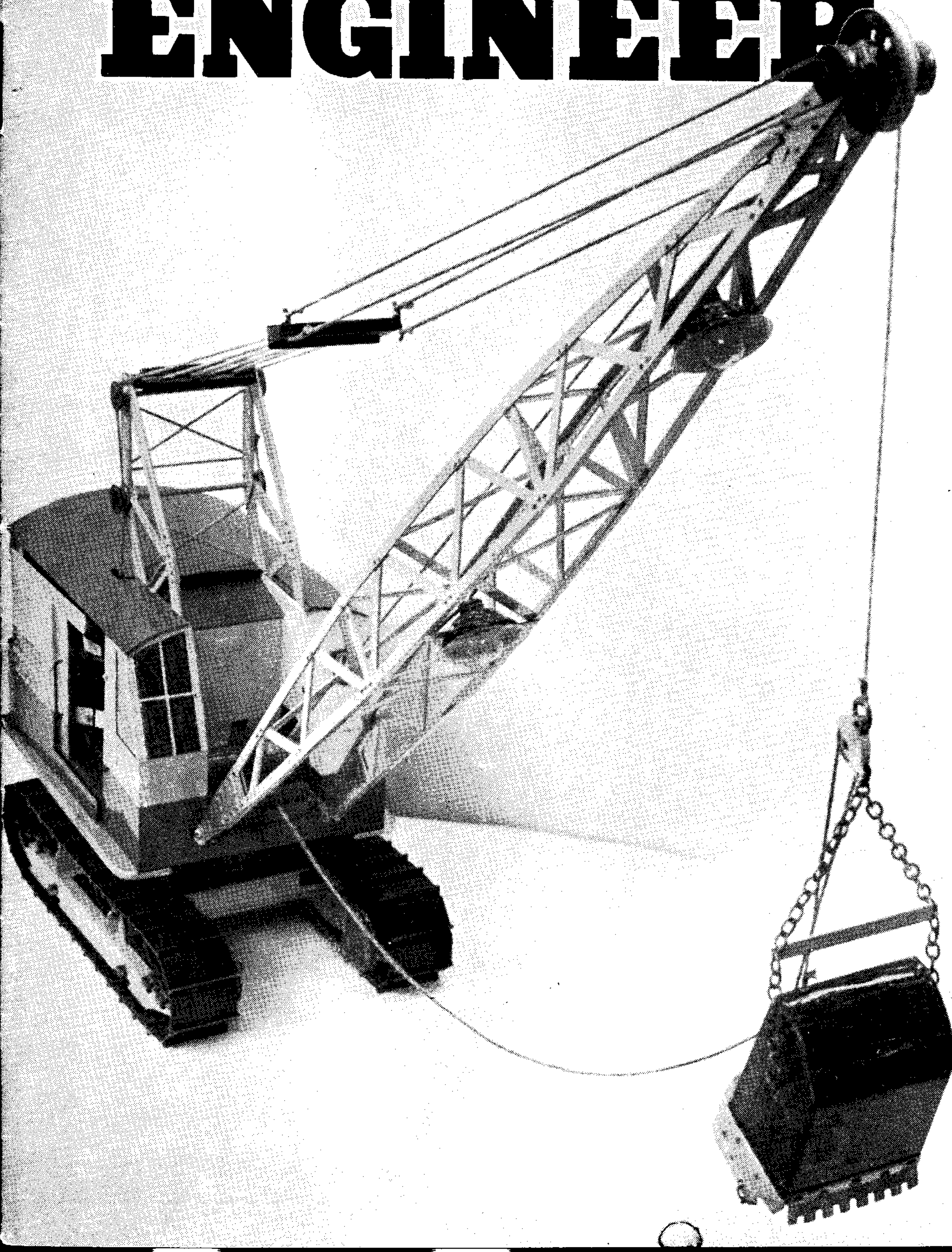
Vol. 104 No. 2601 THURSDAY MAR 29 1951 9d.

THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, *GREAT QUEEN ST., LONDON, W.C.2*

29TH MARCH 1951 VOL. 104 NO. 2601

SMOKE RINGS

Our Cover Picture

● THE MODEL in this photograph was built by Mr. E. Ruhlman, of Spalding, Lincs, and shown at last year's "M.E." Exhibition, also at the Grantham Model Engineering Society's Exhibition, where it was awarded first prize in the General Engineering section. It represents a fairly accurate scale model of a dragline excavator, the modern development of the historic "steam shovel" or "mechanical navvy," which has almost completely superseded manual methods of digging and quarrying. Machines of this type, driven by diesel engines or electric motors, are becoming increasingly common and are used both in rural and urban districts for open-cast mining, clearing bombed sites and preparing foundations for building. They are sufficiently interesting and spectacular, both in construction and subsequent working, to form worthy objects for the attention of model engineers who are looking for something "a little out of the ordinary" to build. An interesting feature of this model is that it was constructed mostly from odd materials, the girder frames of the chassis being made from brass curtain rail.

The Canvey Island Locomotive

● WE DID not have very long to wait for an answer to the request for information about the locomotive illustrated on page 252 of our February 22nd issue; our old friend Mr. C. R. H. Simpson got on the telephone next day! He identified the engine as having been designed by no less a celebrity than Dugald Drummond; it was one of five built for the Glasgow Corporation Gasworks. These little engines were for 2-ft. gauge and had the following dimensions: Cylinders, 6 in. diameter by 9 in. stroke; coupled wheels, 1 ft. 8 in. diameter; heating surface of tubes, 71 sq. ft., of firebox, 13 sq. ft.; tank capacity 22 gallons and the weight in working order three tons. Other readers have supplied similar details.

As to our hazy recollection of having read or heard of a proposed railway for Canvey Island, our old friend Mr. C. Courtice has given us some information which seems to provide a clue; he writes: "I am not certain of the year, but I think it was 1905, when a standard-gauge electric railway was laid across Canvey Island. It commenced opposite the then L.T. & S.R. station at Benfleet and I remember walking along the track with my father and inspecting a train set which had just been delivered. There was also a power station being built, but suddenly all operations ceased and the tracks were removed."

So it is evident that there was some idea of providing a railway for Canvey Island, and our surmise that we had heard of it before is correct. Obviously, the little locomotive seen in Mr. Tait's photograph was in no way concerned with the project.

Incidentally, the little engines referred to were the subject of an article, with working drawings, published in *Engineering* for September 11th, 1896.

The Cornish Pumping Engine

● WE WERE delighted to receive a letter from Mr. Terence Cuneo, the artist whose splendid studies of railway operation and equipment are so familiar as posters on railway stations; he wrote in connection with the article describing Mr. Jarvis's magnificent model of a Cornish pumping engine published in our issue of February 1st: "As you see from the enclosed, I have painted this old pumping engine of Camborne, Cornwall, and to my knowledge this is the first time an oil painting has been made direct from one of these wonderful old engines.

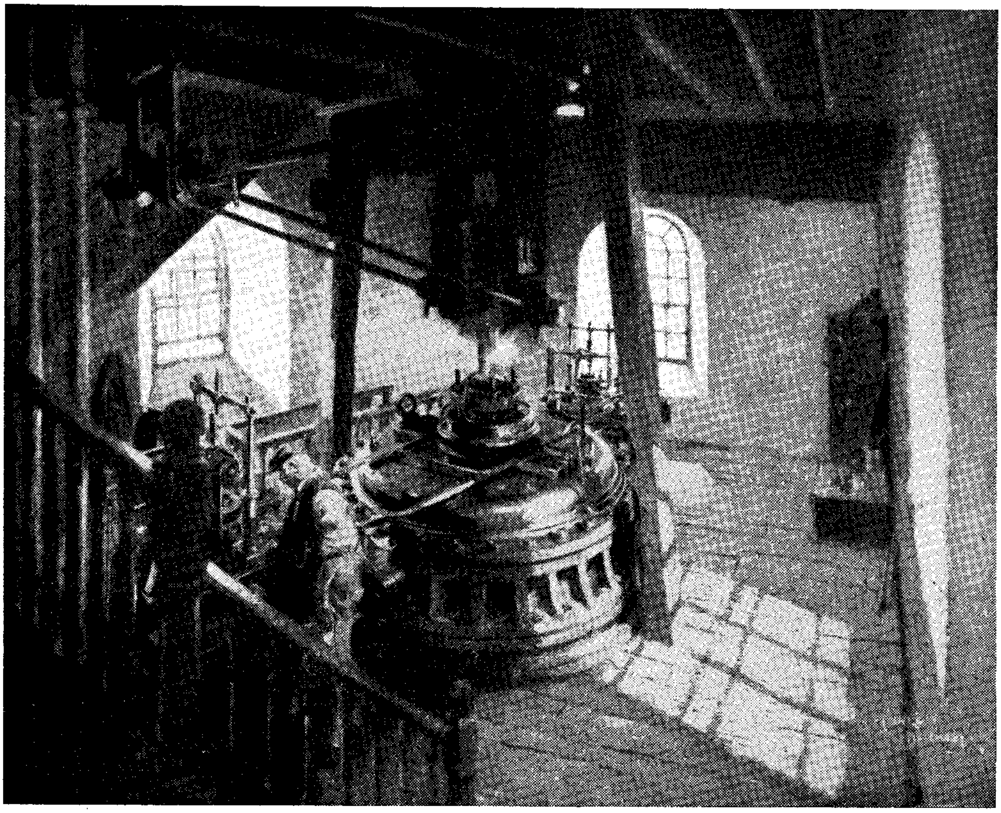
"I shall always remember the fascinating atmosphere of that engine-house. Incredibly peaceful, with the regular, rumbling sigh of the piston descending. Then the pause, the clack of the valves as they moved across the cylinder-head and the piston-rod shooting upwards again as the beam changed position. Two-and-a-half strokes to the minute!!

"That middle room had the qualities of a lighthouse, a windmill and a church. Funny mixture, I suppose, but a wonderful place in which to meditate.

"I have also worked (making drawings) 2,000 ft. below the ground on which this engine-house stands, walking for over $4\frac{1}{2}$ miles through old and new workings; so you see I have a very real interest in this superb model of Mr. Jarvis's.

"The work I have been engaged on is the illustrating of a history of the Holman Bros firm in Camborne, and this pumping engine is one of the subjects commissioned by them."

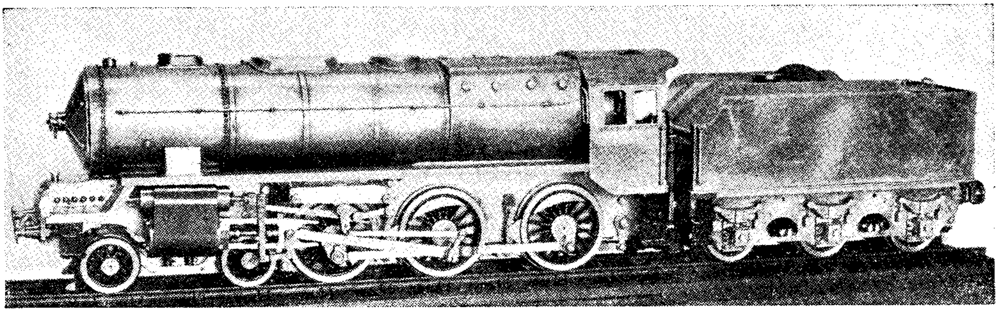
We have had a block made from "the enclosed" which was a very fine study, in full colours, mounted on a calendar. Even in halftone it is impressive, as our reproduction shows.



An Old Pullman Car

● WE HAVE received a letter from a reader who mentions what he describes as "a fine and fruity Pullman car of the 1875 vintage" which stands as a hut at the north of Little Ilford carriage sidings, hard against the Up District line from Upminster. The car has the clerestory roof, open ends and the oval beading midway along the sides.

We, too, have noticed that car when we have made rare trips along that part of the District Railway; it appears to be very well preserved, but has been surmounted with enormous galvanised iron ventilators of the sort often seen on temporary iron huts, especially chapels. We believe that this car is one of those which originally ran on the old Midland Railway some 50 years, or so, ago; but we wonder if any reader can confirm our impression and possibly say which car it was.



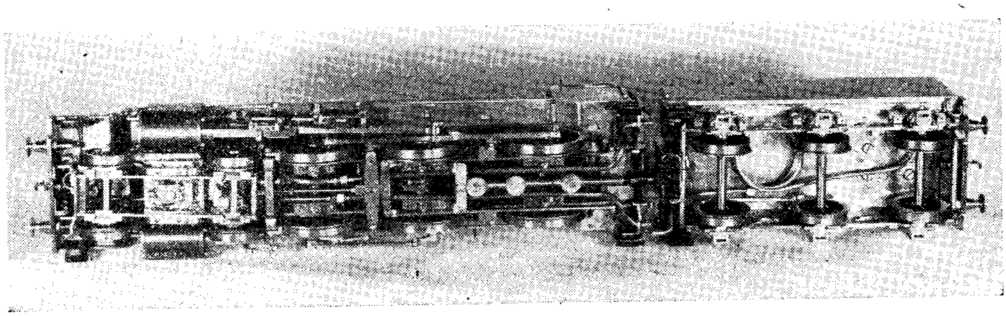
A $1\frac{3}{4}$-in. Gauge 4-6-0 Locomotive

by Max Millar

AN illustrated article published in THE MODEL ENGINEER May 13th, 1948, dealt with a simple test stand for carrying out preliminary steam trials of a $1\frac{3}{4}$ in. 4-6-0 locomotive in a partly-built state, the stand proving a great success since the model was a first effort, and many small faults and adjustments were corrected at the right time before the rest of the locomotive was completed.

The accompanying illustrations show the model as finished except for small details such as lamps, coupling links, nameplates and organ whistle. On the original test stand, a gas blowpipe was used for temporary firing, but a three-wick spirit lamp ($\frac{1}{2}$ in. diameter asbestos wicks), is now fitted, making plenty of steam in the Smithie's type boiler, with the blower slightly on to give good combustion. A large firebox door is fitted with a revolving shutter for experimentation in bleeding air to the burners to aid combustion, the door being very useful also for access to the burners for lighting, trimming and blowing out when runs are ended. The boiler outer and inner shells are $2\frac{1}{2}$ in. and $1\frac{7}{8}$ in. in diameter respectively, while the firebox is $3\frac{3}{8}$ in. long, by 1 in. wide. Three $\frac{1}{4}$ in. diameter water tubes are fitted and a superheater is provided for the blower, in addition to the main superheater for the cylinders. As it is the writer's intention eventually to fit a paraffin burner to the locomotive, arrangements have been made so that the complete spirit firing outfit can be removed in a minute, leaving a clear space in the front end of the tender for a paraffin tank. With that object in view, the spirit tank has been arranged to feed into a sump which is attached to the rear end of the burner pipe on the locomotive chassis, the supply of spirit being regulated by an air pipe on the bird fountain principle. The sump is wide enough to allow for unrestricted movement of the fuel feed and air pipes in the sump when the model is on a curve or rolling on a poor track.

