ „	37a	1 „ „	62a	1 „ „	79a	2 „ „	103c	2 „ „	119	4 „ „	163
46 „ „	6a	107 „ „	10	4 „ „	19	192 „ „	38	36 „ „	62b	1 „ „	80a	1 „ „	103d	7 „ „	120a	11 „ „	164
10 „ „	7	11 „ „	11	3 „ „	19s	1 „ „	43	18 „ „	63	3 „ „	81	11 „ „	103f	3 „ „	125	1 „ „	166
6 „ „	7a	97 „ „	12	9 „ „	19b	10 „ „	48	2 „ „	63b	1 „ „	82	6 „ „	103g	4 „ „	126	1 „ „	168a
7 „ „	8	6 „ „	12a	6 „ „	20b	6 „ „	48a	8 „ „	63c	6 „ „	89a	8 „ „	103h	6 „ „	126a	1 „ „	171
																1	E.6 Electric Motor

1 in. Scale Meccano Model of L.N.E.R. High-Pressure Locomotive "No. 10000"



IN this article we continue our description of the Meccano model of the L.N.E.R. locomotive "No. 10000."

Last month the boiler and boiler fittings of the model were described. The next section claiming our attention is the chimney and smoke-deflector, Figs. 1 and 2. An underneath view of the deflector is shown in Fig. 1, and from this will be seen the general construction of this part of the model. Commence by building the front girder, which consists of two $4\frac{1}{2}''$ Angle Girders overlapping five holes. The extremities of the complete girder each carry a $2\frac{1}{2}''$ Strip and an Angle Bracket. The $2\frac{1}{2}''$ Strips are fitted with $9\frac{1}{2}''$ Strips at their free ends, and these form the outer edges of the deflector. The outer ends of the $9\frac{1}{2}''$ Strips are drawn together until they are 3″ apart, and the triangular space so enclosed is filled in as shown in the illustration. The oblong space remaining near the bottom of the deflector is used in actual practice as a trap for air, feeding the fire, and is fitted with a shutter that controls the volume of air passing through it. This system allows an adequate amount of hot air to be delivered to the fire-box under all conditions.

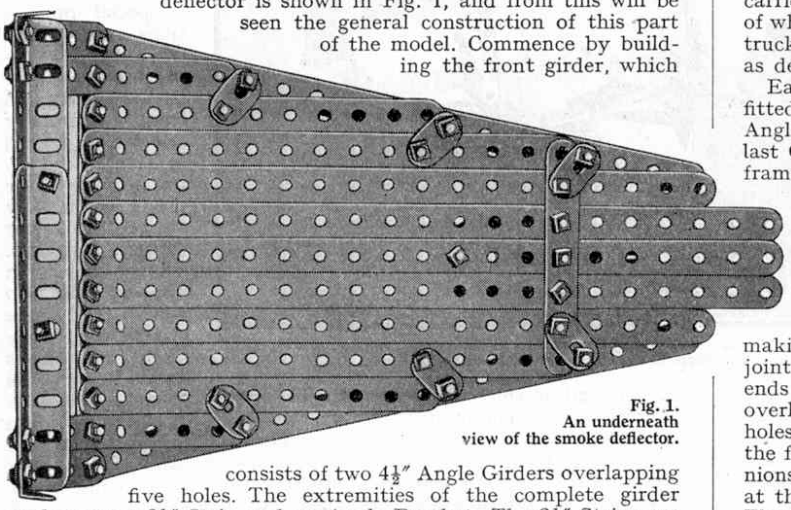


Fig. 1. An underneath view of the smoke deflector.

When the deflector is built up it must be curved to the correct shape, for which purpose the front of the already shaped boiler must be constantly referred to. When bent it is held in place at its lower end by the Angle Brackets shown in Fig. 1, and at its upper end it is attached to the boiler by the ends of the three centre Strips. The position of the Angle Brackets will be found on reference to Fig. 1 of last month's article.

The chimney is constructed in the following manner. A $2\frac{1}{2}''$ Flat Girder is bent round the periphery of a 1″ loose Pulley, and at each end is fitted with two $2\frac{1}{2}''$ Strips, the four being connected together by a $\frac{3}{8}''$ Bolt in order to give the desired tapered effect. Two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets are now fitted, and these carry two $1\frac{1}{2}''$ Strips, the end holes of which are connected together by a $\frac{3}{4}''$ Bolt, which passes into the top of the smoke-deflector when the chimney is placed in position. The top of the chimney consists of a 1″ loose Pulley held in place by means of a 6 B.A. Bolt, the shank of which passes through the slotted hole of a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket attached to the chimney. The complete chimney is attached to the deflector by the $\frac{3}{4}''$ Bolt already mentioned, and also by an Angle Bracket, part of which is shown in Fig. 2.

Building the Main Frames

Fig. 5 shows the construction of one side of the main frames, and from this it will be seen that two $24\frac{1}{2}''$ Angle Girders, overlapping 12 holes, form a base on which is constructed the remainder of the main frame, and also the bearings for the wheel axles. The part of the frame that carries the driving wheel axles is strengthened by fitting five $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates and one $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate. Each Plate overlaps its neighbour one hole, with the exception of that at the rear end of the strengthened portion. The upper edges of these plates are coupled together by a girder consisting of one 3″ Angle Girder overlapping an $18\frac{1}{2}''$ Angle Girder two holes, and this latter in turn overlaps a $9\frac{1}{2}''$ Angle Girder four holes. The front end of the frame is fitted with a $2\frac{1}{2}''$ Angle Girder, which will be used later for joining the two sides of the main frame together. An $18\frac{1}{2}''$ Angle Girder is now fitted to the near end of the frames and this carries a Boss Bell Crank, which is used for supporting the rear pair of wheels. In the actual engine these wheels are carried on a Bissel truck, but in the demonstration model it is advisable to fit them as described owing to the fact that they are raised off the rails.

Each side of the front bogie is constructed from a $7\frac{1}{2}''$ Flat Girder fitted with a $7\frac{1}{2}''$ Angle Girder and attached, by means of a $3\frac{1}{2}''$ Angle Girder and two Flat Brackets, to a $4\frac{1}{2}''$ Angle Girder. This last Girder is secured by two Bolts to the underside of the main frame, and $2\frac{1}{2}''$ large radius Curved Strips are fitted to the bogie as shown, so that the main frame appears to be cut away in order to accommodate the bogie wheels. When the two frame sides have been completed they are joined together by bolting a $7\frac{1}{2}''$ Angle Girder, carrying the buffer beam and buffers, across the front of the frames. The Girder is held in place by means of two $1'' \times 1''$ Angle Brackets, and the two ends of the Girder overhang the frames three holes, thus making the frames $4\frac{1}{2}''$ wide. The lower edges of the bogie are jointed together by two $4\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The rear ends of the frames are coupled together by two $4\frac{1}{2}''$ Angle Girders overlapping each other five holes and overhanging the frames two holes on each side. Three intermediate struts are fitted between the frames and these consist of $4\frac{1}{2}''$ Angle Girders bolted to Trunnions. A $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate is secured between the Angle Girder at the front of the model, and above this is carried two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates shown in Fig. 6.

