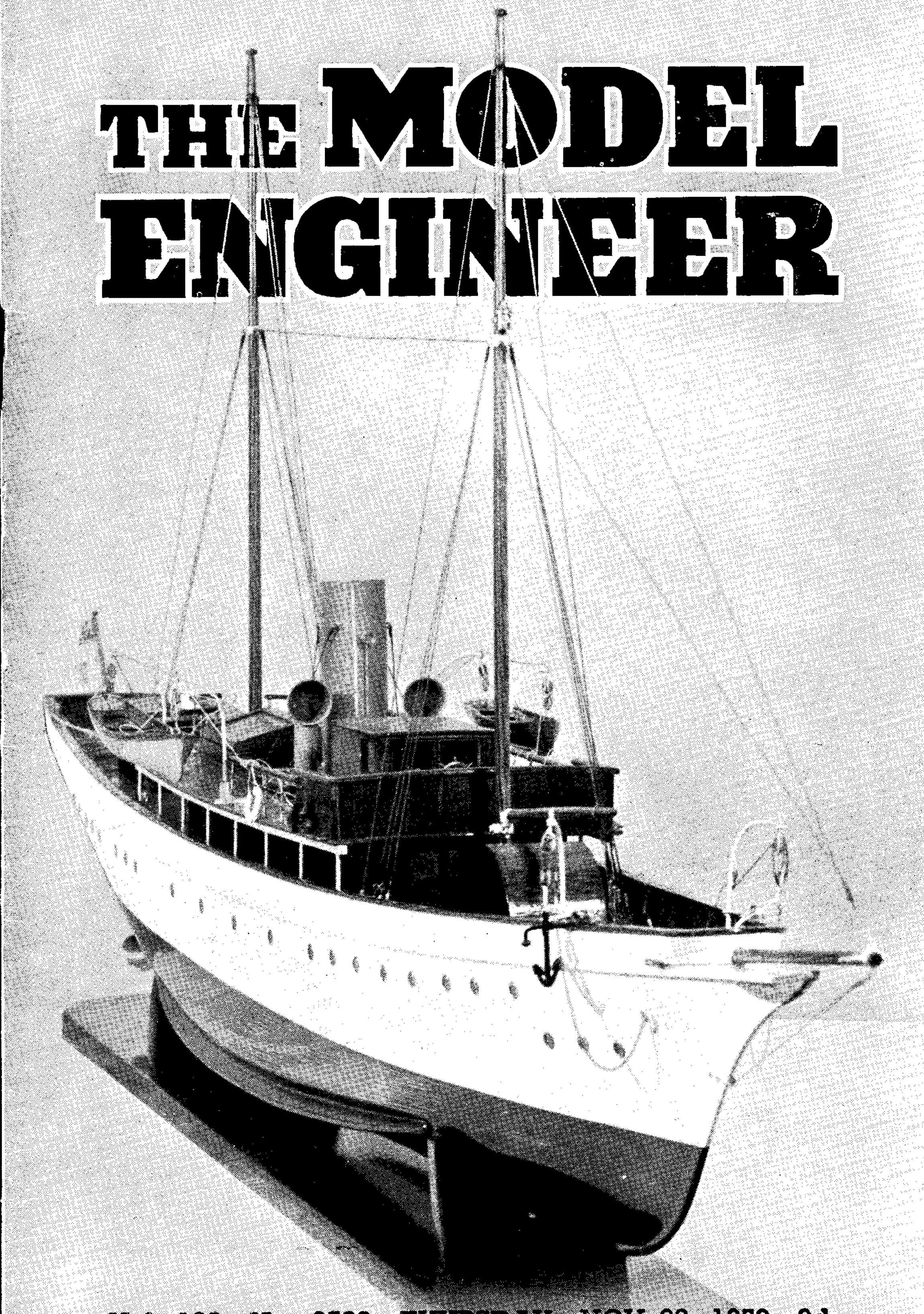
THE MODEL ENGINEER



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The MODEL ENGINEER

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

23RD NOVEMBER 1950 VOL. 103 NO. 2583

SMOKE RINGS

Our Cover Picture

● THIS WEEK we have used a photograph of the steam yacht *Iolaire* which was shown in the recent "M.E." Exhibition. It was built by Dr. T. Fletcher, of Colne, Lancashire, who holds the record of winning the Working Model Steamer Championship in two successive exhibitions. The model is not of any particular ship but is typical of the lovely steam yachts that used to grace the famous yachting centres of fifty years ago. Their slim, graceful hulls with their clipper bows, long counters and easy flowing lines were directly descended from the racing clippers of the mid-nineteenth century. Their shining mahogany deckhouses and sumptuous fittings were typical of the spacious days which, whether for better or worse, are now no more. But as prototypes for models it is difficult to imagine anything more graceful or more satisfying to the eye. Great speed is not required but the opportunity for clean artistic design and finish is not to be found in any other type of model. A good model of such a ship is a real craftsman's job and Dr. Fletcher certainly has shown us a fine example of the type.

Model Railway Exhibition at Coulsdon

● THE COULSDON Model Railway Society's annual exhibition will be held this year on December 2nd, at the Coulsdon Boys' Club, Chipstead Valley Road, Coulsdon, Surrey. It will be opened by Mr. J. N. Maskelyne at 11 a.m., and will remain open for the rest of the day. We understand there will be over 100 exhibits and a passenger-carrying track, as well as some marine and other models. Local trade firms and neighbouring societies will be collaborating in the show.

New President of the S.M.E.E.

● WE ARE very pleased to learn that the Earl of Northesk has agreed to accept the post of President of the Society of Model and Experimental Engineers in succession to Lord Forres. In the years just prior to the war, Lord Northesk was the society's president, but his wartime duties compelled him to relinquish the post. His interest in the society's activities, and in model making generally, remains undiminished, however, and he is occupying much of his spare time in the construction of an elaborate model railway in the grounds of his home; it is 10 mm. scale (Gauge "1") and is being planned in accordance with prototype practice, especially in the signalling arrangements.

His unbounded enthusiasm for model engineering, his genial disposition and his readiness to do all he can to help our hobby forward, endear him to everybody and make his resumption of the presidency of the S.M.E.E. a matter upon which the society is to be warmly congratulated

The Last G.N.R. Atlantic

● THE IVATT Atlantics of the old Great Northern Railway have, in their time, been responsible for feats of haulage and speed which must remain for ever classic in the annals of British locomotive history. Their useful life has now come to an end and, at the time of writing, only one engine of the class remains on the active list, though she is due to be withdrawn from traffic on Sunday, November 26th next. To mark the occasion, British Railways, on that day, will be running a special train from King's Cross to Doncaster, and the engine, No. 62822 (originally G.N.R. No. 294) will haul the train. There will be available accommodation for about 300 passengers, and the full programme will be: Depart from King's Cross 11 a.m.; arrive Doncaster 2.15 p.m.; depart Doncaster 4.47 p.m.; arrive King's Cross, 8 p.m. Return fare 19s. 3d. Buffet car on the train (refreshments *not* included in the fare). The down train, as already stated, will be hauled by engine No. 62822 which will thus be making her final run. The return train will be worked, it is hoped, by "A1" class Pacific, *H. A. Ivatt.* The arrangements include facilities for a limited visit to Doncaster works, where the first of the big-boilered Ivatt Atlantics, No. 251, as restored to the original design for preservation in York Railway Museum, will be on view. Other modern locomotive types will also be available for inspection. A special engine headboard, featuring Ivatt "Atlantic No. 251" will be carried on both outward and return trips. Passengers will be able to retain their journey tickets as mementos.

Tickets are obtainable now from No. 6 window King's Cross main line booking-office, and enthusiasts who are able to go on this unique trip are advised to book early, in view of the strictly limited accommodation.

Thus will admirers of the old Great Northern Railway and the far-famed Ivatt Atlantics have an opportunity of paying homage, for the last time, and in remarkably appropriate circumstances, to the final representative of one of Britain's most outstanding breeds of locomotives.

More Appreciation

● MR. A. C. NEGUS, writing from Newcastle, New South Wales, writes: "May I take this opportunity of congratulating you on the recent improvements you have made in THE MODEL ENGINEER, the arrival of every issue of which is eagerly awaited. My interest lies in the field of small locomotives, and I am endeavouring to apply the 'live steam' principles, as expounded by 'L.B.S.C.', to an 'O' gauge spirit-fired model of the N.S.W.G.R. C-36 class 4-6-0—this being my 'first attempt.' Many of the fittings which were described for the Gauge '1' L.M.R. Class 5 design (*Dot*) were suitable for this locomotive, and were duly made and incorporated in its construction. At present, the locomotive requires cab and running-boards, while the tender bogies have not been completed.

"There is also an N.S.W.G.R. C-38 class 4-6-2 in 2½-in. gauge under way, but up to the present it has only reached the stage where the chassis is assembled. Work on these jobs has been temporarily held up and will not be resumed until the workshop is installed at our new address. On completion, I hope to be able to submit photographs for your perusal.

"In conclusion, may I add that, although I have as yet limited my constructional efforts to locomotives, I read every article in THE MODEL ENGINEER, and, in addition, all the advertisements, which I find very intriguing. I hope to be able to have the pleasure of reading them for many years to come, and I can assure you that nothing will be more pleasant to me than to send my yearly subscription to the stationer. It is one of the best investments I have made. Best wishes to all who contribute to the success of THE MODEL ENGINEER."

We are sure that our contributors will wish to join us in hearty reciprocal good wishes to Mr. Negus and will look forward as eagerly as we do to seeing some illustrated descriptions of his models, in due course.

It is notable that Mr. Negus, like so many others of our overseas readers, is applying "L.B.S.C.'s" principles to a type of locomotive which "L.B.S.C." himself has never referred to. In every case of this kind that has ever come to our notice—and they add up to a respectable total—the result has been successful, and we have no reason to think Mr. Negus's example will be otherwise.

Blackburn Live Steamers' Progress

● WE HAVE received from Mr. John Fowler, the hon. secretary of the Blackburn and District Live Steamers, the welcome news that the full circuit of the society's 330-ft. track has now been completed. Several trial runs have been made, and results show that it is a good road. On one occasion, an average speed of 8¼ m.p.h. for one lap was recorded, though the comparatively small radius of 35 ft. on the curves tends to restrict the speed of 3½-in. gauge locomotives.

Arrangements are being made for members to meet at monthly intervals for the exchange of views and news, and it is hoped that next summer will see the completion of the steam-raising plant and test track; there is also to be a clearing-up of the site, in preparation for an opening ceremony.

Mr. Fowler adds: "Although the Blackburn and District Live Steamers' locomotive production falls short of that of the Brighton Society's total of 43, we can say that, from a club membership of 15, we have 11 locomotives completed and 13 under construction, all of them for either 2½-in. or 3½-in. gauge; and I gather from members that 'orders' are likely to keep the 'shops' in full production for some time to come."

We think this is an excellent record; we are not sure how many active locomotive enthusiasts there are in the Brighton society, but we would be interested to know the ratio of number of builders to number of locomotives built and building. In Blackburn the ratio is 15 to 24 at present, or not quite two locomotives per member.

An Electric Timing Apparatus
for Model Power Boats

Made and used by The North London Society of Model Engineers

by L. V. Raxworthy

WHEN a model engineer has made a high speed power boat or hydroplane the question of how fast it goes (?) is sure to arise. There are several ways of finding an answer. The simplest is probably by means of a stop-watch which can, in skilled hands, give fairly close approximations, but it is obvious that when high speeds have to be accurately recorded, something less dependent upon human judgment and response is called for. In the apparatus about to be described, an attempt has been made to eliminate the human element by making the action entirely automatic, and also to provide a permanent record of performance. For the purpose of description, the equipment will be described under a number of convenient headings.

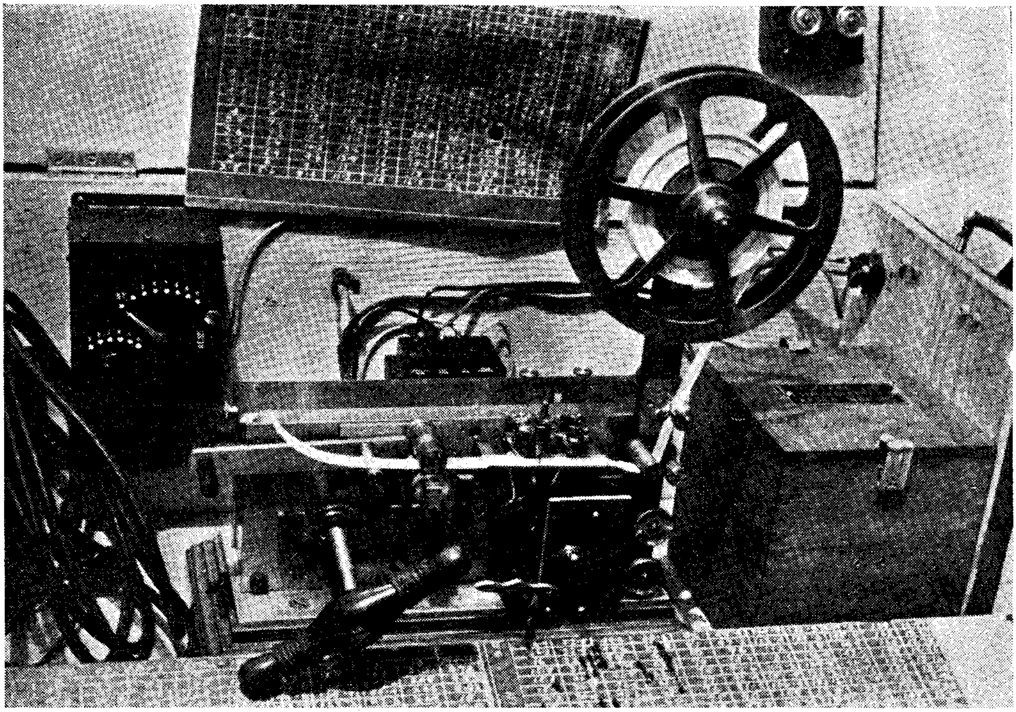


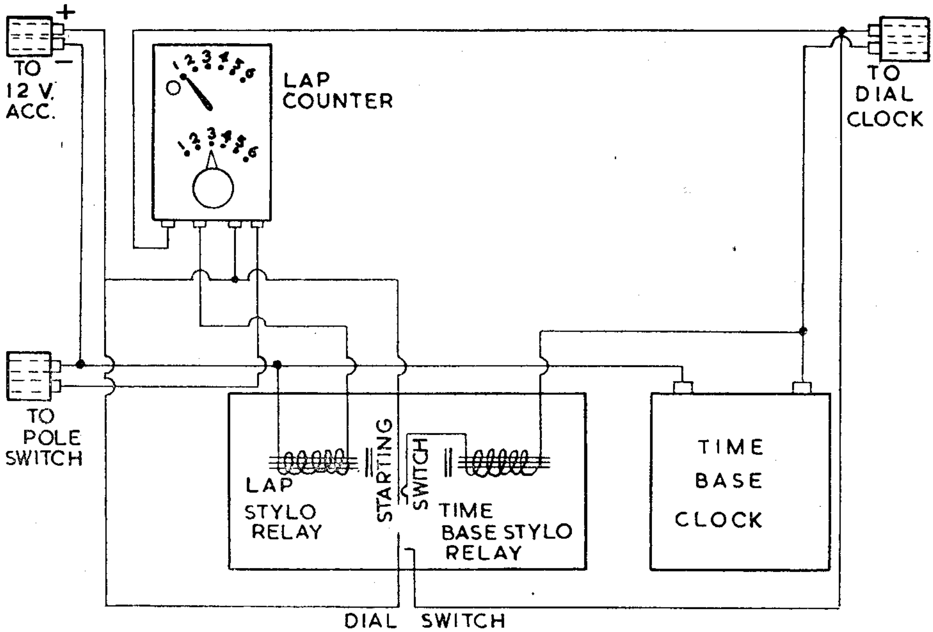
Photo by courtesy] [*" News Sheet," N.L.S.M.E.*

The timer ready for use

Recorder

This is derived from a clockwork-driven morse inker. When first acquired, this was found to have a double-pole electromagnet to operate an inking roller. This was dismantled and rewound to form two independent magnets which were each made to operate on separate stylus arms, one for the time base and the other for lap impulse recording. A paper recording tape is drawn along a nickel channel under the two pens. Provision is made for raising and lowering the pens on to the paper. The pens are left in contact with the paper while the time recording only is taking place. " Uno " medium standard pens are used and have given every satisfaction. Ink caused some worry, but after considerable experiment it was found that barograph ink was the most suitable, as it runs freely and dries quickly on the paper strip, and also does not clog the pens.

A strip of recording is shown. It will be seen that the time base takes the form of " battlements " each of ½ sec. duration. The lap record-



The wiring diagram

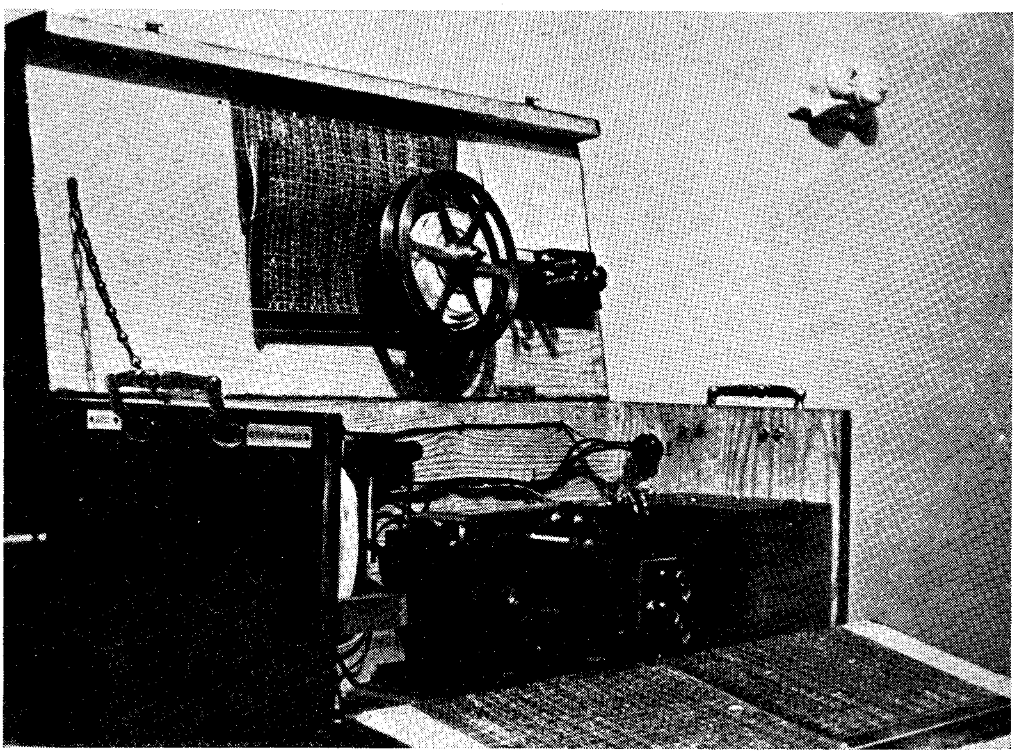


Photo by courtesy] [" *News Sheet,*" *N.L.S.M.E.*

The timer, showing the tape reel packed away

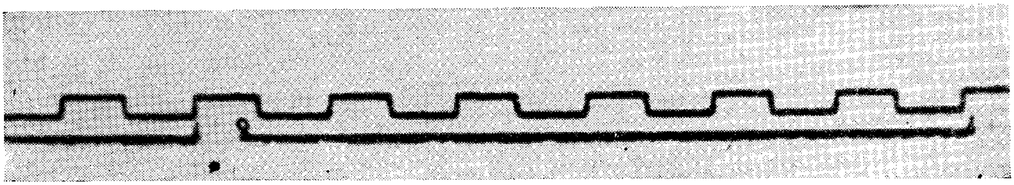


Photo by courtesy] [" *News Sheet*," N.L.S.M.E.

The time strip, showing time base and lap count

ing is shown by the continuous line. The time taken for the boat to complete one lap is from the beginning of the line to the start of the next. Conversion from time to m.p.h. is simply a matter of reference to a time-speed chart.

Time Base

A Venner ½-sec. impulse clockwork mechanism is connected to one of the stylus operating coils and it also controls the visual indicator. A switch causes the recorder and visual indicator to come into action simultaneously.

Lap Counter

This part of the apparatus may be broken down into three parts, the first being the pole top. This has a loose revolving head to which the boat is attached by means of a line. During 5 deg. of its rotation, a micro switch is depressed which causes the lap-recording stylus to be lifted momentarily from the tape. The angle of 5 deg. was arrived at after considerable experiment, it being found that a smaller angle was not sufficient for a signal to operate the electromagnet when boats were travelling at high speeds.

The second part is the actual lap counter, and it may be seen in the photograph on the left of the recorder. An arc of six numbered studs are set on a square black panel, and a pointer moves over one stud on the completion of each lap. Thus is provided visual indication of the number of laps run. If more than six laps are required, a key is depressed which returns the pointer to zero. This key is also used to reset after each recording.

The third part is the lap predetermination device which is used when a set of number laps is being run. By its use, recording will auto-

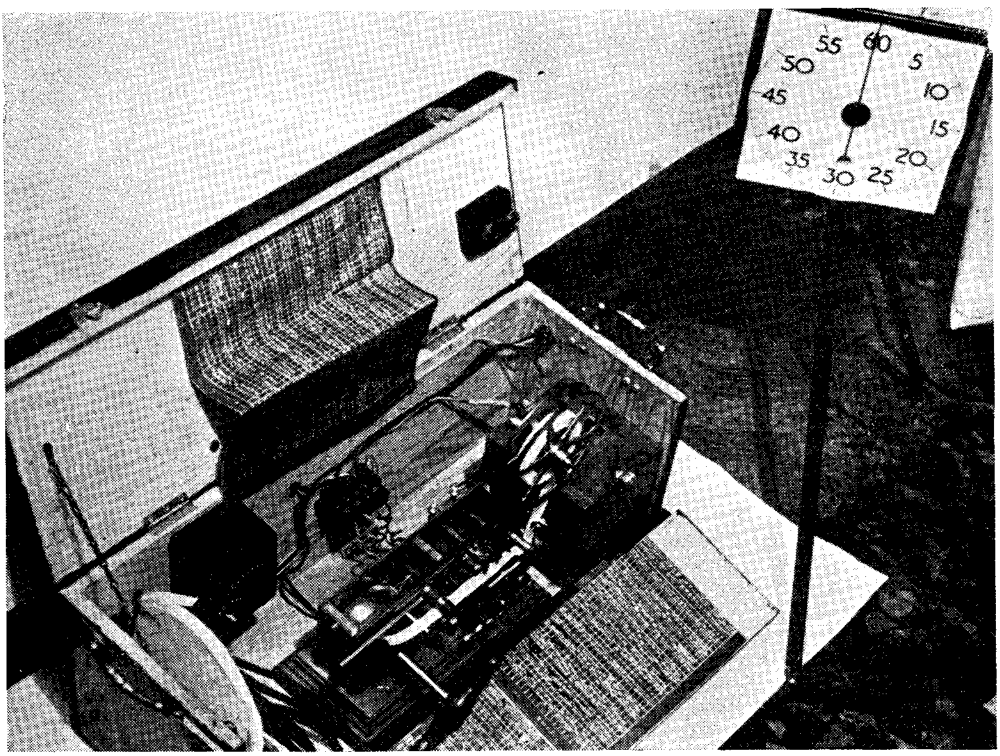


Photo by courtesy] [" *News Sheet*," N.S.L.M.E.