Steam is raised quickly from cold by a Heath Robinson affair, which is remarkably effective in practice, and saves much personal exertion in trying to maintain air pressure for the blower with a bicycle pump. This apparatus consists of a light brass tank about $2\frac{1}{2}$ in. diameter and 2 in. deep (a tin with a soldered up lid and central wire stay would be equally effective), supported on a wire tripod and heated by a small spirit burner. A short length of $\frac{1}{2}$ in. diameter tube soldered in the top of the tank carries a cork from a medicine bottle (the cork acting as a safety valve) and a small bit of $\frac{1}{8}$-in. copper or brass tubing sweated also at the top carries steam through a length of rubber tube to an auxiliary blower jet fitted into

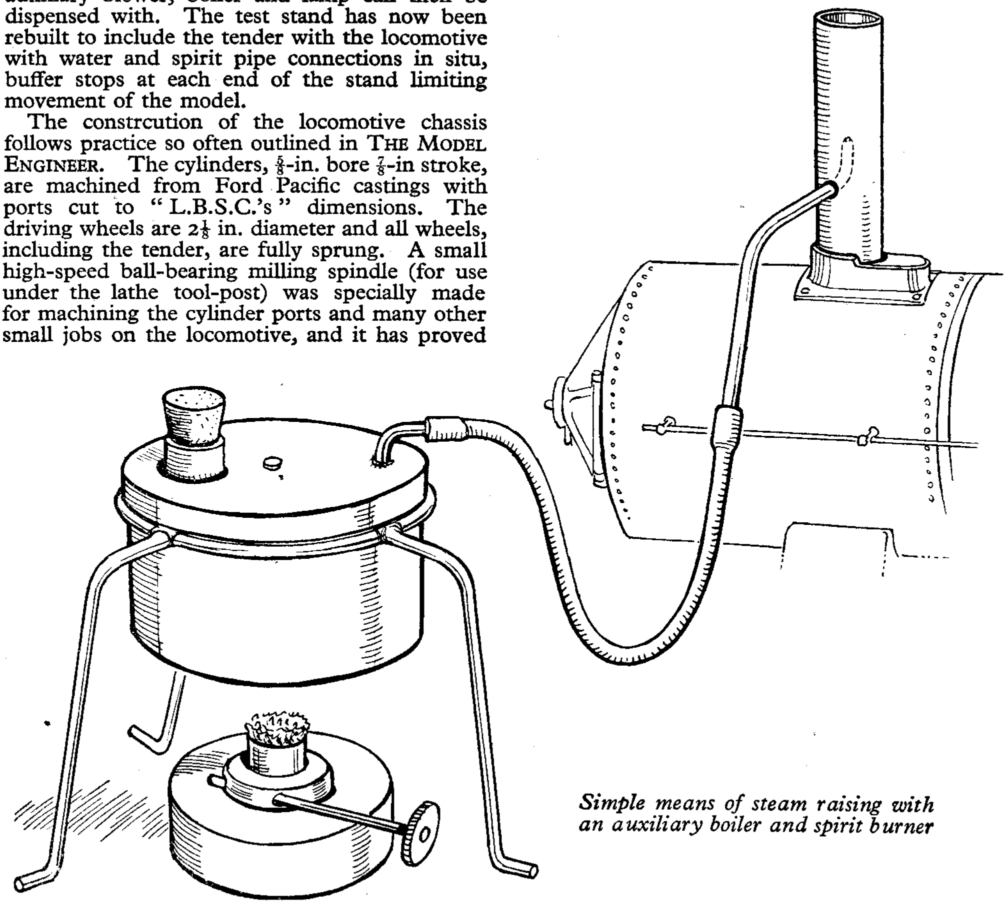


Underneath view, showing brake gear and driving wheels, three-wick spirit burner, and tender an extension tube in the locomotive chimney.

With the tank filled about a third with water, enough steam at a very low pressure is made to keep the auxiliary blower going for some time, and the pressure can be regulated easily by adjusting the height of the spirit lamp wick. In actual practice the draught up the chimney is so effective that the locomotive commences its own steam blowing in two or three minutes, and the auxiliary blower, boiler and lamp can then be dispensed with. The test stand has now been rebuilt to include the tender with the locomotive with water and spirit pipe connections in situ, buffer stops at each end of the stand limiting movement of the model.

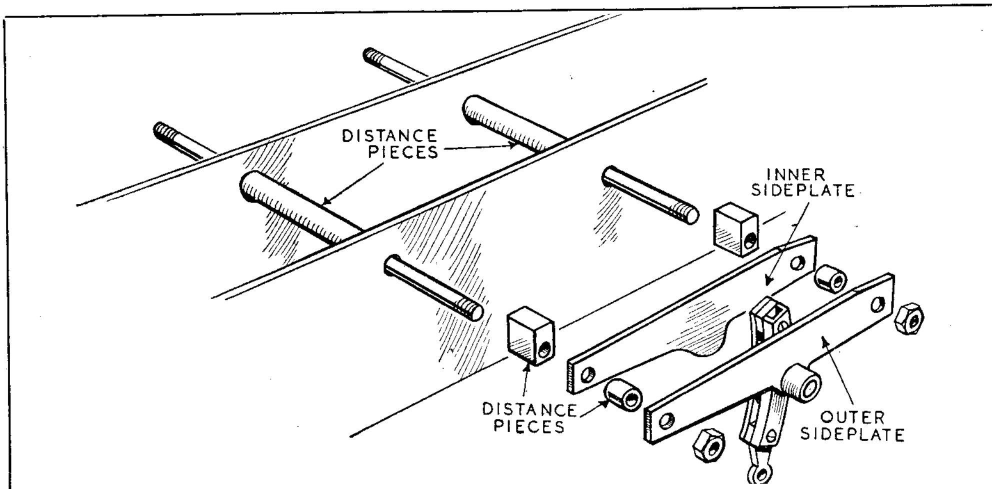
The constrcution of the locomotive chassis follows practice so often outlined in THE MODEL ENGINEER. The cylinders, $\frac{5}{8}$-in. bore $\frac{7}{8}$-in stroke, are machined from Ford Pacific castings with ports cut to "L.B.S.C.'s" dimensions. The driving wheels are $2\frac{1}{8}$ in. diameter and all wheels, including the tender, are fully sprung. A small high-speed ball-bearing milling spindle (for use under the lathe tool-post) was specially made for machining the cylinder ports and many other small jobs on the locomotive, and it has proved to be a most effective tool. This lathe adjunct, made from scrap (except for a pair of ball-bearings costing 1s. 6d.) is operated by a flexible drive from an 80 W vacuum cleaner motor given to me by a friend.

The Walschaerts valve gear calls for no comment except for the construction of the framework carrying the links, the aim being to ensure accuracy and ease in assembly from the commencement of building. When the main frames were riveted together in the early stages, two master holes were drilled to take a pair of $\frac{1}{8}$-in. silver-steel rods. The same holes were used to jig drill the side plates carrying the valve gear links, consequently when the main frames were finally assembled, the side plates (with suitable distance pieces) could be fitted on the rods, now threaded and provided with nuts, and everything was square and accurately aligned. This method of construction has the advantage that by taking off a pair of nuts on each side the links can be withdrawn very quickly for attention when required.



Simple means of steam raising with an auxiliary boiler and spirit burner

The links are made from $\frac{1}{4}$-in square silver-steel, bent to a radius, and soldered to a back-plate for machining of the curved slot in the lathe. Each link is supported by a central overhanging pin and also by a curved backing-plate (attached by two $\frac{1}{16}$-in. screws) on the link abutting against the inner side-plate of the frame. The construction will be seen in the sketch, and it will be noted that the radius rod of the valve gear cannot move laterally out of engagement of the die-block in the link, owing to the close support given by the backing-plate. A $\frac{1}{16}$-in. silver-steel pin engages the die block and all moving parts are hardened. Phosphor-bronze bushes are fitted to all pins in the valve gear, also sliding

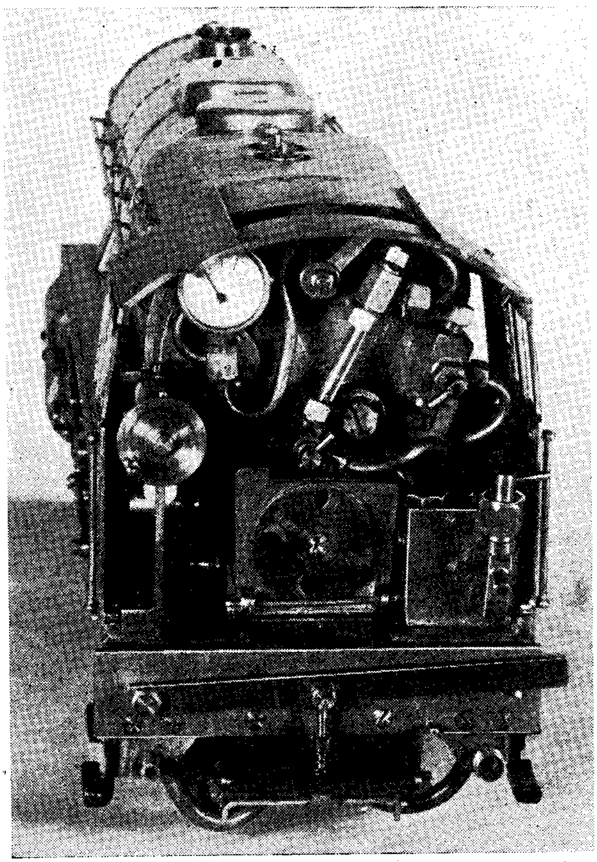


Showing how the links and sideplates are supported on steel rods extending through the main frames

blocks of the same material in the slots at the tail ends of the radius-rods, and reversing is by a wheel and worm gear in the cab.

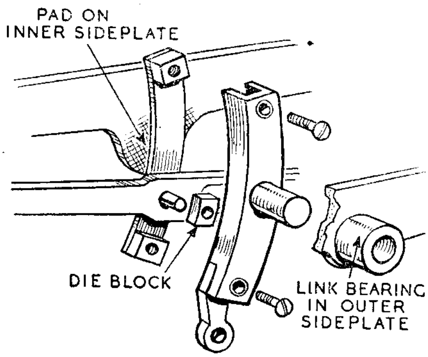
An axle-driven water pump, in addition to a pump in the tender, feeds the boiler through a pair of clack valves embodied in a single block on the right-hand side of the cab footplate, discharging water to the front end of the boiler through a common backhead fitting and internal pipe.

By employing an oversize clack-valve unit, large ball-valves and fittings can be used (and more easily serviced) and the block being in the cab, the external appearance of the locomotive is not spoilt. A by-pass valve is fitted to the side of the clack-valve block for returning water through a short length of rubber tube to the tender.



The firebox door with air bleed shutter, twin clack-valve box on footplate and "lift-up" brake lever are seen in this view

The cylinders are lubricated by a ratchet-driven oscillating oil pump (based on "L.B.S.C.'s" designs) immersed in a small oil tank behind the front buffer beam. With a $\frac{1}{4}$-in. stroke and 3/32 in. diameter ram, too much oil was being delivered at first to the cylinders, so the ram was reduced to $\frac{1}{16}$ in. diameter which gives the right feed of heavy oil. At the time the pump was made no ratchet wheels were available on the market, so a substitute had to be used in the form of a flint wheel from an old petrol lighter, which by a stroke of luck was of a suitable diameter and had the required number of teeth—36. The wheel was first softened and mounted in a small split chuck in the lathe for drilling and threading to suit the pump spindle. Each of the teeth was then trimmed with a Swiss file to clean off burrs, followed by a further polishing under a magnifying glass with a stone slip, after which the wheel was re-hardened.

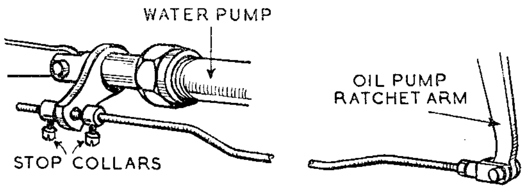


Construction of valve-gear link and its support between side plates

The oil pump ratchet is operated from the axle-driven water pump since there was no further room between the frames for another eccentric, and as the stroke of the ratchet arm was $\frac{5}{16}$ in. and that of the water pump $\frac{3}{8}$ in., a problem arose as to how to lose the difference in strokes before a coupling could be made. The difficulty was overcome very simply by taking a $\frac{1}{16}$ in. diameter silver-steel rod, hinged by a small fork, and pin at the lower end of the ratchet arm to a sliding coupling on the rear end of the water pump ram, a small collar and set screw being fitted to the rod on each side of the extension arm silver-soldered to the ram. The rod is free to slide easily in the arm and the collars are set to provide the required amount of fore and aft backlash, to give the reduction in stroke for the oil pump arm; they also can be adjusted (as was very necessary) to give the right arc of movement of the arm for engagement of the ratchet pawls. An advantage of the small diameter rod is that it can be bent easily in certain places to clear cylinder and other obstructions between the main frames.

Working brakes in the six-coupled wheels were fitted to prevent movement of the locomotive on the track when not required, and especially on the short piece of exhibition track on which the model rests at home. Well-meaning folk *will* push the locomotive along to see the wheels go round, and if the model slides off the track and on to the floor, considerable damage can be done generally, while the brakes are also a check on unauthorised fingers on the throttle when the locomotive is under steam.

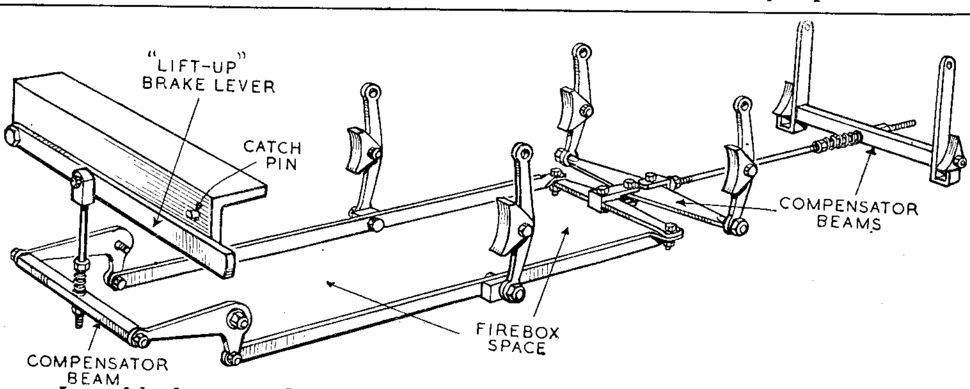
In a comparatively small locomotive the application of the brakes by a hand wheel is not a practical proposition, as one cannot easily get at the wheel for operation, owing to the lack of room in the cab, or tender, so in my model the brakes are controlled by a horizontal "lift-up" lever pivoted on the rear buffer beam below the cab. The lever projects $\frac{1}{4}$ in. from the beam and when the brakes are fully engaged the lever "clicks" over a pin which holds the lever until released. The sketch shows the layout of the brake gear which has horizontal rocking bars to give full compensation to the brakes on the first and second pairs of driving wheels and a certain amount to the rear pair. The arrangement of rods and levers gives a clear space for the firebox and burner, with adjustments for primary and secondary compensation; and despite the extra complication, the brake gear



How the oil pump is driven from the axle-driven water pump

adds very considerably to the appearance of the model.