The front footplates are now fitted, and consist of two $2\frac{1}{2}''$ Angle Girders, one of which is shown in Fig. 5. A 2″ Angle Girder situated to the side of this, but running parallel to it, is bolted in the end hole of the Girder forming the buffer beam and is connected by a 3″ Curved Strip and a 3″ Strip to two $7\frac{1}{2}''$ Angle Girders representing the side of the footplating. These are extended at their rear end for a distance of 1″ by two 2″ Angle Girders, and the complete girder carries one $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate and one $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate. The latter Plate overlaps the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate one hole. Each support for the rocking links of the valve gear consists of two Girder Brackets joined together at right angles by a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket. The whole is connected to the main frames by a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket and a $2\frac{1}{2}''$ Flat Girder. A 1″ Triangular Plate is bolted to the extremity of each outside Girder Bracket.

Each side of the rear of the main frame is shaped from Flat Girders of varying lengths secured to a $12\frac{1}{2}''$ Angle Girder attached at one end to the main inner Girder by a $1'' \times 1''$ Angle Bracket. The other end of this Girder is bolted to the outer extremity of one of the $4\frac{1}{2}''$ Angle Girders mentioned earlier. The cab steps, built up from $2\frac{1}{2}''$ Flat Girders bolted to $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, are fitted

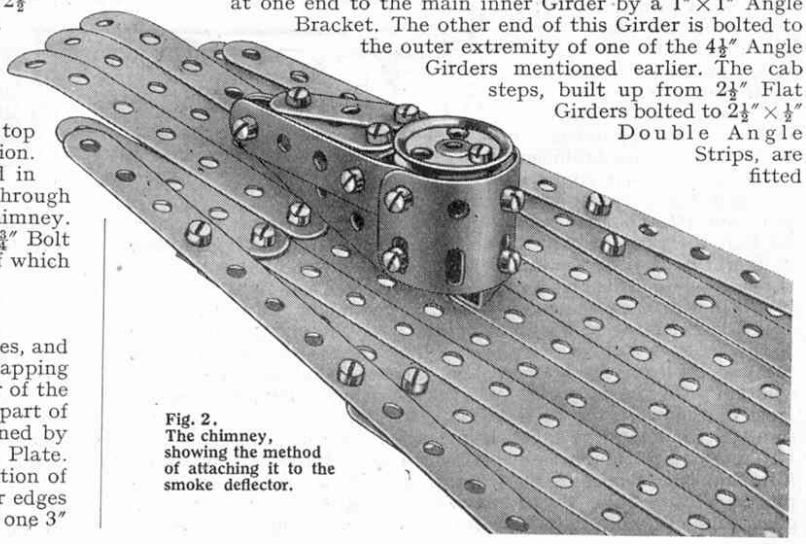


Fig. 2. The chimney, showing the method of attaching it to the smoke deflector.

to the rear of the main frames as shown in the illustration.

The front bogie wheels consist of Face Plates on each of which is mounted a Wheel Flange. The axles, 5″ Rods, are journalled in Double Arm Cranks bolted to the top of the 7½″ Flat Girders forming the bogie sides. The front axle carries a 1″ Sprocket Wheel and the second axle carries two Sprockets of a similar size. One of the two latter Sprockets is connected by Sprocket Chain to the Sprocket on the front axle. The two front wheels are protected by guards made from ½″ Reversed Angle Brackets. Each of the main driving wheels is constructed from a Circular Plate and a Hub Disc, a Bush Wheel being bolted in the centre of the wheel so formed, to enable it to be secured to an Axle Rod. A Double Arm Crank is also fitted to each wheel in the position shown in Fig. 6. The Wheels are mounted on 5″ Axle Rods journalled in Double Arm Cranks and the three Wheels on one side of the locomotive have their cranks set at an angle of 90 degrees to those of the other side.

The Double Arm Cranks on the front and rear wheels are connected to those on the centre wheels by means of 7½″ Strips, the Strips being so arranged that they overlap each other three holes at the point where they are fitted to the centre wheels. Pivot Bolts are used for attaching the Strips to the front and rear wheels, and 1″ Rods are used where they are connected in the centre. The 1″ Rods each carry a Crank, termed the return crank, so arranged that it moves a little in advance of the crank pin when the locomotive is travelling forward. The front and rear 5″ Rods each carry two 2″ Sprocket Wheels. One of each of these is used for connecting the front and rear set of driving wheels together; the remaining two connect the driving wheels with the 1″ Sprockets on the bogie axles.

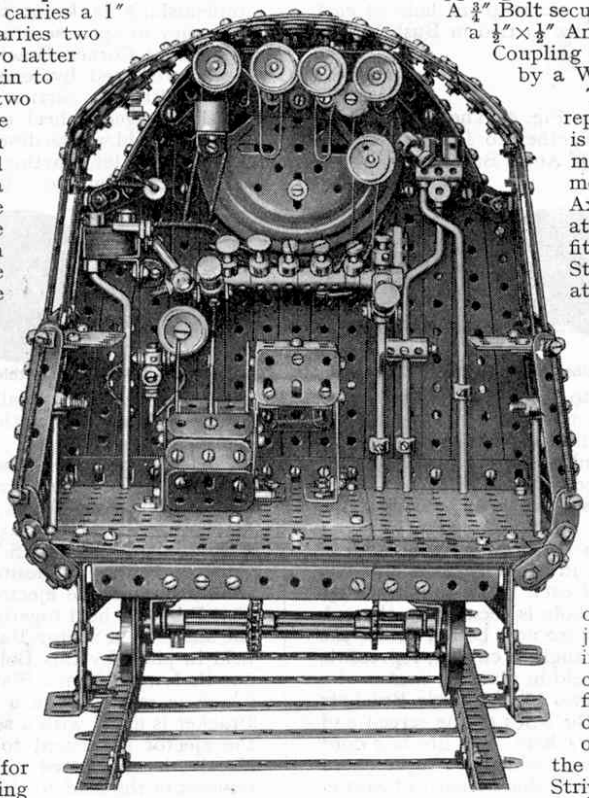


Fig. 3. This illustration shows the boiler end complete with its various fittings.

The front pair of wheels, of what appears to be a rear bogie, is carried on a 6½″ Rod journalled in Double Arm Cranks. These Cranks are partially hidden by axle-boxes, each of which is constructed from two 1″×½″ Angle Brackets bolted to laminated springs by a ⅜″ Bolt. This Bolt also carries a Hinge fitted with a Flat Bracket forming the axle-box flap. Each laminated spring is built up from two 4½″, 3½″, 2½″ and 1½″ Strips, and the whole is carried on two ¾″ Bolts supported by two Handrail Supports.