A general view of the timer

matically cease after a predetermined number of laps up to six, even though the boat may continue to run. In the photograph it is immediately below the actual lap counter.

Visual Indicator

This is a large 60 sec. clock mounted on a tripod. Its purpose is to create public interest in the timing of boats. It is made from a

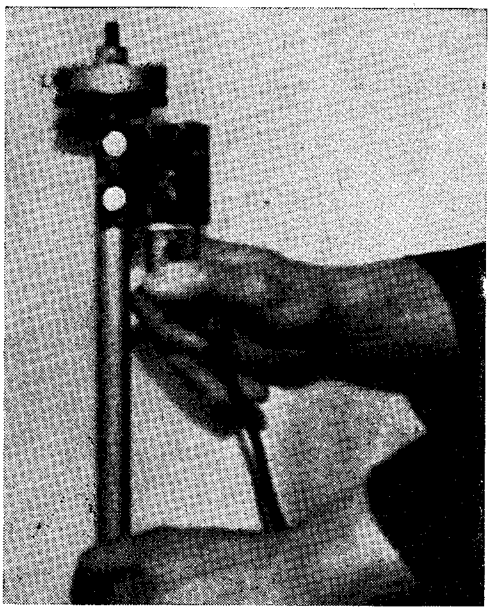


Photo by courtesy "News Sheet," N.L.S.M.E.
The pole, showing micro-switch

synchronome slave clock, and as already mentioned, it is controlled by the Venner ½-sec. impulse clock. Time is shown in seconds for the period of recording. Provision is made for resetting the point to zero.

For timing nomination events, a switch is provided which allows the rest of the machine to

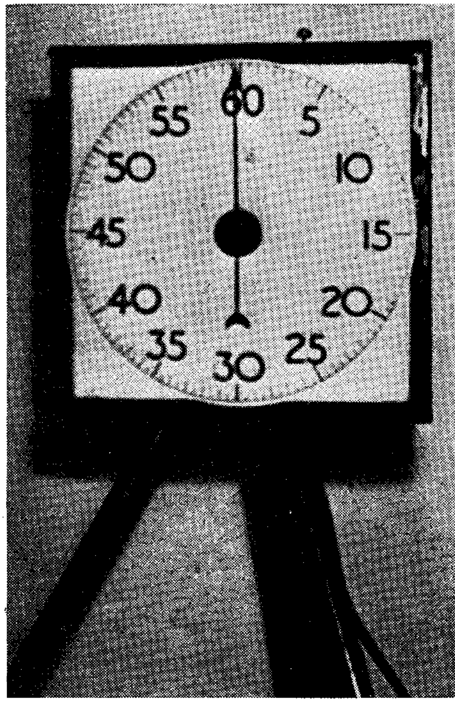


Photo by courtesy "News Sheet," N.L.S.M.E.
The visual indicator

be isolated so that only the visual indicator is in operation.

A 12-V accumulator is used for power.

The timer is essentially a piece of club apparatus, and should any society contemplate the construction of similar equipment, the Science and Research Section of the N.L.S.M.E. will be happy to assist through the good offices of THE MODEL ENGINEER. It would also be possible to supply copies of the time/speed chart as used with this apparatus.

The "Silver Ghost"

Mr. N. D. Willoughby writes :—"It was with great interest that I read the article by C.W.M. in the October 12th issue of THE MODEL ENGINEER. From 1906 to 1913 my family lived at Knutsford in Cheshire. Mr. F. H. Royce also lived there, and I well remember his beautiful 'Silver Ghost' sneaking along in truly ghost-like fashion. Many of the larger cars of that era were chain-driven and were extremely noisy, a typical example being the famous 40-h.p. Daimlers, aptly known as 'The Roaring Forties.'

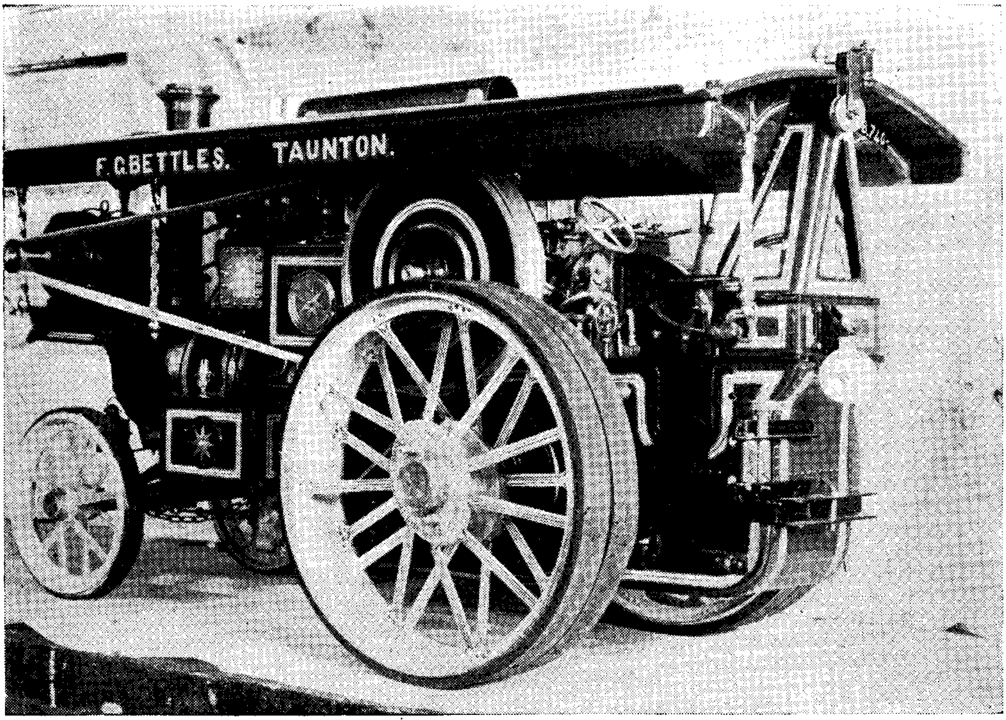
The detachable rims on the 'Ghost' are 'Shrewsbury & Challoner,' made by Shrewsbury & Challoner Co. Ltd., of Ardwick, Manchester and Page Street, Westminster, of which firm my father was a director and my brother (the late G. S. Willoughby), London manager, until the firm was absorbed by Charles Mackintosh Ltd., in, I think, 1915. The rims were very reliable and easily changed by undoing eight nuts and removing a steel flange on the outside of the wheel rim. They were fitted to many makes of cars, including a number of London taxis and they were popular with the drivers of the latter, who were not permitted to ply for hire when a Stepney wheel was in use, but could, of course, carry on with the spare rim fitted."

*A $1\frac{1}{2}$-in. Scale Showman's Engine

by F. G. Bettles

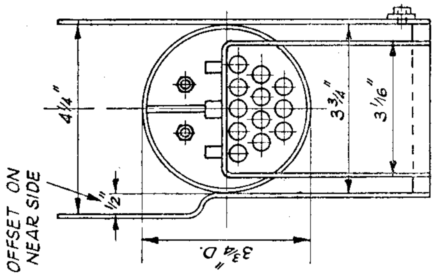
THE motion-bracket must now be set up as for the saddle. It must be put on a circular angle-plate and marked on the centres and the weighbar shaft hole. The valve-rod bearings and weighbar shaft-bearing holes must be bushed to get the exact centres matching the cylinder-rods. Measure over the rods with a micrometer, subtract half the diameters, and this will give the exact centres. As the cylinder-block may be a few thous. out., set out with the height gauge, or the scribing-block, as it is important to get these centres as accurate as possible. The slide-bars are let into slots, the bottom bar is fixed by a cheese-head screw with an undersized head. The top has to be opened out to 5/32 in. to allow a screwdriver to pass it for tightening up. The top bar is held by a shoulder-screw, 3/32 in. in diameter, to hold the bar. This is increased to 5/32 in. with a hex. head on top for pulling up. In truing up the slide-bars, a few shims may be required.

We must now look at the boiler and see what has to be done to it. "L.B.S.C." has given enough instructions as to the flanging and building of boilers, so this matter need not be described fully. There is a good deal of difference in a traction engine, and my way of dealing with this may be helpful. The big boilers are made of several rolled plates ; in the small boilers, however, it is important that there is as little obstruction as possible to keep the circulation free. As the boiler is lagged, as far as the barrel is concerned, I use a plain tube $3\frac{3}{4}$ in. o.d. This is flanged out at the smokebox end, to carry the smokebox, and is cut out where the throat plate will come ; the rest is carried right back to the backhead. It is cut lengthways about $\frac{1}{2}$ in. below the centre-line on each side for the double row of rivets used to hold the barrel to the horn-plates. The throat plate is first put in, riveted and silver-soldered. I follow this with the back-head ; but this is only riveted and silver-soldered round to where it meets the horn-plate joint. It is important to see that it winds with the throat plate as the boiler will otherwise be twisted on the firebox shell.

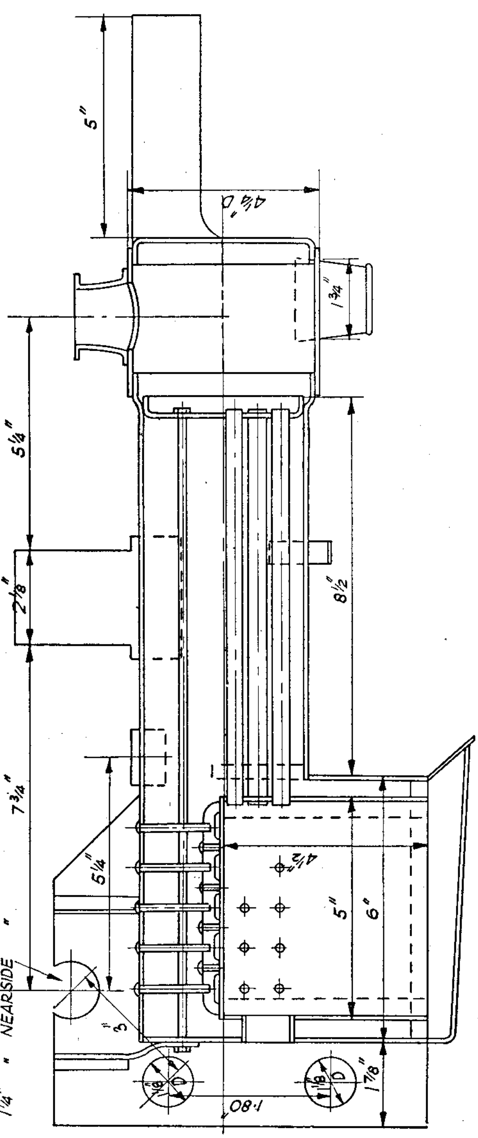


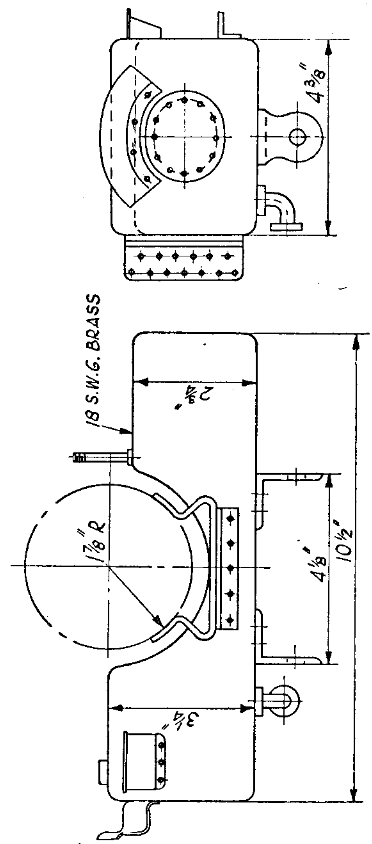
A three-quarter rear end view

**Continued from page 720, " M.E.," November 9, 1950.*



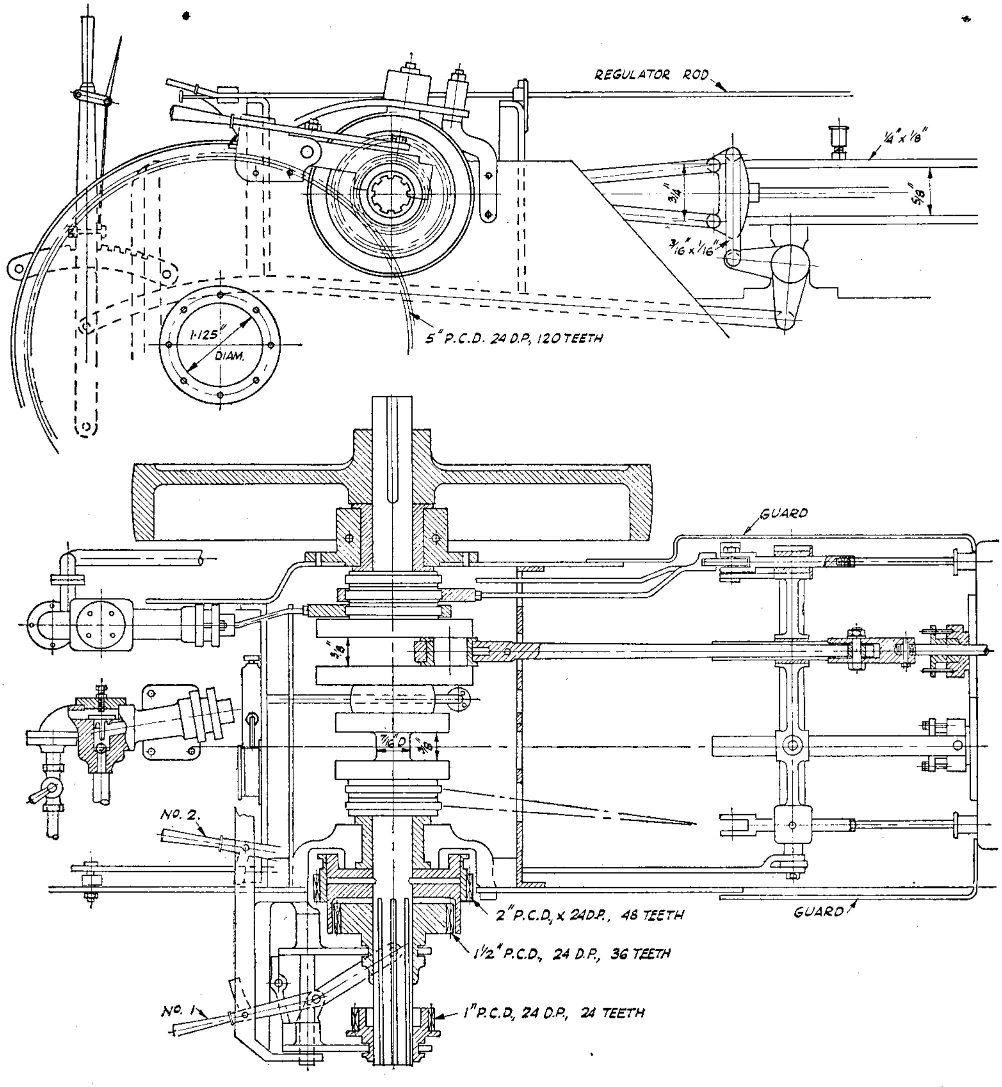
Fix the horn-plates on with cramps and line up. Take your time over this, making sure that you put both sides on together. Put on your rivet lines and stagger the riveting by putting a few in on one side and then in the other. I found that this method kept it true. It is as well to scarf the barrel to a feather edge where the barrel meets the backhead and throat-plate, then the horn-plates will lie level to make a straight joint. The throat-plate is also carried beyond the centre-line of barrel to make sure of the joint. Clean the plates and flux joints well before riveting up ; the rest of the shell is now silver-soldered.





Before firebox is put in, fit the flanges for water gauge, the two top right-angle flanges for steam manifold, and top end of water gauge, the check valve seatings, blow-down valve, the side plates and support for belly tank, the exciter dynamo brackets, the two stiffening $\frac{1}{16}$-in. copper plates inside and under cylinder block, and motion bracket ; this is to get extra grip on threads for holding these two important parts.

It is necessary to see that the shell is perfectly square, making sure that all dents and bumps are removed, and then put in the firebox. Rivet and stay this, but do not put in the tubes. Many holes have to be drilled and tapped, and it is difficult to remove the chips if the tubes are in it. It is better to make the front tube-plate and the tube-plate of the firebox 3/32 in. thick, the remainder being $\frac{1}{16}$-in. or 16-s.w.g. copper. The tubes are screwed into the firebox and expanded in the tube-plate ; they are screwed 30 t.p.i. for only 5/32 in., that is, three or four that the ends in the firebox can be expanded when the tubes have been sweated up. The flanges, mentioned for the different fittings, are left untapped until they are on the boiler. A drill is then put through the copper plates and tapped out. By this method one can get a clean thread through it.

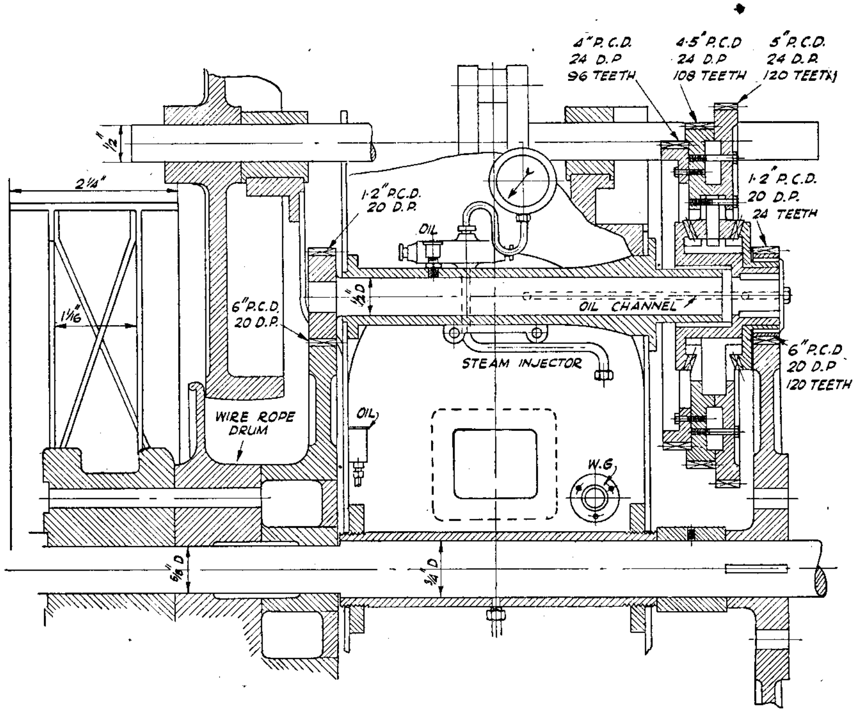


threads. Do not try to tap the firebox tube-plate before putting it in, but make a long tap out of a piece of silver-steel and tap each hole by putting this through the corresponding hole in the front tube-plate. You will have no trouble to get them in. The front end of the tubes and the flanges, etc., should be tinned and wiped off before final assembly. This is to make doubly certain

To go back a little, before the tubes are put in, stand the boiler on a surface-plate or a piece of flat glass, and, with a large square, test to see that the backs of the horn-plates are square. This can be done by standing the boiler vertically, and putting the square against the barrel. If they do not wind up they must be filed until all is correct, otherwise the tender will not fit in line with the boiler. Later, the crankshaft bearings can be marked out and tested from here.

The boiler must next be laid on its side and packed up where necessary until the barrel is exactly parallel with the surface-plate. With the height gauge or scribing block, come down $1\frac{7}{8}$ in. or exactly half the diameter of the boiler and scribe a line down the entire length of the

deep, thus reducing the shaft to $\frac{7}{16}$ in. diameter. The profile of the milling cutter must be at such an angle each side that it leaves the keys square. A broach should now be made about 7 in. long and tapering from $\frac{1}{2}$ in. to $\frac{7}{16}$ in. This is an exact copy of the crankshaft end just milled, to finish the inside of the gears that have to slide over it while this is set up for milling.



barrel. This is the high-pressure cylinder line and all measurements are taken from this line; it is very important that this line is correct. Stand the boiler upright again on the horn-plates and mark out the position of the cylinder-block, motion-bracket, crankshaft centres and transmission holes, remembering not to drill these holes before putting on the horn-plates.

The crankshaft and gear assembly is a very interesting piece of work and will give a great deal of experience of a type which seems to turn a lot of people from traction engines. Gear-cutting is not a difficult job, but it is just a long repetition of the same thing. The setting-out will probably be explained by the drawings.

The crankshaft can be made by any of the approved methods, its finished size being $\frac{1}{2}$ in. diameter, $\frac{3}{4}$ in. throw for $1\frac{1}{2}$ in. stroke. The cranks are at 90 deg., and balanced; on the gear end, there are 8 keyways, as far as the second gear, cut from the solid; the keys are $\frac{1}{16}$ in. each wide, and the space between is milled out 1/32 in.

The eight keyways should be roughly cut before forcing through the broach, as this might break, owing to the pressure required. I borrowed a friend's fly-press for this work. The broach should be put through several times, changing the position of the slot each time. The gears should now run freely on the crankshaft. The high gear drum is secured to the crankshaft by a sunk key and grub-screws, as shown. Eight $\frac{1}{8}$-in. wide keys were used to drive this gear cut on this drum. The ways were milled out to 1/32 in. deep for the keys, only 1/32 in. of which is standing up. The internal keyways in the high gear must be slotted out, while held in the lathe chuck, using the same division indexing, as used on the drum. It should now match perfectly. The keys in the drum are sunk, riveted each end, soldered in and then cleaned up. The teeth are cut by fitting gear-wheels on mandrels the size of bores. On the other end of the crankshaft a keyway $\frac{1}{8}$ in. wide is required for the flywheel. The eccentrics are locked into position by grub-screws made of high-tensile steel.