"L.B.S.C." has given several designs for $1\frac{3}{4}$-in. gauge locomotives over the years that he has so regularly written for THE MODEL ENGINEER, but it has always been my impression that this



Lay of brake gear and operation from horizontal brake lever mounted on rear buffer beam of locomotive particular gauge has not been as popular as it might be. This scale of locomotive is attractive for several reasons, chiefly because the building is not as finicky as on an "O" gauge model, while the size of components of the chassis can approach the ½-in. scale outfit for handability and robustness. The driving wheels are small enough to be machined on lathes lighter than the standard 3½ in. pattern, and the main frames and boiler can be built on a table or small bench. Moreover, when the locomotive is finished, it can generally be moved about comfortably in an ordinary suit-case, (if a track or other workshop has to be visited) without considerable exertion in weight lifting, and if a scenic railway is to be built in a garden, the 1¾-in. gauge scores in economy and room saving compared with larger rail sizes.

I have observed that few clubs include this gauge in their multi-gauge rail system, which of course precludes members from using 1¾-in. gauge locomotives for passenger hauling, if they have no track at home. Perhaps "L.B.S.C.'s" recent design for a 4-6-0 and a Pacific for this size may induce clubs to add another gauge to their track facilities for future use.

A SIMPLE FILTER

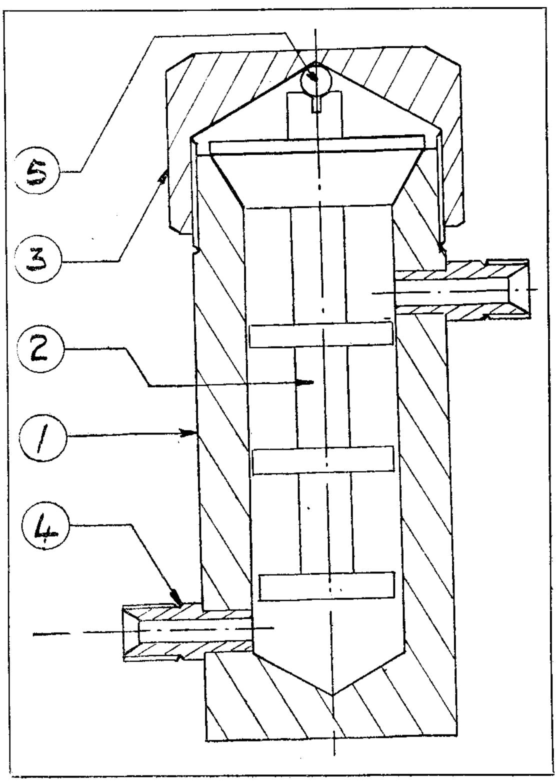
by John Houstoun, M.I.Mar.E.

ONE of "L.B.S.C.'s" favourite remarks is that "Nature can't be scaled," and the truth of this saying is very evident when dealing with particles of dirt in liquids.

I suppose there are many, like myself, whose main interest is in prototype power boats, and to a lesser extent in "flying saucers," and who have been exasperated beyond words by the tantrums (positively feminine at times) of choked blowlamp nipples, in spite of most careful filtering of paraffin through recognised, and frequently original, filtering mediums.

Due to the nature of my present employment, I am living abroad amongst hills, where the only means of cooking is by paraffin stoves, etc.; and frequently on arrival home have been faced with a miniature revolution together with the ultimatum that unless either (a) A new stove is bought immediately, or (b) "Calor" or similar gas is installed at once, my family will stage an immediate return home.

After cleaning nipples, tubes, containers, etc., *ad infinitum*, it eventually dawned on me that "Something Must Be Done." I attacked the problem by allowing for what little material I had, and the result has passed all expectations, so much so that appreciation and respect is now paid to the time spent pottering about in "Daddy's workshop."



No dimensions have been given to the drawing, as the parts can be made to suit available material and space. Item 1 may be made from brass; it is important that the external thread for cap, Item 3, is concentric, and also that the bore is circular and, if possible, reamed. The inlet and outlet branches, Item 4, can be screwed and sweated, or silver-soldered, into Item 1, and all machining completed at one setting. Item 2 may also be made from brass, and completely machined at one setting. The degree of filtration is governed by the clearance between the three collars and the reamed bore of the body, Item 1. If these diameters are equal to, respectively, bore minus 2 thous., bore minus 1 thou. and bore minus half a thou., a very fine degree of filtration can be achieved. It is important to note that a slight increase in the bore gives a greatly increased filtering area, and reduced internal resistance. The seating on Item 2 should be ground into the body, Item 1, to provide a perfect seal and to hold the discs truly central. I advise fitting a small ball-bearing, Item 5, between Item 2 and cap, Item 3, which should be made from hexagonal bar.

A TRACTION ENGINE AND ITS HABITS

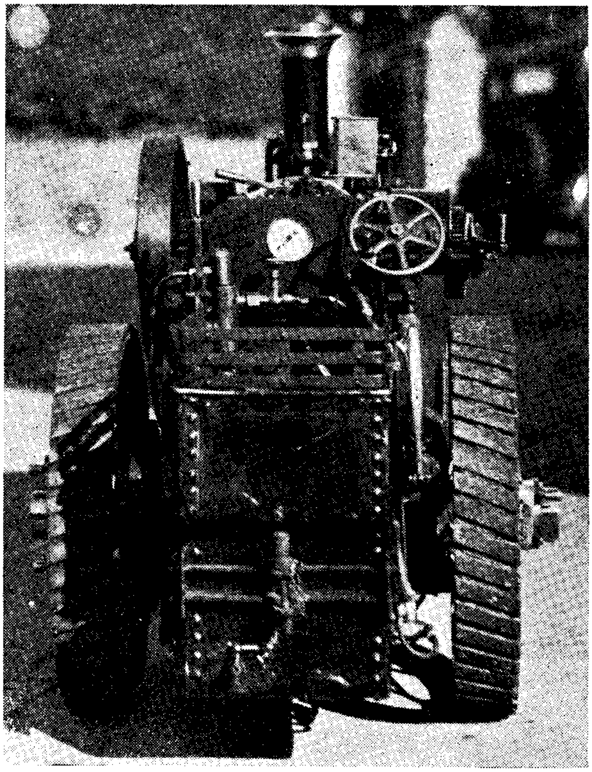
by E. J. Baughen (Malden and District S.M.E.)

I FULLY realise that the true lover of traction engines will probably shed tears before finishing this tale, but hope that if not humorous it will at least be interesting.

I had previously made two $1\frac{1}{4}$-in. scale engines before building this one, and I longed for something bigger. Also, I wanted an engine that I wouldn't be afraid of getting knocked about, would steam for hours on end, and really take a hammering. One sees plenty of glass-case models, but whoever saw a traction engine which wasn't made to get dirty and work hard? I know that I am on dangerous ground now. A compound was ruled out, because I am sure that in model work at least, size for size, the two-cylinder high-pressure engine is far the best and most powerful.

After a lot of scouting around, I found that a Mr. Roper, of Westway, had started to supply 2-in. scale castings, and these were just what I wanted; at that time, he had not fully completed the drawings, but me being me, decided to go ahead without any, and at the same time fit in one or two of my own pet ideas. Now I don't possess a posh workshop; I have a 3-in. treadle lathe, hand drill, grinder, and the usual collection of small tools. The rims for road wheels and the flywheel were turned where I earn my daily bread, and these jobs, works foremen please note, were done as "foreigners"!! 240 rivets are in each rear wheel, and were all drilled by hand; my arms still ache! The spokes were also hand cut, by hacksaw.

By the way, does anyone know of a way of keeping rubber tyres on the rear wheels? After trying various ways without success, I have come to the conclusion that the only answer is to have the tyres bonded on, as with every other method, Bostik included, the wheels revolve and leave the tyres behind.



"Ohio," as her driver sees her

The boiler is of $\frac{1}{8}$-in. copper plate, and follows the usual teachings of "L.B.S.C." It contains fourteen $\frac{1}{2}$ in. diameter and four $\frac{3}{8}$ in. tubes; working pressure is 90 lb. per sq. in. Being a bit of a hammer-and-chisel mechanic, I really enjoyed the boiler-making, as it was something that could be hit, and wasn't exactly a watchmaking job! It is fed by a mechanical pump geared down off the crankshaft, an injector and hand pump are also fitted. The cylinders are $1\frac{1}{2}$ in. bore × $2\frac{1}{4}$ in. stroke, but were originally $1\frac{5}{16}$ in. bore. The reason for the alteration was that, after seeing the *Maid of Kent* locomotive at the 1948 "M.E." Exhibition built by my club members, I thought that if that boiler will steam $1\frac{5}{8}$-in. cylinders, mine will surely steam $1\frac{1}{2}$-in. bore. Anything for a bit more power!

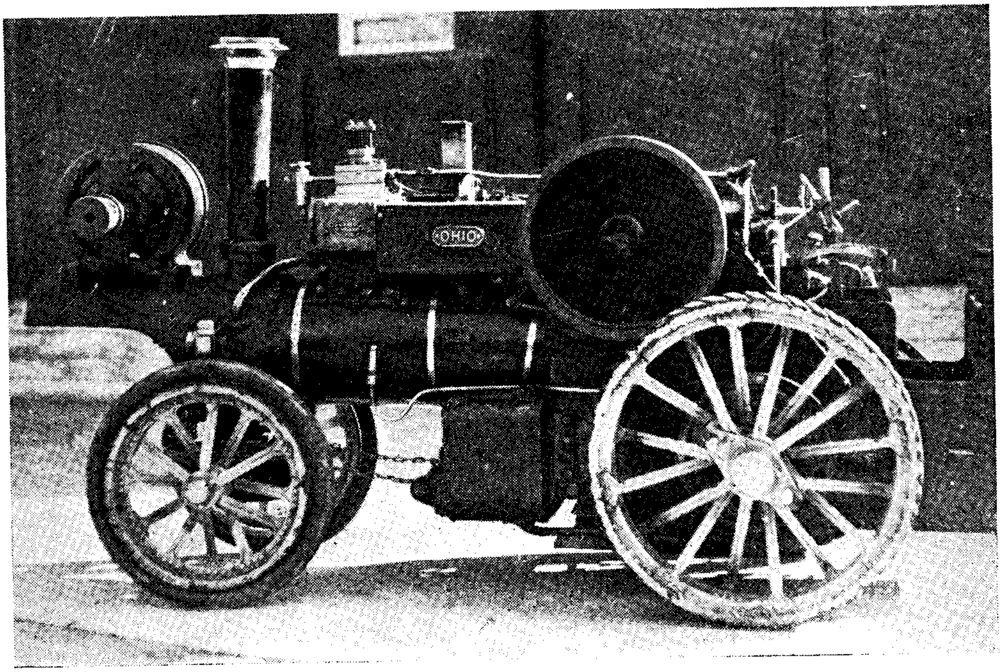
So a new cylinder block was purchased, and the whole motion work was remade according to the *Maid of Kent* specification. A traction engine, you will say, with locomotive top works? "Never 'eard of sich a thing!" But, you critics, it was gee-gees I wanted, not looks, and if that wizard "L.B.S.C." doesn't know how to get power, surely no one else does.

This engine is of the 3-shaft type, the final drive being by chain; the idea was copied from a Tasker engine. Gear ratio is 5-1 high gear and 11-1 low. Both these ratios are on the high side, but as the engine seems quite happy about it, why worry? The heaviest known load so far hauled is 17 cwts., but I am sure that it could be bettered, and will try it sometime.

Readers will probably want to know if the chain-drive has been successful. Well, when first tried out I had a lot of trouble with stretch, so I fitted a jockey sprocket, which worked very well for 2 years. Then one day at a fete I had the local scoutmaster and some boys in the trailer, all dressed up like Christmas trees and trying not to look too self-conscious, waiting for me, at a given signal, to go ahead and break a tape and declare the fete open. Well, I broke something all right, but it wasn't a tape. Having got the signal, I opened the regulator and—Bang!! Now, what, I thought, has gone, and to mine and everyone's embarrassment I found that the chain had broken! This was an ordinary bicycle-chain, and obviously wasn't man enough for the job, so a larger chain was fitted, and has given no further trouble.

On another occasion, at an exhibition with my partner Jack Lester driving, I suddenly noticed that no pressure was showing on the gauge, and just as I was in the middle of telling him what I thought of him in no uncertain way, the safety valve started to blow off. This, of course, was a most peculiar state of affairs, but as we had a crowd of children waiting for rides, we had not time to investigate the trouble, and so long as the wheels went round, what did a few pounds of steam either way matter? We found later that the syphon tube was furred up.

Each year at Whitsun my club runs a three-day fete, and on one such occasion, I had been driving children around all the Saturday and Sunday, when I suddenly noticed that the fly-wheel was wandering about in the breeze, and on having a close look, I found that the cranks instead of being at 90°, had decided each to go their own way. This was a built-up shaft, and the brazing had not penetrated through the webs. As the next day was Bank Holiday this, of course, was a terrible state of affairs, and something had to be done quickly. It was then that the real club spirit came in, for after I had taken the shaft out, those two big-hearted fellows, Dick Marshall and Bert Jenner, took the job home, made a temporary repair. We had everything back and the engine was steaming again by midday Monday. True, the bearings and hornplates had got a decided touch of the jitters, but I kept the engine going all that afternoon and evening, and so helped in a small way to raise much-needed club funds.



Side view of "Ohio"

We now come to that often asked question, why don't you license it and drive it on the road? Have any of you ever tried to get a Road Fund Licence for one of these engines? Believe me, if ever you do, you will find out the real meaning of "Red Tape." To tell the full story of this would take up about three issues of THE MODEL ENGINEER, but suffice to say that over a period of two years, during which I have written to the Ministry of Transport, Local County Council

(Continued on next page)

A Model Royal Marine

by J. F. Owers

THIS model of a Royal Marine is 1 ft. 6 in. high, representing a 6 ft. man.

The whole body is made of deal, painted with flesh-coloured flat paint.

Badges and belt buckle are of thin brass, cut and filed to shape and stamped with a nail. These were shaped on sheet lead.

The belt, bayonet frog and rifle sling are made of white plastic. If buckskin had been used it would need cleaning from time to time. Buckles are made from brass wire, while the belt comes to pieces.

The uniform and cap are made from marine's trousers, the scarlet piping in the trouser legs providing the material for the band round the cap and for the strip in the side of the trousers, which have pockets in them.

The bayonet is made from a piece of old band-saw blade, with wooden grips riveted to the handle. It is detachable from the rifle and goes in a scabbard behind the left leg of the model.

The rifle is made to scale and proportion from teak wood. The proportion was arrived at by scaling diagrams in an army musketry book.

Boots are of leather and laced on to the feet. They have backs as on the real boots.

As this model is somewhat out of the ordinary, I thought it might be of interest to readers.

A TRACTION ENGINE AND ITS HABITS

(*Continued from previous page*)

and the Metropolitan Police, I have at last received a form enabling me to get a licence at £25 per year! When you consider that a full-size engine, if it is taxed as an agricultural vehicle, is only 5s. per annum, it rather makes you wonder how this figure is arrived at. Needless to say, the engine is still not licensed.

The name plates, "Ohio," are of the correct raised-letter pattern, and I was enabled to do this through the kindness of our very worthy president Mr. F. W. Bentor, who was good enough to engrave the die for me.

Before closing this tale, I should like to say that, although the engine may not be an exhibition-piece, and is often badly treated and overloaded, at the same time, I have had a lot of pleasure in building it, and still get a lot of fun driving it.