Each cylinder is built up in the following way, and care must be taken to see that a right-hand and a left-hand cylinder are constructed, and not two for the same side. Two Sleeve Pieces, using ½″ Bolts with their shanks outward, are bolted by their centre holes to the end slotted holes of a 2½″ Angle Girder, and matters are so arranged that these fall on the inside of the Girder. Five 4½″ Strips are now curved to the shape shown in Fig. 6, and bolted by means of Set-Screws to the 2½″ Angle Girder, a 2½″ Strip being used for spacing purposes beneath the heads of the set-screws. The simplest way of bending the Strips is to press each one separately round the circumference of a wooden roller 1½″ in diameter, a bend being made in the last hole but one in the opposite direction to the curve. The free ends of the Strips are connected together by a 2½″×½″ Double Angle Strip, a second Double Angle Strip being used in the centre of the Strips.

These two Double Angle Strips carry two 1½″ Pulley Wheels that form the end of the cylinder. A third 2½″×½″ Double Angle Strip is used to form a connection between these Pulleys and the Sleeve Pieces forming the valve chest. Drain cock pipes are fitted to the underside of the cylinders, and these are constructed similarly to the handrails on the boiler. The cylinders, when completed, are each secured to the main frames by locking the ½″ Bolts protruding from the top of the steam chest to the outer holes of two 1½″×½″ Double Angle Strips. These Double Angle Strips are bolted between the outer Girder of the footplating and the main frames. A further support is formed for the cylinder by substituting two of the Bolts securing the free ends of the Strips of the cylinder for two ¾″ Bolts. The ends of these are passed through suitable holes in the main frame and are locked in position by two nuts.

A ½″×½″ Angle Bracket secures the slide bar, Fig. 6, to its cylinder. This consists of two 5½″ Strips spaced apart at each end by one Washer, and the lower strip carries an Eye Piece, the overlapped portions of which slide between the two Strips. A ¾″ Bolt secured in the boss of the Eye Piece carries a ½″×½″ Angle Bracket and a Strip Coupling, the Coupling being spaced from the Angle Bracket by a Washer.

The valve gear, which is an accurate reproduction of Walschaerts valve motion, is now proceeded with in the following manner. The Strip Coupling already mentioned carries the piston rod, a 3½″ Axle Rod, in its drilled hole, and the slot at the opposite end of the Coupling is fitted with one end of a 9½″ Strip. This Strip forms the connecting Rod, and it is attached to the wheels by passing its free end over the 1″ Rod that is carried in the boss of the Double Arm Crank bolted to the centre driving wheel.

The return crank, the position of which has already been described, is secured to the 1″ Rod on the outside of the connecting Rod. The Angle Bracket secured to the Strip Coupling has a 2″ Strip pivotally attached to it, and this Strip in turn carries a 3″ Strip. This latter Strip is secured by its next to top hole to a Collar, a Set-Screw being used for this purpose in place of a Bolt. The Collar is carried on the side valve Rod, a 3½″ Rod, that is journalled in Chimney Adaptors carried in the Sleeve Pieces forming the steam chest. The top hole of the 3″ Strip is fitted with a pivotally mounted Strip composed of one 3″ and one 3½″ Strip overlapping two holes. The free end of the Strip is carried, together with a 1½″ Strip, on a ½″ Bolt clamped in the boss of an Eye Piece. This Eye Piece slides almost vertically on the reversing link that is built up from two 2½″ large radius Curved Strips spaced apart at each end by means of two Washers.

The outside Strip of the link is carried on a lock-nutted bolt secured to the Triangular Plate the fitting of which has already been described. The lower securing Bolt of the link carries a Flat Bracket, and this is connected by two 3½″ Strips, overlapping two holes, to the return crank on the centre driving wheel. The top hole of the 1½″ Strip, attach to the reversing link, is attached by a Bolt and lock-nuts to a 2½″ Strip that is bolted to a Crank, thus forming a lever 2½″ long. The Crank is mounted on a 6½″ Rod, journalled in Handrail Supports, that runs transversely across the main frames; thus a connection is formed between the two reversing links of the valve motion. The Rod also carries a Crank fitted with an End Bearing, and this will be connected later to a lever in the cab.

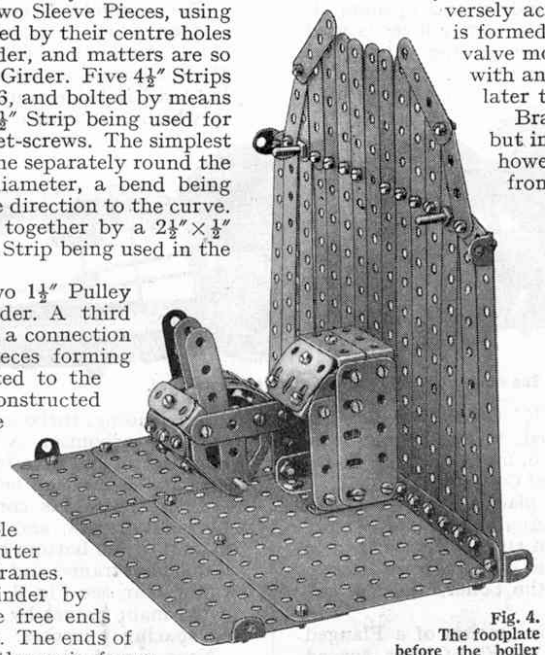


Fig. 4. The footplate before the boiler fittings, etc., have been added.

Brakes are fitted to all six driving wheels, but in the model they do not work. They may, however, be coupled together, and operated from a lever in the cab. The brakes on the front and centre driving wheels consist of 3½″ Strips, fitted with Flat Brackets, carried on ¾″ Bolts. Those on the rear wheels consists of 2½″ Strips, fitted with Flat Brackets, and carried on ½″×½″ Angle Brackets. Sand pipes, constructed on similar lines to the handrails on the boiler, are fitted to the front and centre driving wheels.

When the main frames have been completed the supports for raising them above the level of the rails are fitted. At the front end the support is formed from two 4½″ Angle Girders (see Fig. 1 of last month's article). These two Girders are bolted together to form a reversed angle girder, and are attached to the main frames by means of the foremost 4½″×½″ Double Angle Strip of the bogie. The remaining 4½″×½″ Double Angle Strip of the bogie is fitted with two Double Arm Cranks carrying 1″ Rods, the lower ends of which rest in Bush Wheels

screwed to the board of the model. The supports at the rear of the main frames consist of Couplings secured by means of two Bolts each to the cab steps. The steps are prevented from distorting under the weight of the engine by securing a Rod between the two Couplings, this Rod being held in the centre plain hole of each Coupling. The lower ends of the Rods are carried in Bush Wheels as before.

Constructing and fitting the Cab

The framework of the cab is shown in Fig. 4. The floor consists of four 5½″×3½″ Flat Plates bolted together to form an oblong 8½″ in length and 5″ in width. Two ½″×½″ Angle Brackets and two 4½″ Angle Girders, overlapping one hole, are fitted to the front end of this platform, the 4½″ Girders being used for carrying the front wall of the cab. This wall is built up from seven 7½″ Strips, shorter Strips being used at each side in order to obtain the desired shape as shown in the illustration. When all the Strips are in place, a 5½″ Strip is bolted horizontally across the back of the wall and 10 of the Strips are bolted to this, the centre one not being secured until the end of the boiler is in place. The four ½″×½″ Angle Brackets are now fitted; these are used later for securing the complete cab in place.