(To be continued)

CLAPPER BOX TOOL HOLDERS

by Andrew Todd

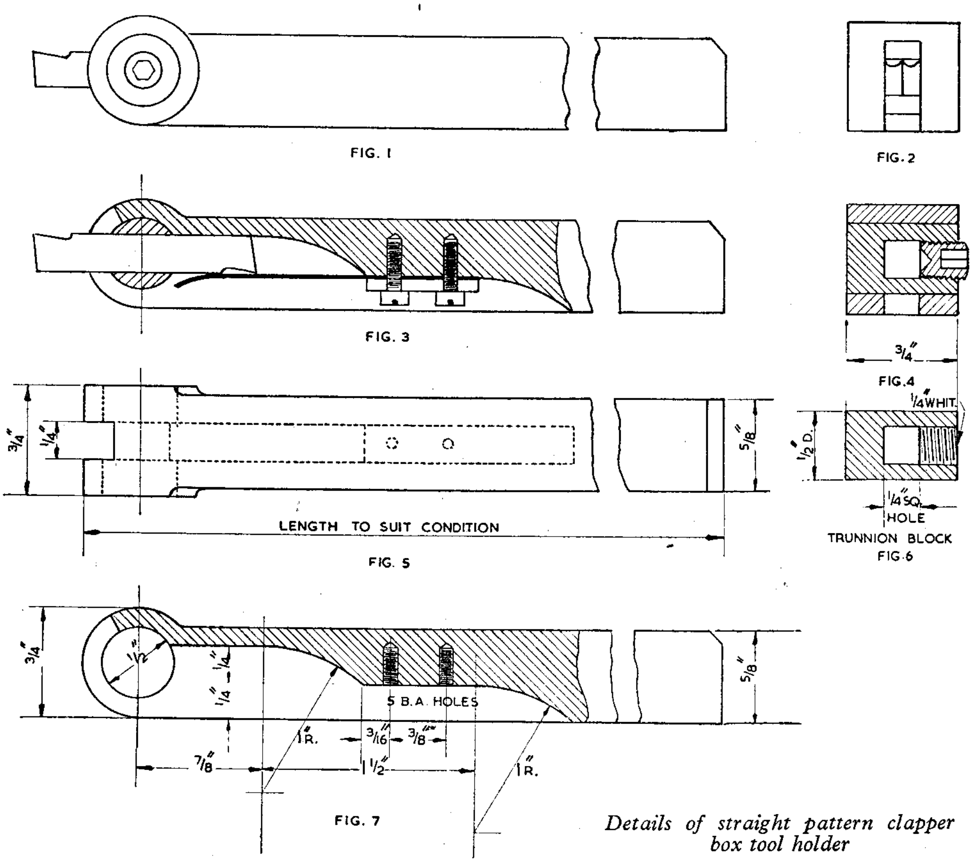
SOME time ago, I had to engrave some index dials for my lathe. The method adopted was to use a V-pointed tool lying on its side, and to "pump" it back and forth by means of the carriage rack. It was found that on the backward stroke the point rubbed off the tool. Withdrawing the tool on each backward stroke, and resetting it again was difficult and slow, as no index was available for depth of cut. This difficulty was overcome by using a backstop to the lathe cross-slide. My troubles were over when I made the tool-holders to be described. They were made specially for "pumping" or shaping in the lathe.

The drawings show the arrangement of the tools. The ideas are not new, as I have met a number of different types of these tools during the last 20 years. The design is generally neater and smaller than most of the other arrangements I have seen, and may be of some interest to readers.

The tools are designed to take short lengths of standard $\frac{1}{4}$ in. sq. H.S.S. cutters. They may be a little bit heavy for some small lathes, in which case they can be scaled down to $\frac{3}{4}$ or $\frac{1}{2}$ the size to take $\frac{3}{16}$ in. or $\frac{1}{8}$ in. sq. H.S.S. cutters.

The angle pattern, if made for $\frac{1}{8}$ in. sq. cutters, would easily go into a 1 in. diameter hole to cut a keyway in a pulley or gear-wheel, etc. Many years ago I made one to machine a splined hole in a gear wheel which had to slide on a 3 in. diameter shaft; the shaft had six splines on it. All the work was done while the gear was held in the chuck. A temporary index was fitted to the back gear for spacing splines. This job was done very quickly and was as accurate as the rest of the job, which was a very old two speed haulage gear for use in a mine.

The angle-type when fitted on the vertical slide can convert the lathe into a very useful shaper. The straight pattern is very useful on some small shapers where the clapper box is not made to swivel for side facing. Some of the work carried out by this tool was the engraving of index dials already mentioned, the making of lighter wheels, making ratchet wheels for mechanical lubricators, and the gashing of some small



Details of straight pattern clapper box tool holder

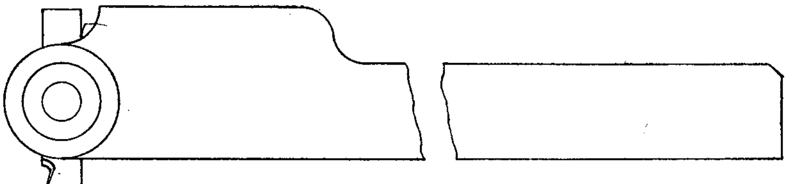


FIG. 8

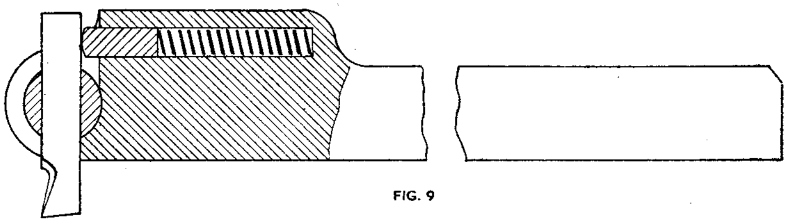


FIG. 9

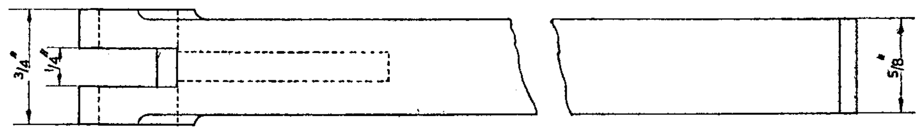


FIG. 10

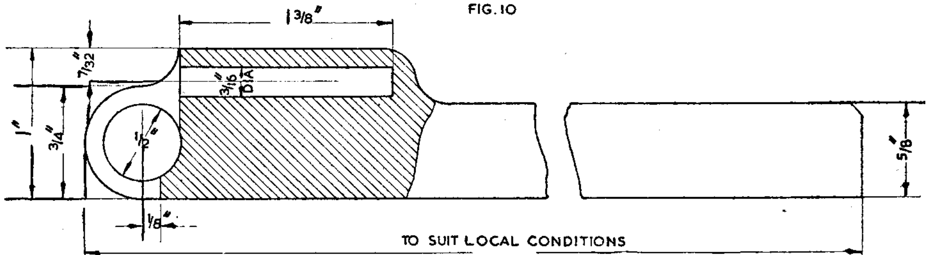


FIG. 11

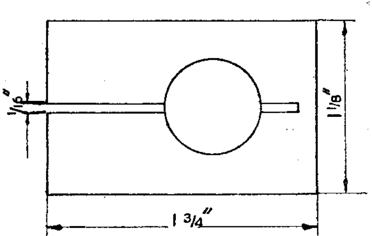


FIG. 12

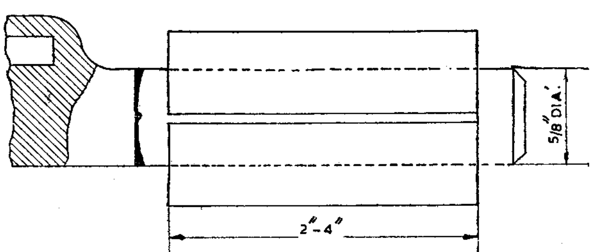


FIG. 13

Details of angle pattern clapper box tool holder

gear wheels prior to fly-cutting them. It was also used to machine the hornblocks on a set of locomotive frames, the frames being mounted across the lathe bed on a small machine vice.

The usefulness of the angle pattern holder can be considerably increased by making the shank round and clamping it with a split clamp, as in boring-tool practice.

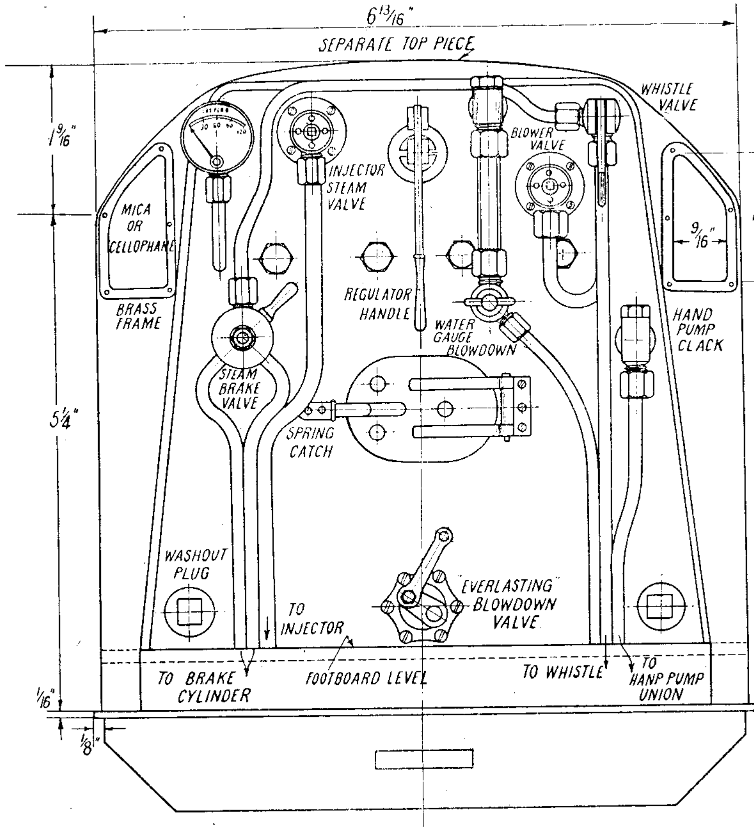
The tools are not difficult to make and none

(*Continued on page* 791)

Boiler Fittings for "Pamela"

by "L.B.S.C."

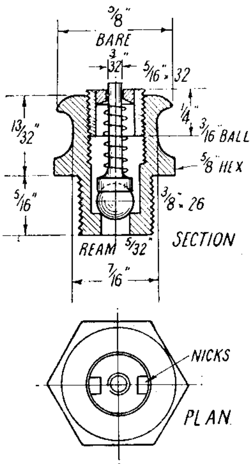
THERE isn't a wonderful lot of difference between the construction and arrangement of the boiler fittings and mountings for *Pamela*, and those of previously-described engines of $3\frac{1}{2}$-in. gauge. If I find that any component is inefficient in any way, it is ruthlessly scrapped; if, on the other hand, a component proves itself again in full detail, so I propose to skim more or less briefly through them, and call attention to any differences which are included. Full instructions for making my "standard" fittings, are given in the *Live Steam Book*; and all being well, I shall deal with the fittings and mountings for *Tich* in full detail, for beginners'



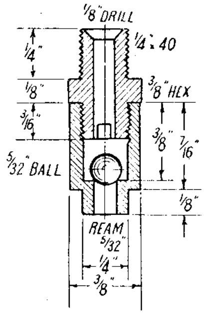
Arrangement of footplate fittings

"tried, trusted and true," in a manner of speaking my motto is "Let well alone," except for any slight improvement in detail. This has been the policy of the Swindon locomotive works for the best part of half-a-century; and our older readers don't need any reminding how the Great Western engines have always done the job, and how their "fundamentals" have been applied elsewhere. Incidentally, the same thing has happened to your humble servant's designs! There will be no need to describe all the fittings benefit, just as I have described the whole of the building of that engine to date.

An illustration of the complete backhead is given here, showing how the "handles" are set out. Owing to the height of the firebox, there is not enough clearance between the cab roof and the top of the Belpaire wrapper, for a combined turret and whistle valve made to my usual specification, so I have included a horizontal turret, with a screw for attachment to the backhead. This carries an internal pipe which extends to the top of the Belpaire firebox casing at the front end of same, and ensures that the steam is dry. If water goes over, you promptly get a blower which "sneezes" as though it had influenza pretty badly, and a whistle with a "frog in its throat." The injector steam valve is near the left-hand top corner, and has a similar internal pipe. Water going over with the steam supply to an injector, will cause



Safety-valve



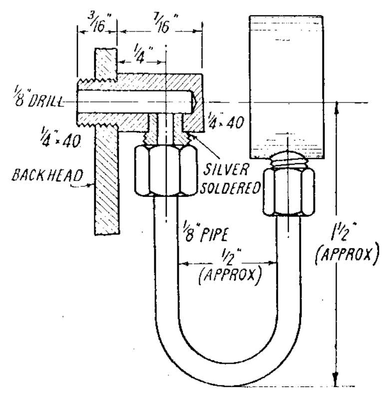
Snifting-valve

continual spluttering at the overflow, and it will be next door to impossible to keep the injector feeding on the run. Injectors which won't feed when running as well as standing, are of no use to Curly; at the time of writing, I have just come across a case of this sort. The valve was screwed into the backhead just above high-level water line; as soon as the engine got a move on, and the water started to "slosh about" as the kiddies would say, over it went, and the injector promptly went on strike. I might add that the owner of the engine had been fiddling about with the injector for a matter of fifteen months or more, when there was nothing at all the matter with it. I told him to put the injector "as-you-were," according to instructions, and fit a pipe to take dry steam from the dome. He did—and suddenly found he had an uncle named Robert. As the injector depends for its efficient working, on a jet of steam condensing in water, it stands to reason that if you supply it with water, you won't get any further condensation; a simple fact that many folk overlook.

A Water-gauge Tip

There doesn't seem anything unusual about the water-gauge until you take a look at it sideways, and then you see that the bottom fitting comes below the place where the backhead begins to slope. If the fitting were screwed direct into the plate, at right-angles as usual, the glass would miss the top part by a mile or so. It only needs a simple wheeze to get the two mountings to screw in parallel. Simply solder a washer, filed to a wedge shape, at the point where the bottom part of the gauge screws in. See that the face of the washer is parallel with the top part of the backhead; if you lay your "stick of inches" across the washer, it will show at a glance, whether O.K. or otherwise. Drill and tap clean through washer and backhead, at right-angles to the former, and the trick is done. The top part of the gauge will naturally need a longer stem than the bottom part, to bring the glands in line; this is shown in the side view. Some folk might think that the position of the bottom part, close to the inner firebox plate, would keep the glass filled with bubbles. I thought so myself, in days gone by, until I got up steam in a piece of laboratory glassware, to find out why a pop safety-valve lifted water; Curly was always plenty inquisitive, but only about things concerned with the job, and not with other people's business! It was then that I found out exactly where the steam came from; and it wasn't where most people would imagine. My engines *Grosvenor* and *Jeanie Deans* have their glasses in the location shown, and they keep so steady, and free from bubbles, that they never need blowing down on the run.

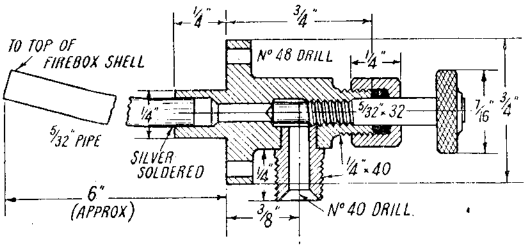
The valve to the right of the water-gauge, is the blower valve. If a steam brake is fitted, the valve for that, may be in the position shown. The steam gauge is either ¾ in. or 1 in. diameter, just as you fancy, and is attached by the usual syphon tube; the range should be from 0 to 120 lb. per square inch. The working pressure need not be higher than 80 lb., as *Pamela* will be able to "astonish the natives" quite well with that much. Only one clack is needed on the backhead, to take the feed from the emergency hand-pump in the tender. Some folk



How to fit steam gauge

can say what they like about hand pumps, and deride if they wish; but I happen to know of one case where a hand-pump would have saved a boiler from sprouting a goodly crop of Welsh vegetables. It is also handy if, in the excitement of a good run, steam suddenly drops, and you find the water in the bottom nut, and not enough pressure to work an injector, even if one were fitted. I fit hand-pumps to my engines as a kind of insurance; even if they are never used, I have the satisfaction of knowing they ARE there, if emergency arises, and a contented mind is a great asset!

The full-size " spam cans " have the " Everlasting " type of blowdown valve, as described in full detail for *Doris*, and I recommend that our " rebuild " should be furnished with a similar device. However, if builders don't fancy going to the trouble of making and fitting



Injector steam valve

one, just use the ordinary big screwdown valve, glandless, and with a squared head that can be operated by what a kiddy called a " clock key " when he saw me use a box-spanner with a cross handle to it. A good hefty washout plug is also shown, at each side.

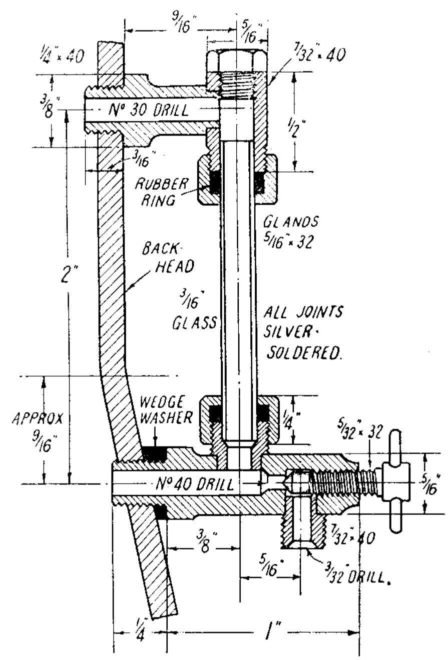
A " butterfly " firehole door *could* be installed, there is just about room for it, but the trouble would be in operating it; so the good old reliable swing door is shown, with a spring catch, and a hook handle which can be operated with the fireman's shovel. For the sake of convenience, the cab front is shown along with the backhead and the fittings; this is a plain flat one, not like the new standard British Railways type, as shown in the published illustrations of the " mock-up." Incidentally, the new standard cab *could* be fitted to this engine if desired, and would give it the anticipated appearance of the new 70,000 class Pacifics which British Railways have just announced, at the time of writing, that they are putting into production. Now let me whisper in your ear—followers of these notes are in for a big surprise when full particulars of these engines are disclosed by the " powers that be." 'Nuff sed for the time being!

External Fitments

If you fit safety-valves on the forward end of the boiler barrel, and give them the full pop action, you'll never keep any water in the boiler; so I am specifying ordinary plain valves. Top feeds are specified, and these deliver into each side of the dome casing, the pipes having short internal bends, to throw the incoming water clear of the regulator valve, and up towards the smokebox tubeplate, as we don't use trays to catch the scale and other impurities. One side takes the feed from the eccentric-driven pump, and the other takes the feed from the injector. This will be of my " standard " type, similar to the old " Vic," but much smaller; my adaptation of this type of injector is another item which others have copied, and are still copying, and claiming as their own. It has been fully described in these notes, and you can learn all about it in the *Live Steam Book*; but I have made a slight variation in the cone size and arrangement, which has a marked effect on the steam consumption. *Pamela* should be able to blow off with the injector working; and it should make no appreciable difference to the position of the steam gauge needle, if used when running—provided, of course, that the fire is normal, neither black nor clinkered up. The injector is fitted in the same location as on my *Tugboat Annie*, and as it will be fitted on the new British lion-and-wheel brand engines; see the photographs of the before-mentioned " mock-up." Well, I fancy that about covers the general field; below, you will find just a brief specification of the various blobs and gadgets on the backhead. About the " externals," more anon when we erect the boiler on the frames.

Steam Gauge

Starting at top left, we find the steam gauge. I have described how to make them in previous notes, but it isn't worth while, just for one single item, as you have to get a big gauge, and rig up a pressure tank, with valves and unions, to calibrate it. It is easier and quicker to get one ready-made and tested, from one of our approved



Water gauge

advertisers. It is attached by a syphon of $\frac{1}{8}$-in. copper tube with a union nut and cone at each end. Drill and tap a $\frac{1}{4}$-in. $\times$ 40 hole in the left top corner of the backhead; and in it, fit an elbow made from $\frac{5}{16}$-in. square or $\frac{3}{8}$-in. round rod, as shown. This is made like a blind nipple, but without tapping the inside hole; instead, drill a 5/32-in. hole in one of the facets, make a

¼-in. × 40 union screw, and silver-solder it into the hole. When the elbow is screwed in tightly, the union screw should hang straight down. One end of the syphon tube is attached to the union screw, and the other to the screw on the gauge. Soften the pipe well when silver-soldering the cones on to it, and take good care not to kink it when bending the swan neck. I always bend these small pipes by finger pressure only; result, an unmarked pipe without any kinks.

The steam brake being optional, I'll leave the description of the valve, until we come to the brake gear, and then kill all the birds at one shot.

Injector Steam Valve

This can be made from ¾-in. round bronze or gunmetal rod, or from a casting. A piece 1 in. full length is needed. Chuck in three-jaw with about 11/16 in. projecting; face the end, and turn down ⅝ in. length to ⅜ in. diameter. Turn ¼ in. of the end to ¼ in. diameter, and screw ¼ in. × 40. Centre, and drill right through with 3/32-in. or No. 42 drill; then open out, drill, and tap, exactly as described for the *Tich* blower valve in October 19th issue, page 597, except that the 5/32-in. hole for the union screw is drilled near the middle of the plain part, instead of close to the gland screw. Reverse in chuck, turn down ¼ in. of the other end to ¼ in. diameter, but don't screw it; see that the face of the flange is true instead, by taking a light skim over it. Open out the centre hole for 3/16 in. depth with No. 23 drill. Four screwholes are needed in the flange; drill them No. 48. Silver-solder a ¼-in. × 40 union screw into the side hole, and fit valve pin, hand wheel, and gland, exactly as described for *Tich* in above-mentioned issue. Tip: if anybody's fingers are especially tender, fit a cross-handle made from 15-gauge rustless steel, or spoke wire, instead of a wheel, and operate it with a piece of tube, or a piece of steel rod drilled at one end to fit over the valve pin, and slotted like the winding key of a gramophone or other piece of clockwork apparatus. The outer end of the rod can be furnished with a wheel of larger diameter than that shown on the valve pin, or another cross handle, or any means of operation that the builder fancies.

A piece of thin-walled 5/32-in. copper tube 6 in. long, is silver-soldered into the plain end of the valve, as shown, and the end bent up, so that when the valve is attached to the boiler, the tube will touch the top of the wrapper sheet, and so collect dry steam.

To erect, drill a ¼-in. clearing hole in the backhead at the point indicated; insert the end of the tube, press flange against the backhead, with the union screw hanging down, and locate, drill, and tap the screwholes exactly as described for fitting cylinder covers. Use No. 53 drill, and 9-B.A. tap; remove valve, smooth off any burrs, and replace, securing with 9-B.A. round-head brass screws, and putting a 1/64-in. Hallite or similar joint gasket between the flange and backhead.

Castings are machined up exactly the same way, the union screw being made separately from a bit of ¼-in. round rod, and silver-soldered in. If a boss for it were cast on, you couldn't turn the outside of the body; and the boss itself couldn't be turned and screwed, as the flange is in the way.

