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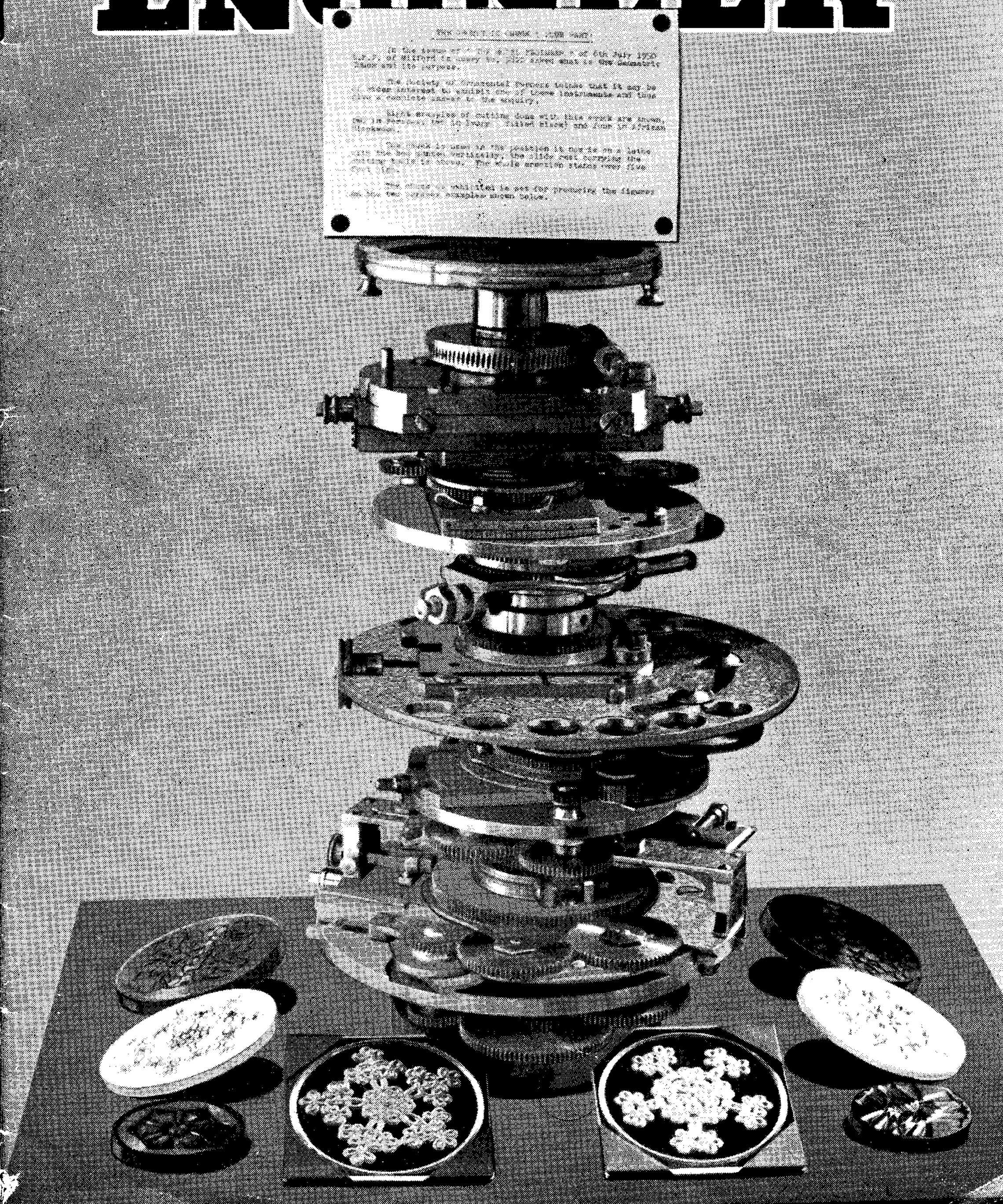
THE MODEL ENGINEER



The MODEL ENGINEER

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

9TH NOVEMBER 1950 VOL. 103 NO. 2581

SMOKE RINGS

Our Cover Picture

● THIS PHOTOGRAPH depicts a rather unusual piece of mechanism, such as is rarely encountered at the present day; namely, a remarkable specimen of a geometric chuck, which formed a part of the exhibit of the Society of Ornamental Turners at this year's "M.E." Exhibition. Many of our readers have submitted queries regarding devices of this nature, which were formerly popular among users of the very elaborately-equipped ornamental-turning lathes built by Holtzapffel and his contemporaries. These chucks were attached to the lathe mandrel nose, and embodied gearing which enabled the work attached to the front plate to be moved in complex geometrical orbits, and thereby to be turned or milled to intricate patterns. The particular example of this type of appliance is one of the most complete and well-preserved we have seen, and its use would call for considerable skill. Some examples of work produced with the aid of the chuck are shown beside it, and give a very good idea of its possibilities. There are at present some signs of a revival of interest in ornamental turning, which was once the hobby of the aristocracy, and even royalty; any of our readers who may be interested in taking up this pursuit may obtain further information on the subject from the secretary of the above society, Mr. F. J. Howe, 5, Southbourne, Hayes, Bromley, Kent.