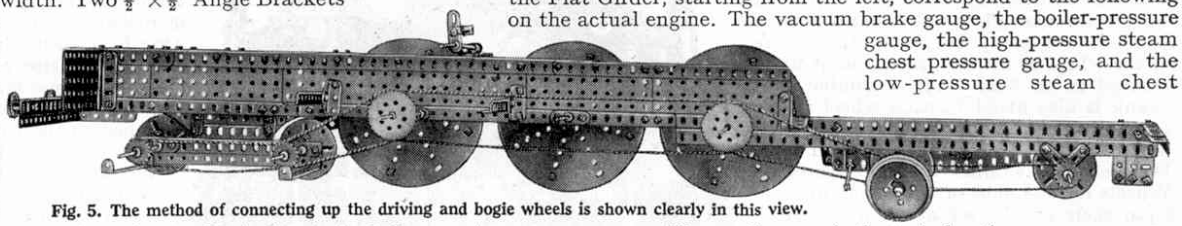


Fig. 5. The method of connecting up the driving and bogie wheels is shown clearly in this view.

The fire-box door screen is built up from two 2½″ and two 2″ Flat Girders, joined together as shown in order to form the two sides of the screen. The bottom end of each is fitted with a 1½″ Angle Girder by means of which the whole is secured to the cab floor. Two 1½″×½″ Double Angle Strips are now bolted across the top of the screen and a 1½″ Flat Girder, slightly curved, represents the glare deflector. This Flat Girder is held in place by means of a Flat Bracket at its upper edge and by two ½″×½″ Angle Brackets at its lower edge. The spaces between the sides of the screen and the deflector are filled in by the Flat Brackets. The fire-box door consists of a 1½″ Flat Girder, the hinges of which are represented by two Flat Brackets and the lift bar by a short length of Spring Cord. Part of the door is shown in Fig. 3.

The lever frame is built up in the following manner. The sides consist of Flat Trunnions joined together at each upper corner by a 1½″×½″ Double Angle Strip. A 2″ Strip is fitted to one side of the frame and a 1″×1″ Angle Bracket to the other. These two parts are used for securing the lever frame in position. The near side of the frame, shown in Fig. 4, is filled in by means of a 1½″ Strip and a 1½″ Flat Girder, held in place by means of Flat Brackets. The top consists of two 2″ Strips, curved to shape and clamped in position at each end by a 1½″ Strip. The three levers, two of which are dummy, are carried on a 2″ Rod, Collars being used for holding them in position. In actual practice the levers, starting from the right-hand side, are used for reversing the low-pressure cylinders, reversing the high-pressure cylinders, and opening the cylinder drain cocks. On the model only the centre lever is used, this being for actuating the reversing links on the valve-gears. A Flat Bracket is attached to this lever, and a Collar, carried in the end hole of this, supports one end of a 3½″ Crank Handle. The inner end of the Crank Handle is coupled, when the cab is in position, to the End Bearing, shown in Fig. 6, by 11½″ and 4½″ Rods. These Rods are joined together by means of Couplings.

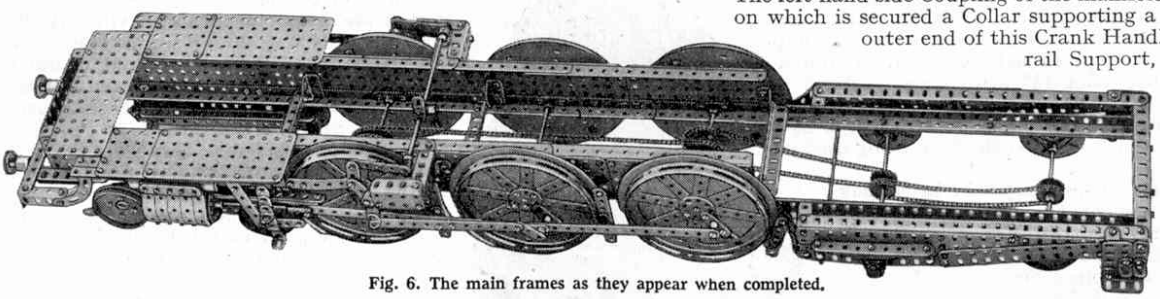


Fig. 6. The main frames as they appear when completed.

All is now ready for fitting the cab in place inside the boiler. This is accomplished by bolting the six Angle Brackets already mentioned to the inside of the cab sides in the position shown in Fig. 3. The short strips at the top of the front of the cab are altered, if necessary, to conform to the shape of the boiler, and the cab fittings are then proceeded with.

The end of the boiler is first fitted. This consists of a Flanged Disc (Part No. 168a) to which is bolted a 3½″ Flat Girder, spaced away from the boiler end by means of three Washers. The Flat Girder is bent outward slightly at the right-hand side, and this enables the driver, in actual practice, to get a clear view of the gauges. Two large Corner Brackets shown protruding below the Flat Girder are now fitted, the left-hand one of which carries the oil replenishing tank for the telemotors. This is represented by a Chimney Adaptor secured by means of a ½″×½″ Angle Bracket to its respective Corner Bracket. The pipes leading to the telemotors are represented by lengths of Spring Cord. The right-hand side Corner Bracket carries a Threaded Pin on which is mounted a small Flanged Wheel representing the manifold pressure gauge. The manifold will be described later. The four large gauges fitted on the Flat Girder, starting from the left, correspond to the following on the actual engine. The vacuum brake gauge, the boiler-pressure gauge, the high-pressure steam chest pressure gauge, and the low-pressure steam chest pressure gauge. The small gauge is the train heating pressure gauge. The pipe-loops below the gauges consist of short lengths of 23 S.W.G. wire.

The regulator is in the top left-hand corner of the cab and it consists of a Coupling mounted on a Threaded Pin as shown in Fig. 3. The regulator handles, of which there are three, are represented by short lengths of Spring Cord, down the centres of which is passed a double length of 23 S.W.G. wire. This wire enables the Spring Cord to retain its desired shape. Below the regulator is fitted the vacuum brake ejector. The body of this is built up from 20 Flat Brackets held together by a ¾″ Bolt, the head of which carries the shank of a Spring Buffer. Two ½″×½″ Angle Brackets are also held in place by this Bolt. One of these Angle Brackets carries a handle formed from a Flat Bracket and Threaded Pin, the whole of which is mounted on a lock-nutted Bolt. The remaining Angle Bracket is fitted with a second similar Bracket by means of which the ejector is secured to the cab front. The top of a 3½″ Crank Handle is now fitted in place as shown in the illustration, and represents the lead to the vacuum pipe connections seen between the coaches of a train.