Water Gauge

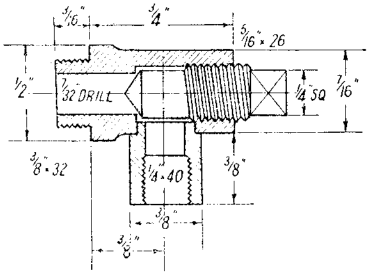
As I have already dealt with the regulator handle and gland, when describing the regulator itself, the next job is the water gauge; and the only difference between it, and those previously described, is the unequal lengths of the stems, the reason for which I explained above. The top mounting is made from 5/16-in. rod, bronze or gunmetal, and the stem from ⅜-in. rod, turned as shown, and silver-soldered into a 5/32-in. hole drilled in the side of the vertical part. The top cap is turned from 5/16-in. hexagon rod; or ¼-in. will do, if you want the fittings to look specially neat. The bottom part is made from ⅜-in. rod, turned and screwed as shown, the socket for the glass being made from 5/16-in. rod, and the blowdown screw from 7/32-in. rod. I use up all my short ends of rod on these jobs, holding the screwed parts in tapped bushes, in the three-jaw, when operating on the other ends.

If you can get hold of a bit of 3/16-in. glass tube with half the diameter white, with a red line in it, as used in thermometer work, it makes the water level very easy to read when the engine is running, as the water magnifies the red line almost to the full diameter of the glass. Some of my own engines have these glasses. If ordinary glass tube is used, the hole through it should be approximately ⅛ in. diameter. I have received complaints that the rubber packing rings which I specify, sometimes blow out. There are two reasons for this; one is, that the holes in the gland nuts are much larger than the glass tube—I know of several cases where builders have erected their gauge fittings out of line, and reamed out the holes to prevent the nuts binding on the glass; poor workmanship, that!—and the other is, that the rubber is too soft for the job. If the gland nuts fit the glass properly, and slices of fairly hard rubber tube are used, there won't be any trouble. However, a strand of hydraulic pump packing, or even graphited yarn, can be used; but don't use the stuff with which plumbers pack their stuffing-boxes on water taps, viz., tallowed hemp. It not only sets hard, and causes leakage, but the acid in the tallow attacks the metal of the fittings. When a child, I contracted a poisoned finger through getting a scratch off the kitchen tap, where the metal had corroded. Linseed poultices cured it—the old-fashioned remedies certainly did the job!

Blower Valve

The valve itself is a replica of the injector steam valve described above; in fact you might as well make the two "at one go," whilst on the job. Personally, I nearly always make three or more; if not for the same engine, they come in useful on another one—that is, if I don't give them away, "for services rendered." Instead of the tube being only 6 in. long, it must be long enough to reach to the smokebox tubeplate, and project about ⅛ in. beyond it. The tube will also need bending a little, as the nipple on the smokebox tubeplate, and the blower valve on the backhead, are not in line, although on the same level. Were it not for this, you could use the *Tich* arrangement exactly as shown in the issue mentioned above, screwing it into a tapped hole in the backhead.

In the present case, drill a $\frac{1}{4}$-in. clearing hole in the backhead, in the position shown, $1\frac{1}{8}$ in. from the top of the wrapper, and $1\frac{3}{8}$ in. from the vertical centre line of the backhead. Fit the



Alternative blowdown valve

valve in this hole, and secure it with four 9-B.A. brass screws, same as the injector valve. Make a "thoroughfare" nipple for the other end, same as described for *Tich*, and fit it exactly the same way; see illustration.

Turret and Whistle Valve

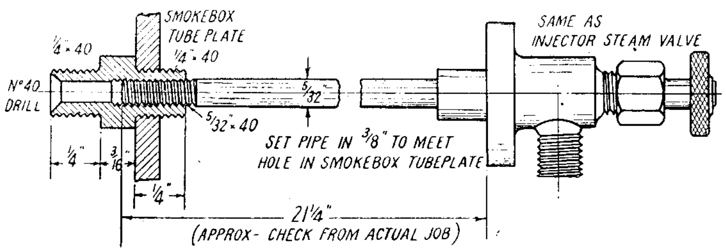
The body of the turret, which in this case isn't a turret at all, says Pat, as it isn't on top of the backhead, is made from a 1-in. length of $\frac{5}{16}$-in. round rod. Chuck it in the three-jaw; face, centre and drill right through with No. 43 drill. Open out and bottom to $\frac{3}{8}$ in. depth with $\frac{3}{16}$-in. drill and D-bit, and tap the end 7/32 in. × 40; slightly countersink, and skim off truly. Reverse in chuck, and repeat operations at the other end, except that the D-bit isn't used. Ream the remnants of the No. 43 hole with a 3/32-in. parallel reamer. The drawing shows the overall length of the body as 29/32 in., but the exact length doesn't matter a bean. At $\frac{1}{4}$ in. from the D-bitted end, drill two 5/32-in. holes at right-angles; and in them, fit two $\frac{1}{4}$-in. × 40 union screws. At 7/32 in. from the other end, drill a similar hole, and fit a 7/32-in. × 40 union screw. This should line up with the $\frac{1}{4}$-in. one which is hanging down, when you look at the end that isn't D-bitted, with the other union screw pointing to your left. The gadget is shown in place, in the top right-hand corner of the backhead, and the position of the unions can be plainly seen. Silver-solder all three at one heat.

For the bit that screws into the boiler, chuck a piece of $\frac{3}{8}$-in. hexagon brass rod in three-jaw, face the end, centre, and drill down about $\frac{5}{8}$ in. with a 3/32 in. drill. Open out for $\frac{3}{16}$ in. depth with No. 23; turn down $\frac{1}{4}$ in. of the outside to $\frac{1}{4}$ in. diameter and screw $\frac{1}{4}$ in. × 40. Part off at a full $\frac{9}{16}$ in. from the end. Reverse in chuck—you can use a tapped bush, or just grip the hexagon; please yourselves—turn down 5/32 in. of the end to 7/32 in. diameter, and screw 7/32 in. × 40. Run a No. 30 drill down the centre hole for $\frac{5}{16}$ in. depth. Silver-solder a 6-in. length of 5/32-in. copper tube in the larger end; then fit a $\frac{1}{8}$-in. ball and spring in the D-bitted end of the body, same as in the check-valve of the mechanical lubricator, and screw the cap home.

The nipple at the other end is made from either $\frac{3}{8}$-in. square or hexagon rod. Chuck truly, face, centre, drill down about $\frac{7}{16}$ in. depth with No. 48 drill, turn down 5/32 in. of outside to 7/32 in. diameter, and screw 7/32 in. × 40. Part off at $\frac{1}{4}$ in. from the shoulder. If hexagon rod is used, file away two opposite corners, and make it oblong when viewed from the end. Cut a $\frac{1}{16}$-in. slot across, and fit a lever as shown; what the enginemen would call "a pup off the regulator handle." The pin is a bit of 15-gauge rustless steel or hard bronze wire, of such a length that it just pushes the ball off the seat, when the lever is pressed right in. Trial-and-error job, that!

Bend up the end of the pipe slightly, so that it inclines upward when the two in-line unions are hanging down. Drill and tap a $\frac{1}{4}$-in. × 40 hole in the top right-hand corner of the backhead,

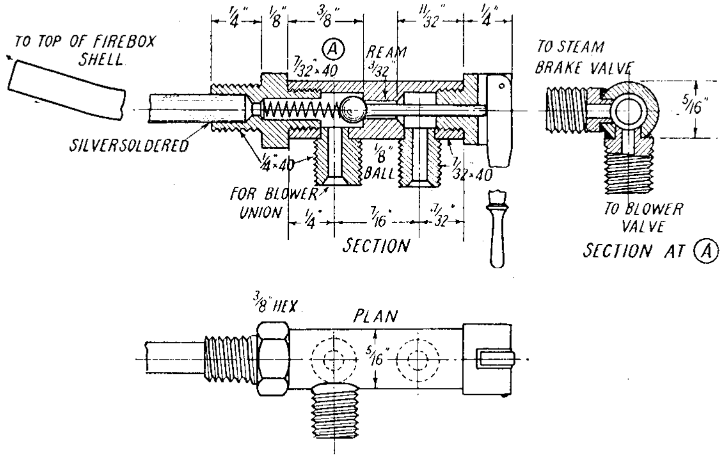
Blower valve assembly



and screw the fitting home. The bottom union screw nearest the backhead is connected to the one under the blower-valve, by a U-shaped piece of $\frac{1}{8}$-in. copper pipe with a union nut and cone on each end, as shown in the backhead illustration. Until such time as the steam brake is fitted, turn up a solid cone or "lining," from a bit of 7/32-in. brass rod, and fix it to the horizontal union screw by an ordinary union nut.

Hand Pump Clack

I've described how to make clack-boxes so many times, that regular followers of these notes should know the ritual by heart! Anyway, the illustration of the hand-pump clack for *Pamela* practically explains itself; the drilling, D-bitting, and reaming is done in a manner somewhat similar to the valve end of the turret, and the stem is fitted, same as the one on the water gauge. The ball should have about 3/64 in. of lift. Incidentally, some folk query these right-angled seatings, saying that bits of grit can lodge on them, and get under the ball, causing leakage; and they advocate the type of valve which looks like a golf ball sitting on top of a tee, which was a favourite of a designer now passed on. I have never had any trouble with the right-angled seatings, and that is why I specify them. I have tried the others, and my experience is that they won't stand up to "hard graft." When the balls get busy, as is the case when the pump has to "earn its living," in a manner of speaking, they soon make a fine hash of a frail seating. Even with only a 1/32-in. lift, the balls come down a tidy "cosh" when the boiler pressure is at 80 lb. or over. Don't forget that the tap-tap of a knocking big-end on a full-sized inside-cylinder engine, will eventually break the crank-axle, as some of the old locomotive superintendents learned to their cost.



Turret and whistle valve

Drill and tap a ¼-in. × 40 hole in the backhead, anywhere on the right-hand side; just above the level of the firehole, as shown, does nicely. Screw the clack in tightly; a smear of plumber's jointing on the threads of any of the fittings attached to the backhead, will insure against leakage.

Washout Plugs

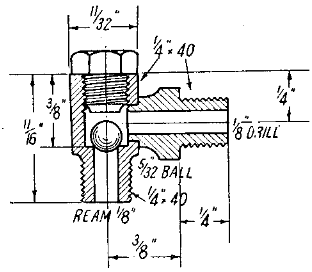
If the feedwater is chalky, or contains other impurities which "boil out" into a muddy deposit, the sludge always settles around the foundation ring, that being the lowest point in the boiler; incidentally, that is why they call it a "mud ring" on the other side of the big pond. The confounded stuff has no respect for the size of the boiler; both big and little boilers "cop it," as the kiddies would say. It is, therefore, advisable to fit a couple of washout plugs at the bottom corners of the backhead. These are turned from ½-in. rod (ordinary "screw-rod" does for a job like this, as it takes a good thread) and are just a kiddy's practice job. After turning and screwing, part off at a full 7/16 in. from the end, reverse in chuck, and grip with a full ⅛ in. projecting from the chuck jaws. The square can then be filed with No. 1 jaw of the chuck in the three, six. nine and twelve o'clock positions, using a safe-edged flat file. held horizontally with the safe-edge against the chuck jaws. Drill and tap a ⅜-in. × 32 hole at each bottom corner of the backhead, and screw in the plugs; a 1/64-in. Hallite washer can be used if desired, but I recommend a copper-asbestos one, as used for spark plugs and various other joints in automobile work. Copper-asbestos washers are made in small sizes, as a commercial proposition, right down to 3/16 in. diameter; they don't cost much, form a perfect seal, are split-proof, and can be used over and over again, with ordinary care. Nearly all garagemen sell them, and probably some of our approved advertisers will be stocking them as well. Incidentally, when I first built old *Ayesha*, now nearly thirty years ago, I used a big copper-asbestos washer to keep the smokebox door airtight, turning a rebate in the cast front ring to accommodate it. At the present moment, the rebate is packed with a couple of turns of asbestos string. The "prohpets" who gave her a week to live, should have seen her the other night, after darkness had fallen, with a big load which made her "send the rockets up" as she started off. Talking about rockets, just as I was approaching the bridge at the end of Ashford station, on the gasoline buggy, one evening not so long ago, a "spam can" went underneath; and oh boy! WAS she "chucking it out." It was too late to stop, so I had to "give her the lot" and make a frantic dash to escape the shower of golden rain. As it was, there are still some marks on the roof of the car where some of the bits came down. It is on record that a red-hot cinder from one of these contraptions set fire to the wool on the back of a live sheep. No wonder the coal consumption is excessive!

Blowdown Valve

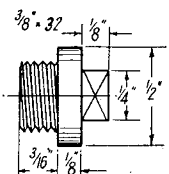
An "Everlasting" blowdown valve is shown in the illustration of the complete backhead. Full instructions for making this type, from particulars kindly supplied by Mr. F. S. Lovick-Johnson, managing director of the firm who makes them, were given in the notes on building *Doris*, so I need not repeat them here. The blueprint sheet, showing all the details of the valve, can be obtained from our offices; and as all the parts are shown separately, besides the complete assembly, anybody with average "savvy" should be able to make the valve, even if they had not read the instructions. However, for those who prefer the simple screwdown type, a section of the latter is shown here. It is simply a glorified edition of the blowdown valve on the bottom fitting of the water gauge, and is made in the same way. The body is turned from a bit of $\frac{1}{2}$-in. round rod, or from a casting, and is screwed same as the washout plugs. Centre, and drill down about 1 in. depth with 7/32-in. drill; part off at $\frac{3}{4}$ in. from the shoulder. Reverse in chuck, holding in a tapped bush; turn the outside to the profile shown, open out to $\frac{9}{16}$ in. depth with 9/32-in. drill and D-bit, and tap $\frac{5}{16}$ in. × 26 or 32. The valve pin is made from $\frac{5}{16}$-in. rustless steel or phosphor-bronze, and squared at the end. Instead of a union screw, like the water-gauge, a socket, made from $\frac{3}{8}$-in. round rod, and tapped $\frac{1}{4}$ in. × 40, is silver-soldered into a $\frac{5}{16}$-in. hole drilled in the side. When the boiler is erected, a piece of thin-walled copper tube will be fitted into the socket, to take the discharge below the footplate when the boiler is blown down.

Firehole Door

Castings will be available for the firehole door, and these will have the hinges cast on;

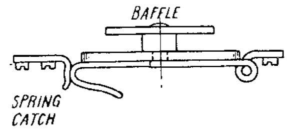


Hand pump clack-box



Washout plug

so the ends will only need cleaning up and drilling for the hinge pin. Use No. 51 drill for a $\frac{1}{16}$-in. pin. The hinge lug can be filed from the solid, or cut from sheet steel about 18-gauge, the part fitting between the hinge straps being bent around a bit of steel wire, same size as the pin. The handle is a strip of 18-gauge steel, a full $\frac{1}{8}$-in. wide, riveted to the door by bits of domestic pins. This engages a spring catch, made from a bit of bronze or hard brass strip, bent to the shape shown in the plan view. Make the screws from bronze rod; chuck a bit $\frac{1}{8}$ in. diameter, and turn down about $\frac{3}{16}$ in. length to a full 5/64 in. diameter. Screw 8-B.A. and part off to leave a head about 3/32 in. thick, which can be slotted with a fine hacksaw. If you use ordinary commercial "brass" screws, they will probably rot and break off, through too much zinc in the alloy. This gives clean threads, but the screws are not suited for boiler work. It is no trouble to make them as above, and they will last as long as the boiler. Maybe, two or three of our enterprising advertisers may consider stocking bronze screws. Old George Kennion used to stock gunmetal screws, maybe he still does.



Plan of firehole door

The cast firehole door may have the baffle-plate cast on. If it hasn't, it will have a boss for attaching the baffle; in that case, cut it from 16-gauge sheet steel, same shape as firehole but $\frac{1}{16}$ in. smaller all around, and fit it to the boss either with a screw or a rivet. When erecting, don't make it shut with a snap, like a purse or handbag; bend the catch so that it prevents the door opening on its own. Just that and no more; then, when firing the engine on the run, you only have to touch the handle with the shovel blade, and the door opens. Another touch with the shovel, closes it; saves both time and burnt fingers.

In the drawing of the backhead complete with fittings, the cab front is shown, as a matter of convenience, to save making a separate drawing later on. There is no need to make it yet, as it cannot be fitted until the boiler is erected on the frames; but I'll just call attention to the fact that it is made in three separate pieces, like the cab of my *Tugboat Annie*, the top and the two sides being separate. In order to clear the loading gauge, the roof of the cab will have to rest on the top corners of the Belpaire firebox casing.

Regulator Erratum—the distance from "step" to centre of port should be 11/32 in., not 7/32 in. as given. Sincere apologies! It is correctly shown on the blueprint.

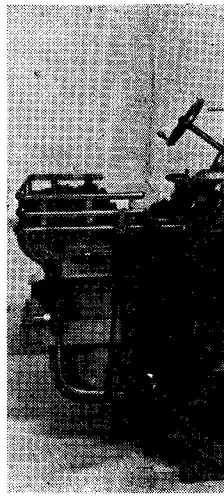
CLAPPER BOX TOOL HOLDERS

(*Continued from page* 784)

of the dimensions are important, but the trunnion should be a good fit in the body. The hole in the trunnion for the cutter should be square with the axis, and the slot for the tool in the body should be a good fit for the section of tool used, and, of course, this slot should be square with the axis of the hole for the trunnion. The tool is clamped in the trunnion by an Allen grub-screw. A good piece of steel should be used for the body of the holder—I used a $\frac{3}{4}$-in. gib-headed key for mine. Silver-steel was used for the trunnion.

The spring in the straight pattern was made from a piece of clock spring clamped to the holder by a $\frac{1}{16}$ in. thick mild-steel cover plate and two 5-B.A. screws. The bend at the other end of the spring was to make insertion of the cutter easy. In the angle pattern, the spring was coiled from a piece of piano wire. The spring need only be strong enough to snap the cutter gently back on to the stop.

The "M.E." Visits the Grantham Society



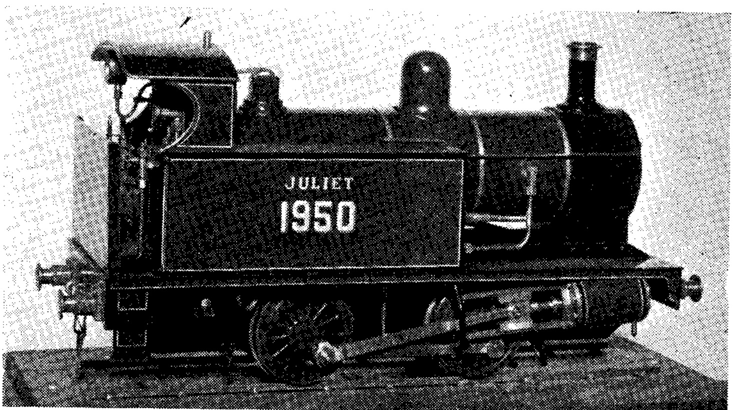
WE recently paid a visit to the Guildhall, Grantham, where the Grantham S.M.E. were holding their second annual exhibition.

As will be evident from the photographs reproduced on these two pages, a very high standard was prevalent in all sections, and the enthusiasm of all connected with the exhibition was undoubtedly responsible for the very pleasant atmosphere favourably commented upon by several of the visitors. It is upon foundations of this nature that the success of future exhibitions is built!

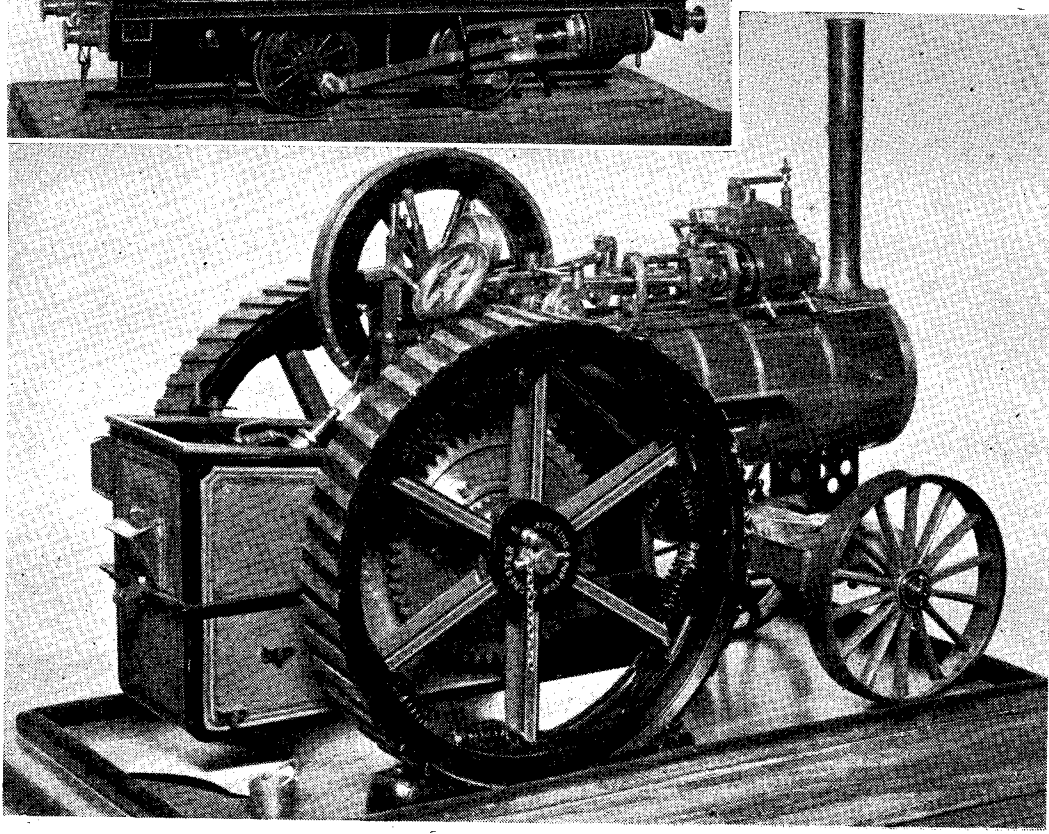
The exhibits numbered approximately 180 *and included a splendid variety of subjects covering almost every known branch of model engineering. Attendance during the three days the exhibition was open was in the region of* 2,500.