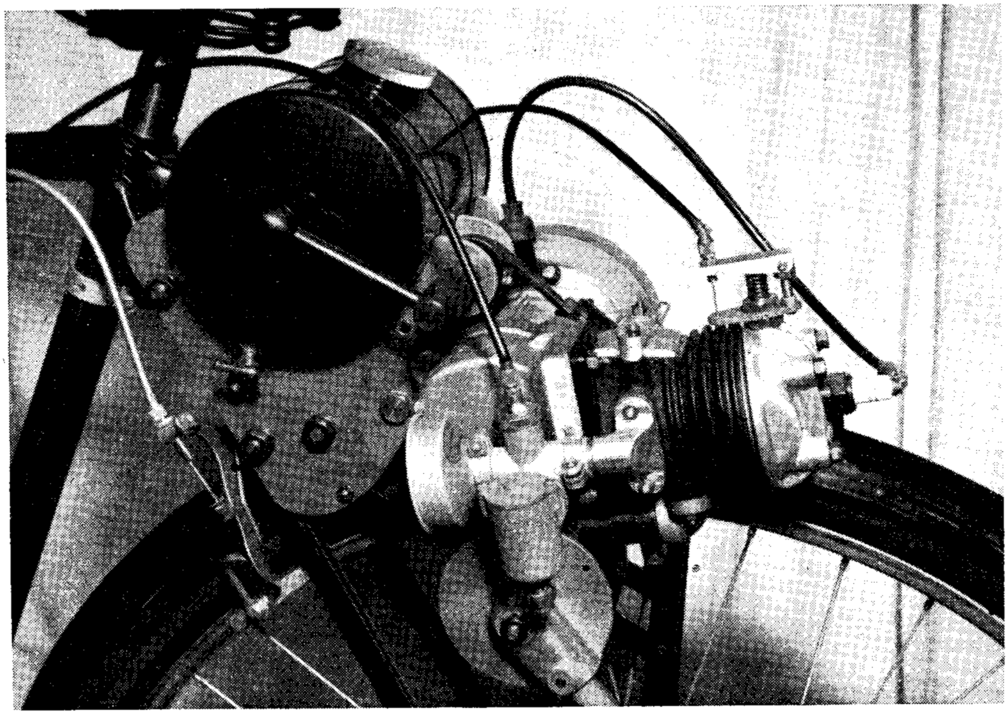
PETROL ENGINE TOPICS

A 50 c.c. Auxiliary Engine

by Edgar T. Westbury

THE tendency in the development of model i.c. engines during the last decade or so has been towards smaller and smaller capacity, and in some cases this has been carried *par reductio ad absurdum* almost to the vanishing point. While the ultra-tiny engine has its advantages for certain purposes, not to mention an irresistible fascination for a small number of constructors, it is hardly suited to the skill and facilities of the vast majority who constitute the rank and file of model engineers. Commercial manufacturers with special equipment for small scale precision work have exploited the possibilities of very small capacity engines to an extent which tends to discourage the amateur from pursuing this particular line of construction.

Be that as it may, however, it is a fact that, at the present time, there are definite signs of a return swing of the pendulum, and it is clear, from the opinions expressed by correspondents, that many of them are becoming interested in engines of larger capacity. Such engines are less exacting in respect of limits of accuracy in machining and fitting, but they give more scope for little refinements of detail design which help to make miniature engines look more like their full-size prototypes, and, what is still more important, to behave like them, too.

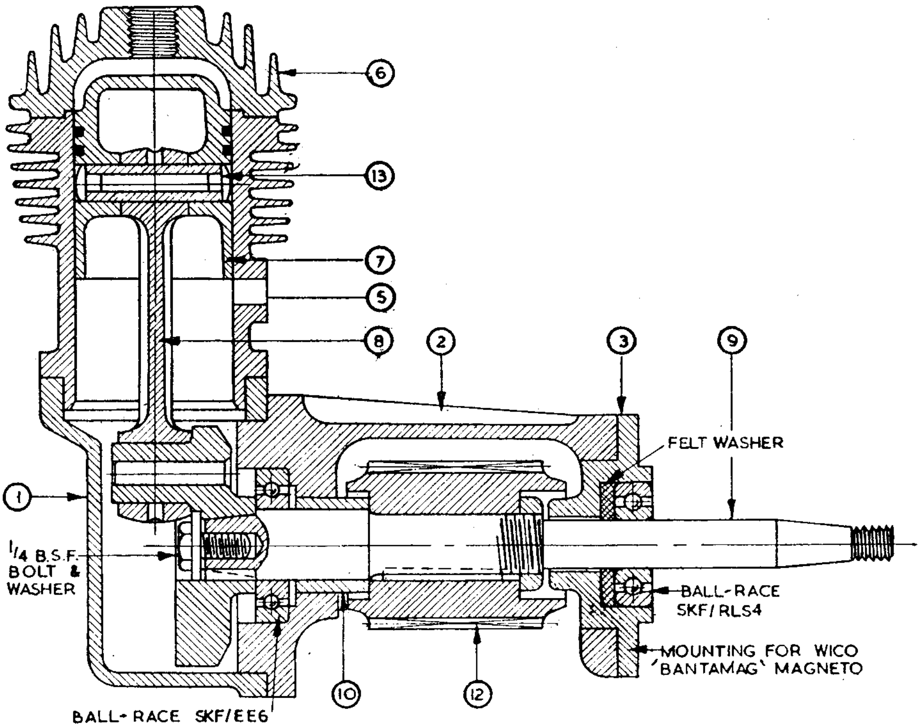


The "Busy Bee" engine mounted on cycle and driving rear wheel by means of a friction roller

For some years now, I have had discussions with readers on the subject of engines of fairly large size, as models go, which could be applied to utility purposes, such as generating current, pumping water, driving a lathe or turning the cutter cylinder of a small lawn mower. These readers have been very persistent, and their claims have not by any means been ignored. I have gone so far as to lay out two or three tentative designs for utility engines, both of the 2-stroke and 4-stroke type, as a basis for development, but the more popular demand for small engines have tended to push these projects into the background, and have prevented me doing much practical work on them until comparatively recently, when it became clear that engines of small capacity were beginning to attract much more attention, and proving themselves capable of very wide application.

In recent years, there has been almost a complete metamorphosis in the design of small-power stationary engines, from heavy and massive water-cooled types with large bore, long stroke and slow speed, to light small-capacity fan-cooled high-speed types. In motor-cycle practice, the popularity of the large "slogger" has declined in favour of small high-revving engines. A very important development of the modern era has been the practical realisation of a very early idea, namely, the application of an engine attachment to pedal cycles, and this has been rendered possible only by getting down to engines of sizes as small as 50 c.c. or less. The construction of such engines is well within the capacity of the amateur workshop, and it is not surprising to find that many readers of THE MODEL ENGINEER are definitely interested in this class of work.

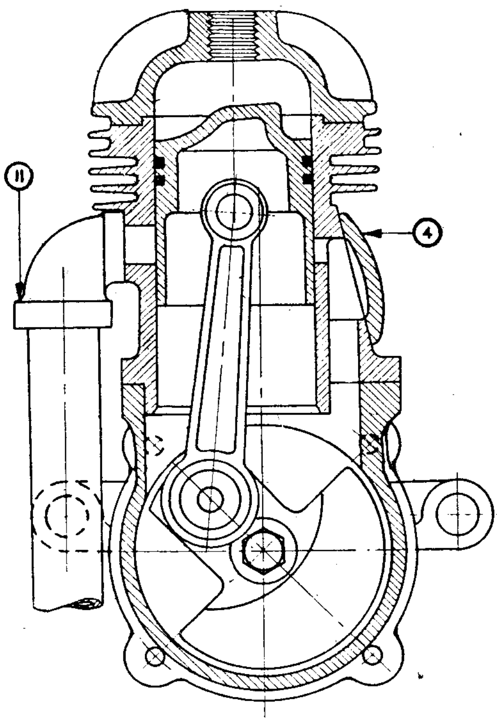
It would, of course, be idle to suppose that the reduction in the size of engines is an unmixed blessing. Large and massive engines have many advantages for stationary work where there are no urgent restrictions on weight or space occupied. By using a large cylinder displacement, it is possible to obtain the required power at low pressure and slow speed, which makes for free and comparatively silent running, with long wear of working parts and little vibration. Small high-speed engines are admittedly more noisy and fussy; they lack flexibility and are generally more addicted to "a short life and a gay one." A large engine may be actually more economical to run than a small one for a given output, as it can be adjusted to run with a weak fuel setting, and its maintenance costs may also be lower. In automobile paractice, the merits of having ample engine capacity in hand are fully recognised, but are offset by the anomalies of the existing taxation system.



Side view of the "Busy Bee" 50-c.c. auxiliary engine, showing vertical cylinder arrangement

However, small engines, if well designed, are capable of doing very useful work, and have many advantages in respect of lightness, portability, and small bulk, not to mention low initial cost. In the case of engine attachments for cycles, small size and lightness are really essential factors to their success. The attachments which were produced in the early days of engine development usually failed because they were too heavy and bulky for the lightly-constructed standard cycle frame, which often gave way or quickly rattled itself to destruction. The intermediate stage between the true motor-cycle and the motor-assisted cycle, namely, the auto-cycle (a cycle with specially strengthened structure and adapted for power drive), owes its present success and popularity to the evolution of a light, but sturdy and reliable, engine and transmission unit.

A good many amateurs have attempted, with a varying degree of success, to build their own engines for pedal cycle attachments, and at least one of these efforts has been described in THE MODEL ENGINEER. I can claim to have done some pioneering in the application of miniature engines to "personal traction," though my experiments were not aimed at the development of a utility power unit, but simply to demonstrate what a small engine was capable of doing. They were carried out over 20 years ago, and consisted



End view, section on centre-line of cylinder

of mounting my now historic "Atom I" 52 c.c. engine, complete with a 24-in. airscrew, on the handlebars of a cycle. This simple "lash-up" proved capable of propelling the cycle (and rider) at a speed of 10 m.p.h. on the level, and of climbing moderate gradients, but airscrew drive is obviously inconvenient for use on the King's Highway, and probably illegal, though I do not know whether there is any definite ruling on this matter at present. No attempt was made at the time to develop an alternative form of transmission gear.

Since the war, I have followed with interest the development in the use of power attachments for cycles on the Continent, and I have made some further experiments which gave results sufficiently encouraging to justify the development on a special engine design. I would like to make it clear, however, that no commercial application of the idea was visualised, as I was of the opinion that the more conservative British cyclists would not be very keen on power drive ; but it would appear from present indications, I was entirely wrong. My object was simply to produce an adaptable form of engine design suitable for amateur construction, and applicable to practically any utility purpose, within its power capacity.

Why an "Auxiliary Engine"?

I have called this an auxiliary engine because it was, and still is, intended to have a much wider application than that of a cycle motor. The literal meaning of the term as given by a well-known etymological dictionary is "rendering assistance, helping, aiding ; subsidiary to." For some reason, modern technical usage favours the very similar word "ancillary" which is apparently taken to mean much the same thing, though it is derived from a Latin word which specifically denotes "female servants." I mention this because, in common with most writers, I am regarded as legitimate prey by those pedants who delight to split hairs over the exact meaning of technical terms, and somebody is sure to take me up over this one!

In a previous issue of THE MODEL ENGINEER I made some comments on the application of small engines to everyday utility work, and emphasised that the paramount qualities called for in such engines are stamina, durability and complete reliability. It is in this respect, apart from the mere matter of size, that they differ from the type of engine most commonly encountered within the sphere of model practice. The great majority of such engines are intended only to run for comparatively short periods, and have a relatively short life in actual working hours. As a result, it is possible to work to narrow margins of strength in their structural and working parts, and bearings are often restricted in diameter and surface area far below what would be considered adequate for continuous work.

Some model engineers have attempted to build engines for utility work which are practically scaled-up versions of popular high-efficiency racing engines, but the all-round results are not likely to be highly satisfactory. Not only is the life span of such engines too short to be worth while, but the porting of an engine intended to work at something well over 10,000 r.p.m. is by no means the best possible for one which is not likely to attain much more than one-fourth this speed, and in which flexibility and ability to pull at much lower speeds are highly desirable factors. A very strong objection to running utility engines at very high speed is that lubrication is difficult, and oil consumption heavy, apart from other disadvantages such as increased wear, noise and vibration. It is my firm belief that simplicity is a prime necessity in the practical success of the auxiliary engine as applied to cycles. Not only must the engine itself be simple, but the means of attachment to the machine, and the method of transmission, should conform to type. In this respect, the friction drive to the cycle tyre, although mechanically crude, gives remarkably good results in practice, and requires the minimum of adaptation or alteration to the cycle itself. This is the method recommended for the engine now to be described.

It will be seen from the general arrangement drawing that the engine is a straightforward type

(*Continued on page* 418)

Novices' Corner

Removing Tailstock Fittings

ALL too often, a visit to some workshop shows that the fittings used in the lathe tailstock have been damaged by careless methods of removal. The back-centre, of course, does not usually suffer in this way, for not only is it hardened, but, where the tailstock is not of the self-ejecting pattern, two flats are commonly provided which enable the centre to be withdrawn by applying a spanner with a twisting motion. On the other hand, cutters with Morse taper shanks usually do not have these spanner flats, and commercial drill chuck arbors are left plain and are generally unhardened. Should the tailstock barrel have a central bore, these fittings can readily be bumped-out from behind with a length of rod ; but, where the barrel is solid, it is not unusual to find that a hammer is used to loosen the fitting by tapping it from side to side, or, again, a grip may be obtained with gas pliers on any projecting portion. Needless to say, these rather brutal methods are likely to damage the tailstock barrel itself and to cause unsightly bruising of the fittings concerned.

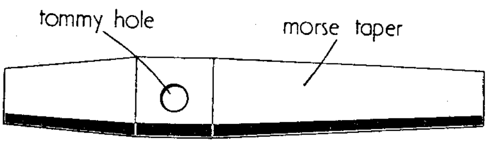


Fig. 1. *Chuck arbor drilled for a tommy bar*

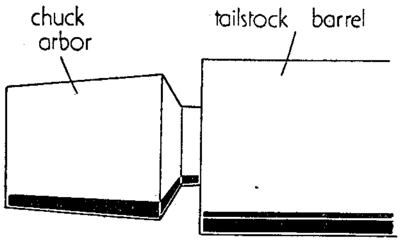


Fig. 2. *The arbor in place in the tailstock*

Where a drill chuck arbor projects for some distance beyond the end of the tailstock barrel, a cross-hole may be drilled to take a small tommy bar of, say, $\frac{3}{16}$ in. diameter, as represented in Fig. 1. This not only provides a good grip when twisting the arbor during removal, but at the same time the part is held so that it cannot fall on to the lathe bed and become damaged.

Recently, a new drill chuck, mounted on a double-tapered arbor, was used in the lathe tailstock, and it was assumed that, after a preliminary trial, it would be possible to remove the arbor from the tailstock by inserting the chuck key in the chuck body and giving the parts a twist. However, as usually happens if a chance is taken, the chuck came away leaving the arbor firmly held in the tailstock barrel. To remove the arbor, therefore, a method was used similar to that employed for withdrawing the coned centres from the draw-in collets belonging to a precision lathe. The appearance of the tailstock barrel with the chuck arbor in place is shown in Fig. 2, and the method employed for removal is illustrated in Fig. 3. A short length of $\frac{3}{16}$ in. diameter brass rod was placed on either side of the arbor in the recess between it and the end of the tailstock barrel. A small vice was then applied and, when the jaws were tightened, the wedging action of the rods pressing against the sloping face of the arbor caused prompt ejection. If more than moderate pressure has to be applied in this way, a swivelling jaw-piece should be used, such as that supplied with the Myford machine vice ; the pressure on the two ends of the vice jaws is then equalised by inserting a distance-piece between the jaws at their far end. It is advisable during this operation to cover the lathe bed with several layers of rag, so that no damage will be done should any of the parts slip from the hand.