The Ladder of Success

● MANY OF our older readers have told us how important a part THE MODEL ENGINEER has played in shaping their careers. In many cases, a knowledge of how to tackle the many little problems which crop up every day in the home workshop has meant all the difference between success and failure in carrying out much bigger tasks in industrial life; and information gleaned from the pages of THE MODEL ENGINEER has been applied to many full-size engineering operations. Readers have recalled how this knowledge has helped them to obtain jobs, or advancement in their existing positions. A typical story of this kind is contained in a recent letter from a Chesterfield reader, who has taken THE MODEL ENGINEER since 1905, at which date he was working as a miner in a local colliery. He had no special training in engineering, and was unable to attend night school, but thanks to self-education, obtained mainly from the pages of THE MODEL ENGINEER, he was able to obtain a job in the colliery fitting shop, and for the last eight years of his working life he occupied the responsible position of enginewright. Now retired, after over 48 years at the same colliery, he is still making models. This is only one of the many letters which show that, so far from being a "useless hobby" as sometimes suggested, model engineering can be a very useful aid to those who are trying to climb the ladder of success.

Quoting for a Traction Engine

● ONE OF our Scottish readers, Mr. C. D. Nicholl, has sent us an interesting document, a copy of which is set out below. A Dundee firm, in 1902, required a traction engine of rather a special nature, and Aveling & Porter, of Rochester, submitted this typical tender :—

Rochester,
25th February, 1902.

Gentlemen,

We beg to offer you an Engine suitable for your work at the Quarry at Maryfield and are pleased to place you upon our very best terms.

One 8 h.p. Traction Engine adaptable for a Steam Roller and capable of working a Rock-drill as well as driving a Stone-breaker. Such as already fixed.

The price of this engine is as a Traction	£520	0	0
Fitted for Injector ..	10	0	0
	£530	0	0
Less 10 per cent. ..	53	0	0
	£477	0	0
Less 2½ per cent. for cash	11	18	6
	£465	1	6
Delivered free at Dundee.			
If fitted for Roller with extra set Roller wheels	175	0	0
Less 10 per cent. ..	17	10	0
	£157	10	0
Less 2½ per cent. for cash	3	18	9
	£153	11	3

also delivered free Dundee.

We are the largest makers of these Engines in the World, and in fact make these engines exclusively so that we can generally supply in two or three weeks after receipt of order.

We should much value your order and will send you the very best engine we can make.

We are, Gentlemen,
Your obedient Servants,
(Sgd.) Aveling and Porter Limited,
H. PITTS.
Director.

We are pleased to add that they secured the order ; but we wonder if they photographed the engine. We do not recall having seen an illustration of a traction-cum-portable engine-cum-steam roller !

A Society for Acton

● A LONG letter from Mr. Andrew R. Lyon has informed us of the existence of the Acton Model Engineering Society which seems to be firmly established to cater for our hobby in that densely-populated area of London. The society has been functioning for about six months, though little has been known about it until now, and for a good reason. It was founded by a little group of nine enthusiasts who were fortunate in acquiring the use of a basement room as headquarters ; it was in poor condition, however, but the members joined forces in putting in hand the necessary redecoration and the installation of work-benches.

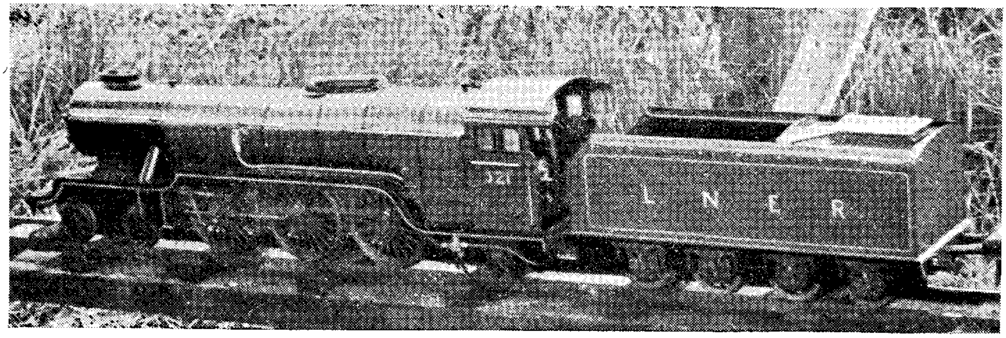
So far, the equipment consists of two lathes, 2-in. and 1⅝-in., a drilling-machine, a heavy-duty vice and sundry smaller items ; a 3½-in. lathe is shortly to be added, together with grinders, more vices and (outside) a brazing hearth.