The photographs are of models selected at random by the writer, and taken by Mr. Walter Lee, of Grantham. They are good examples of how exhibition models should *be photographed!*

Below—First prize winner. Locomotive section. (Over gauge " 1.*") A* $3\frac{1}{2}$*-in. gauge* 0-4-0*T, "Juliet," to "L.B.S.C.'s" design, by S. Wakefield (Leicester S.M.E.)*



Below—Loan exhibit. Aveling-Porter steam tractor of 1874*, loaned by Messrs. Aveling-Barford Ltd. Note springs on rear wheel spokes and wooden laggin on boiler and smokebox*



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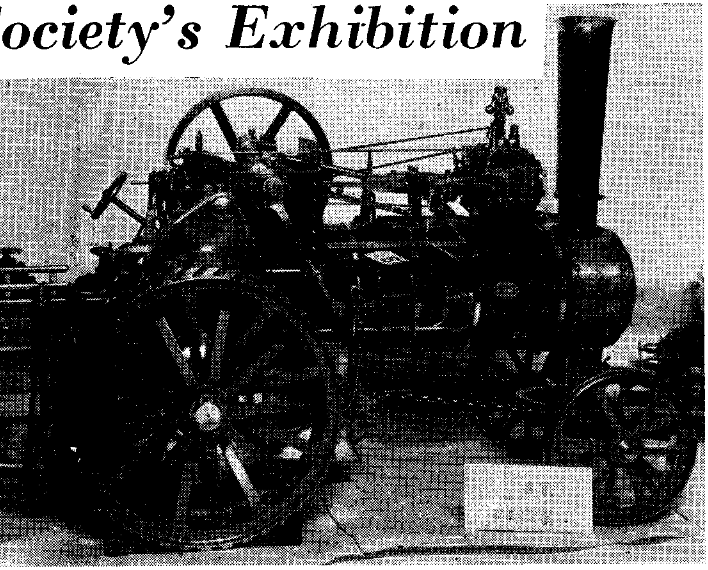

Above—Road vehicle section. First prize winner. A 2-in. scale free-lance traction engine, by R. Swallow (Grantham)

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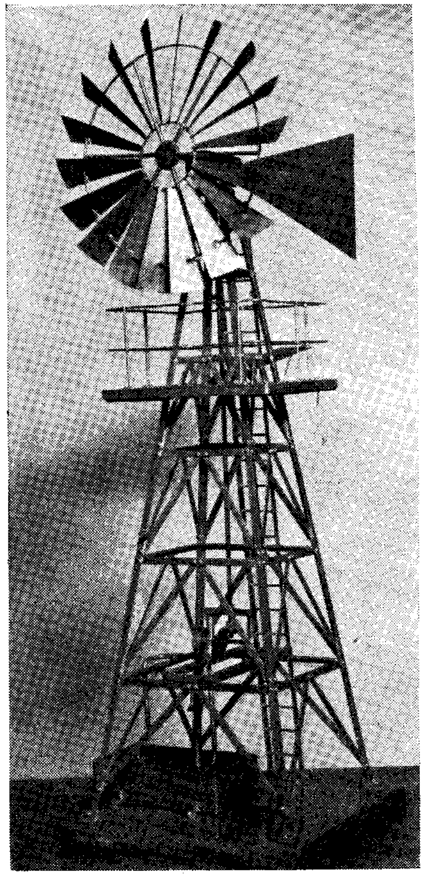
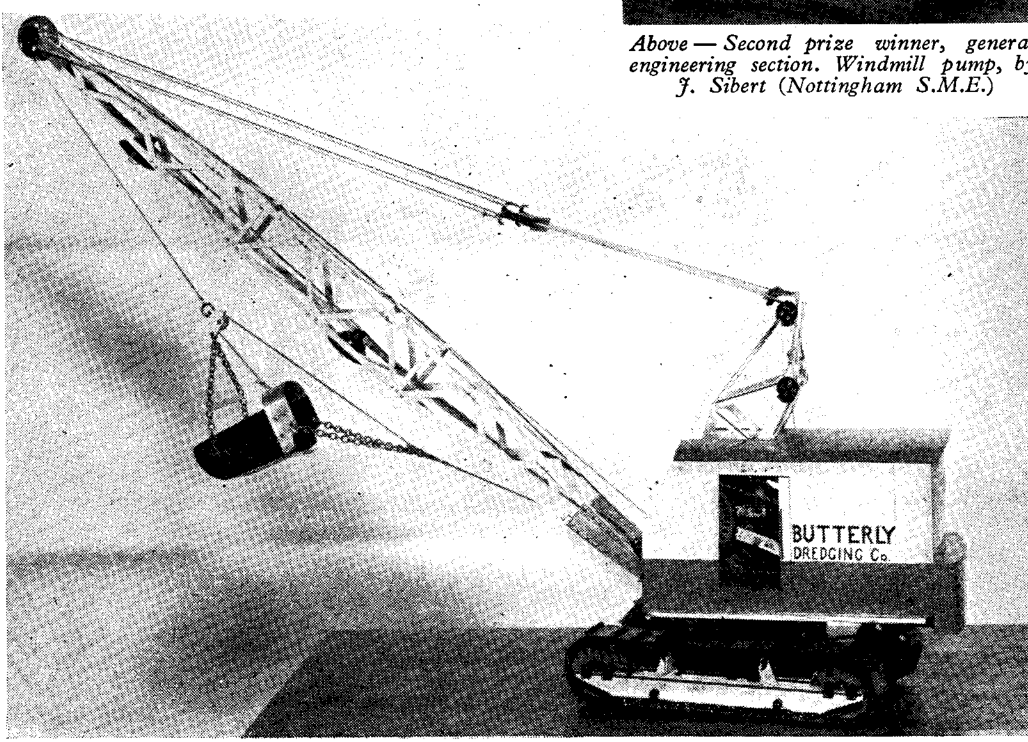


Above — Second prize winner, general engineering section. Windmill pump, by J. Sibert (Nottingham S.M.E.)

Below—First prize winner, general engineering section. Electrically-operated dragline, by Erich Ruehlemann (Spalding). Constructed mainly from odds and ends of material. The girders of chassis and jib are cut from brass curtain rail



PETROL ENGINE TOPICS

*A 10 c.c. Twin Four-Stroke

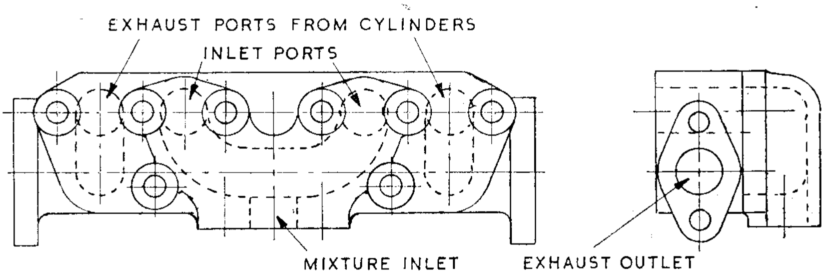
by Edgar T. Westbury

BEFORE concluding the description of the ignition equipment, one or two final points may be discussed, though they may be dealt with most conveniently after the general assembly of the engine is completed. It has been mentioned that the timing of the contact-breaker cam is not critical, owing to the latitude of advance and retard obtainable by the control lever ; it is, however, important that the points at which contact is broken by the cam should be equally spaced so that the spark occurs at the same crank position on each revolution.

If the cam has the flats accurately indexed, and of the same radial depth, this will be ensured automatically, but in any case it is advisable to check up on it by marking the flywheel at the point where the break occurs, then turning it one complete revolution and noting whether there is any discrepancy in the timing of the second break. If so, it can be corrected by filing one or other of the flats as required. The timing of the " make," and the angular period of contact, are not highly important.

It will be seen from the general arrangement drawing that the free end of the contact spring comes rather close to the inside of the casing when in the open-circuit position ; on no account however, must it be allowed to touch, or the contacts will be shorted, and unwanted sparks produced at the wrong time. This is mainly a matter of adjustment, but it is important to see that the tip of the spring is not left longer than necessary, and the cam diameter arranged so that the spring does not lift too high. By way of insurance against accidental shorting, a slip of thin insulating material may be cemented inside the casing near the top of the spring.

Unlike the majority of contact breakers on small engines, this one is not provided with a friction clamp to prevent shifting of the control lever, as it is intended to be operated from a remote control, but an alternative would be to attach a slotted sector plate to the front of the timing case and fit a clamping bolt to the eye of the control lever. Only a small range of running adjustment is required when once the best timing position has been found, as the angular movement on the camshaft represents twice as much on the crankshaft.



INLET-EXHAUST MANIFOLD ASSEMBLY

Exhaust-Inlet Manifold

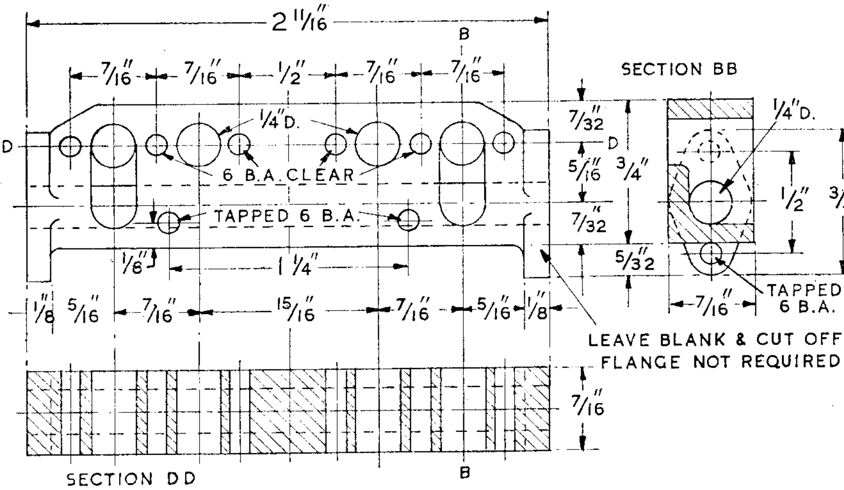
In the type of engine from which this design was mainly adapted, it is usual to provide some means of heating the incoming mixture, in order to improve carburation when running on low-grade fuels, which in the past often included high flash point oils such as paraffin. The most common arrangement is some form of " hot-spot " manifold, though in some cases more elaborate forms of " vaporisers," some of which resemble small fire-tube boilers, have been used. Modern practice does not favour the use of paraffin, as it is generally better to go the whole hog and use injection type engines if low-grade fuels are used ; but the hot-spot manifold is still popular for petrol engines, as it assists carburation and helps to ensure that all cylinders receive mixture of the same quality. Where maximum power is required, heating the mixture is undesirable, as it thereby becomes rarefied, lowering the amount of fuel which can usefully be consumed ; but for engines of moderate performance, where flexible control is desirable, it is definitely beneficial.

The combined inlet-exhaust manifold designed for the " Seal " four-cylinder engine has certainly justified its existence, but its construction has worried several readers, as it calls for very accurate casting, and the location of bolt holes is also critical if leakage between exhaust and inlet passages is to be avoided.

**Continued from page 726, " M.E.," November 9, 1950.*

In the " Seagull " engine, a simpler solution of the constructional problem has been sought, and in the original version of the engine, a fabricated exhaust manifold was used, made from rectangular brass tube, with end pieces brazed in, and also two cross tubes to convey mixture from the inlet pipe to the cylinder ports, thereby forming the hot spot. The inlet manifold was cut from the solid, with a groove milled deeply in its joint face to form the branch passage. This is the form of manifold shown in the photographs, and is quite satisfactory in practice, but it is by no means as easy to make as I intended it to be, and would probably not be favoured by constructors who are not experienced in brazing.

A new manifold has therefore been designed, and as shown in the drawings, consists of two aluminium castings bolted together, in which respect it resembles the " Seal " engine manifold ; but it differs from it in having the exhaust passages formed in one casting and the inlet passages formed in the other. This simplifies the castings, and also facilitates cleaning up the passages by milling or hand riffling. As in the case of the " Seal " engine, the exhaust pipe can be attached either end, flanges being provided both ends, and the one that is not wanted can be cut away. The carburettor is attached vertically to the underside of the manifold, though it would be practicable to mount it horizontally on the outer wall if preferred.



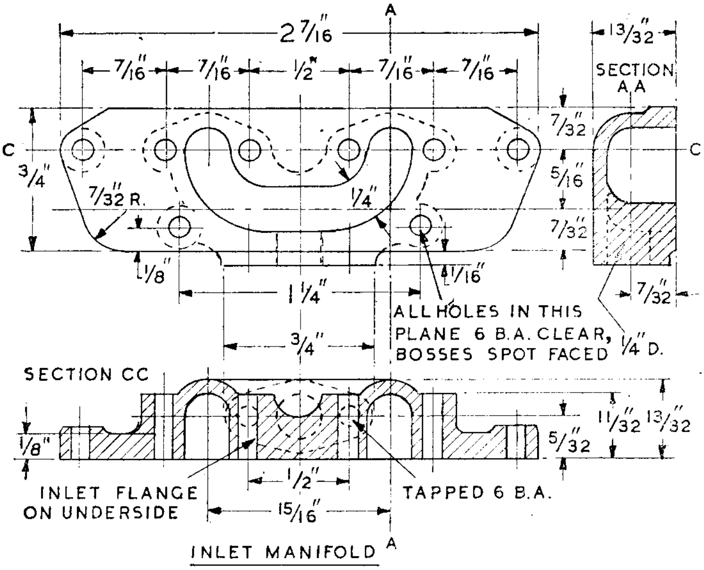
Exhaust manifold casting

Machining Manifold Castings

The exhaust manifold is machined flat on both sides, and can conveniently be held across the jaws of the four-jaw chuck for the facing operations. It is now necessary to decide which end is to be left open for fitting the exhaust pipe ; in most cases it is convenient to run the pipe aft, but as the engine is reversible end for end, and may be coupled to the propeller shart either at the flywheel or timing end, this will affect the relative position of the manifold. Having decided this point, the casting may now be clamped by one of its machined sides to an angle plate mounted on the lathe faceplate, with the " open " end outwards, and set up so that its horizontal axis is parallel with the lathe axis, and the centre of the flange (which should be previously marked out) coincides with the running centre. The flange is faced and centred, and a $\frac{1}{4}$-in. hole drilled axially to a depth sufficient to line up with the further transverse exhaust passage.

The positions of the four ports, and also the stud holes, should then be carefully marked out and drilled, noting that while the top row of stud holes are clearance size, the two lower holes are tapped for 6-B.A. screws. It is best to leave the latter until the other casting has been drilled. As it is necessary to avoid risk of forcing the drill out of truth when drilling the longitudinal hole in the casting, it will not be practicable to cast the transverse passages in to their full depth, and, therefore, a certain amount of milling and hand filing will be necessary in order to open up the communication between the exhaust ports from the cylinder and the drilled passage, to the shape shown in section *BB*.

In the case of the inlet manifold, it is only necessary to face one side of the casting, and then clamp it to the angle plate for facing and drilling the underside flange. The top row of clearance holes may be spotted from those in the exhaust manifold, but the reverse order will be preferable for the two lower holes. However, the sequence of drilling operations will depend very largely on whether the stud holes in the two cylinders, for the attachment of the manifold, have been previously drilled and tapped ; if not, it may be found best to start from the inlet manifold side, but in any case, the position of the holes should be marked out as accurately as possible to dimensions, and when drilling, a wary eye should be kept on any tendency of the drill to wander from the " straight and narrow path."



marine, and looks very fine if the pipes are neatly made and finished ; but it lacks the practical benefits obtainable from a heated manifold. Needless to say, the flanges must of equal thickness where they are truncated and clamped by a common nut in this way.

There is one type of manifolding, all too common on small steam and i.c. engines, which I do not recommend ; namely, that built up from screwed elbows, tees and nipples, with running joints and locknuts. The art of the coppersmith may appropriately find plenty of scope in the construction of these engines, but while I bear no malice against plumbers and gas fitters, their particular technique is rather out of place in this class of work.

The machined faces of both castings should be lapped to ensure perfect flatness, and when assembling the manifold, it should only be necessary to apply a little jointing varnish to the joint faces, though a thin gasket of tough paper is permissible.

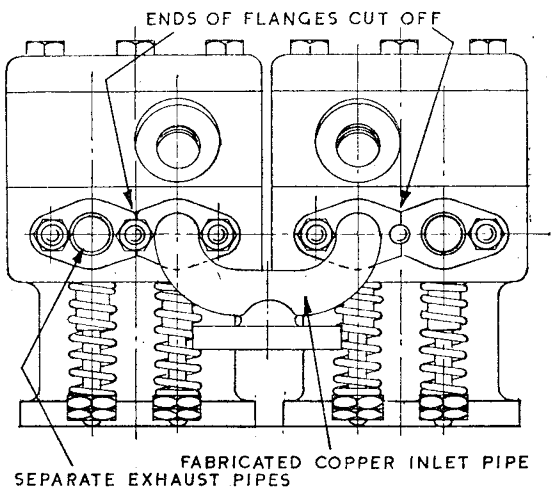
Modified Manifold Arrangements

Regarding possible alternative forms of manifolds, I have received a query from a reader who proposes to use a "Seagull" engine in a "vintage" model car he is building, as a twin engine is correct to prototype in this case. The design calls for two separate exhaust pipes leading from the respective cylinders, and he asks if such an arrangement is practicable on this engine. As a matter of fact it is possible to do it in two or three different ways ; first, the manifold castings may be used, but instead of drilling the longitudinal exhaust passages, both flanges may be cut off and the casting filed flush with the ends of the inlet manifold casting. Holes are then drilled in the outer face of the latter, $1\frac{3}{16}$ in. apart, to coincide with the spacing of the exhaust ports, and the separate exhaust pipes may either be screwed in with a fine thread, or they may have flange joints attached to machined facings on the casting.

Another method consists of using a fabricated copper inlet pipe, with flanges for the carburettor and cylinder ports, and separate exhaust pipes with flanges attached. The outer ends of the inlet pipe flanges, and the inner ends of the exhaust flanges, are cut off at the centre of the stud hole, so that one nut will clamp the two flanges at this point. This method is quite in keeping with normal practice in certain types of "vintage" engines, both automobile and

It may be mentioned that the design of the inlet manifold on any engine of more than one cylinder may have an important bearing on the efficiency and smooth running of the engine, and in the past, a great deal of ingenuity has been displayed by engine designers in such manifolds to ensure good distribution of mixture. Generally speaking, sharp bends are undesirable in the induction system, though strangely enough, branch connections often work better in the form of T-joints than Y-joints. Twin-cylinder engines with equal firing intervals are simpler in this respect than V-twins, or engines with larger numbers of cylinders.

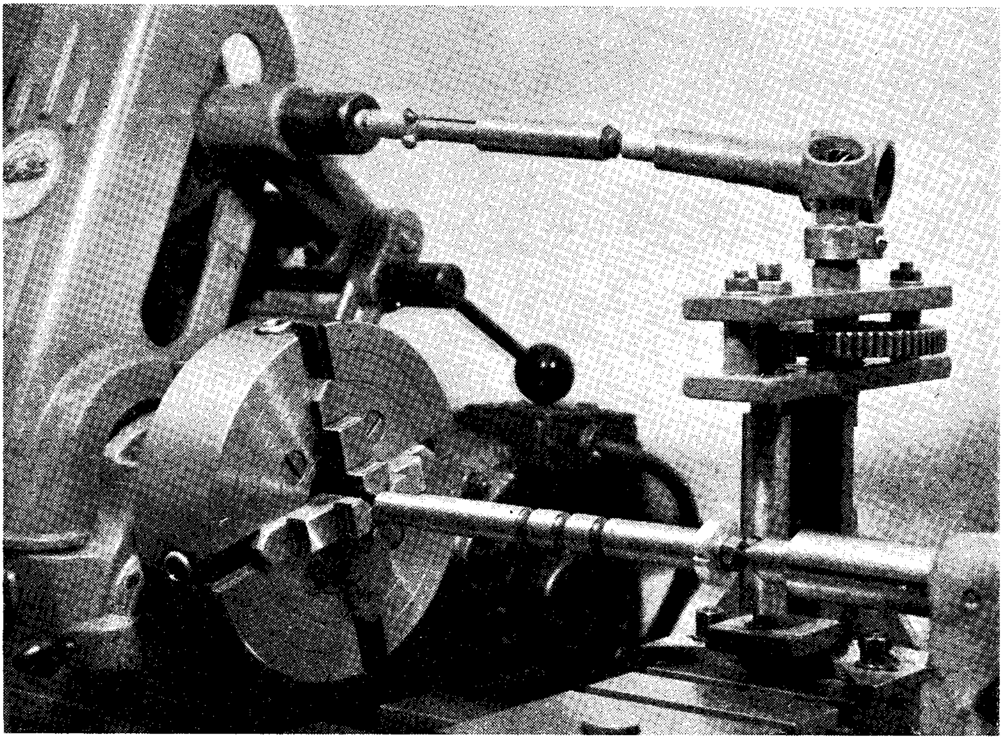
(*To be continued*)



Alternative manifold system, suitable for engines fitted to "vintage" models

A Cutter Frame and Drive
for the Myford M.L.7. Lathe
by A. H. Hartup

WHEN I disposed of my faithful twenty-nine years old Drummond 4 in. lathe to a friend, I included the overhead gear, which incorporated a friction clutch to avoid repeatedly switching on and off the motor. This gear always worked very satisfactorily, and I was in stationary, the countershaft is still merrily revolving at a useful speed. I wonder if it would deliver sufficient power to drive the cutter frame when the belts are slackened thus ? A good tight grip on the protruding end of the countershaft soon proved that it would, because,



some doubt as to whether my new Myford M.L.7, with its extremely compact countershaft drive, would give the same satisfaction. However, I have found that the Myford belt tension lever gear, works out very nicely as a clutch in actual practice, and the lathe itself never fails to give me the greatest joy in use.

It was when I contemplated making a new fly-cutter frame for milling the teeth in the worm wheel for a thread dial indicator that I started doing some "head scratching." There I was, with a beautiful lathe, but no overhead gear or spare motor to drive the cutter-frame if I made one. But wait a minute, when that belt tension lever is right back and the lathe mandrel is whilst the belt from the countershaft to the lathe mandrel is slackened enough to take off all the drive, the other belt from the motor to the countershaft, is only slightly slackened, and thanks to the use of vee-belts, the drive is not taken off this section. O.K. so far. Now a simple arithmetical calculation in round figures (which is about my limit in such matters) showed me that a step-up in r.p.m. of about five-to-one from the countershaft to the cutter spindle would be required to make a single-point cutter do the needful in such jobs as I had in mind, namely, brass or gunmetal worm wheels, gear wheels, or small keyways in mild-steel, etc.