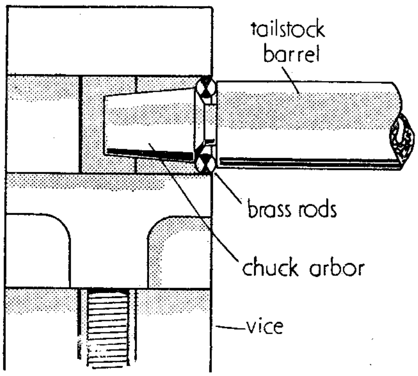


Fig. 3. *Method of ejecting an arbor from the tailstock*

Any recurrence of the trouble caused by the arbor becoming stuck in the tailstock is prevented, and easy removal is ensured, if, as shown in Fig. 4, two spanner flats are formed at the base of the larger tapered portion of the arbor.

The outside diameter of the arbor is first measured with the micrometer (Fig. 5A) and the gap between the jaws of the spanner selected is also measured with a rule (Fig. 5B). In the pre-

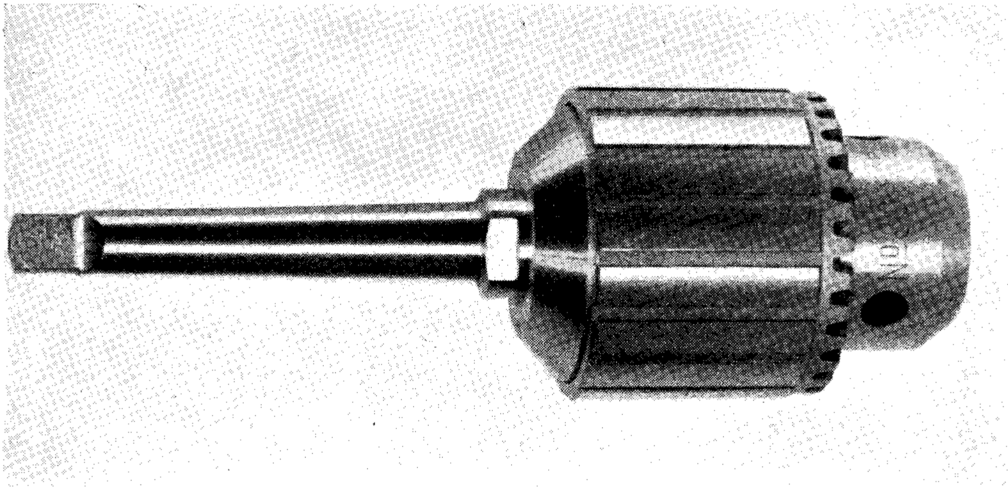


Fig. 4. Showing the arbor with filed spanner flats

sent instance, the arbor measured 0.634 in., and the ¼ in. Whitworth spanner 17/32 in., or 0.531 in. As the difference between these two dimensions is 0.103 in., some 50 thousandths of an inch is removed from either side of the arbor, and the remainder is reserved for the final fitting operation to allow the spanner to engage accurately. To indicate the permissible breadth of the flats, the arbor is inserted in the chuck, and as shown in Fig. 5C, a mark is made with the grease pencil close to the line of junction. Next, the arbor is put in the tailstock and the distance from the base of the chuck to the end of the tailstock barrel is measured; as this was found to be 5/16 in., a standard spanner, having a jaw thickness of ¼ in., could be used.

However, should the available space be less than ¼ in., it will then be necessary to rely on a lock-nut spanner, for in these the standard thickness of the jaws is only ⅛ in.

After the two spanner flats have been marked-out, the next operation is to file them to size. For this purpose, the arbor is gripped in the vice between two strips of soft wood, and as illustrated

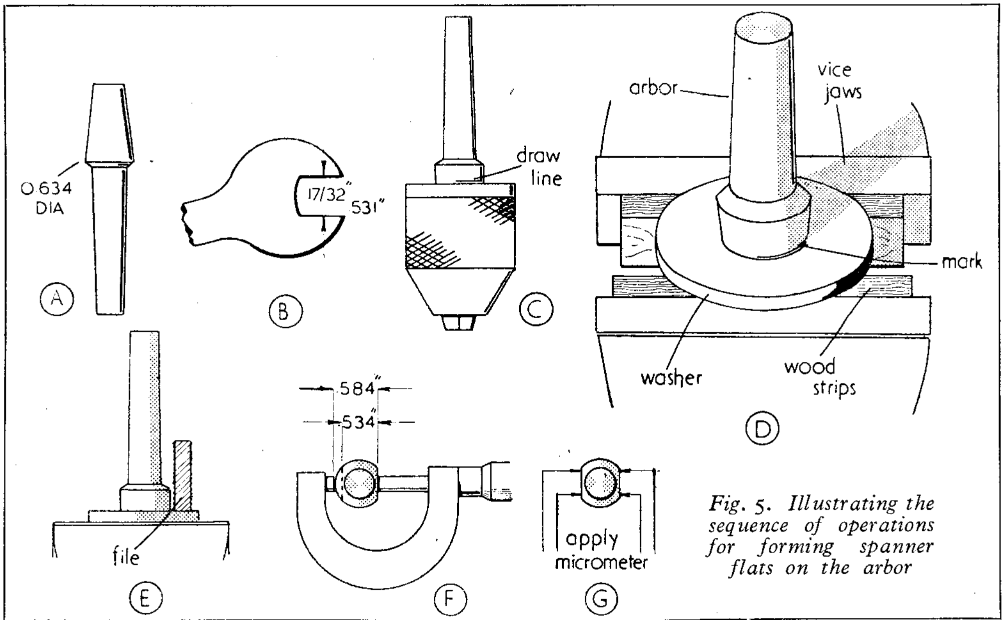


Fig. 5. Illustrating the sequence of operations for forming spanner flats on the arbor

in Fig. 5D, a $\frac{5}{8}$-in. washer is slipped on and rests on the surface of the vice-jaws. The height of the arbor in the vice is then adjusted to bring the pencil mark level with the upper surface of the washer. To form the first flat, the file, with its safe-edge downwards, is applied as shown in Fig. 5E and filing is continued until a micrometer measurement, Fig. 5F, shows that nearly 50-thousandths of an inch has been removed. At the same time, the file must be kept truly upright and the strokes made squarely across the vice-jaws. This operation is then repeated, without moving the arbor in the vice, to form the second flat parallel with the first and to reduce the distance across the two flats to approximately 0.534 in. It is, however, advisable to check the parallelism of the two flats from time to time with the micrometer during the filing operation, as represented in Fig. 5G. It now only remains to file the two flats in turn with a fine file until the spanner fits closely in place. As this spanner will be required so often when using the lathe, it should be kept where it can easily be found and not allowed merely to lie somewhere on the bench. Where the lathe is mounted on a wooden bench, the spanner can be attached to the front edge of the bench itself in a position near to the tailstock; two round-headed wood screws, fitted as shown in Fig. 6, make a convenient form of attachment. Spanners so mounted are very easily picked up and returned to their places; moreover, as they

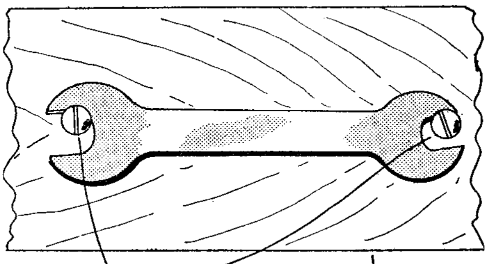


Fig. 6. Hanging the spanner on the bench

do not project below the bench top they are not liable to be knocked from their hangings when the operator is using the lathe.

Petrol Engine Topics

(*Continued from page* 415)

of three-port two-stroke, in which the general working parts are fairly conventional in design, but the details have been adapted to suit the particular class of work for which it is intended. The bore is $1\frac{5}{8}$ in. and the stroke $1\frac{1}{2}$ in., giving a capacity of slightly over 50 c.c., but as there are no class restrictions at present in existence on these engines, I have not considered it necessary to keep within the 50 c.c. limit. The parts of the engine are individually simple, and though there is more work in actual construction than usually encountered in small model two-stroke engines, there are no operations which should give any difficulty to the constructor of average ability.

In the development of this engine, I have been very fortunate in securing the co-operation of the Myford Engineering Co. Ltd., of Beeston, Notts, who have used the engine as an exercise and practical demonstration in the operation of the M.L.7 lathe. As readers are well aware, the engine designs which I have described in THE MODEL ENGINEER have all been claimed as suitable for construction on a $3\frac{1}{2}$-in. lathe of the type generally used in model workshops. This applies, not only to actual turning operations, but all the machining processes. This policy has been followed in the case of the present engine, and its construction has amply demonstrated the suitability of the M.L.7 lathe for this class of work. Many of the photographs which will be used to illustrate the constructional processes were taken in the Myford works, but I would like to make it quite clear that the only machine tool used was the type of lathe already mentioned, and a standard lathe of exactly the same type as that available to readers was employed. Some of the machining processes on the engine were demonstrated on the Myford stand at last year's "M.E." Exhibition, and a finished engine, though at the time in the embryo stage of practical development, was shown fitted to a cycle on the same stand.

In order to simplify the work of construction, the engine has been made suitable for use with a commercially available type of carburettor and magneto, though in the case of both these items, I have prepared special designs which are well suited to amateur construction. Whether these will be described in detail will depend very largely on whether there is any great demand for them. It would, of course, be quite possible to employ coil ignition on this engine, and some readers may prefer to do this. The engine may be built with either horizontal or vertical cylinder (the latter is shown in the general arrangement drawing), without any actual alteration of its working parts, and when used for cycle propulsion, it may be fitted either on the front or rear of the machine, the latter position being used in the case of the engine seen in the photograph. For other purposes, some adaptation of the structural components of the engine is desirable.

I would like to make it quite clear that the engine is not designed for quantity production, but for individual construction by the methods and facilities available to amateurs. Castings for the construction of the engine, also the accessory components, can be obtained from Messrs. Braid Bros., 50, Birchwood Road, Hackbridge, Surrey. The name adopted for this engine is the "Busy Bee" which, in common with the names of my previous engines, means something—I hope!

(*To be continued*)

*The Mechanical Aspect of Radio Control

by A. M. Colbridge

ON any of the simple type actuators we can get a further control by mounting a rotary switch on the escapement arm, as in Fig. 8. A simple application is shown where in one position the contacts on the disc contact two brushes and complete a second electrical circuit at one position of the actuator which may be connected to another actuator or operate a motor control. The position selected might be one of the neutrals or one of the rudder positions.

*Continued from page 388, " M.E.," March 22, 1951.

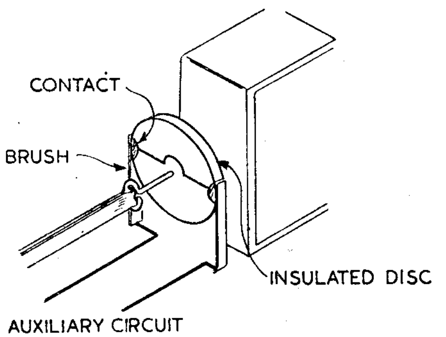


Fig. 8

If it were a motor cut control, for example, neutral after right might be selected. Switching quickly through this neutral would cause only a momentary motor miss; dwelling in neutral after right would cut the motor. This is still a sequence control, but fairly simple to appreciate under the heat of operation. The motor cut position is always in the neutral after right, whether the operator has lost the original sequence of operation or not. If in re-synchronising his control the operator finds the model turning left on applying a signal he knows that the motor will not cut in the following neutral; but if it turns right he knows that it *will* cut in the following neutral.

Some of the latest sequence actuators are of the permanent magnet type and many are employing similar switching devices. The permanent magnet actuator, in fact, gives every indication of becoming a reliable, low drain type. Another ingenious form of sequence control developed

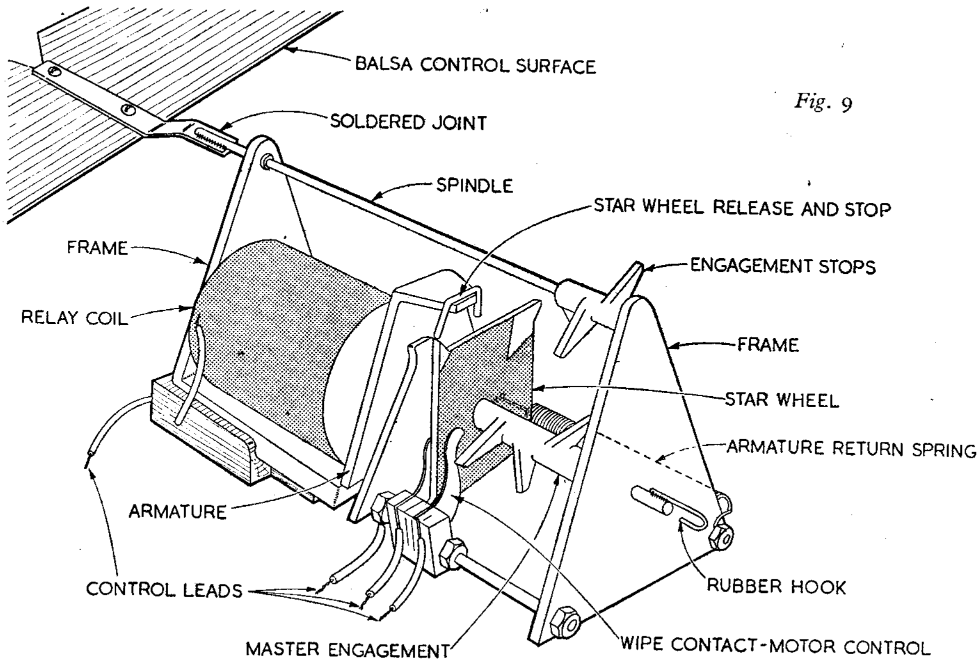


Fig. 9

for aircraft work is " rudevator " which, developed from a simple coil-operated escapement, gives four angular lock positions to a shaft which is normally free to rotate in the neutral positions. The escapement is self-neutralising. (Fig. 9.)

To this shaft is mounted a control surface set

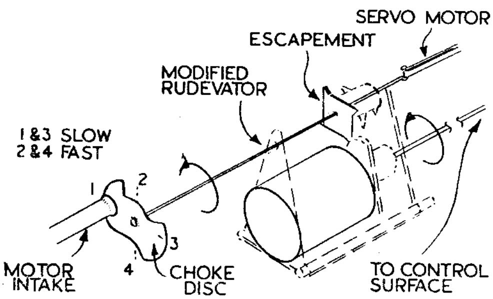


Fig. 10

at a certain angle. In an airstream, with th shaft free, this rotates or windmills (although it is a straight control surface, not twisted like a fan or propeller blade) and has no effect on the performance of the model. Locked, in sequence, in any one of four positions, the angular attitude and original offset of the control surface give control positions corresponding to right and left rudder and up and down elevato r. Furthermore it is possible to arrange the stops so that rudder effect is combined with elevator effect, preventing loss of height in turns. A further control circuit is provided by two small brushes rubbing on the star-wheel, used normally for two-speed motor control, selecting half speed for turns, full speed in up or down elevator, half speed in one or more neutrals and full speed in the others, or, in fact, a considerable variety of combinations. A control box similar to Fig. 7 is employed with the same necessity of synchronisation—and the same basic fault in that skipping of the rudevator demands re-synchronisation.