Most of the members are interested in railway modelling in some form or another ; there are a 3½-in. gauge G.W. "King" and 72XX 2-8-2 tank and a 2½-in. gauge "Dyak" rebuild in various stages of progress, while a comprehensive "OO"-gauge layout has been planned and will be accommodated in an adjoining room. Meanwhile, a "OO"-gauge test track has been laid along one of the walls of the workshop. Exhibitions of films and visits to places of interest have been arranged.

All this appears to make up into quite an auspicious beginning and augurs well for the future. The hon. secretary is Mr. S. Hickmore, 106, Milton Road, Hanwell, London, W.7.

A "Lassie" from Devon

● THE "HIELAN' LASSIE" illustrated herewith was built by Mr. J. E. P. Hutchinson, hon. secretary of the North Devon Society of Model Engineers, one of the members of which, Mr. L. C. Munro, is responsible for the photograph. We learn that the engine is an excellent steamer and "very lively on her feet" now that she has been relieved of her initial stiffness. Her only fault is that she keeps blowing off ! The injector was made by Mr. G. T. Bainbridge, late of the British Oxygen Co., and was the last thing he made before he retired and sold all his tools ; but he still takes a keen interest in the society's activities. Incidentally, his son, Mr. C. G. Bainbridge, unfortunately for the North Devon M.E.S., has removed to Canada, where he has joined the Toronto M.E.S.



Notes on Chuck Settings

by G. Gentry

THE following notes on some simple lathe chuck settings may be of help to beginners generally.

Chucks

Many beginners in the use of the lathe appear to think that jaw chucks, and especially self-centring jaw chucks, are the only accessories to which the name of chuck can be applied. As a matter of fact, any apparatus which can be attached firmly to the revolving spindle (i.e. mandrel), so to revolve with it, and capable of both guiding and driving the work, which is held in or on it, is a chuck. All the old lathe makers described a faceplate as the faceplate chuck, and when they made the head centre in one with the driver, screwed together on the lathe nose, they called it a centre driver chuck. These are seldom fitted to lathes nowadays, but have the centre, which guides the work only, distinct from the driver plate. Neither is known nor can it be described as a chuck.

On modern precision lathes there is supplied a range of small brass faceplate chucks known as shellac chucks. They are quite simple things to use. With a small piece of shellac melted on the surface by the application of a spirit flame or bunsen gas flame they can take small wheels, or other circular parts of watches or small clocks, which can be trued up for central position by running the lathe while the chuck is still hot enough to maintain the shellac tacky, and guiding the work by a pointed pegwood to the true position. Then, when allowed to cool, the shellac sets and holds small parts sufficiently tightly to resist the cut of the tool. The writer has contrived such chucks, but has secured small parts to them by tacking with solder. There are many more types of chuck including the ranges of collet (i.e. split chucks) and step chucks, all of which are variations of the jaw chucks, but the main business of these notes has reference to the use of wood faceplate chucks.

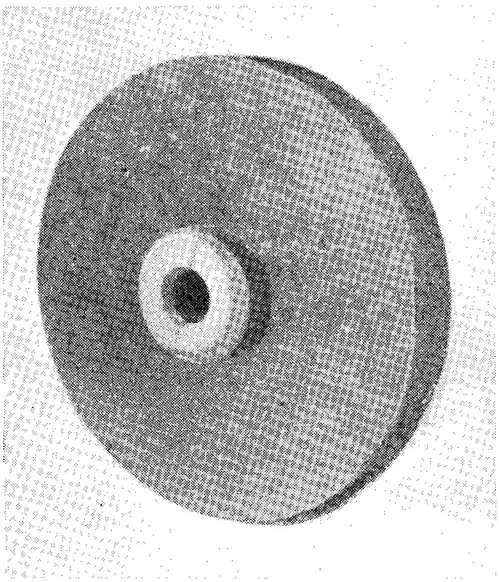


Fig. 1. Back view of a wood faceplate, showing boxwood nose nut glued in

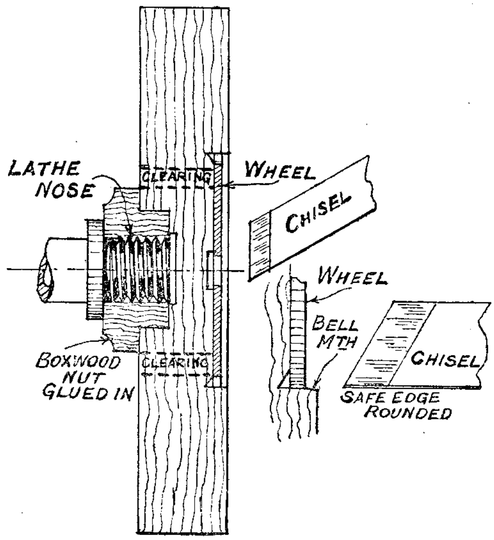


Fig. 2. Section of wood faceplate, showing nut recess and method of chucking fine tooth wheels