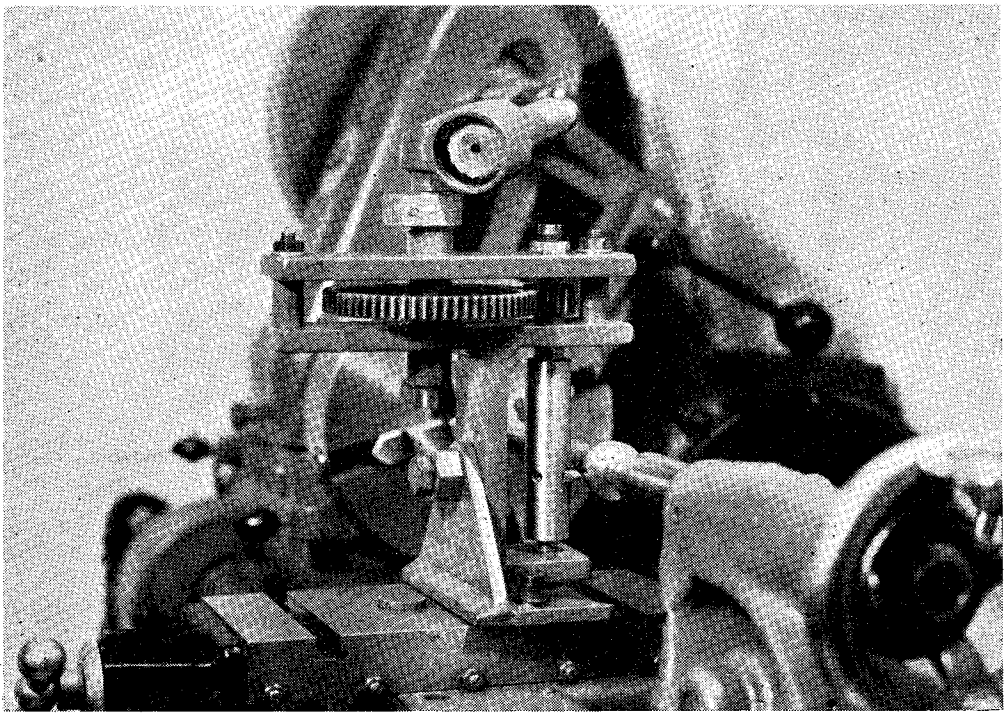
Now followed the inevitable search in the scrap box, which brought forth a pair of old magneto spur gears and an old motor-cycle speedometer drive containing a pair of skew gears. These items working in conjunction gave me the necessary step-up in revs. and also the change in direction of drive. I decided to make the drive from the countershaft to the cutter frame *via* the medium of a telescopic shaft with universal joints at each end, so that traverse could be obtained in both cross and longitudinal directions.

The universal joints were also from the scrap box and originally came from some ex-R.A.F. equipment. They seem to be rather too small to stand up to continual hard work, so I propose to either obtain, or make, some more robust ones, because the rest of the gear seems capable of heavier cutting than the present joints can stand.

Cutting Worm Wheels

The frame, carrying the cutter spindle and gears, is bolted to the angle-plate base by one bolt, which enables one to swivel the frame sufficiently to get such angles of cutting as are needed for worm wheels, etc., whilst the base is bolted down each end to the " Tee " slots in the cross-slide. A fair amount of up or down fine adjustment of the cutter is provided, by mounting the spindle carrying the cutter and the pinion, between two screwed and lock-nutted centres top and bottom, and as the pinion has rather wider teeth than the wheel it meshes with, one can raise or lower the whole spindle quite a bit before the gears get dangerously near the " out-of-mesh " position endwise. This adjustment is very useful when cutting ratchet wheels and the like.

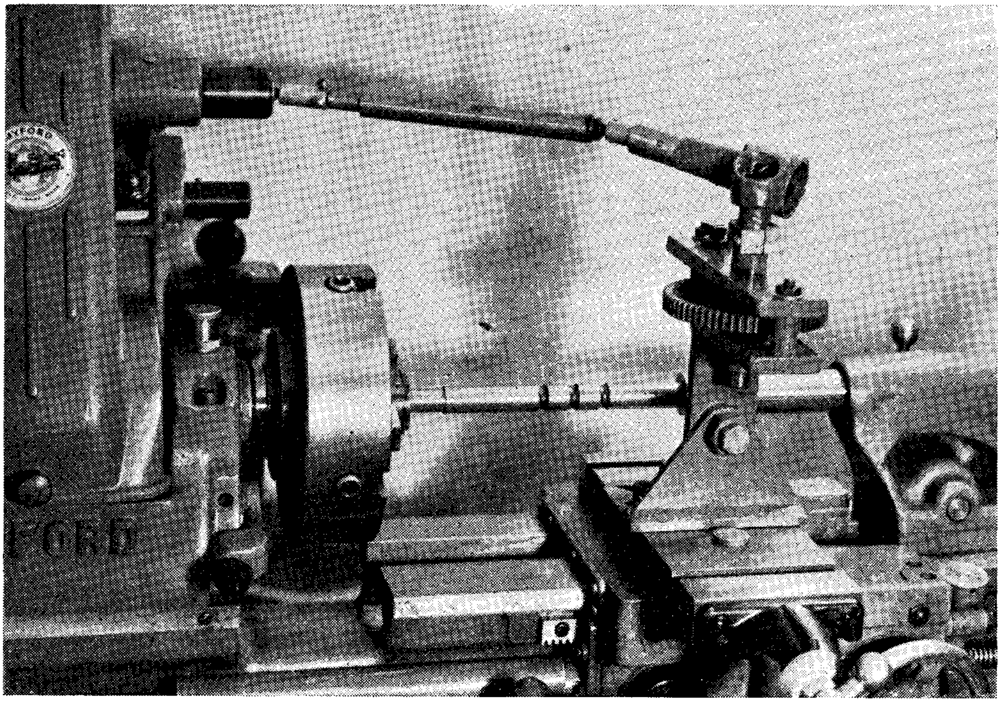
The universal joint on that end of the telescopic shaft which comes adjacent to the lathe countershaft, is inserted into a hole in one end of a long collar, which supplants the original short one on the end of the countershaft, being held and driven by Allen screws bearing on the usual flats on shaft. Incidentally, there is a slot in the end of the countershaft which could be utilised if one cared to arrange it so.



The casing of the speedometer drive is arranged with a clamping ring round the vertical part, so that the nearly horizontal portion may be set to point towards the general direction of the countershaft, according to how much cross traverse is required on any particular job; this avoids extreme angles of drive through the universal joints.

One Direction Only

The complete set-up, can be arranged either in front of, or behind the work-piece, according to which method gives the best view of the cutting operation, or the best direction of cut, because obviously the cutter-spindle can only revolve in



one direction with this attachment, whereas, in the case of the over-head gear being used one can sometimes cross the belt to reverse the direction of spindle revolution.

Interchangeable Shafts

I have found it an advantage to make two telescopic shafts, both interchangeable, one short and one long, so that jobs may be tackled either near to or farther away from the chuck. I also tried out the use of a flexible shaft instead of these telescopic ones, but it was not a success, because when the cutting was only moderately effective, the flexible shaft tried to tie itself in knots, and in protest, it smote me on the nose for my curiosity. Possibly the use of a shorter and stiffer flexible shaft would be successful, and it would certainly give more freedom of traverse in all directions and eliminate the universal joints.

I do not include any drawings, because one usually makes up such attachments as this from materials easily obtained or from scrap, so I hope the photographs produced by my son will explain any points otherwise not lucid.

The frame of my own gear is built up from $1\frac{1}{2}$ in. × $\frac{3}{8}$ in. flat bar iron or mild-steel brazed together where necessary. To get the sharp right-angle bend at the bottom of the frame, I filed a deep vee-groove across the bar, made the bend and then brazed the corner up solid. The other joint at the top of the vertical bar may be held together by one set-screw whilst brazing, with steel fillets in each corner to give the joint more stiffness. I find these "built-up and brazed" jobs so much quicker than waiting for castings in the case of "one off" details.

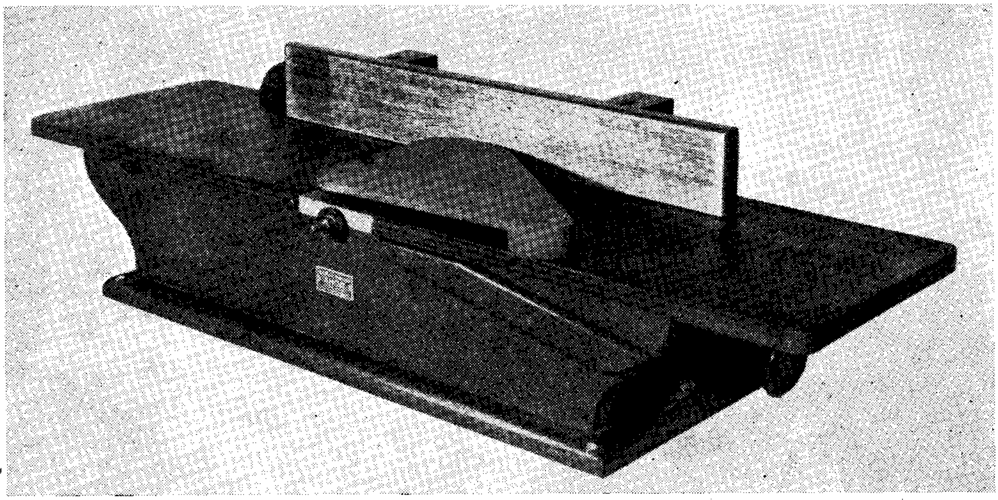
The cutters I prefer are made from short ends of $\frac{3}{16}$ in. square high-speed steel, which will go into a $\frac{1}{4}$-in. round hole if the extreme corners are ground off. They are clamped in the spindle by a No. 2 B.A. Allen screw. Of course, one can also use cutters made from $\frac{1}{4}$-in. round silver-steel if preferable.

A Miniature Overhead Gear

It has occurred to me that a very useful miniature overhead gear could be fitted to the Myford M.L.7. lathe for driving a drilling or small milling spindle, mounted on the cross-slide, with the work held on faceplate or in the chuck, to produce such jobs as division plates or radial slots. It would entail making a bracket or possibly two brackets, with bearings at the top at a suitable height to align approximately with the lathe countershaft, provided with the necessary shaft and pulley and being driven from the countershaft in a similar manner to the previously described cutter frame. Messrs. Myfords have very thoughtfully provided a long flat surface on the back of the lathe bed with several tapped holes—hightly suitable for such attachments as this.

In conclusion, if any others of "this happy breed" require further information regarding the cutter frame, I shall be glad to do my best if they will write me. Our good friend the editor will have my address.

"Ahor" Woodworking Machines

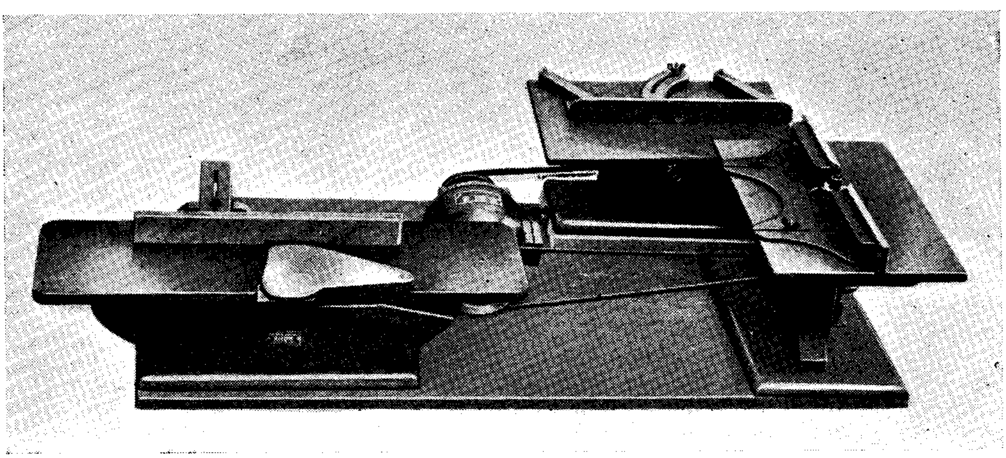


The "Ahor" 9-in. jointer

AT a recent trade display in the East London area, Messrs. Ahor Handy Machines, 25 bis, rue Emile Duclaux, Suresnes (Seine), France, introduced an interesting range of moderately-priced wood-working machinery.

Demonstrations were effective and well carried out, the machines proving themselves capable of competition with many others of far greater price. Their basically wooden construction accounts for this, and is a feature which is claimed by the manufacturers as being responsible for their smooth and vibrationless running at fairly high r.p.m.

The range includes circular-saw benches for blades from 4 in. to 6 in. diameter, bandsaw benches, 6 in. and 9 in. jointers, vertical single and double spindle machines and accessories, woodturning lathes, vertical and horizontal band sanders, 6 in. automatic feed planers, mechanical hacksaws, etc. Illustrated literature and price lists may be obtained on application to the above address.

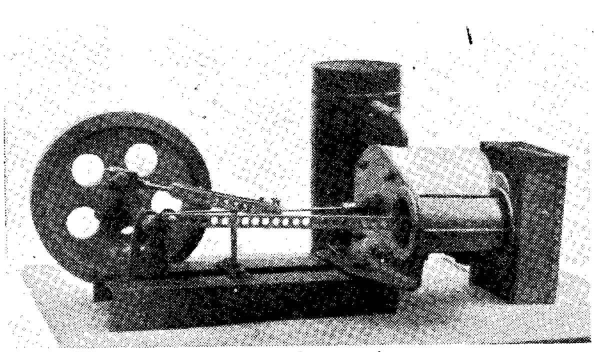


A block of "Ahor" machines at the London demonstration. Left to right—jointer, circular saw and vertical spindle machine

How to Make a Small Hot-Air Engine

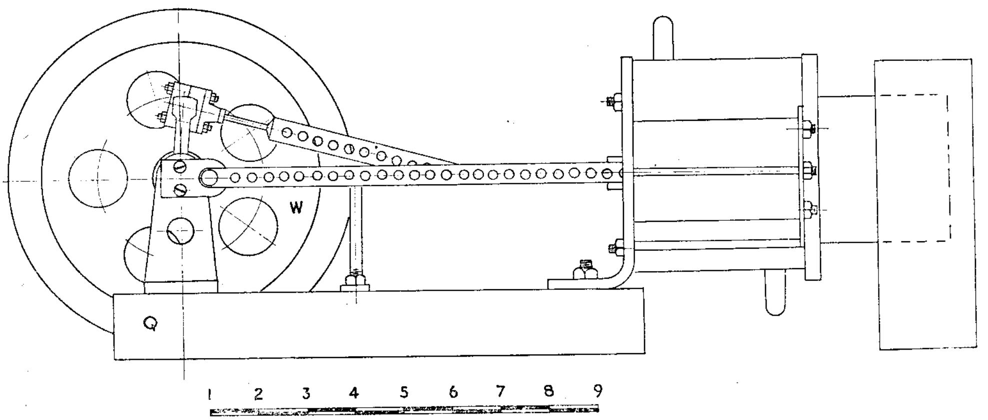
by R. F. M. Woodforde

THE words, "almost from scrap," might be added to the above title. The displacer cylinder was made from 3-in. cast-iron down-spouting, the bedplate from bedstead angle-iron; the cooling tank was a piece of galvanised stove-pipe; the angle bracket that holds the two cylinders in place was a piece of steel motor lorry chassis. This engine runs at about 250 r.p.m., but I strongly suspect that if the power piston and cylinder were ground and polished, this speed might be doubled. A small bunsen burner, using about 7 cu. ft. per hour (about 0.4d.) is used to drive it. Of course, like most of its sisters, much power cannot be obtained. It will, however, drive a group of models or a fan easily.



The complete engine

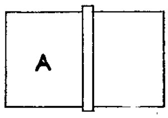
The displacer cylinder (*A*) was a piece of 3-in. cast-iron downspout; it was cut off, mounted on a wooden mandrel, which was in turn mounted on a steel mandrel. The wooden mandrel was hand-turned to fit the pipe. The job was turned at the ends, $6\frac{5}{8}$ in. long. The body was turned down to leave the metal $\frac{1}{16}$ in. thick, but in the centre, a collar, $\frac{3}{4}$ in. wide, was left full-size; this locates the ring (*B*), which holds the cylinder in place against the angle bracket (*E*), by means of four $\frac{3}{16}$-in. studs, $4\frac{5}{8}$ in. long, screwed $\frac{3}{16}$ in. Whit. The outer end of the cylinder is counter-bored to take a $\frac{1}{8}$-in. mild-steel disc. This disc is cut out by saw and file, and sweated to a piece of round brass or steel, and turned to size in the self-centring chuck. It is brazed in place using a high melting point spelter, as the heated end of the cylinder gets red-hot in use. A carbide-tipped tool is best for this turning job, as the cast-iron is very often hard and sandy. As a digression, the writer would like to say that the thinner the cylinder is turned, the better, as one of our contributors stated in "Ours" in his article on "Intruders." The centre ring is drilled and tapped $\frac{1}{8}$ in. iron gas to take the pipe that connects the two cylinders.



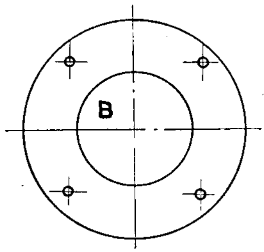
Side elevation of the small hot-air engine

A cast-iron or mild-steel ring (*B*) of $\frac{3}{8}$ in. stuff, is turned about $4\frac{3}{4}$ in. dia. and bored (about) 3 in.; an easy fit over the cylinder end. The four studs are tapped into this evenly spaced. These studs have 3 in. centres and they have to clear the water jacket when it is in position.

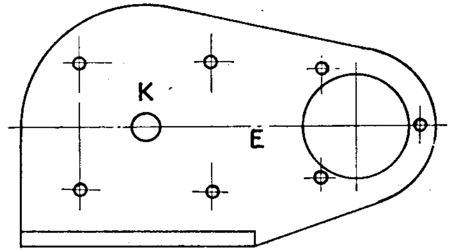
The displacer piston (*D*) is an ordinary tin can with, of course, a folded joint, and *not* soldered. It is about $\frac{1}{16}$ in. smaller than the cylinder bore, and 3 in. long. The two ends are closed by means of a pair of thin annealed copper discs. These are hammered over a pair of turned mild-steel discs turned up in the lathe, the same diameter as the piston. The discs are cut $\frac{1}{4}$ in. to $\frac{3}{8}$ in. larger diameter by the shears, drilled with



Displacer cylinder



Ring



Angle bracket

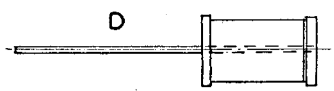
$\frac{1}{8}$ in. hole in the centre of each. The mild-steel plates are bolted together with an $\frac{1}{8}$-in. bolt with a copper disc between and carefully hammered to shape, just like flanging a boiler end. The sharp edge of one mild-steel plate is removed so that the disc is not cut through. These copper ends are brazed in place (low melting point solder, or silver-solder, may be used here). A piece of round silver-steel, $\frac{1}{8}$ in. dia., is brazed in at the same time for the piston rod. Leave 6 in. protruding at the moment. If a suitable can cannot be obtained, then a copper piston, or steel one, must be bent around a metal, or hard wood mandrel, riveted with $\frac{1}{8}$-in. copper rivets, and brazed up. To test for air leaks, immerse in a basin of very hot water; this will expand the air and bubbles will appear, and the joint must be made O.K.

The power cylinder (*F*) is a piece of No. 22 gauge brass tube. It is cut $3\frac{5}{8}$ in. long (on a wooden

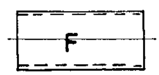
stud; this is used to pull the piston to and fro. It is well smeared with oily dust made by sharpening a wood chisel on an oil stone. This is continued until a pull of $\frac{1}{2}$ lb. or less is attained. It is a long process. A quicker way is to turn a wooden mandrel. Run it fast in the lathe, well smeared with sludge, or "Brasso" metal polish. The whole performance of the engine depends on the fit of the piston; not tight, not leaking air, and very little friction. Inside the piston, a "U"-shaped bracket (*J*) is fixed by means of two 5- or 4-B.A. countersunk screws, heads outside the piston end. The $\frac{3}{16}$ in. hole is soldered up. This bracket carries the small or gudgeon end of the connecting-rod. It is of mild-steel, ends bent square and left $\frac{3}{8}$ in. high, drilled to take a $\frac{3}{16}$ in. pin about $1\frac{1}{2}$ in. long, $1\frac{1}{8}$ in. between limbs.

The angle bracket (*E*) carries the two cylinders. It is 7 in. long, 5 in. high, foot $1\frac{1}{4}$ in. all over made of $\frac{3}{16}$-in. mild-steel. (In my case, a piece of motor lorry chassis.) The cylinders are $3\frac{3}{8}$ in. and $2\frac{7}{16}$ in. from the bottom of the angle piece. The bracket is drilled 17/32 in. at (*K*). The top of the angle is cut away above, radius about $2\frac{3}{8}$ in. The other end is bored so that the piston can easily

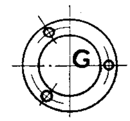
Gland



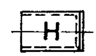
Displacer piston



Power cylinder



Cover



Piston

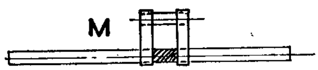
mandrel also). It is 2 in. dia. and must be quite free from dents, etc., and very smooth inside. The cover (*G*) is a disc of $\frac{1}{8}$-in. brass, turned to $2\frac{3}{4}$ in. dia., sweated to a similar disc, turned a neat fit into the cylinder end. If desired, the whole job can be turned from a piece of $\frac{1}{4}$ in. brass sheet. Three 5/64 in. holes are drilled in the cover to take three $\frac{1}{8}$-in. mild-steel studs. These are $4\frac{1}{4}$ in. long and hold the cylinder cover and angle bracket together.

The power piston (*H*) is $1\frac{3}{4}$ in. long, made by bending an annealed brass sheet, $\frac{1}{8}$ in. thick, around a mandrel so as to give the bent part a diameter of $2\frac{1}{16}$ in. The joint can be soft-soldered. It is now turned a tight fit in the cylinder, so tight that it will take a pull of 6 or 8 lb. on a spring balance to pass it through the bore, that is after an end disc of $\frac{1}{8}$ in. brass has been turned and sweated on. It is drilled to take a $\frac{3}{16}$-in.

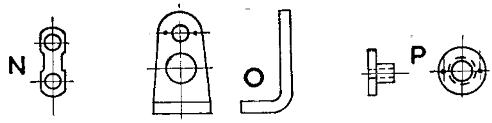
pass through it and counterbored approx. half-way through to hold the power cylinder in place. The bracket is also rounded off here and cut away below the back to the angle bed to give a neat appearance. Three 9-64 in. holes are drilled to take the three power cylinder studs and four 13/64 in. holes to take the displacer cylinder studs. If this boring job is too big to swing in your lathe, it can be done on the saddle with a boring bar.

The crank shaft (*M*) is built up of $\frac{3}{8}$ in. dia. mild-steel with $\frac{1}{2}$ in. square webs. It is $7\frac{1}{2}$ in. all over. The pulley end is $3\frac{1}{2}$ in. long; the power crank $2\frac{1}{4}$ in. The two webs are $2\frac{1}{8}$ in. long, drilled and reamed $\frac{3}{8}$ in. holes. It has a throw of $1\frac{1}{2}$ in. All the holes are slightly countersunk so as to allow the spelter to run in. They are also pinned with $\frac{1}{8}$-in. steel pins before brazing, or silver-soldering. After this, they are cleaned up and the shaded part sawn and filed away; allow a small fillet of brass for strength. The web sides are also well filed away (N) to lighten and look well. The space between the webs is $\frac{9}{16}$ in. The job may be polished, but looks well painted.