The pressure reducing valve, shown on the right-hand side of the cab, is necessary, in the actual engine, in order to allow normal locomotive fittings to be used. In the model it is constructed from a Coupling, to which are secured two Threaded Bosses by means of ½″ Bolts. One of these Threaded Bosses carries a ½″ Bolt in its horizontal tapped hole, and on this is mounted a Collar carrying a Pivot Bolt, representing the control handle for the reducing valve. The under side of the Coupling carries a second similar part, which supports the top end of a 3½″ Crank Handle carrying a Coupling half way down its length. This Crank Handle is held in place by a Collar secured to the cab front by a Collar. A 5″ Crank Handle, the top of which passes behind the reducing valve, is also fitted.

The manifold is now built and fitted. This consists of a 3½″ Rod on which is carried three Couplings and four Collars. Two 1″×1″ Angle Brackets, through the outer end holes of which the 3½″ Rod passes, are used for securing the manifold to the cab front. The left-hand side Coupling of the manifold carries a Threaded Pin, on which is secured a Collar supporting a 3½″ Crank Handle. The outer end of this Crank Handle is fitted with a Hand-rail Support, and the complete unit represents the blower fitted to an actual locomotive for causing a draught over the fire. Attached to the manifold are six handles, the uses of which are as follows. Starting from the left-soot blower, steam reversing gear, whistle, steam sanding, turbo-generator, mechanical lubricator and anti-carboniser. A Coupling is secured vertically to the right-hand end of the manifold by a 1″ Threaded Rod, and this represents the connection between the reducing valve and the manifold.

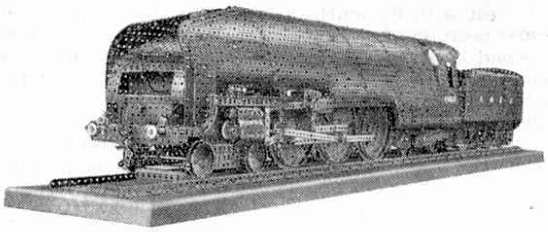
When the cab is completed the boiler is ready for securing to the main frames, and this is carried out as follows. The girder, secured to the bottom of the smoke deflector, is bolted to the front of the main frames and in this way the front of the boiler is secured. At the rear, see Fig. 3, the cab floor is attached to the end girder of the main frames by three ½″ Bolts, eight 7½″ Strips being used for spacing purposes.

Next month the construction of the tender and track will be described.

(To be continued)

1 in. Scale Meccano Model of

L.N.E.R. High-Pressure Locomotive "No. 10000"



LAST month we completed our description of the construction of the Meccano model of the L.N.E.R. locomotive "No. 10000." This month we describe the construction of the tender that accompanies the locomotive. This is a scale reproduction of a standard L.N.E.R. tender, and the parts required to build it were included in the list given at the foot of page 36 of the January "*M.M.*"

Each side of the main frames of the tender consists of an 18½″ Angle Girder fitted with four 12½″ Flat Girders by means of which the frame is made 1½″ in depth. Each end of the frame is fitted with a 2½″ Strip, the lower ends of which form wheel guards. The two side frames when completed are joined together by two girders 65 and 66, each of which consists of two 5½″ Angle Girders overlapping five holes. Two 7½″ Angle Girders 67 are also fitted, the right-hand ends of which are secured to an 18½″ Angle Girder 68. It will be noticed that the Girders 65 and 66 overhang the side main girders for a distance of ½″, and to these lugs are secured two 18½″ Angle Girders 69. Each of these Girders carries one of the tender sides.

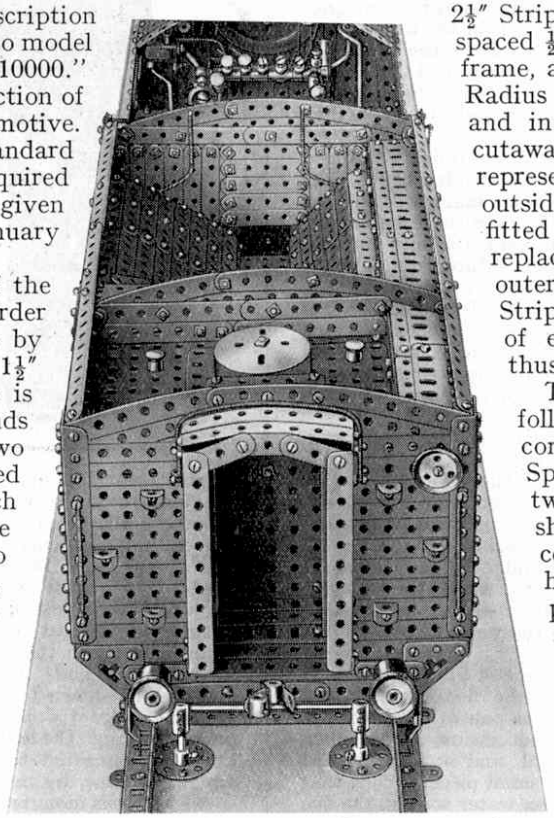


Fig. 1. The tender coal-bunker and corridor-entrance are shown in this illustration.

Each tender side is built up on two vertical Angle Girders, a 5½″ at the rear end and a 4½″ at the front end. Eight 18½″ Strips, each composed of one 7½″ and one 12½″ Strip overlapping three holes, are now secured between the two Girders, and two 5½″ Strips are then fixed in place in order to keep level the various strips forming the side. The two Strips are indicated at 70, Figs. 2 and 4, by the rows of bolt heads. A further strip, ½″ shorter than those forming the tender side, is now fitted to the top of each wall of strips, and above this is secured the coal rail, built up from one 7½″ Strip and one 9½″ Strip. These two Strips overlap four holes, and the complete length is held in place by means of four Flat Brackets bent to the required shape.

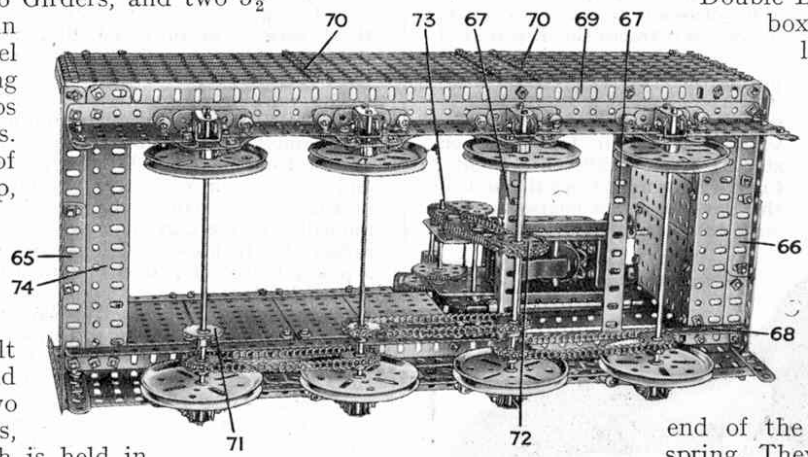


Fig. 2. An underneath view of the tender.