It is as well to refer to the fact that in setting work in a chuck of any kind, one is said to be "chucking" it, and also, in the case of jaw chucks, when the jaws have their steps passing down towards the centre and hold circular work by its outside, such jaws are termed "lathe" pattern; but when jaws are provided stepping down outward, such jaws will hold rings and cups by the interior and also are most suitable for holding straight-shank drills by the long centre step. They are therefore termed "drill" pattern. When chucks have both patterns of jaws or reversible, they are generally known as "Universal."

Wood Chucks and Wood Faceplate Chucks

Such wood chucks as are used by the wood turner are often of the bell chuck type turned in hardwood (probably lignum vitæ) on the turner's own lathe and take other of the softer woods driven into them. Bell chucks are also made in cast-iron, and similarly intended for taking wood work for turning operations driven into them. Bell chucks, however, used in metal turning usually have two sets of three set-screws, or two sets of four set-screws, passing radially in the wall of the bell. They are known respectively as six-screw or eight-screw bell chucks. They tend to mark and score the work badly.

The type of wood chuck of most interest to the young reader, however, should be that as shown at Fig. 1. This is a 6 in. × 1 in. mahogany faceplate chuck adapted to screw to the lathe nose by a boxwood screwcut and tapped nut. Fig. 1 is a back view to show the nut, which is glued into a recess in the manner shown in the section to the left of Fig. 2. Here it will be seen the nut is at

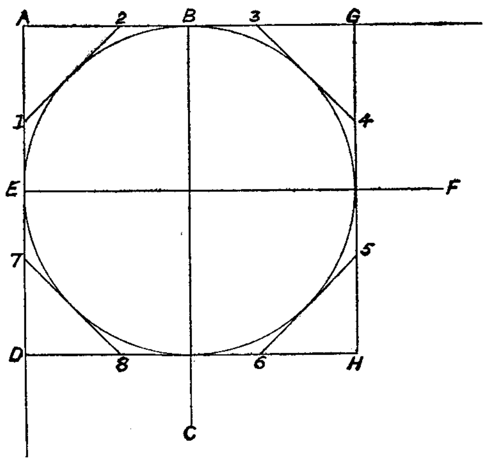


Fig. 3. Setting out to rough out a disc from square material

least as long as the lathe nose, and the main body of the chuck is recessed a little further to escape the bearing of the nose point. In Fig. 1 the front of the faceplate is quite plain and flat, but, in Fig. 2, is seen its use for setting-up and true boring a toothed clock wheel, of which more later. Preparing a wood chuck given a suitable size and quality of wood, is simple. It is finding and roughing out the latter that takes time and trouble. The following describes how the writer dealt with a plank of sound mahogany to produce Fig. 1 :—

In Fig 3 (*A*) is the corner of the plank, in which the end (*AD*) is proved to be square to the side (*AG*), and both side and end square to the face of the wood. At a distance (*AB*)—½ in. short of the height of lathe centre *in the gap, if any*—draw the pencil line (*BC*) parallel to (*AD*), and the same distance (*E*) from (*A*) draw (*EF*) parallel with (*AG*). From the intersection of these as centre, sweep out the circle, touching the side and end at (*B*) and (*E*). From (*G*), which is (2*AB*) from (*A*) draw (*GH*) parallel with (*AD*) and touching the circle; similarly from (*D*) draw (*DH*), also touching the circle, and complete the square (*AGHD*) on the circle. From any corner (say *A*) set off a distance (*A*-1) equal to 2/7ths of the circle diameter or side of the square —this, if (*AD*) be 7 in. (*A*-1) will be 2 in. By joining 1 to 2, touching the circle, will give a tangent very nearly 45 deg., or near enough. Do the same at (*G*-4), (*H*-5) and (*D*-7). The square is next cut out with a hacksaw or fine-tooth rip saw, tending to cut outwards from the circle rather than inwards, so to avoid undercutting the circle. Before taking off the corners, in the same manner, test the thickness at each with a micrometer. These should tally with one another to within two or three thou. Allowing for the original plank saw cut 1 in. stuff comes out about $\frac{15}{16}$ in. When the corner pieces are sawn off, test the points 1, 2, 3, 4, etc., and measure the highest from the centre to find if, when set central, any will foul the bottom of the gap. If this is so, take enough off each to clear, paring downwards with a sharp firmer chisel. Then set the job on to the lathe iron faceplate as shown in Fig. 4 nearest to third of circle slots will allow. The clamps are cut from ½-in. × 3/32-in. mild-steel strip, 1⅜ in. long, and holed centrally with No. 19 drill (0.166 in.). The screws are No. 8 (0.164 in.) iron round-head, of such length to go into the wood not less than ⅜ in. To centralise the setting, measure exact diameter of the faceplate and scribe slightly larger circle in pencil using circle centre as a guide. To some extent the setting may be out, but if when iron faceplate (which must run flat and true on its lathe) is put on lathe nose, the large circle on mahogany runs out at all, the clamp screws must be eased and the job tapped over and run till true, before finally tightening screws. When completed so far, the outside edge has to be turned to clean up the big circle. (For this, use a very sharp tool held in the slide-rest and having a sharp top rake.) Don't run too fast or the tool edge will heat and soften. It is not intended to use this setting of the wood as a chuck but only to turn the edge and recess the centre to take the threaded nut, and is therefore the back of the accessory.