Rudevator has enjoyed more popularity in America than over here. It is, in fact, an American invention. The rotating control surface idea was suggested by Wilfred Rhodes, whilst H. Owbridge was responsible for the mechanical design of the unit. The latest version, with a rotary disc " throttle " control for glow-plug or diesel motors is shown in Fig. 10. Both mechanisms are worthy of study for, whilst primarily developed for aircraft, their very

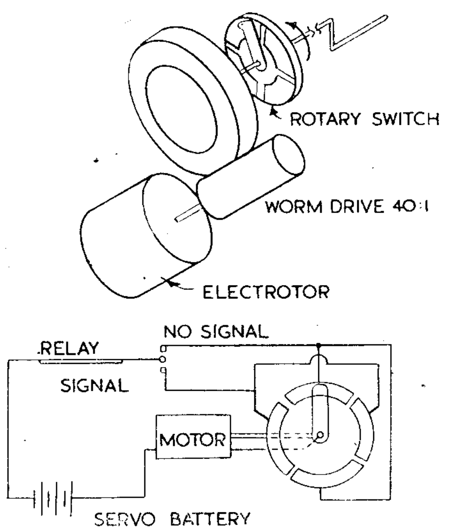


Fig. 11

ingenuity gives rise to ideas for possible developments for other types of models.

Space does not permit a description of some of the other forms of actuator mechanisms, but we will just mention that the armature-operated escapement is far from being the only type. Motor-driven actuators similar to Fig. 11 have been very successful in practice, both in aircraft and boat installations. Even for aircraft use the weight is not excessive. It will be noticed, however, that the controls are still operated in sequence. Coupled motor drives to the control surfaces have been tried, the idea being to stop

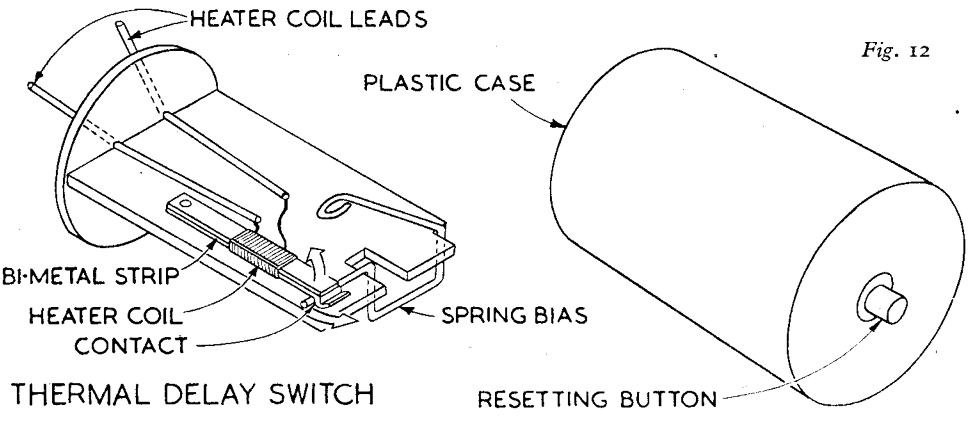


Fig. 12

THERMAL DELAY SWITCH

the motor when the required degree of offset has been attained. In other words, the control movement is infinitely variable between neutral and full position, merely stopping the motor by switching off the signal when the required degree of offset has been reached.

This has proved quite impracticable, for aircraft at least. The lag between control movement and control response as reflected by the model's change of attitude is considerable and it is quite impossible to stop the control surface in the required position by mere observation of the model's behaviour. In the case of boats operated at a closer range some of these objections may be removed.

Proportional controls, or multi-position controls are generally best achieved, however, by modified radio circuits. We have been considering the simplest type of radio receiver with the straightforward "on-off" signal where sequence operation is virtually the only method of obtaining more than one control action response. Multi-controls can be obtained similarly with ingenious modifications of the receiver circuit and transmitter signals, but, of course, radio developments are beyond the scope of this article.

A $3\frac{1}{2}$-in. Drummond Lathe Improvement

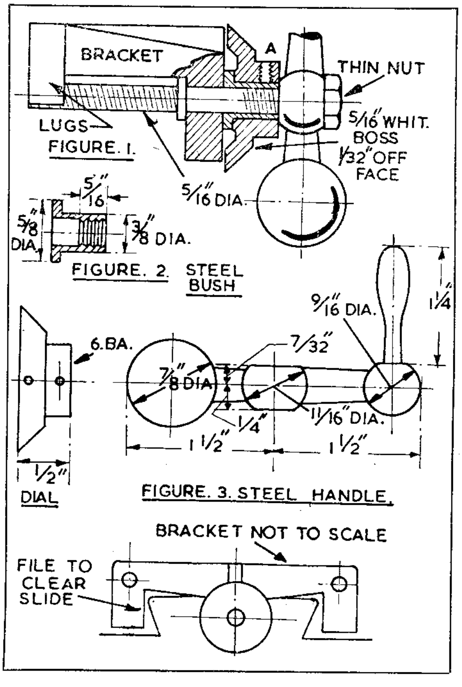
by H. Ginks

THE slotted slide on the $3\frac{1}{2}$-in. Drummond lathe had a limited travel towards the centre; with the result that, to bore out a hole, after outside turning, the top-slide had to be moved into the next slot, disturbing the setting of same, besides being inconvenient at other times.

A neat little bracket on the Myford M.L.7 overcomes this difficulty so, with the co-operation of A. J. Reeves & Co., of Birmingham, who gave me the necessary dimensions, I was able to check up, with the result that a dial and bracket was ordered from them and duly fixed with satisfaction.

The dial is held in a four-jaw chuck at *A*, Fig. 1, face boss, till it protrudes 1/32 in. from face as shown. Bore hole to $\frac{3}{8}$ in., then turn a piece of steel or brass to $\frac{3}{8}$ in., push dial tightly on with small boss *A* outward and machine to $\frac{1}{2}$ in. overall length.

Next, chuck a piece of $\frac{5}{8}$ in. diameter steel, drill through letter D or $\frac{1}{4}$ in., tap $\frac{5}{16}$ in. up, $\frac{5}{16}$ in. Whit., turn outside for dial to revolve freely but not loosely, and just full of dial length, part off leaving flange 3/32 in. thick; hold $\frac{3}{8}$ in. part truly and bore hole to $\frac{5}{16}$ in. diameter to end of thread. (Fig. 2.)



After opening out the hole in the Myford bracket from $\frac{1}{4}$ in. to $\frac{5}{16}$ in., it is placed against the slide, over the plain part of screw, held by toolmakers' clamps. Start end of $\frac{3}{16}$-in. drill through holes, afterwards, drill down 9/64 in. and tap $\frac{3}{16}$ in. Whit., then fix with either cheese- or socket-headed screws. The two lugs hanging down are filed to clear slide, about 1/32 in. off each side.

The bush, Fig. 2, screws on, just far enough to allow the slide screw to move without end shake, the handle locks up to bush, while the thin nut finally locks handle.

A suitable mild-steel handle is shown in Fig. 3, and I assure readers the alterations are worthwhile.

One of these dials can be fitted to the top-slide in a similar way, and a 6-B.A. brass screw is used to lock them on bush.

THE CHICHESTER MODEL ENGINEERING EXHIBITION

WE were pleased recently to visit the extremely interesting exhibition of the Chichester and District Society of Model Engineers, held at the Assembly Rooms, North Street, Chichester.

The opening ceremony was performed by Sir Alliott Verdon-Roe, O.B.E., F.R.Ac.S., M.I.Ae.S., with the Right Worshipful the Mayor of Chichester in the chair. The judges were Messrs. J. N. Maskelyne and E. T. Westbury, of THE MODEL ENGINEER.

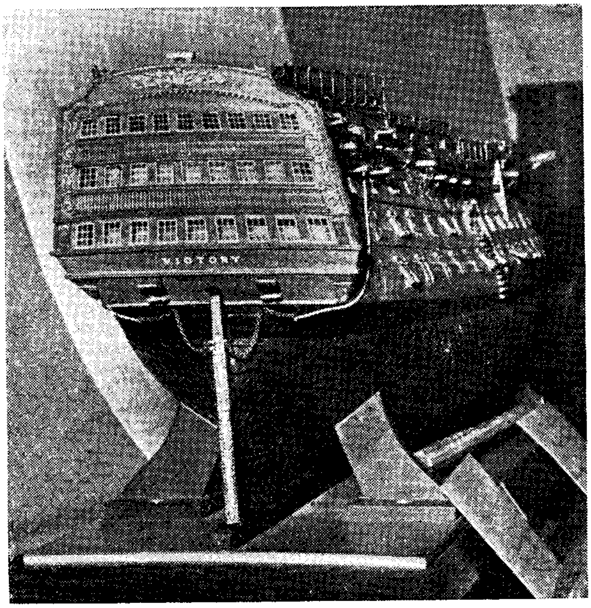


Photo by] [*A. Scotcher*
Mr. N. H. MacLeod's cup-winning model of H.M.S. "Victory"

The championship cup went to Mr. N. H. MacLeod, of Fairfax, Middleton, for his unfinished model of H.M.S. *Victory*. To date, Mr. MacLeod has put in 7,000 hours of work on the model, during which time 3,400 separate copper plates were fitted to the bottom. Oak used in the construction of the hull is from Nelson's actual flagship. The quality of craftsmanship which has gone into this model may be guessed when we tell you that it is indeed unique for an unfinished entry to gain the premier award in any open competition.

In addition to winning the Pine Championship Cup, Mr. MacLeod also secured the Storry Cup for craftsmanship and the award in the appropriate class for model ships.

There were many other interesting models in the ship section, including a $\frac{3}{16}$ in. to 1 ft. scale model of an ocean-going salvage tug by E. J. Meads, of Brighton, two very fine $\frac{3}{4}$ in. to 1 ft. radio-controlled cabin cruisers by R. T. Halliwell of Bishops Waltham, and, in the loan section, a handsome $\frac{1}{8}$ in. to 1 ft. scale model of the Grand Banks record-holding fishing schooner *Bluenose*, made by C. L. Heworth, of Manchester. Add to these the excellent collection of waterline models by E. N. Taylor, of Gosport, plus the many others too varied and numerous to mention, and it will be evident that this was indeed a powerful section.

There was some commendable work in the locomotive section, including the two fine steam models by W. G. Dennis of London and R. P. Brown of Southwick, which won first and second prizes respectively.

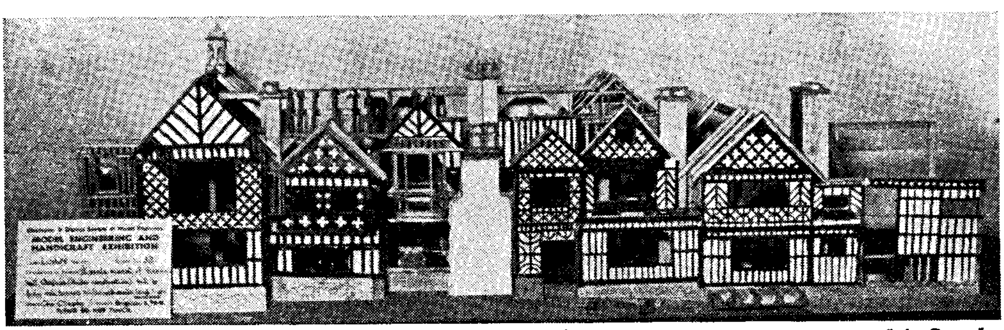


Photo by] [*A. Scotcher*
Mr. G. Clasby's magnificent model, showing some of the work that has taken place since its last appearance in these pages (November 2nd, 1950)

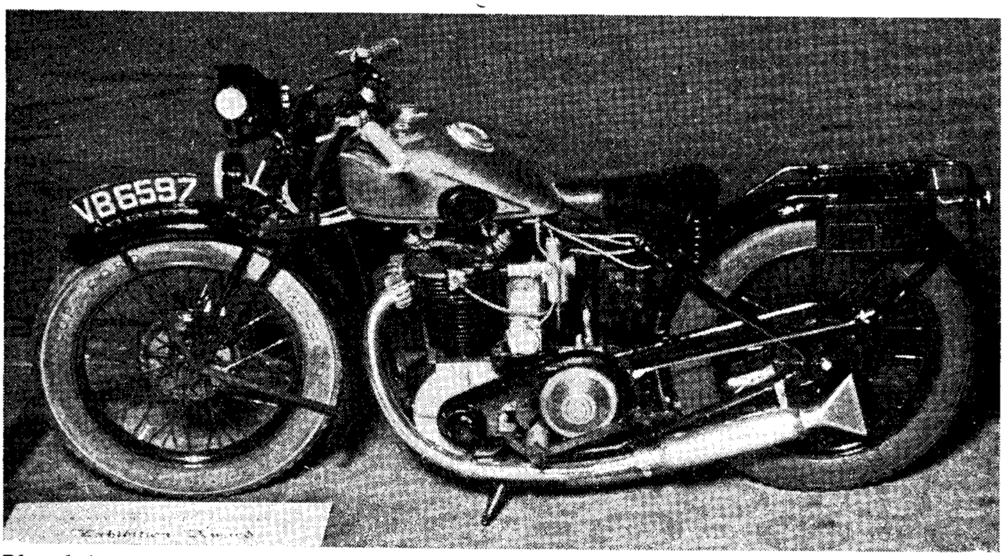


Photo by] [*A. Scotcher*
A very fine motor-cycle by Mr. R. P. Brown, of Southwick. Note the mass of detail and correct all-round scale appearance

A most interesting and spectacular model was the 1/6 in. scale working model of a Churchill tank by A. T. Tamplin of Chichester, which was awarded the Page Cup, for the best exhibit by a Chichester member. This radio-controlled model weighs over two cwt. and has enough power (supplied by an electric motor) to give scale field performance or better. Over six hundred needles are employed in the bearings of the weight-carrying wheels, on which run the true to scale tracks. The realism with which the gun fires from the fully functional turret adds to the interest of this excellent effort.

Altogether, the Chichester Club is to be commended for a truly inspiring show, and we only wish that space would allow mention of some of the other very pleasing models which were on view.