Before proceeding further with the construction of the tender the axle-boxes and frames should be fitted. Eight 2½″ Strips are first bolted in place, in pairs spaced ½″ apart, on each side of the tender frame, as shown in Fig. 2. Next 2½″ Small Radius Curved Strips are secured in place, and in this manner the typical curved cutaway portions of an actual tender are represented. It should be noted that the outside Strips of each end pair are not fitted with Curved Strips, these being replaced by 3″ Strips bolted at their outer ends to the wheel guards. A 1½″ Strip is now secured across the bottom of each pair of vertical 2½″ Strips, thus completing the axle-box frames.

The axle-boxes are built up in the following manner, the same method of construction being used for each. Each Spring consists of two 2½″ Strips and two ½″ Strips, bent to the required shape and secured together in the centre by a ⅜″ Bolt. This Bolt also holds in place a Double Bracket, placed transversely across the spring, and also two 1″×½″ Angle Brackets. These Angle Brackets are arranged in the form of a Single Bent Strip, and the two 1″ lugs are arranged at 90 deg. to the two lugs of the Double Bracket already mentioned. A second Double Bracket is now bolted across the ends of the 1″×½″ Angle Brackets, and the centre hole of this forms a bearing for one side of one of the axles carrying the travelling wheels. A Flat Bracket is now locknutted to the outside lug of the first-mentioned Double Bracket, forming an axle-box cover. It is removed by lifting the free end of the Flat Bracket until it is clear of the end of the axle, and then swinging it to one side. If it is thought necessary, Double Arm Cranks may be fitted in order to increase the bearing surfaces of the axles.

The complete axle-box is fitted to the tender frame by passing ½″ Bolts through each end of the 2½″ Strips forming the spring. They are then screwed into Handrail Supports, fixed securely to the frame, and locked in position by Grub-Screws passed into the threaded bore of the Handrail Supports from the opposite side to the ½″ Bolts.

When all the axle-boxes are complete and in position the wheels and axles are fitted. Each axle consists of an 8″ Rod on which are carried two 3″ Pulley Wheels. Although these Pulleys are not technically correct, having grooves instead of flanges, they are almost the required size, and for this reason they have been used in preference to Wheel Flanges and Face Plates. The drive to the various wheels is arranged as shown in Fig. 2, the 1″ Sprocket Wheel 71 being used for connecting the tender to the engine when they are mounted together on a baseboard. In addition to the 1″ Sprocket Wheels, one of the axles carries a $1\frac{1}{2}$″ Sprocket Wheel 72, driven by Chain from the Electric Motor.

The motive unit consists of a No. E6 Electric Motor, to each flange of which is bolted a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. These Double Angle Strips are held in place on the Girders 67 by passing $4\frac{1}{2}$″ Rods through their $\frac{1}{2}$″ lugs, and also through suitable holes in the Girders. This method of construction enables the motor to be taken out periodically for cleaning purposes without the manipulation of Nuts and Bolts in awkward positions. The drive is taken from a $\frac{1}{2}$″ Pinion on the armature shaft to a 57-teeth Gear mounted on a 2″ Rod. This pair of gears is followed by three similar pairs, the total reduction being 81 : 1 between the armature shaft and the 3″ Rod 73. This Rod carries a $\frac{3}{4}$″ Sprocket Wheel that is connected by a length of Sprocket Chain to the Sprocket Wheel 72.

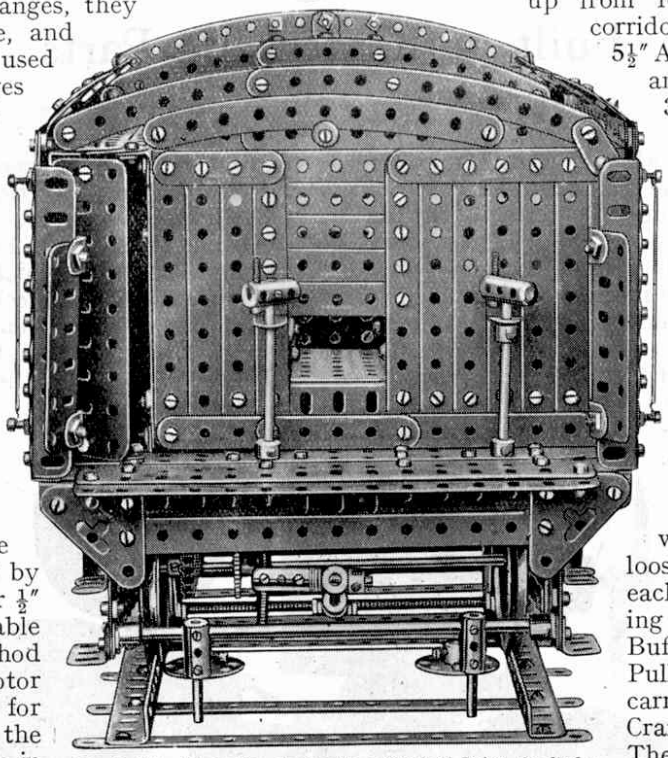


Fig. 3. This illustration shows the method of fitting the brake mechanism.

The rear door and corridor are now built. A $5\frac{1}{2}$″ Flat Girder 74 is first bolted in place, as shown in Fig. 2, one end of which is held down by one end of a $9\frac{1}{2}$″ Angle Girder carrying the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates forming the inner wall of the corridor. There is no need to make a complete inner wall for the corridor as the space will be covered in later when the top of the tender is fitted. The tops of the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates are all joined together by a $12\frac{1}{2}$″ Angle Girder, which is extended by a $3\frac{1}{2}$″ Angle Girder to a length of 16″. An Angle Girder 75 forms the necessary connection between the two girders.

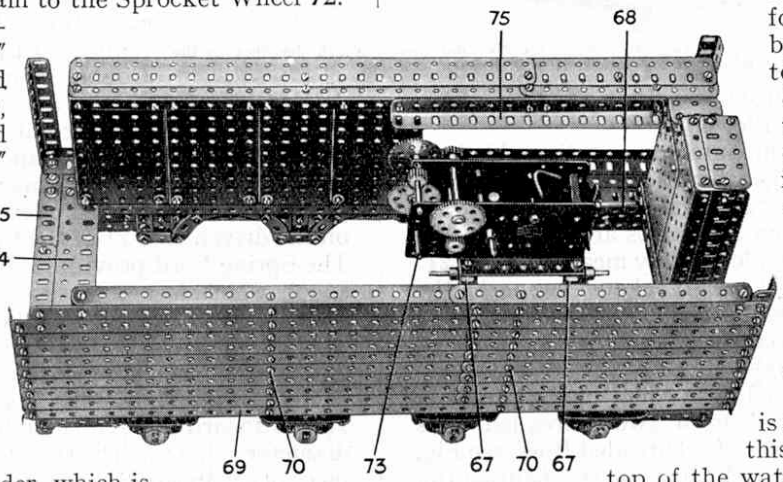


Fig. 4. The driving unit fitted inside the tender.