To make the nut, select a piece of boxwood, either round or square. This should be a trifle larger than the diameter eventually needed. If too thin for the length wanted, glue together two pieces and let them dry under pressure. If round, chuck it projecting in the " lathe " jaws of a self-centring chuck, or, if square, in the same set jaws of a four-jaw independent chuck. In that setting, turn the projecting part to a true cylinder, rather larger than wanted. Face the front, drill through centrally undersize of nose core, and bore out slightly oversize. This is better screwcut and sized up by a sharp flute edged plug tap. If the young reader shies at screwcutting, use a sharp taper tap, supported and followed up by tail centre, and finish with the plug. After opening out the usual bell mouth made, take it off the nose, chuck and all, and try on the nose, just as you would any back plate adapter. Most hardwoods tend to swell superficially after being cut, as in turning, and it is well to give the screw threaded portion a good working backward and forward on the plug tap to make the fit free at first to avoid the nut seizing on the nose. When this is done, and one is sure the face is bearing evenly on the nose shoulder, the nut at this stage is taken out of the chucking, screwed on the nose and turned to fit the recess made in the mahogany plate to which it is glued, as described. The one in Fig. 1 was left all night to harden with a heavy weight on it. It now runs dead true when screwed to the nose shoulder.

Dealing with Fine-toothed Wheels

Before the writer had made any wood faceplate chucks he trued the centre of a clock wheel in the setting, as shown in Fig. 5. A block of beech, trued square on all sides, was chucked in the lathe jaws of an independent and set running true to all four corners and the face faced flat. The centre was chipped out by a graver, and a pencilled circle, the same size as the wheel, was made

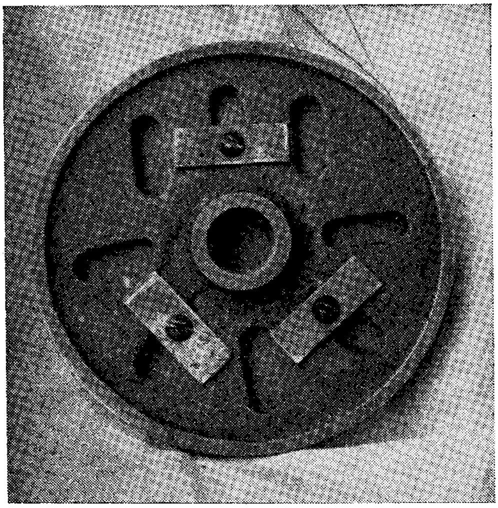


Fig. 4. How to clamp a wood disc on to an iron faceplate at the back

on the face, both as guides to the setting. On this the four spoked crossings of the wheel were straddled by two hardwood clamps screwed to the wood as shown. The truing of the teeth was judged by sound. A piece of very fine watch spring projecting an inch or more was just wiped by the teeth. It was otherwise held under the tool clamp of the slide-rest. By gently advancing it to the teeth, any out of truth produced interference of sound, but when the running wheel was true the constant hum of the wiped spring indicated it exactly. The wheel was truly cut in the first place.

It is impossible to chuck truly fine-toothed wheels of brass, fine knurled discs or shallow nuts, with an ordinary jaw chuck. The jaw surfaces would only deform them. Only one precision jaw chuck is known and this is shown in Fig. 6. It is defined as a universal bezel chuck. Only a small thing taking clock and watch wheels from 2 in. diameter down to 5/32 in. and holding rings and bezels from $1\frac{1}{2}$ in. to $2\frac{1}{2}$ in. When this chuck is held dead true it will hold wheels, etc.,