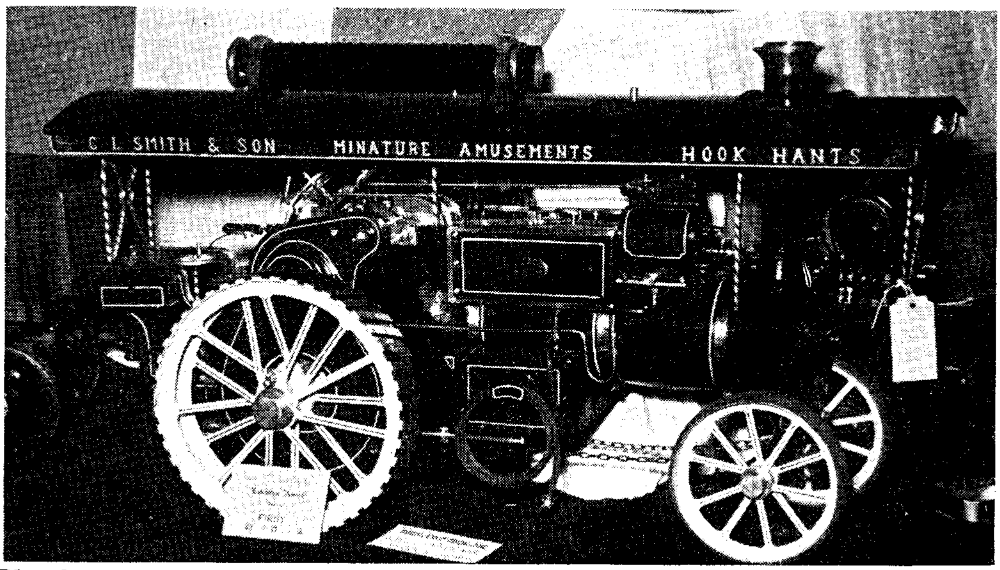


Photo by] [*A. Scotcher*
A great number of parts for this handsome engine were "turned" with a hand drill and file by Mr. C. L. Smith, of Hook

"L.B.S.C.'s" Beginners' Corner

Boiler Fittings for "Tich"

THE next item to be made, is the combined whistle valve and turret, or steam fountain. When drawing and describing this, I often recall, with a smile, the tiny alleged whistle on my five-shilling tin *Ajax* of over three-score years ago. It looked like a split marble, perched on a small plug cock with a long wire handle bent over at the end. As the sound produced, was only a good imitation of a rat with its tail caught in a trap, it was useless for whistling purposes, but was handy for trying if steam was up. Glorified editions with a bell top are still sold commercially; in fact, I have some specimens here now, which I keep as curiosities, remembrances of the old Aldgate firm of "Model Dockyard" fame. Apparently nobody thought of hiding a big whistle underneath the engine!

For making the vertical turret, chuck a piece of $\frac{5}{16}$-in. round rod, face the end truly, and part off a piece a full $\frac{7}{8}$ in. long. Chuck with the parted end outwards; centre, and drill right through with No. 44 drill. Open out to about $\frac{1}{4}$ in depth with $\frac{3}{16}$-in. drill, and bottom the hole to $\frac{3}{8}$ in. depth with $\frac{3}{16}$-in. D-bit, similar to the way in which you formed the ball seats in the pumps. Slightly countersink the end, and tap it 7/32 in. × 40 for about halfway down. Take a slight skim off the end, to true it up. Then reverse in chuck, and repeat operations, except that the D-bit is not needed; just put the $\frac{3}{16}$-in. drill in, to the full $\frac{3}{8}$ in. depth. Next, at $\frac{3}{16}$ in. from the D-bitted end, make a centre-pop. At $\frac{7}{16}$ in. farther along—that is, at $\frac{1}{4}$ in. from the other end, make another one, in line with it. Using 5/32-in. or No. 22 drill, drill clean through the piece of rod at the first centre-pop; but only drill the second one until the drill breaks through into the centre hole. File or scrape off any burring; then fit a union screw or nipple into each hole. These are made as previously described for mechanical lubricator and other fittings, so repetition is unnecessary. The two opposite nipples at the bottom of the fitting, are screwed $\frac{1}{4}$ in. × 40, and the upper one 7/32 in. × 40. The spigots should, of course, be a tight fit in the holes in the body of the fitting; they are drilled No. 40.

Silver-solder them in, same as the water gauge parts; wash off and clean up. Then put a 3/32-in. parallel reamer through the remains of the No. 44 hole in the middle. If you haven't one, file off the end of a couple of inches of 3/32-in. silver-steel on the slant, so that it looks like a long oval. Harden and temper, in the same way that I described for D-bits, pin drills and so on; rub the oval end on your oilstone until the edges of the oval are sharp, and you now have a serviceable reamer, which will do the trick as well as one purchased in the tool store at an outrageous price, which, incidentally, is no fault of the unfortunate tool merchant. He had to buy it first! Don't put the reamer through by hand; chuck the body, and put the reamer in the tailstock chuck.

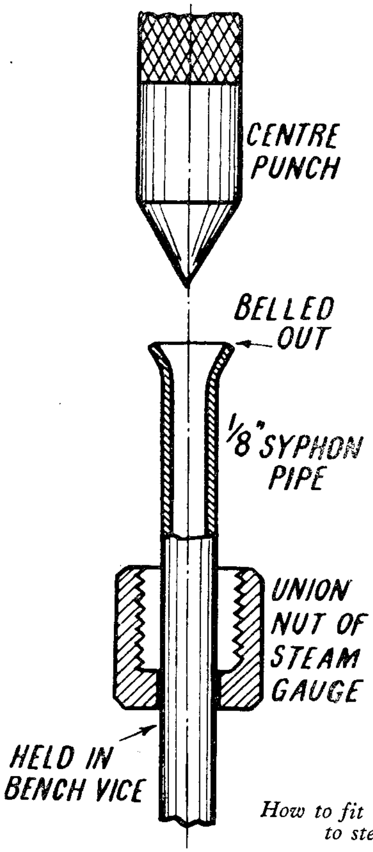
To make the bottom plug, chuck a piece of $\frac{5}{16}$-in. hexagon rod in the three-jaw. Turn down $\frac{3}{16}$ in. of the end, to $\frac{3}{16}$ in. diameter, and screw $\frac{3}{16}$ in. × 40. Face the end off truly. Part off at $\frac{1}{4}$ in. from the shoulder. Reverse in chuck, holding either in a tapped bush, or by the hexagon, which you like. Turn down $\frac{1}{8}$ in. of the end, to 7/32 in. diameter, and screw 7/32 in. × 40. Tip: I've mentioned this before, but it will bear repeating for the sake of the many new recruits who have joined the ranks of the locomotive builders. If your die is what the kiddies call "a bit wonky," and is inclined to tear the first thread or two when starting a cut, turn the job over-length, for a kick-off. Then, when the screwing is completed, you can face off the damaged threads until the screwed part is of the desired length, with a good thread all the way.

Centre, and drill right through with No. 40 drill; then open out to a bare $\frac{1}{4}$ in. depth with No. 24 drill, and chamfer the corners of the hexagon. Seat a $\frac{1}{8}$-in. rustless steel ball on the D-bitted end of the 3/32-in. reamed hole, same as described for pumps. Wind up a spring from 24- or 26-gauge bronze or hard brass wire, on a No. 48 drill shank, if you like, or around a bit of 14-gauge spoke wire; the spring should be an easy sliding fit in the socket. File both ends of the spring off square, and assemble as shown in the sectional illustration. The spring should just start to compress as the threads engage, and a smear of plumbers' jointing, on the last couple of threads nearest the shoulder, will render it steamtight.

To allow steam to pass to the whistle, the ball is pushed off its seating by a little plunger operated by a handle, as shown in the drawing. Chuck a piece of $\frac{3}{8}$-in. hexagon rod in three-jaw; face the end, centre, and drill down a bare $\frac{1}{2}$ in. with No. 48 drill. Turn down $\frac{3}{16}$ in. of the end to 7/32 in. diameter, and screw 7/32 in. × 40; part off at a full 7/32 in. from the shoulder. Cut a $\frac{1}{16}$-in. slot 5/32 in. deep, right across two of the flats; this may be milled by any of the methods already given, or cut on a planer or shaper with a $\frac{1}{16}$-in. parting-tool in the clapper-box. It can also be cut by hand; an Eclipse 4S tool is the boy for that job, with a $\frac{1}{16}$-in. slotting blade in it, or you can make a slot with two hacksaw blades side by side in the frame, and finish with a thin flat file. Many routes lead to the same destination! File off the two corners of the hexagon opposite the slot, so as to leave the end oblong, as shown in the view of the cab fittings.

The lever is made from $\frac{3}{16}$-in. round rod. Nickel-bronze (German silver) is the best for this, as far as appearance goes, but any other non-rusting metal will serve. A bit about $1\frac{1}{8}$ in. long is needed; chuck in three-jaw, and turn the grip to size and shape shown. The rest is filed flat, to fit easily in the groove in the end cap. Note the way the end is filed (like the ends of the arms in the old L.B. & S.C.R. slotted-post signals) the idea being that this catches on the bottom of the groove or slot, and prevents the lever flying right back and letting the pin come out. Two or three of the "foreigners" who have run on my road, have lost their whistle plunger pins for lack of this precaution.

The pin is just a short length of 15-gauge bronze or hard brass rod, the length being obtained from the actual job. It should stand up above the bottom of the groove, about 1/32 in. or so. Drill a weeny hole (I use 57 drill) across one corner of the plug, put the lever in place with the tail just clearing the groove, and the side of the flat part touching the plunger. Make a mark on the lever by putting the drill through the corner hole. Remove lever, drill the mark one size larger, replace lever, and pin it with a piece of wire; I use a piece of a domestic blanket pin, which is a drive fit in a 57 hole, and a working fit in a 56. If the lever is depressed, the ball is forced off its seat, but will reseat again as soon as the lever is released. It does so with such alacrity, that if you don't put the tail on the lever, it will fly right back, and the plunger will promptly emulate a rocket on Guy Fawkes night.

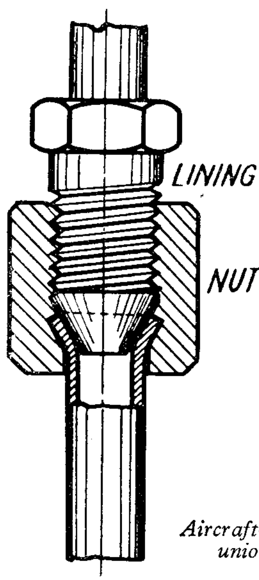


How to fit syphon pipe to steam gauge

How to Erect and Connect Up

On top of the backhead, directly above the regulator-rod, drill a 5/32-in. hole in the wrapper, close to the edge, so that the hole goes through the backhead flange. Tap $\frac{3}{16}$ in. × 40, holding the tap vertical, and screw in the turret with a smear of plumbers' jointing on the threads. When tight, the handle should be square with the boiler and parallel to the backhead; ditto the three unions. Be careful not to strip the thread in an endeavour to get it around to correct position; if more than one-third of a turn is required, file the hole slightly flat (says Pat) on top of the wrapper. Incidentally, did you know that Pat's definition of nothing, was a bunghole with no barrel around it?

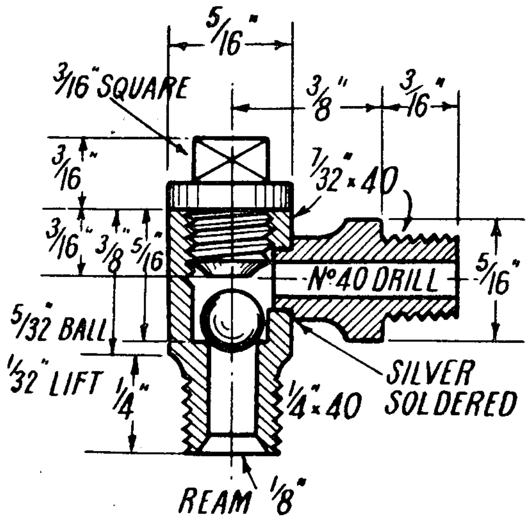
The illustrations of the backheads of both larger and smaller boilers given in the last *Tich* instalment, show clearly how the unions are connected up. It would be best to purchase the steam gauge from one of our approved advertisers. I have given instructions for making these gauges, and many of the more experienced locomotive builders have made their own; but it is a ticklish job for a beginner, and anyway you would need a full-sized steam gauge to calibrate the little one—and thereby a hangs tale. In my early locomotive-building days, the fitter at the locomotive sheds, whose particular job was to attend to defective steam and air gauges on our engines, asked what was the relationship between the pressure indicated by the gauge on my little engine, to that on a full-sized one. I told him the little gauge showed absolute pressure, same as full-size; but he laughed derisively at the idea of 80 lb. per sq. in. in a boiler about 3 in. diameter. I said, "All right, Mr. Cleverdick, you borrow a full-size gauge and bring it around home; and I'll bet you what you like, that if it is connected up to my little boiler, it will show exactly the same pressure as the little one." He thought I was pulling his leg, but finally consented. When I got up steam, with the big gauge connected, and



Aircraft-type union

the hand on the big gauge began to walk around the scale, the look on his face was what the school kiddies called "worth a guinea a box"; and when the safety-valve finally lifted with his gauge showing 85 lb. and mine 80 lb. only (it proved to be a wee bit "slow") he gave me best. However, I had to explain the difference between pressure and volume (something the "scale pressure" merchants haven't grasped, to this day!) before he could thoroughly understand how a given pressure was equal both in a weeny boiler and its full-sized relatives.

A piece of ⅛-in. copper pipe is used to connect the gauge to the union on the turret, and this needs a U-shaped bend in it, which is known as a syphon, though it doesn't syphon anything, says



Check-valve or clackbox

Pat. After the first steam-up, the bend is full of condensate water, which remains in it, and prevents hot steam getting to the gauge and affecting the accuracy of "the works." If the flattened C-shaped tube in the gauge becomes overheated, it loses some of its springiness, and will not return the gauge needle to what the kiddies call "freezo" when the boiler is cold; a very common fault with small steam gauges. Steam presses on one end of the water in the syphon, and the water transfers the pressure to the C-tube, allowing same to remain cool. One end of the syphon pipe has a ¼-in. union nut and cone, made in the same way as those described for the mechanical lubricator oil pipe; this is connected to the left-hand union nipple in the turret. The purchased gauge will have what the catalogue calls a "nut and tail pipe" attached, the nut being just an ordinary union nut, usually 2-B.A. on most ¾-in. commercial gauges; the tail pipe is a bit of 3/32-in. tube about ¼ in. long, with either a cone or flat collar on the end inside the nut. This is supposed to be attached to the end of the syphon pipe, but it looks rather botchy if attached thus, so I usually dispense altogether with the tail pipe, and connect the gauge directly to the syphon, in the following simple way.

Chuck the nut in the three-jaw, and put a No. 30 drill through the hole where the tail pipe went through. File the end of the syphon pipe off square, poke it through the hole in the nut, and bell it out slightly by driving in something with a blunt taper end; the point of your centre punch will do the trick. Note, it only requires belling out enough to fit in the threaded part of the nut; if you overdo it, file off a little around the outside of the bell. Pull it down inside the nut, screw same on to the gauge, and Bob's your uncle once more. The belled-out part, being soft, will make a steam-tight joint with the bottom of the gauge screw. Curiously enough, although I used the wheeze long before the invention of that wonderful machine which has been prostituted into the greatest curse of mankind, a similar union is common in aircraft work, the only difference being that the end of the screwed part is pointed, and fits inside the belled-out part of the pipe, the nut crushing the bell on to the cone.

The connection between the right-hand union and the blower valve, is made in the same way as the oil pipe on the mechanical lubricator, except that the nuts and cones are made to suit the larger nipples; see illustrations of backheads.