The top of the corridor is built up from two $12\frac{1}{2}$″ and two $5\frac{1}{2}$″ Flat Girders as shown in the illustration. The back of the corridor leading to the door is built up from a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ and a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, which are bolted at their lower ends to a $5\frac{1}{2}$″ Angle Girder attached in turn to a $5\frac{1}{2}$″ Flat Girder. This Flat Girder is attached by a similar part, to the girder 65 of the tender frame. The side and top of this part of the corridor are built up from $5\frac{1}{2}$″, $2\frac{1}{2}$″ and $1\frac{1}{2}$″ Flat Girders as shown in the illustration.

The rear of the tender, which is shown in Fig. 1, is formed at each side of the doorway from 3″ Strips, and the curved top is represented by two long curved strips built up from four $5\frac{1}{2}$″ Curved Strips. The corridor connection sides consist of $5\frac{1}{2}$″ Angle Girders and Flat Girders, and for the top and bottom $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are used. The curve at the top of the corridor connection is represented by three $1\frac{1}{2}$″ Strips bolted together as shown. Three handrails are fitted to this part of the tender, one at each side and one over the corridor connection. These consist of Spring Cord with copper wire passed down the centre, the ends being secured to $\frac{3}{8}$″ Bolts each attached by two Nuts to the model.

Other fittings include a window, represented by a 1″ loose Pulley, and three steps on each side of the doorway, consisting of $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. Buffers are built up from 1″ fast Pulleys mounted on $1\frac{1}{2}$″ Rods carried in the bosses of Double Arm Cranks secured to the main frame. The body of each buffer is represented by a Chimney Adaptor. The automatic coupling will be seen construction of the from Fig. 1.

The front of the tender is shown in Fig. 3, and no description is necessary for its construction. The corridor door consists of a $4\frac{1}{2}$″ Flat Girder mounted on two Hinges, and the side doors for the foot-plate are represented by 3″ Flat Girders made to swing on Hinges. Two dummy handles are fitted on the foot-plate both of which are shown in the illustration. If so desired one of these handles may be made to work brakes operating on the eight wheels of the tender, and a simple method of accomplishing this is shown in Fig. 3.

The top of the tender is shown in Fig. 1, and from this it will be seen that the top of the water tank is built up from $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates at its rear end, and from two $3\frac{1}{2}'' \times 5\frac{1}{2}''$ Flat Plates at its fore end. These latter Plates are bent at their centres to an angle of about 45 deg., and when they are fitted in place their lower edges are extended to the bottom of the tender by further $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates. The bottom of the tender is filled in by $5\frac{1}{2}'' \times 3\frac{1}{2}''$ and $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates, secured to the tender sides by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. The sides of the coal compartment are built up from various sized Strips, $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets being used for securing them in place.

(Continued on page 186)

Modern Aeroplane—(*Continued from page 149*)

Petrol is pumped by duplicated engine-driven pumps from the main tanks to the engine. It is interesting to note that special Meccano Bevel Wheels, Nos. 30A and 30C, and the Meccano Pointer, are incorporated in the fuel gauge.

After the installation of the power plant, the controls are installed. A normal control column, fitted with a hand grip that from its shape is known as a "spade" operates the elevators and ailerons by means of straight lengths of cable and chain passing over ball-bearing sprockets. Hanging rudder pedals, the tail trimmer and the wheel-raising mechanism are the other controls that are fitted.

The connections from the engine to the engine speed indicator, oil pressure gauge, and oil thermometer on the pilot's dashboard are now made, and the cowlings and fairings are then placed in position. The metal airscrew is mounted, together with the spinner, and the fuselage is completed. The wings are then attached to the fuselage by wing root forgings on each side, and give the "Courier" a span of 47 ft.

The upholstery of the cabin, which is 8 ft. long by 3 ft. 8 in. wide, remains to be completed in a scheme to suit the purchaser of the machine.

Just before the test flight the machine is weighed and the empty weight should be in the neighbourhood of 2,100 lb.; and on completion of this formality the pilot tests the aeroplane's performance. With the "Lynx" engine, it should have a top speed of 165 m.p.h., a cruising speed of 145 m.p.h., and a landing speed of 50 m.p.h.; and higher speeds are attained with more powerful engines.

It will be noticed in the illustration of the cockpit that wireless equipment is fitted between the front seats. When wireless is to be installed the whole machine requires to be "bonded"; that is every metal part on the machine has to be joined by wire and connected to the set to form an "earth." The bonding of the machine is done immediately before any covering is commenced.

A wind-driven electrical generator to provide power for the set is mounted in the front of the centre section on the starboard side, and a trailing aerial is so fitted that it can be let down through the floor of the cockpit when required, and drawn in again by turning a hand-wheel when the wireless is not being used, or when a landing is to be made. The set itself is slung in shock absorbers at the rear of the cabin beneath the luggage locker.

The "blind-flying" instruments are also well shown in the illustration of the cockpit. These consist of a turn and bank indicator and a fore-and-aft level. The compass can be seen immediately below these two instruments. Before delivery to the owner, the machine is taxied out to a special concrete circle on the aerodrome showing the points of the compass and there the instrument is carefully "swung"; that is the machine is turned towards each point of the compass and the compass needle is adjusted by means of small magnets. When the errors have been reduced to a minimum a table of deviations is prepared for use with the compass. This table is pinned up in the machine, and is an essential factor in accurate cross-country flying.

The new Airspeed "Courier" is then ready to leave the factory after passing through the hands of woodworkers, sheet metal workers, fabric workers, fitters, and dopers, each man a skilled worker and a specialist.

New Machine at Swindon—(*Cont. from page 161*)

depends on the mode of drive to be used. Machines of the past have, almost universally, relied upon a main shafting driven by a power plant, with the power transmitted by belts to countershafting and thence to machines; but the modern practice is to dispense with main shafting and operate the drive from a separate electric motor.

If it be the first case, then the fitter must be busy again, fitting the necessary pulleys to main shafting and countershafting; but if it be the other, then the electrician generally performs the final rites, although it does not always follow that a separate unit machine is without countershafts; and with such, the "strappy" or belt man would be called in to administer the *coup de grace*.

Thus, in the works at Swindon the march of progress goes on; and, it may be added, not without interest on the part of the men does a new machine commence its career. They are human enough to want to know "all about it," and, after all, when one fresh wonder succeeds another, each outstripping beyond comparison the performances of old machines, such interest is feasible.