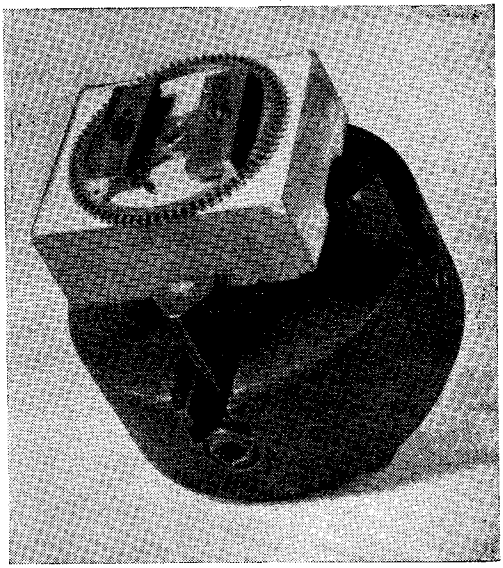


Fig. 5. A crossed out clock wheel chucked to a hardwood block held in a jaw chuck

also dead true. It is beautifully made and is very expensive, and, therefore, out of the question. Equal accuracy of holding can be done on a wood faceplate as shown in Fig. 2. A shallow recess is turned by the hand chisel slightly bell-mouthed just to take a toothed wheel, which when tapped into the faced inner surface, has its teeth gripped by the annular surface of the recess. The corners

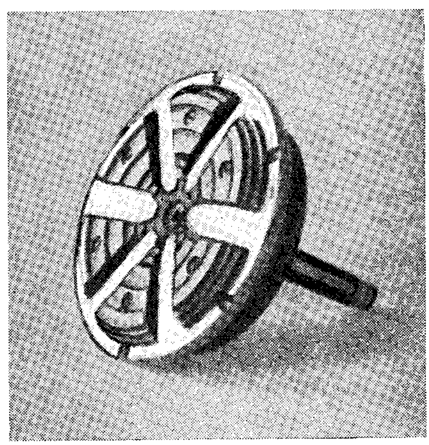


Fig. 6. A small precision universal jaw chuck used in horological work

of the recess are undercut by means of a safe-edged chisel, as shown inset, at double size. Clearing holes, $\frac{3}{16}$ in., as shown dotted, should be drilled through chuck to tap out the wheel by $\frac{1}{8}$ in. brass or copper wire punches, after correcting or enlarging the bore. Little more need be

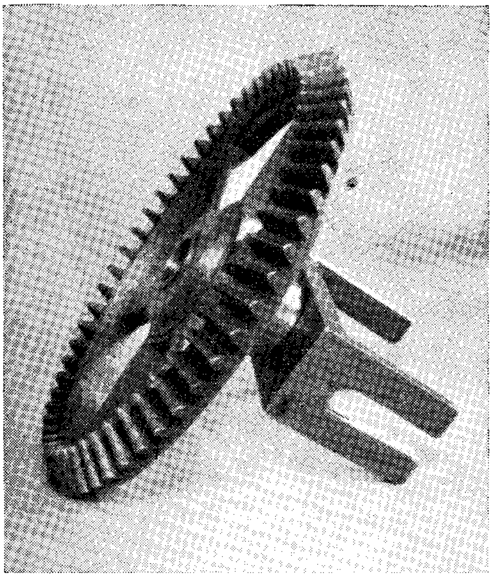


Fig. 7. *A* 56-*tooth G.M. mitre wheel,* 4 *in. dia.*

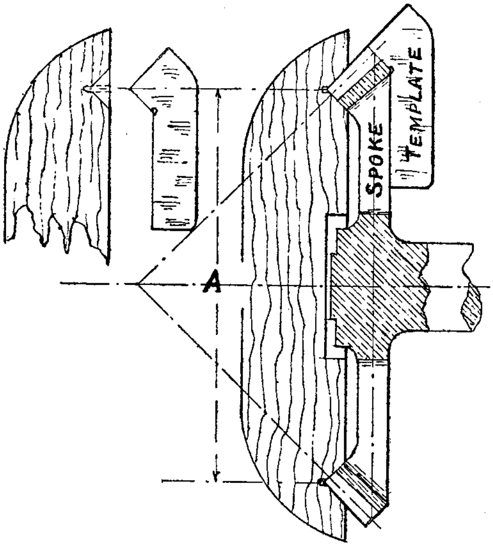
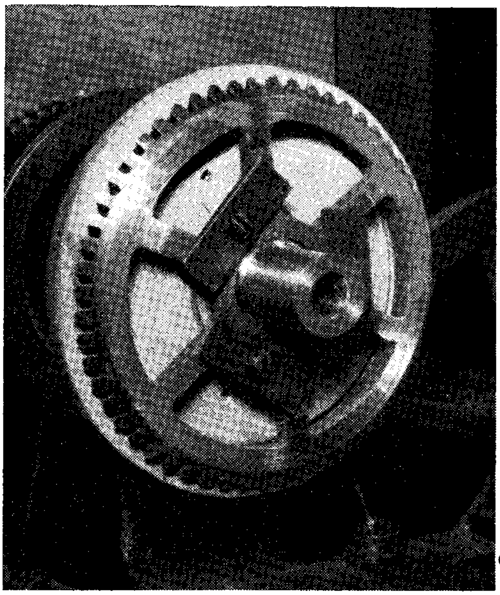