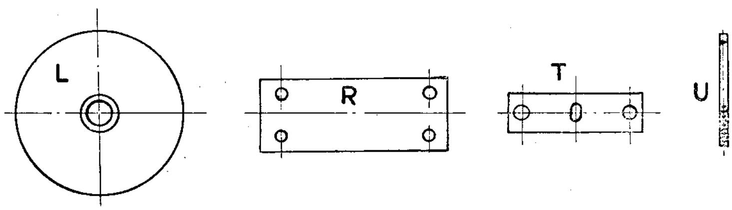
The bearing pedestals (O) are bent hot of $1\frac{1}{2}$ in. $\times$ $\frac{1}{4}$ in. mild-steel, base to centre $2\frac{3}{16}$ in.; feet are $1\frac{1}{2}$ in. all over. They are drilled two holes in each, 7/32 in. A $\frac{1}{2}$ in. hole is drilled in each to take the bush. A $\frac{3}{4}$ in. hole is drilled to lighten the job

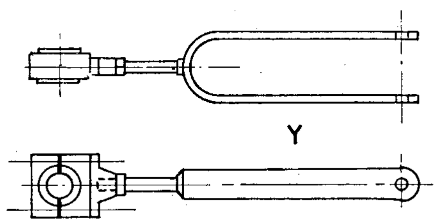


Shaft

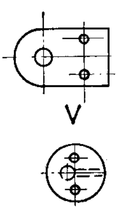


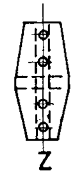
Pedestals



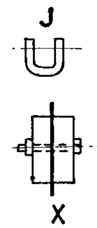


Connecting-rod





Crosshead



Piston ends jig

below the bush hole. The pedestal tops are rounded, and tapered up to 1 in. at the bush. Two brass bushes are fitted in, $\frac{1}{2}$ in. dia. and $\frac{3}{8}$ in. bore (reamed to size). These are sweated to two brass discs, $\frac{1}{2}$ in. bore, screwed to the pedestals by means of a pair of $\frac{1}{8}$ in. or 5-B.A. screws, tapped into the mild-steel.

The bedplate (Q) consists of two mild-steel angles 11 in. $\times$ $1\frac{1}{2}$ in. $\times$ $1\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in. (Old bedstead does well.) The pedestals are mounted on this angle and on a piece of flat mild-steel or wrought iron (R) $3\frac{3}{4}$ in. $\times$ $1\frac{1}{2}$ in. $\times$ $\frac{1}{4}$ in. The approx. sizes are given in the drawing, but do not locate the holes until more parts are made.

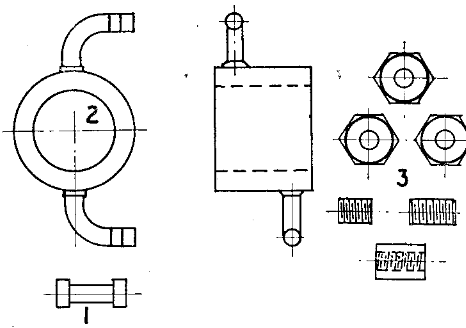
A cross-piece (T) is cut from mild-steel or wrought iron (all parts not specially mentioned may be of this) $2\frac{1}{2}$ in. $\times$ $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in., drilled 2 in. centres to take $\frac{3}{16}$ in. or 2-B.A. screws and nuts (clear holes). A centre hole is slotted to take a $\frac{1}{4}$ in. brass pillar (U). This carries the big cylinder piston-rod; it is $3\frac{1}{2}$ in. long screwed $\frac{1}{4}$ in. or 0 B.A. and is kept in place by two nuts makings it adjustable for height. A $\frac{1}{8}$ in. reamed hole carries the rod $2\frac{3}{4}$ in. from the bottom. Make it a nice easy fit to the rod.

The power crank (V) is a piece of mild-steel, $1\frac{1}{4}$ in. $\times$ $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in.; it is sweated and afterwards held by two 5-B.A. or $\frac{1}{8}$-in. screws, to a mild-steel bush, $\frac{3}{4}$ in. dia., $\frac{5}{8}$ in. long. The bush is drilled $\frac{3}{8}$ in. about $\frac{1}{8}$ in. out of centre so as to allow a good length of thread for the $\frac{3}{16}$ in. screw that secures it to the shaft. The crankpin is a $\frac{3}{16}$ in. dia. mild-steel screw; it is tapped into the crank at $\frac{5}{8}$ in. so as to allow a $1\frac{1}{4}$ in. stroke to piston. The pin is nutted at the back with a thin nut. The theoretical position of the two cranks is 90 deg., but it is often found that somewhere between 80 and 90 deg. is better; trial is best before sinking the screw point into the shaft.

The power connecting-rod (W) is a piece of mild-steel, $\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in. It is approximately $12\frac{1}{2}$ in. long, but must be cut shorter when job is assembled. It is fitted with the piston bracket (J) to give a $\frac{1}{16}$ in. end clearance of the piston. The big-end has a brass bush sweated in the $\frac{3}{16}$ in. reamed bore $\frac{1}{4}$ in. long. The gudgeon-pin end is fitted with a bush to take a $\frac{3}{16}$ in. pin. It may be 1 in long, $\frac{3}{8}$ in. dia., screwed $\frac{1}{8}$ in. gas, and two thin nuts keep it in place. The rod is drilled all along with $\frac{1}{4}$ in. holes, spaced $\frac{3}{8}$ in.

The gland and bearing (C) is a piece of mild-steel, $1\frac{3}{4}$ in. long round steel, $\frac{7}{8}$ in. dia. It is turned down all except a $\frac{1}{16}$ in. length to a diameter of 33/64 in. It is drilled and reamed through dead $\frac{1}{8}$ in., a nice fit for the $\frac{1}{8}$ in. piston rod—not tight, not a shade slack. A D-bit made of the same stuff (silver-steel) can be made and used. It is screwed $\frac{1}{4}$ in. iron gas (i.e. 19 threads). The small-end may be turned clear of threads

1 in. It is held in place through the bracket by a nut, not a thin lock nut, but a $\frac{3}{8}$ in. Whit. steel nut tapped out to $\frac{1}{4}$ in. gas. This nut and gland also holds an $\frac{1}{8}$ in. mild-steel disc turned (L) to fit the displacer cylinder, drilled 17/64 in. and the hole counterbored $\frac{7}{8}$ in. to take the big-end of the gland $\frac{1}{16}$ in. Four 7/32 in. holes in the bracket are drilled to take the studs that keep the displacer cylinder in place.



Water jacket

The displacer connecting-rod (*Y*) is bent from mild-steel (hot at the bend). A 12 in. piece, $\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in., is bent in the middle around a piece of $\frac{7}{8}$ in. stuff so limbs are $\frac{7}{8}$ in. apart. A $\frac{3}{16}$ in. tapped hole is drilled at the middle of bend. Limbs are cut to $4\frac{1}{16}$ in. all over, $\frac{3}{16}$ in. holes drilled at $3\frac{7}{8}$ in. to take the crosshead pin $\frac{3}{16}$ in. dia. mild-steel, $1\frac{3}{8}$ in. long, screwed at ends to take thin nuts. This connecting-rod is drilled with $\frac{1}{4}$ in. holes spaced $\frac{3}{8}$ in. Do not attempt to do this until the bending is complete. A $\frac{3}{16}$ in. rod is screwed, tapped and nutted into the bent part. It is $1\frac{1}{2}$ in. long also screwed at the free end. This is brazed into the U-fork of the rod. A mild-steel piece, $\frac{7}{8}$ in. $\times$ $\frac{3}{8}$ in. $\times$ $\frac{1}{2}$ in., is cut T-shaped. This screws on the $\frac{3}{16}$ in. dia. end of the connecting-rod, is lock-nutted. It carries the two big-end brasses made of $\frac{3}{8}$ in. square brass soldered together temporarily, bored $\frac{3}{8}$ in. and drilled to take No. 4-B.A. studs tapped into the mild-steel T-piece. There is no room to lose here; the centres are $\frac{9}{16}$ in.

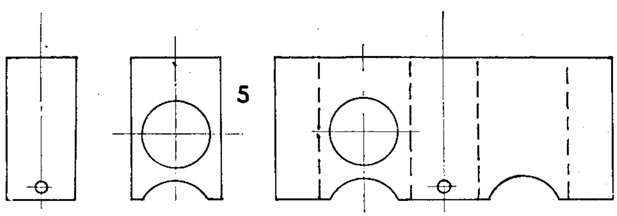
The cross head (*Z*) is a $\frac{1}{2}$ in. square piece of mild-steel, 1 in. long. It is drilled lengthways $\frac{1}{8}$ in. The two ends are turned taper. The centre is drilled at right angles to take the $\frac{3}{16}$ in. pin. The holes are tapped into each end about 6 B.A. These clamp the two piston rods. The piston rod part that passes through the pillar (*U*) is about 4 in. long, but must be cut when parts are erected.

Erecting

The parts now made can be put on the bed. The bracket (*E*) is bolted in place by two $\frac{5}{16}$ in. bolts. After this the pedestals (*O*), piece (*R*), cross piece and pillar (*U*) and (*T*) placed in position. (Small clamps used if desired.) The crankshaft (*M*) is put in its bearings, gland (*C*) displacer connecting-rod, piston rods and displacer, all must turn very freely. The rods are cut to clear and the displacer to clear the forward end by about $\frac{1}{16}$ in. When all is found to be clear the holes in bed can be drilled (clear holes to give a better adjustment). A 7-in. flywheel can be fitted to the shaft; it may be cast-iron, 5 to 6 lb. in weight, rim $\frac{3}{4}$ in. wide, $\frac{1}{2}$ in. thick. Boss $1\frac{1}{4}$ in. dia. by $1\frac{1}{4}$ in. wide, bored $\frac{3}{8}$ in., rim turned and polished. Five $1\frac{1}{4}$ in. holes look well in the inner part. It is held in place by a $\frac{1}{4}$ in. screw locked by $\frac{1}{4}$ in. nut. Point well sunk in the shaft. There is also room to fit a small pulley. The writer has a pattern for this wheel to lend, if wanted, and our friends, Messrs. Stuart Turner (usual disclaimer), will make a good job of it in a few days. It is the only casting used here. When all spins easily the power cylinder (*F*) is put in place with its piston and connecting-rod. The rod is cut so that the piston at back end clears by $\frac{1}{16}$ in. The distance pieces of mild-steel (No. 1) $\frac{5}{8}$ in. dia. and about $\frac{7}{8}$ in. long, are bored $\frac{3}{8}$ in. easy to take the play up between the pedestals and crank webs. Angle bed pieces are 4 in. apart, inside the bottom ends.

The water jacket (No. 2) is made a slip-on fit to the cold end of the displacer cylinder. It is made of (about) No. 22 galvanised iron sheet. It is $2\frac{3}{4}$ in. long. The central piece is bent on a mandrel (tube, bar, etc.) to fit the cylinder. It is riveted with four $\frac{1}{8}$-in. copper rivets, preferably countersunk and soldered watertight (use raw spirits or Baker's as a flux). The outer shell is 4 in. dia. also riveted and soldered. The two ends are cut (preferably) in the lathe to fit in between these tubes and soldered in place. Two $\frac{3}{8}$ in. copper tubes and soldered in one each end, top and bottom, bent with easy bends at right-angles a good fillet can be made by using a heavy square, or round, copper wire bent to fit pipe say No. 14 gauge.

A coupling pipe (No. 3) $\frac{3}{8}$ in. dia. screwed $\frac{1}{8}$ in. gas, is made in two portions, one $\frac{3}{8}$ in. and



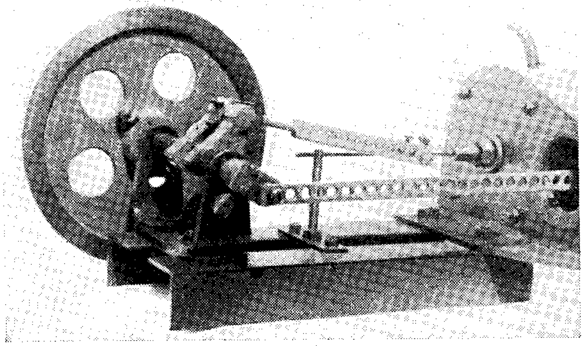
Furnace

the other $\frac{3}{4}$ in. The shorter is soldered to the power cylinder, because the metal is too thin to take a thread. The longer part is screwed into the displacer cylinder, locked with a thin nut. The ends of these pipes should just touch when in place. A square (or hexagon) long brass nut (a running coupling) joins these pipes and is locked by two very thin nuts. "Flexo" covered cotton is used as a joint between all these surfaces.

The cooling tank (No. 4) is a piece of galvanised stove pipe, 4 in. dia., 8 to 9 in. long. It has a bottom soldered on and has two pieces of $\frac{3}{8}$ in. copper tube soldered in near the top and bottom or by means of $\frac{1}{8}$ in. gas lock-nuts with pipe screwed. The tank can also be bent on a mandrel, riveted and soldered if required.

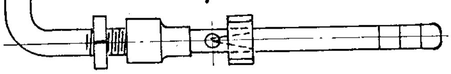
The furnace (No. 5) is made of heavy-gauge galvanised iron sheet, 6 in. high, 4 in. wide × 2 in. It can be cut in one piece, bent and riveted with eight rivets, or made in two parts ditto. A piece of $12\frac{1}{4}$ in. by 6 in. will do in one piece. A $3\frac{1}{8}$ in. hole is cut to admit the cylinder end (about) $3\frac{3}{4}$ in. from the bottom. Two air ways are cut $2\frac{1}{2}$ in. wide × 1 in. It is lined on three sides with $\frac{1}{8}$ in. asbestos sheet, these held in by $\frac{3}{16}$ in. screws and nuts.

The burner (No. 7) is of bunsen type. A $\frac{1}{4}$ in. gas iron bend enters the furnace side, the hole is $\frac{1}{2}$ in. centre above the base. A lock-nut and $\frac{1}{4}$ in. to $\frac{1}{8}$ in. reducing socket hold the burner in place. The small pipe is $\frac{1}{8}$ in. iron gas, a $\frac{1}{4}$ in. hole is drilled through at right-angles and a brass coupling takes an $\frac{1}{8}$ in. copper pipe 2 in. long. An air U-shaped cover made of thin copper slips on to adjust the air supply.



A close-up of the motion

7



Burner

Oil holes, $\frac{1}{16}$ in. and slightly countersunk, are drilled in bearing, big-ends, etc.

Engine looks well if motion painted red and other parts green, flywheel rim *bright*. Furnace and hot parts motorcycle cylinder paint.

To make sure no air leaks. Take out the crank-pin insert engine cylinder down in a bucket of water, then push piston down ; air leaks will be revealed by bubbles, and must be remedied. The tank is coupled to the jacket by means of short rubber tubes.

A polished aluminium cover looks well bent half-circle to cover the jacket, etc. Cut away for pipes. For long running a small oil cup could be fitted to the power cylinder half way along on top. The writer will be pleased to answer any points not made clear through our Editor. There is no need to keep to these exact sizes ; however, if they are departed from, by all means make the power cylinder crank and connecting-rod adjustable to try various strokes, and use the best. It was done in this engine.

The small drawings are not to scale. " Flexo " is a paste used in place of red and white lead.

Buxton's Third Exhibition

The Buxton Model Engineering Society held a very successful exhibition recently at the Hardwick Square Schools, the third public show since the club was formed in 1946.

There were about 200 exhibits and, during the time the show was open, from 10 a.m. until 9 p.m., something like 1,750 people passed through the doors.

The passenger track had a busy time, the youngsters were queueing all day for free rides and one of the locomotives, recently completed by a club member, was continuously in steam for nine hours. Assistance was also given by two locomotives from neighbouring clubs and most of the day there were two locomotives on the track at the same time. The society's air compressor ran non-stop supplying air to a variety of models, including a beam engine and a small traction engine. Some control-line flying was put on in the school yard, but owing to the very restricted space, two planes were badly damaged. Following the flying display a model car successfully showed its paces, again under difficult conditions. Of special interest was the gauge " O " layout with some thirty yards of continuous track, most of which was specially built by club members in the three or four weeks before the exhibition. This layout was in action all day with steam, electric and clockwork locomotives hauling trains of various types. Other interesting items included an experimental radio valve made by a club member ; a small hand loom on which demonstrations of simple weaving were given ; a working Cornish beam winding engine and house, with boiler ; two electrically-operated showcase model locomotives, loaned by British Railways ; many excellent examples of steam locomotives in various gauges and, finally, a display of woodwork by the boys of a local school.

An unusual feature was a stand by Buxton Junior M.E.S. This society was formed by the sons of some of the senior society members, and their friends, and it holds regular meetings. Its members also attend suitable meetings, film shows, etc., put on by the senior society.

Prizes were awarded in the following sections : locomotives, general railways models, workshop tools, aircraft, ships and miscellaneous.

A noticeable point about the show was the wide area from which visitors and models were drawn. There were visitors from Wigan, Huddersfield, Sheffield, Chesterfield, Crewe and Stockport, and models from as far away as Chichester in Sussex, and Shipley in Yorkshire. Many reunions and a lot of friendly gossiping took place.

Turning Thin Metal Discs

DIFFICULTY is often experienced in turning and cutting a disc from a piece of sheet metal. The sheet of metal is often held in the chuck, but this method gives much trouble due to tool chatter, and chatter marks are out of the question if the disc is required highly polished. When next you have a job of disc turning, try the following method.

Obtain a piece of hardwood and see that it is sound and quite free from cracks. The wood

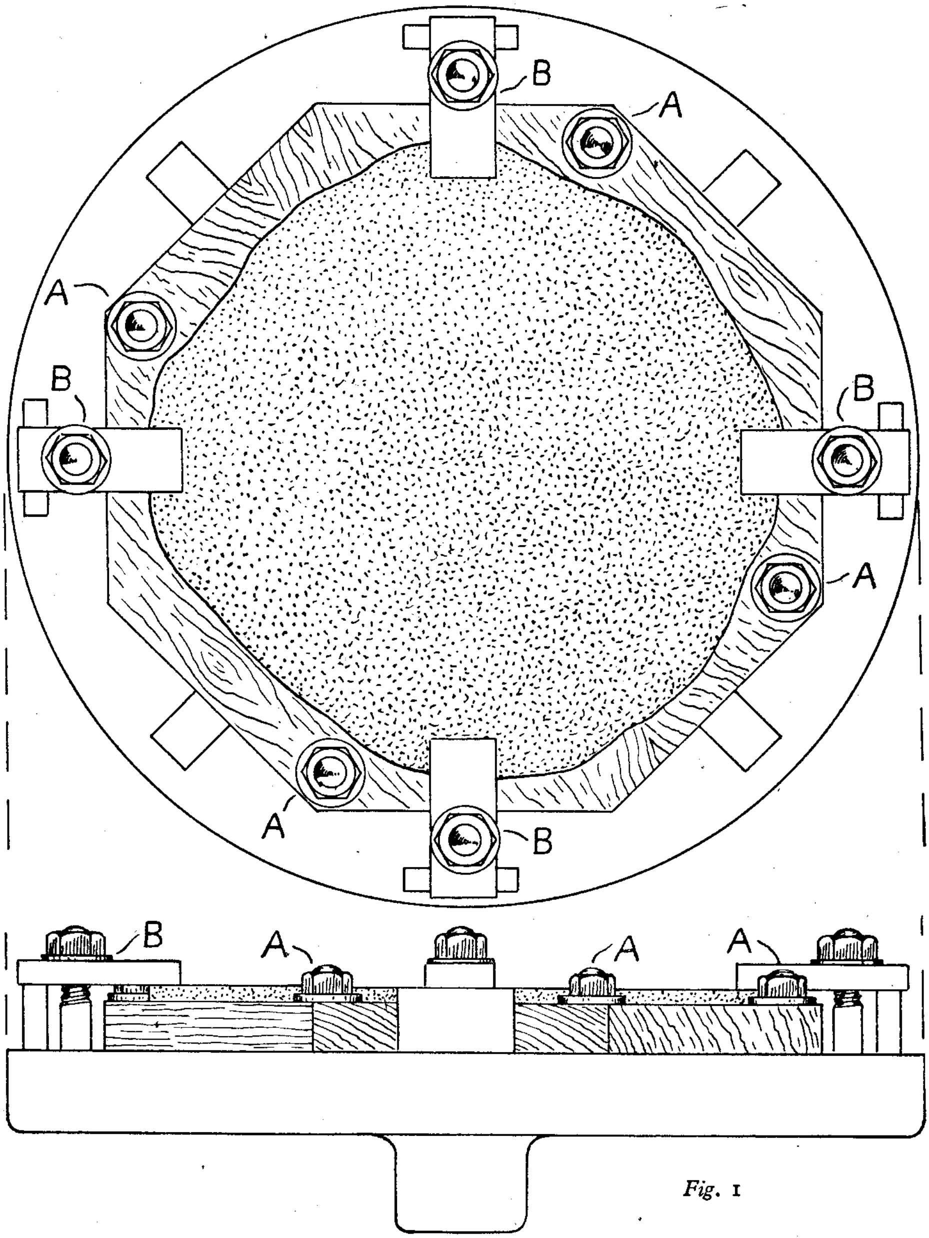


Fig. 1

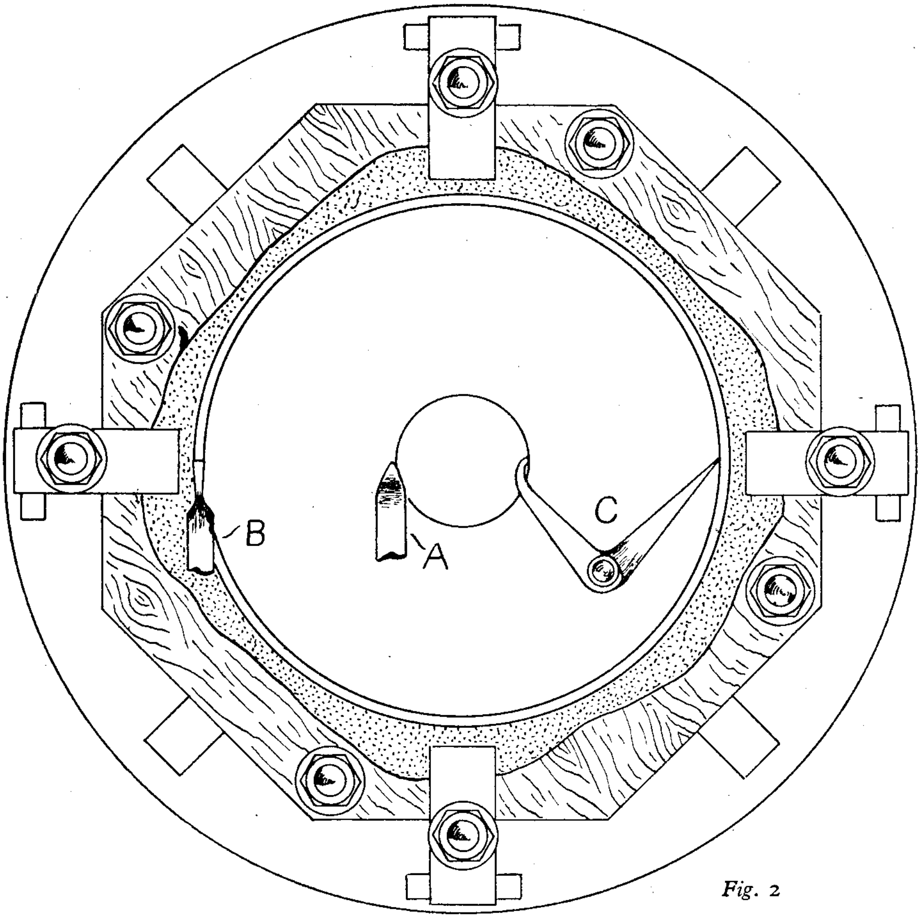


Fig. 2

should not be less than ½ in. thick, and level off one face. Drill four holes in the wood, and then bolt to the faceplate as indicated at *A* in the accompanying illustrations, with the planed face in contact with the faceplate. Skim the surface of the wood across the face far enough to take the piece of sheet metal, and bolt the metal to the wood surface, as indicated at *B*. It is best first to drill the centre of the disc, unless, of course, a blank disc is required. If a blank disc is required, have the cutting point of the facing tool on dead centre, and it is a good plan to centre pop the metal and take the cuts from the centre to the outside. In Fig. 2, a method is indicated for machining and cutting out a disc with the centre drilled out. After taking a cut across the face with the tool, commencing as indicated at *A*, Fig. 2, the hole in the centre is bored to correct size. The face is now finish-turned and polished, when it is ready to cut out.