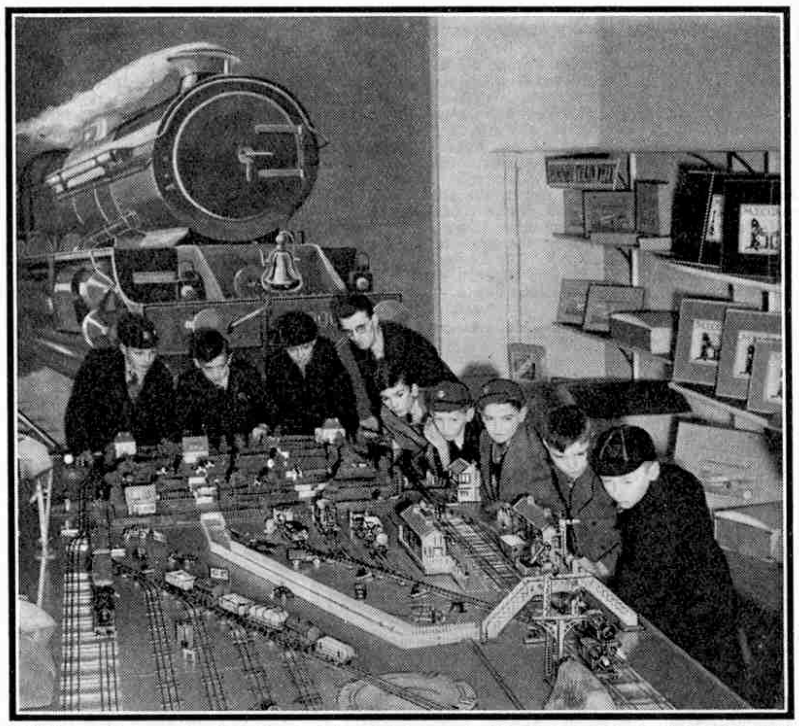
And yet, I believe that "Charles," that incorrigible veteran fitter with the famous rakish cap, gazes with a disapproving eye at them all, and pines in his heart for the unwieldy monstrosities he laid down reverently in his youth.

We are indebted to the courtesy of the Editor of the "*Great Western Railway Magazine*" for permission to reprint this interesting article.

Special Trains—(*Continued from page 155*)

train speed, and usually signalmen are under orders to give the specials precedence of all other traffic except express passenger trains, breakdown van trains going to clear the line, light engines going to assist disabled trains, or fire brigade trains.

Most readers are by now familiar with the wonderful wagons that British railways possess for dealing with exceptionally heavy or out-of-gauge loads. For loads of very exceptional dimensions special trains are required. With them travel expert staffs, who "nurse" the loads throughout their journeys; instructions to the staff concerning one of these trains may easily occupy as much as eight closely printed pages of type. Most of the movements of exceptional loads take place through the night or on a Sunday, when traffic is at a minimum. Such consignments as ships' rudders and electrical rotors are at times so wide that they block the parallel line for a whole journey. It has been known to be necessary to slew a section of main line railway into a new position, and to remove bodily such obstacles as signal posts, gate posts and even fog signalmen's huts, to allow one of these special trains to pass.



Miniature railway enthusiasts keenly interested in an electrically operated Hornby train layout arranged by Rushworths Ltd., of Huddersfield. The railway system includes a complete main line with sections of double track and two separate systems of sidings for shunting purposes.

A New Cycle White Patch

To enable every cyclist to meet the provisions of the new Road Traffic Acts, Bluemel Brothers Ltd. have introduced a new lightweight combined white patch and reflector of exceptionally neat design. The fitting consists of a piece of white celluloid of the well-known Bluemel "Featherweight" section, fitted with two strong mudguard clips and a white celluloid covered "Prismatic" reflector of new design. Full details of this useful unit, which costs only 1/6, can be had from Bluemel Brothers Ltd., Wolston, Coventry, on mentioning the "*M.M.*"

High Pressure Locomotive—(*Cont. from p. 175*)

Two vent pipes are fitted to these sloping sides, for in actual practice they are the tops of water tanks. The vents are built up in a similar manner to the handrails at the rear of the tender. The water-scoop top is represented in the model by a Boiler End, and the main tank vents by Buffer-shanks fitted with Collars.

For mounting the tender above the rails two horizontal Rods are fitted similar to those at the rear of the engine. The short vertical supports consist of 1½" Rods, the lower ends of which are carried in Bush Wheels secured to the baseboard.

The baseboard for this model should be at least 1" in thickness, and must measure about 6' 6" in length and 10" in width. The engine and tender are secured to this in the manner already described and in their correct positions, after which the track is screwed into position. Each rail consists of three 24½" Angle Girders overlapping each other two or more holes, the number depending upon the exact length of the baseboard. The sleepers, which consist of 7½" Strips, are then placed in position, one being used every 2½", and the whole track screwed down, preferably with black round headed screws. The model is now complete except for the piece of Sprocket Chain connecting the engine and tender, this being fitted last in order to get the exact length required.

If it is desired the characteristic letters L.N.E.R. and the number "10000" may be painted on the model, as shown in Fig. 1 of the first article of this series.

Moving Picture Projector—(*Cont. from p. 177*)

construction of this ingenious mechanism is quite simple, as a study of Fig. 4 will show.

Two Rods act as guides and keep the film pressed against the Pawls when they advance to pull the film downward. After leaving the gate the film passes over the take-up sprocket 16 (Fig. 1), which is driven by Sprocket Chain from the main drive. A small spring-controlled roller is provided to keep the film in engagement with the teeth of the sprocket.

The built-up crank handle 32 (Fig. 5) is intended for driving the projector by hand when "threading" the film.

The Electric Motor for driving the model is mounted in front of the projector below the lens housing, and the drive is transmitted by belts and Sprocket Chain. We understand that when fitted with an ordinary electric lamp the machine is capable of projecting a really bright and steady picture.

Meccano Exhibition in Wallasey

The Annual Conversazione of Wallasey Grammar School, held on 9th February, included a Hobbies Competition of which a Meccano Model-building Contest formed a popular section. The models shown were remarkable for their originality, and for the ingenuity displayed in overcoming difficulties. F. S. Miles won the First Prize with a model showing a section of the Mersey Tunnel, through which motor cars and lorries of the Dinky Toy series ran continuously. Above the tunnel itself was the Mersey, with ferry boats passing to and fro between the Liverpool and Wallasey landing stages. The Second Prize was won by F. Lawson, whose entry represented a pit shaft with winding gear, and an excellent model of an electric power station by L. Howson Jones was awarded honourable mention. Interest was added to the Conversazione by a display of working models, including a Workshop and a Ship Coaler, loaned by Meccano Ltd.

Turog Essay Competition

Spillers Ltd., millers of the famous Turog Flour, announce this month an interesting Prize Essay Competition open to boys and girls of all ages. Prizes to a total value of £320 are offered for essays not exceeding 150 words in length. General details of the competition will be found on *page xvi* of this issue, and further details are given in a special competition folder that may be obtained from any Turog baker or direct from Spillers Ltd., 40, St. Mary Axe, London, E.C.3. This folder contains also details of a generous free gift scheme.

The Rivercraft Canoe Club

Those of our readers who are fond of water sports—particularly those residing within easy reach of the Thames—will find the Rivercraft Canoe Club of interest. Among its objects are the improvement of canoeing technique and the provision of centres where canoeists may meet for canoeing and camping. The Secretary of the Club, Mr. Owen Jones, will be glad to give full details to any reader of the "*M.M.*" who writes to him at Walton Bridge, Surrey.

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