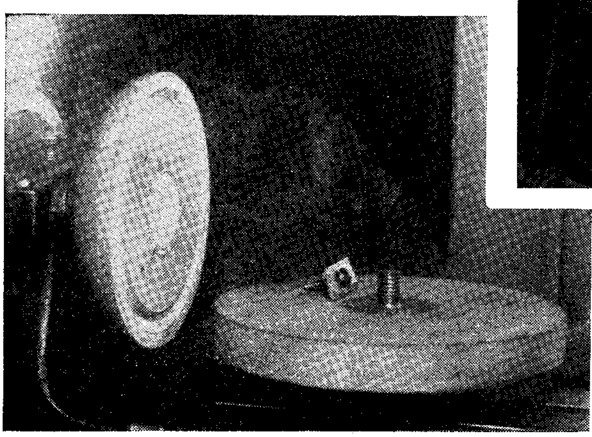
Fig. 8. *Section showing how the bevel wheel was mounted and the template made for grooving the wood chuck*

written on this except to point out that the bedding face must be either flat or very slightly recessed behind bore to clear boring tool point and allow of inserting hooked wires to withdraw smaller wheels.

Fig. 7 is a 4 in. G.M. mitre wheel of 56 teeth, which had lost its pair. To replace the latter and avoid work of making pattern, turning, boring and bevel-tooth cutting, the pair was cast from it, stopping off the double-forked driver. After dressing the teeth, which tended to bind, due to shrinkage, on their sides only, the problem of chucking it to the bore and turning the solid boss was presented. This is how it was done. Fig. 8 is almost explanatory, Fig. 9 shows the wood chuck mounted on lathe in course of preparation to take it, and Fig. 10 shows it clamped to setting as after the boss was turned and bored. The diameter (*A*) across



Above—Fig. 10. *The copied bevel wheel clamped to the turned plate*



Left—Fig. 9. *The grooved wood chuck and another (on bed) fitted with a screw nose* inner points of teeth was carefully measured and a pencil circle scribed on the face of the chuck, which was part of a beech vegetable presser found on a bomb scrap heap. A zinc plate template was made from the pattern wheel with the 45 deg. tooth end filed to fit and a straight-edge continuation of the tooth crest filed as shown. The latter is obviously more than 45 deg. to axis. A parting recessing tool made from a strip of broken hacksaw blade was cut in at the (*A*) diameter circle as shown dotted in the inset to left of Fig. 8 and then, using the template, the vee-groove was turned to fit exactly with its vertical inner edge against the face of the chuck. Fig. 10 shows how it was clamped. This wheel, running on shaft set mitre to its mate (i.e. 90 deg.), runs at speed almost silently, although, in use, it makes only one revolution per hour. This had to be set true to its tooth surfaces. This is not theory, but was actually done as described.

Fig. 9 shows on bed a special faceplate chuck, found almost as it appears, with a projecting boss at back, which has since been bored and threaded to fit the writer's lathe. It is ideal wood (thought to be Canadian birch) to turn and screwcut. It carries dead central a $\frac{3}{8}$ in. × 16 (Whitworth standard) flanged nose from which it was nose-threaded, and, when mounted, runs truly all ways. It has been used to clamp and carry discs held by nut and washer on the centre screw. It is thought to be part of some kitchen accessory and is $5\frac{1}{2}$ in. diameter. Recently a 4 in. disc, holed $\frac{3}{8}$ in., and roughed out as in Fig. 3, was turned dead truly on it.

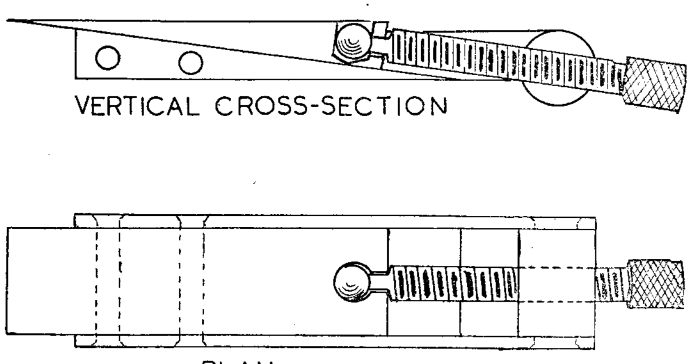
An Adjustable Lathe-Tool Packing

by M. E. Pitcher

HAVING recently installed a new lathe, I decided that the varied collection of tool packings previously in use should be discarded, in favour of some self-contained and adjustable device. The drawings reproduced below (vertical cross-section, and plan) show the packing produced.