Cutting out the disc is best done with a narrow parting-off tool, as indicated at *B* Fig. 2, and the tool is set to the correct outside diameter with a pair of odd-leg calipers, indicated at *C*. When the parting tool is almost through the metal, it is best to finish off by pulling round on the lathe belt. If a disc is required machined on both faces, machine one face, then reverse and bolt the metal down and complete the job as already described.

—W. J. Saunders

Catalogue Received

Messrs. Bassett-Lowke have favoured us with a copy of their latest catalogue of model ships and ships' fittings. For many years, the firm has specialised in these products and can claim to have pioneered most of them. This catalogue should interest all who wish to model ships of any kind from the stately liner to the humble fishing-smack, not to mention battleships and galleons. A large selection of drawings is available as well as a wonderful range of fittings of all kinds for model ships and yachts.

The catalogue, price 1s., can be obtained from Bassett-Lowke shops or from the head office at Northampton.

Novices' Corner

Some Hacksawing Problems

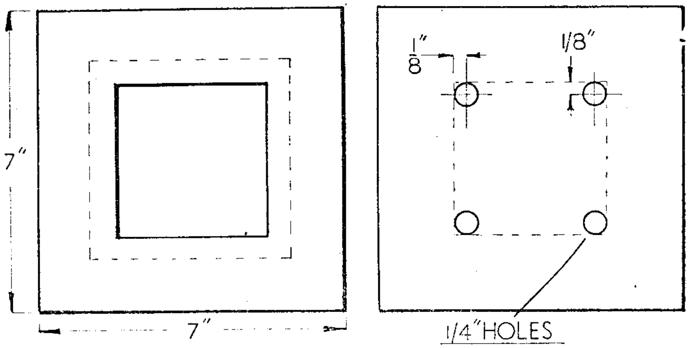


Fig. 1. Showing the frames made and the method of marking-out

WHEN making some photographic apparatus recently, several frames were required, made of both heavy-gauge sheet steel and wood of ½ in. thickness. These frames, as illustrated in Fig. 1, were of various sizes and had to be made with the ordinary hand tools found in the small workshop, but a fretsaw, which might have been useful, was not included in the tool equipment.

The frames were cut out of the solid material by using the hacksaw as a piercing saw to form the central window, and entering the blade through a hole drilled at the corner of the frame.

The opening was first marked-out and a ¼ in. diameter hole was drilled at each corner so that the blades could be turned to follow the dimension lines. When a small hacksaw was used in this way, it was found that the depth of the saw bow was insufficient to allow the blade to make a cut of the full length required. This difficulty is usually overcome either by using a saw frame having a deep throat, like a fretsaw or, by mounting the blade horizontally in the ordinary hacksaw frame ; when mounted in this way, the saw bow lies at the side of the work and not vertically above it, as represented in Fig. 2. Another method of cutting out these openings is to use a round blade somewhat similar to a slender round file, for a blade of this form will, of course, cut in any direction and, at the same time, the saw frame can be held either vertically or horizontally at will.

It so happened that samples had been received from the manufacturers of a new type of Eclipse blade. This round, flexible blade is 5 in. in length and has a diameter of only 0.046 in. ; the teeth are formed to lie spirally on the surface of the blade, and feel quite sharp to the finger. The two ends of the blade are left flat so that they can be gripped in a frame furnished with clamping-screws, such as a jeweller's hacksaw or a piercing-saw frame. A jeweller's hacksaw with one of these round blades mounted in place is shown in Fig. 3. This type of blade is apparently intended for cutting thin sheet metal, and is not, of course, designed to withstand the heavier cutting pressure required when sawing thicker material ; nevertheless, the cutting capacity of the blade was surprisingly good even on thick sheet and, by taking care, no difficulty was experi-

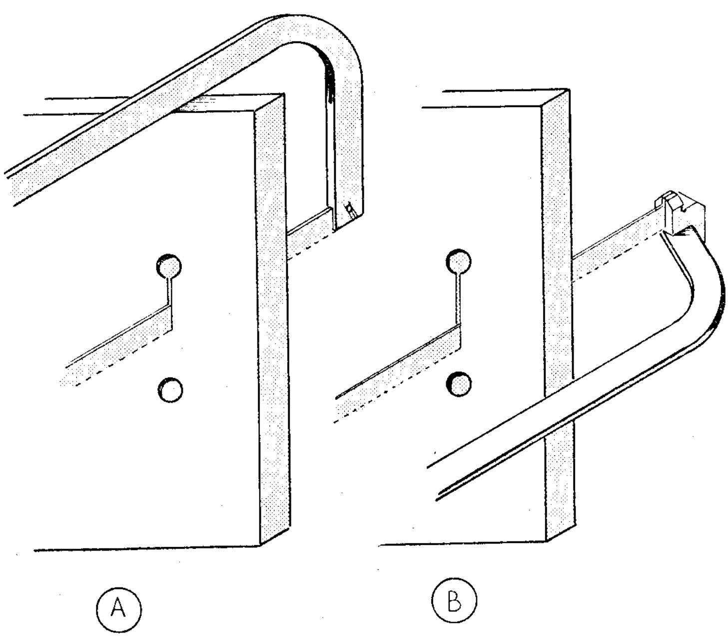


Fig. 2. The Eclipse Junior hacksaw : A—cutting vertically ; B—the frame with the attachment used horizontally

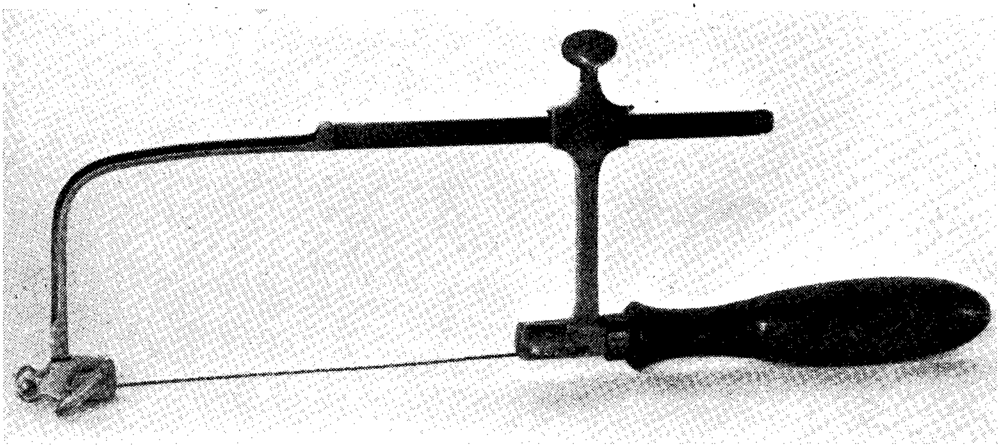


Fig. 3. The Eclipse round blade mounted in a jeweller's hacksaw frame

ended in cutting out samples of both the wooden and the steel frames. However, to obtain quicker cutting, it was decided to use a hacksaw fitted with a flat blade for making the remainder of the frames. For this kind of work, a 10-in. hacksaw is rather too clumsy, and, moreover, a large hole would have to be drilled to allow the blade to be entered. The 6-in. Junior Eclipse hacksaw blade is, however, well-suited for this purpose as it is only $\frac{1}{4}$ in. in breadth, but the Eclipse No. 70 frame holds the blade vertically and does not permit the saw to be used horizontally as represented in Fig. 2B.

It was decided, therefore, to adapt the frame to carry the blade in any position required. The threaded saw mounting at the handle end of the frame is used for tensioning the blade and is furnished with a squared portion which slides in a corresponding square opening in the frame. This construction allows the rear end of the blade to be mounted in four positions at right-angles to one another, but at the forward end the blade is carried in a slot cut vertically in the frame itself. To allow the blade to be mounted horizontally in the frame, a special attachment was, therefore, made to fit on to the forward vertical limb of the frame, as illustrated in Figs. 4 and 5. For the sake of clarity, the fitting is represented in Fig. 2B as lying above the frame, but in practice and as shown in the photographs, the saw is fitted below the frame; the pressure applied while sawing then tends to press the blade against the body of the attachment and there is thus no danger of the blade becoming detached. No attachment screws are necessary, as the tension of the blade is itself sufficient to keep the fitting in place. If the frame in question is examined, it will be seen that, as represented in Fig. 6, the forward limb forms an angle greater than a right-angle with the back of the saw. In order, therefore, to allow the blade when under tension to lie in a straight line, the end of the limb is filed to stand at right-angles to the back, as indicated in Fig. 6.

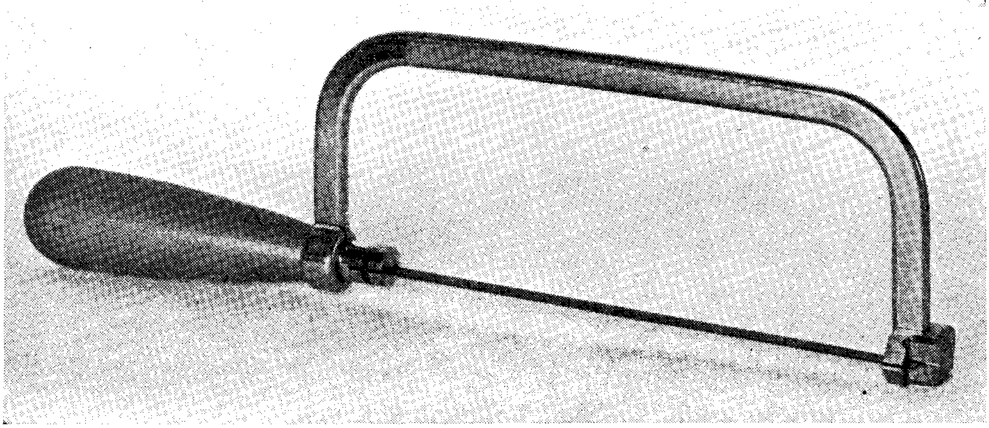


Fig. 4. The special attachment used to mount the blade in the Junior frame

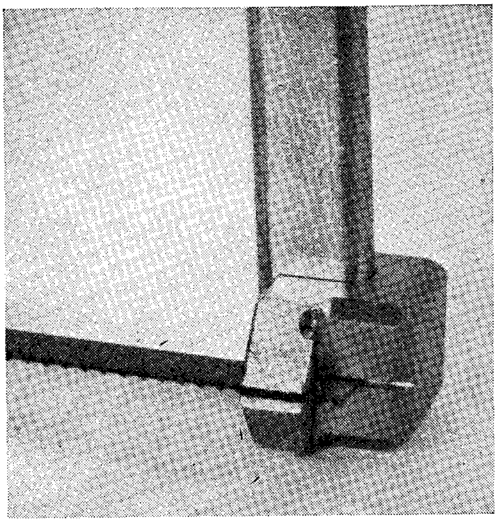


Fig. 5. An enlarged view of the attachment

The attachment is best made from a short length of ½ in. square mild-steel, and although it may appear fully large for its purpose, it will, nevertheless, afford a convenient finger-hold when sawing. The material is marked-out as shown in Fig. 7 and the two holes shown at *A* and *B* are then drilled right through the work. A slot is next cut with a file to meet the hole *A* and to make the part a push fit on the end of the saw frame. The work is now cut to length, and its lower end is filed to the given dimensions to receive the tension-pin of the saw blade. A centre-line is marked-out on the front face, Fig. 8, and a saw-cut is carefully made to a

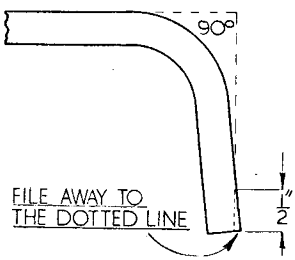


Fig. 6. Showing how the saw frame is adapted for fitting the attachment

depth of ¼ in. to allow a spare blade to enter and its tension-pin to engage in the remaining portion of the hole *B*.

The teeth of the Junior blade are, of course, given an outward set so that the blade, when cutting, will form a wide kerf which will check any tendency for the saw to bind in the cut; this means that the plain part of the blade behind the teeth will be a loose fit in the saw cut. To obtain a closer fit for the blade in the attachment, a cut of the correct width can be made by using a blade from which the set has been removed.

To adapt the blade in this way, the sides of the teeth, for a short distance, are flattened by gripping the blade in a machine vice and then applying it carefully to the side of the grinding-wheel. The appearance of the finished attachment will be improved if its edges are deeply chamfered and, at the same time, all surfaces given a smooth finish with a fine file.

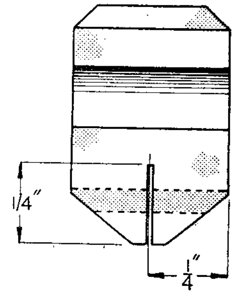


Fig. 8. Forming the saw cut to mount the blade

Parting-off with the Hacksaw

When parting-off small parts in the lathe, such as a batch of brass screws, it will save material and may even prove quicker to use the hacksaw for this purpose. For small work, a saw of the Eclipse Junior pattern should be used, and the full-size hacksaw reserved for parting larger or tougher material. As a preliminary step, a groove to guide the saw at starting should be turned with a V-pointed tool. The lathe is run at medium speed for light parting-off operations, but when dealing with small brass parts, a higher speed may be used.

After the lathe has been started, the saw is entered in the guide groove and then worked to and fro as when sawing stationary work; likewise, the cutting pressure should be increased as the saw is thrust forward and relieved on the return stroke. The whole length of the blade should be brought into use so that the wear is evenly distributed on the teeth. Care must, of course, be taken to saw lightly towards the end of the operation, in order to maintain full control of the hacksaw and keep it from coming into contact with the lathe parts as it breaks through; if preferred, however, the lathe can be stopped when the saw is nearly through and the cut completed by operating the hacksaw in the ordinary way.

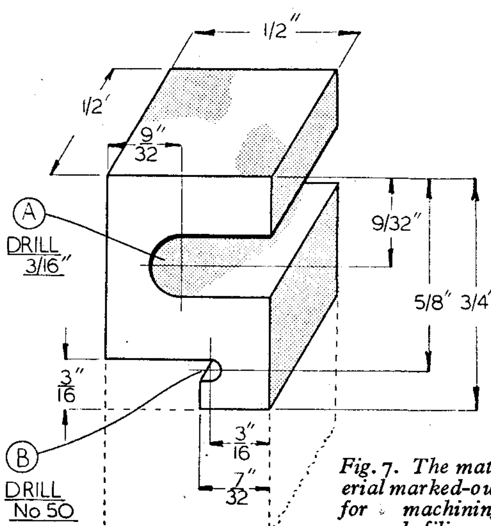


Fig. 7. The material marked-out for machining and filing

Queries and Replies

Enquiries from readers, either on technical matters directly connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed: "Queries Dept.," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 9850.—Balancing an Engine
J.A.T. (Poynton)

Q.—I would be very grateful if you would advise me how to balance a four-cylinder radial engine.

R.—You do not give sufficiently definite information about your four-cylinder radial engine to enable us to give you exact advice on the balancing of same. Presumably, this would be a steam engine, as the great majority of internal combustion engines of the radial type have an odd number of cylinders. The question also arises, whether forked connecting-rods all working on the crankpin are employed, or a master rod and three articulated rods, as in the latter case the balancing calculations would be very much complicated. Assuming, however, that all rods operate directly on the crankpin, it is usually satisfactory to balance out all the reciprocating weight of one opposed pair of pistons and connecting-rods, plus the rotating weight of the two big-ends, crankpin, etc. The simplest way to do this in practice is to hang the two complete assemblies on the crankpin, and set the main shaft on knife edges, adjusting the balance weight so as to balance all the weight on the crankpin.

No. 9845.—An Unusual Clock
E.F.G. (Coventry)

Q.—Can you give me any information on an old clock which I have seen? It was built like an old-fashioned cuckoo clock, but underneath were little chains for winding, and a china girl seated on a swing which rose up and down on a spring.

R.—We have seen similar clocks to the one you describe, though we have no exact details of their construction. In principle, however, the oscillating device takes the place of the pendulum, and controls the pallets of an escapement, usually of fairly normal type. It may be mentioned that any weight suspended by a spring in this way has a natural period of oscillation, the weight tending to slow the period and the spring tending to accelerate it. These can be so adjusted that the oscillation takes a definite period of time, and there is usually a lever connected with the moving part, in such a way as to allow the escapement wheel of the clock to pass one tooth at a time for each oscillation of the weight.

No. 9841.—Cracks in Castings
J.D.H. (Wembley Park)

Q.—I am building a 16 mm. sound projector, which comprises a base built up from aluminium castings. I find that in the centre of one of the sides there is a crack extending about 2½ in. but light is hardly perceptable through this. The total size of this side casting is 18½ in. × 8½ in., and of the panel in question 8½ in. × 8½ in. The thickness here is about ⅛ in. I should be extremely obliged if you would let me know whether there is any possibility of the crack extending due to heat from the lamphouse, amplifier, etc.

R.—We think it is extremely unlikely that the crack in the casting referred to would spread, unless it is in some part under heavy mechanical stress. It could, however, be definitely prevented spreading by finding exactly where the crack terminates and drilling at each end, and plugging with a soft aluminium screw or rivet. Should there be any sign of light leakage caused by the crack, it can be stopped by using metal cement or the preparation known as "cold solder."

No. 9842.—Electrical Testing Set
G.W.T. (Portsmouth)

Q.—By trade I am an electrical fitter and come in contact with a number of small armatures, most of which require rewinding. Could you furnish me with particulars, diagrams, etc., of a small testing set, for registering a correct drop-potential test working on several dry cells?

R.—We regret that we are unable to supply drawings and instructions for building an electrical testing set of the type referred to. We may mention, however, that this device consists essentially of a sensitive galvanometer, preferably one of the moving-coil type, with calibrated shunts and resistances arranged in such a way as to cover a number of voltage and current ranges. In cases where resistance measurements are also incorporated, it is usual to employ one of the voltage ranges in conjunction with a battery of known voltage, which will normally deflect the needle full scale when on closed circuit. The instrument is then calibrated with a standard resistance, reading backwards on the voltage scale. We think that if the principles of this type of instrument are fully grasped, and you have the means of winding calibrated resistances and shunts, it should be a fairly simple matter to make up the complete testing instrument, using a moving-coil meter of the type now obtainable quite cheaply on the surplus market.

PRACTICAL LETTERS

Marking-out Dye

DEAR SIR,—There is a preparation made by Spectra Products, Spectra Works, High Street, Caterham, Surrey. This is made in the following colours: red, brown, pink, orange, magenta, blue, green, violet, yellow, sea-green and white.

I have used this preparation for years professionally on marking-out and can recommend it. In use I have found that by using green instead of blue it is far easier on the eye and not so confusing. The white is, of course, ideal for castings.

Yours faithfully,
Slough. C. A. SMITH.

Splined Shaft Drive for Heywood Type Compressor

DEAR SIR,—Referring to the article on "Piston-type Compressors" (p. 901 THE MODEL ENGINEER June 22, 1950), perhaps it will be of interest to note that the female spline fitted upon this compressor is fitted by either the drive pinion or gearbox main shaft as fitted to the Ford Anglia or Prefect. I have no doubt that any reader wishing to procure one of these parts will be able to obtain one at any main Ford dealer from discarded ones, completely free of charge, but in case of any difficulty I will be only too glad to obtain either of these parts for anyone wishing one, merely for return of postage.

Now to broach the subject of compressors for refrigerators and to refer to Mr. Sherell's article and Mr. D. Brother's practical letter, September 21st, 1950. Having myself completed all the necessary parts for Mr. Sherell's refrigerator with the exception of the compressor I am rather at a loss to know what to do in view of Mr. Brother's remarks that Freon 12 is non-corrosive to aluminium. All the data I have on refrigeration simply state "Aluminium must *not* be used." I would welcome some real practical information on this question, because it seems rather a shame that this beautiful Heywood compressor cannot be put to a more useful life than pumping up car tyres.

If my hopes are realised and Freon 12 can be used with non-corrosive effects on an aluminium compressor, perhaps some information on the necessary modification to the Heywood compressor for use in domestic refrigeration will be welcomed by a great number of readers, including myself.

Yours faithfully,
Prestwich. CHARLES H. CONNELL.

Gear-cutting

DEAR SIR,—In the interests of truth, I feel I must comment on Mr. K. Horsfall's letter, published in THE MODEL ENGINEER of October 12th. While wholeheartedly agreeing with him in congratulating "Base Circle" on an excellent article (in fact, I would go so far as to say the best that has appeared in our pages on gear cutting), I feel sure that Mr. Horsfall has missed the point of the method.

The tool used is not a single-point tool; if this were the case, then the generating disc would be base circle diameter minus wire diameter. The tool is actually one tooth of a straight-sided rack; the tangential contact gives far better surface finish than a single-point tool, as "Base Circle" points out, and, to obtain true involute teeth in this way, the gear should be rolled along its pitch circle, as given in the original article, relative to the cutting tool. If the diameter of the generating disc is made equal to pitch circle diameter minus wire diameter, the correct motion will be given to the blank.

Yours faithfully,
S.E.9. A. A. SHERWOOD.

Windmill Terminology

DEAR SIR,—May I point out that the windmill so admirably portrayed on the cover of the October 5th issue, is not a "tower" mill, but is of the type known as a "smock" mill in poetic allusion to the white smock then so common an article of attire among country men. "Tower" mills are of brick or stone.

The type of mill illustrated was built of wood, the principals being of oak and covered by weather board, chiefly of octagonal form but, very rarely, of hexagonal style.

The exhibition example closely examined by the writer, can hardly be considered complete, as there is not even a "token" suggestion of transmission gear from the "fan tail" to the rotary "cap."

This gear covers practically every type of mechanical unit, bevel, spur and worm, the reduction being of the order of 2,000-1. Apart from this, the work on the "sweeps," the simulation of weather boarding and the representation of the brick plinth covering the ground or "sack" floor is admirable. It is to be hoped this excellent example will be followed in next year's exhibition.

Yours faithfully,
Kingsgate. WARING S. SHOLL.