Variation for Horizontal Turret

The only differences in the construction of the horizontal turret are, that the end plug is solid, and a third connection is made between the two bottom union nipples for screwing into the boiler. Make the body part as described above, but in between the two bottom holes, drill a third one at right-angles. Chuck a bit of 5/16-in. hexagon rod in three-jaw; face, centre, and drill down about ⅝ in. depth with No. 40 drill. Turn down 3/16 in. of the end to 3/16 in. diameter, and screw 3/16 in. × 40. Part off at ⅜ in. from the shoulder. Reverse in chuck holding in a tapped bush; turn down the outside to about 7/32 in. diameter, leaving ⅛ in. of the hexagon at the end nearest the screw. Turn down 1/16 in. of the outer end, to a tight fit in the third hole in the body of the fitting; press it in, and silver-solder it at the same heat as the union nipples. The end plug is made as shown in the part section, which needs no description, as the end is machined exactly the same way as the larger end of the thoroughfare plug. The turret is screwed into a tapped hole on top of the wrapper, and connected up, just the same as the vertical one.

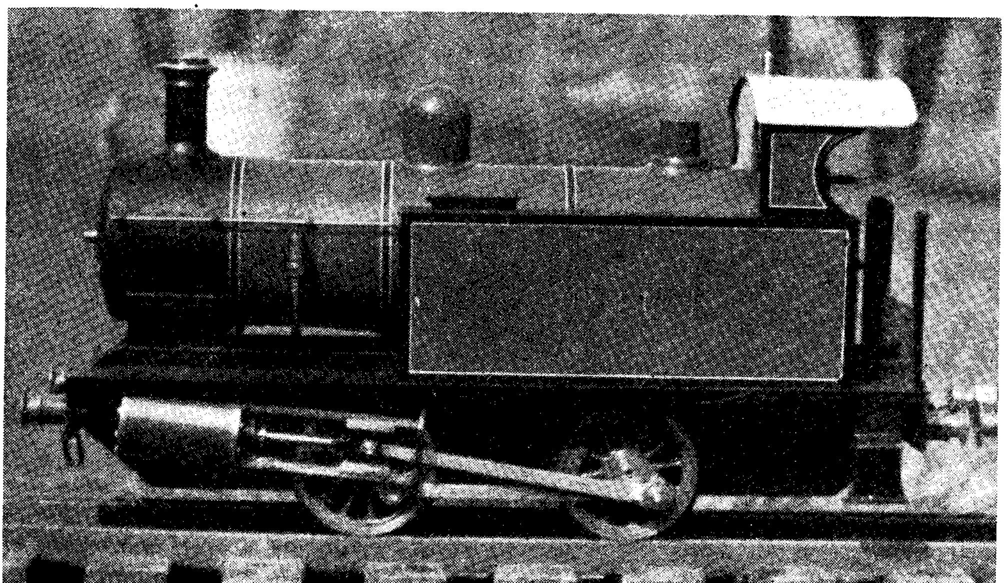
Check-Valves or Clacks

Check-valves, or back-pressure valves, are usually known as clacks, or clack-boxes, from the noise they make when working. Two are required for *Tich*, to be fitted into the two bushes at the front end of the boiler barrel. To make them, beginners will be able to put their acquired knowledge and experience to practical use, for the complete operations have already been fully described; so now let's see what you can do, if I give the sequence of those operations. Chuck a piece of 5/16-in. round rod, face the end, turn and screw ¼ in. × 40 for ¼ in. length; centre deeply, and drill down about ¾ in. depth with No. 34 drill. Part off at ⅝ in. from the end, reverse in chuck, and open out, bottom, and tap as described for whistle-valve, but to the dimensions given on

The limit of adhesion—Harry says she would pull a still bigger load if he sat on the boiler!

accompanying sectional illustration. Ream $\frac{1}{8}$ in., then drill a 5/32-in. hole in the side, and make and fit a side connection, same as the bottom one in the horizontal turret, or the top fitting of the water gauge, silver-soldering it in.

After cleaning up, seat a 5/32-in. rustless ball on the hole as shown, then turn and fit the top cap, taking depth of ball, and allowing for 1/32 in. lift, same as for the pumps. Make the cap from round stuff instead of hexagon, and part off $\frac{3}{16}$ in. from the shoulder; then chuck it in a tapped bush, and file a $\frac{3}{16}$-in. square on the end, by the same process described for the squares on the ends of the valve pins, where the wheels fit. Most big engines with clacks on the side of the boiler, have squared covers to the clacks; all ours on the L.B. & S.C.R. were made thus. When you have made them both, screw them into the bushes on the boiler barrel, with a smear of plumbers' jointing on the threads. If they are more than $\frac{1}{4}$ turn out of vertical, when tight, don't strain the threads, but file a shade off the contact faces of the bushes, or take off a scrape with a $\frac{3}{8}$-in. pin drill.



A "Juliet" built by Harry Allen, of Toronto

PRACTICAL LETTERS

Marking Clock Dials

Dear Sir,—I have just constructed the battery-driven electric clock by Mr. C. R. Jones, and an excellent clock it has proved to be, especially with the later modification of the cranked pendulum-rod which brings the trigger in centre-line of pendulum.

Owing to my lathe being small ($2\frac{1}{2}$ in.), I could not construct the dial as directed, and had to resort to hand work, and I thought perhaps the following description might be useful to other readers.

The 16-gauge brass plate was first marked out with compasses to design, the minute circles being inscribed hard in, also the bottom circle. The centre circle was then cut out and the edges trued with a file, and the minute circle band was divided into 60 divisions. These also were scribed in hard with a scriber and the whole plate was then polished.

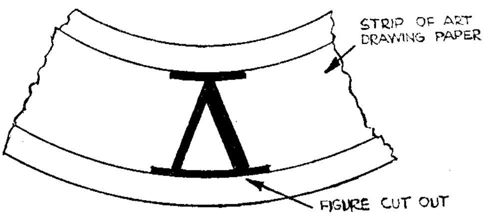


FIG. 2

The figures were next tackled, and after various trials, the following method was adopted and found to give a good appearance.

A piece of art drawing paper was used, a band being struck out the same width as figures on dial. (See Fig. 2.)

Next, the figures were cut out with a very sharp pen-knife on a piece of plate glass (keep the oilstone handy to touch up the knife, as the plate glass takes the edge off a little), care being taken to keep all edges on figures nice and sharp so as to give a good appearance. The hour dots or small squares were also cut from a narrow strip of the paper.

When all was ready, the figures were coated on the back with a thin coat of Lepage's glue, and pressed into place, also the hour dots. Only a thin coat of glue is required, as too much squeezes out and proves difficult to remove.

After allowing time for setting, the figures were coated with an undercoat of paint or shellac to close the pores of the paper.

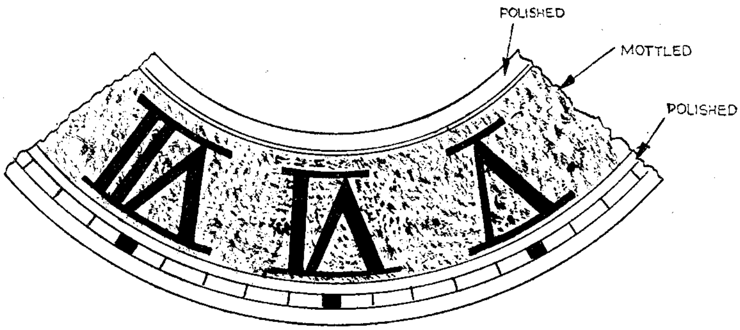


FIG. 1

After this has dried, rub down lightly with fine sandpaper, and apply a final coat of enamel paint of desired colour which is then allowed to dry. The space in between the figures was then mottled by using a narrow-pointed stick rubbed round in pin-point circles, a coating of pumice powder being fed under the stick continuously; this marks the polished surface of the brass. (See Fig. 1.)

When finished, the whole surface of the plate was given a good coat of pale gold lacquer; it is advisable to apply the lacquer immediately the mottling is finished, to preserve the appearance.

Yours faithfully,

Cambridge. A. Fox.

The Canvey Island Locomotive

Dear Sir,—The locomotive illustrated in "Smoke Rings" of February 22nd was, I consider, more of an industrial than miniature type, being almost without doubt one of two purchased by a showman of Canvey Island from the Commercial Gas Co., of Poplar.

It was his intention to "streamline" them for running in an amusement park (hence, perhaps, your reference to Canvey Island Railway), but, I believe, the local authorities stepped in and prevented it materialising owing to smoke nuisance, so there they remained for some years (when photograph was taken, no doubt) until broken up around 1938. They were built by Sharp Stewart, of Manchester, in 1895, to a gauge of 2 ft. $11\frac{1}{2}$ in., a rare size!

Yours faithfully,

Wembley. A. E. Tyler.

Small Steam Turbines

DEAR SIR,—I thank Mr. W. Brown for his letter, drawing my attention to the "Terry" type turbine, and agree that in very small sizes it has undoubted advantages. Chief among these is, I think, its lower windage loss and the fact that by cutting similar pockets in the casing it is readily velocity compounded.

In fact, Mr. D. C. Gerrard's first turbine was of this type and with it he conducted a most interesting series of experiments to determine the best number of velocity stages. If he could be persuaded to put it on paper in the pages of THE MODEL ENGINEER it would, I am sure, be a most valuable contribution to knowledge on the subject.

Since publication of my article, further developments have put the speed up to 120,000 r.p.m. under load, and at least one model engineer of greater skill than I has joined the ranks of model turbine enthusiasts. I hope there will be many more.

Yours faithfully,

Sevenoaks. D. H. CHADDOCK.

The Giffard Injector

DEAR SIR,—Mr. Porter's query about the position of Giffard injectors on top of the water tank is really not very remarkable; these injectors were designed to lift, and if one looks at photographs of locomotives during the 60's, it will be seen that as often as not the injector was fitted above the platform at the side of the firebox, about on the level with the top of the water with a full tank.

These injectors, of course, had no secondary overflow and so were not restarting; but they had a variable steam cone, quite a different matter to throttling the steam supply, and so could use a small high-pressure jet of steam that could get away from the primary overflow and create a vacuum in the combining cone. This latter was also adjustable as to position so that the rate of delivery could be varied; in fact, for the "first ever" attempt, they showed a remarkable grasp of the injector theory; even now, only the shape of the steam cone could be improved.

Yours faithfully,

Bexhill-on-Sea. C. M. KEILLER.

CLUB ANNOUNCEMENTS

P.A.D.S.M.E.E.

The February meeting of the Plymouth and District Society of Model and Experimental Engineers consisted of the usual society business, followed by a very interesting film show. The programme of four films, taking nearly two hours to show, was made up as follows: "The Transfer of Power," "A New Hobby," "British Aircraft Review," "The Cornish Engine," the latter being of particular interest in view of the many talks and discussions on the subject from time to time.

Hon. Secretary: H. A. TUCKER, 42, Cobbett Road, Honicknowle, Plymouth.

Bolton and District Society of Model Engineers

The secretary for the above club is now J. T. BOARDMAN, 2, Mesne Lea Estate, Walkden Road, Worsley, nr. Manchester.

We are holding our open exhibition at the Bolton County Grammar School, from July 28th to August 4th inclusive; we are also holding open meetings at our locomotive and car tracks at Leverhulme Park, Bolton, in May, June, July, August and September, the first meeting being held on May 13th.

Headquarters and workshop: B.W.T. Buildings, 174, Newport Street, Bolton, Lancs.

The Society of Model and Experimental Engineers' Affiliation

By courtesy of the Kodak Society of Experimental Engineers and Craftsmen, the Affiliation has arranged a social to be held at the Kodak Social Centre, on Saturday, March 31st, from 2 p.m. until about 6.30 p.m. Due to limitations of space and difficulty of catering it is, unfortunately, impossible to invite all members of all affiliated societies, but it is hoped that every society that can possibly do so will send three representatives with their lady friends.

The programme will include: cine films, display of models, drawings and photographs, visits to part of the Kodak works, power house, and the famous Kodak museum. Arrangements are being made to set up a "rummage stall" for the afternoon, and visitors will be welcome to bring along any tools, materials, models, etc., of which they wish to dispose. Such articles must have the price clearly marked on them and 1d. in the shilling will be taken as commission and paid into the funds of the Affiliation. Unsold goods must be removed at the end of the afternoon, as the Kodak Society have no storage facilities. It is hoped that visiting club members will make good use of this facility.

We look to all affiliated clubs to send along at least one model finished or partly finished. Photographs, drawings, will also be welcomed.

Hon. Secretary: JOHN W. REED, 60, Ennerdale Drive, Kingsbury, N.W.3.

Marlow S.M.E.E.

Great progress is being made in fitting out the workshop. Meetings are held at the workshop every Wednesday evening.

We should be pleased to hear from any enthusiasts who would like to join.

Hon. Secretary: J. HOBBS, JNR., "The Boathouse," Marlow, Bucks.

City of Leeds Society of Model and Experimental Engineers

A good attendance of members at a recent meeting listened to a most enjoyable talk by our hon. secretary, Mr. R. G. Colbran, on "Railway Bridges"; this was illustrated with the assistance of Mr. T. C. Laycock's episcope.

The next meeting will be held on Tuesday, April 3rd, and will be an ordinary meeting at Salem Church, Hunslet Road, Leeds, 10.

Hon. Secretary: R. G. COLBRAN, 9, Church Wood Avenue, Headingley, Leeds, 6. Phone No. 55333.

The Junior Institution of Engineers

Friday, March 30th, at 6.30 p.m., 39, Victoria Street, S.W.1. Informal meeting. Paper, "A Review of Modern Basic Machine Tools" by S. C. North. (Associate Member.)

Midland Section. Wednesday, April 4th, at 7 p.m., James Watt Memorial Institute, Great Charles Street, Birmingham. Ordinary meeting. Paper, "Engineering Practice in the Production of Tyre Moulds" by T. F. Luck. (Member.)

Friday, April 6th, at 6.30 p.m., 39, Victoria Street, S.W.1. Informal meeting. Films: (1) "Precision Machine Tools"; (2) "Metallic Bearing Surfaces." To be introduced by Messrs. S. G. Jennings and F. Baxter.

Friday, April 13th, at 6.30 p.m., 39, Victoria Street, S.W.1. Ordinary meeting. Paper, "The use of Models in Industry, Education, Invention and Recreation" by R. H. Fuller.

Friday, April 20th, at 6.30 p.m., 39, Victoria Street, S.W.1. Extraordinary meeting. Paper, "Aluminium as an Engineering Material" by E. G. West, Ph.D., B.Sc., to be preceded by a short film, "This is Aluminium."

Sheffield and District Section. Friday, April 20th, at 7.30 p.m., Grand Hotel, Sheffield. Ordinary meeting. Paper, "The Science of Dust Collection as Applied to Industry" by G. F. H. Peacock. (Member.)

Friday, April 27th, at 6.15 p.m. for 6.45 p.m., The Connaught Rooms, Great Queen Street, W.C.2. Annual dinner.

Midland Section. Wednesday, May 2nd, at 7 p.m., James Watt Memorial Institute, Great Charles Street, Birmingham. Presidential address "What is Coal?" by Professor Stacey G. Ward, M.Sc., Ph.D. (Member.)

Midland Section. Thursday, June 7th, at 7 p.m., James Watt Memorial Institute, Great Charles Street, Birmingham. Festival of Britain; special meeting to commemorate this event.