Two wedges, 2 in. long and $\frac{1}{4}$ in. thick at the thick end were filed from a piece of steel $1\frac{1}{4}$ in. wide, which was then split lengthwise to make knurled grip, with a blind axial 2-B.A. hole. A hole was drilled in the top wedge at the thick end, but not quite through, and a narrow slot cut to fit the neck behind the ball, after which the whole was assembled to slide smoothly, and the $\frac{3}{8}$ in. round "nut" riveted up.

The dimensions mentioned are suitable for $\frac{3}{8}$ in. square tools and an M.L.7. To accommodate some smaller tools, some packing is necessary to prevent excessive overhang of the top wedge.



wedges about 9/16 in. wide. Two lengths of steel strip, shaped rather like a railway signal-arm, were riveted on either side of the lower wedge, with a length of $\frac{3}{8}$ in. round steel, shouldered at the ends, cross-drilled and tapped 2 B.A. at the bulged end.

A 2-B.A. bolt was beheaded and a neck and ball turned at the end, largely by manipulation of files, after which the thread was run right up to the ball. The other end was furnished with a

Two holes (not shown in the drawings) were drilled in the lower face of the bottom wedge, and a set of packings, in increments of $\frac{1}{16}$ in., cut to size, with dowels to match the holes in the wedge. Thus the wedge and packing can be moved bodily without relative movement. The packing is normally used square to the top-slide, with the screw sloping downwards, but if necessary, e.g. when setting a tool at an angle, can be reversed.

Mr. Jones (Victoria) with his cabin cruiser "Regina" (15 c.c. o.h.v. engine)

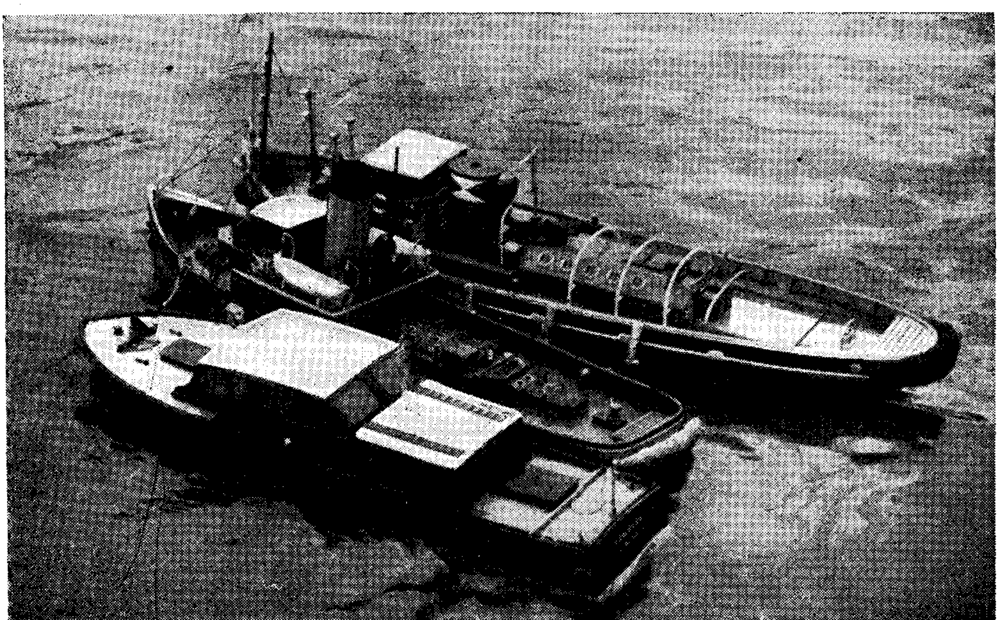
The Bedford Model Power Boat Regatta

THE Power Boat Section of the Bedford Model Yacht & Power Boat Club held its first annual regatta at Longholme Lake, Bedford, on a recent Sunday. A total of 34 entries from 12 clubs was most encouraging to the organisers.

The weather conditions were far from ideal, as fresh winds and frequent squally showers persisted throughout the day; however, very good performances were put up.

The programme commenced with the Nomination Competition, for which there were 15 entries, and was run straight into the wind over a course of 50 yd. Mr. Phillips of Victoria Club was a comfortable winner with *Kenvera* with a 2 per cent. error. His nearest rival was Mr. Duncan's *Zoe* with 7.22 per cent. error.

The "C" and "D" classes were together and there was an entry of six boats, two of which were powered by 3.5 c.c. engines. Mr. Phillips of South London won the "C" Class with *Foz* with two very good runs, the better of which recorded a speed of 46.66 m.p.h. In the "C" restricted, another South London competitor was victorious, Mr. Ridley's *Maree* on his second run returned 36.96 m.p.h. Mr.



Three typical Victoria prototype boats: Mr. Phillips's petrol-driven cruiser "Kenvera," Mr. Evans's steam tug "Maycock," and Mr. Brown's petrol-driven tug "S. A. Everard"

Mr. Pilliner starting "Ginger," which, after a promising start, retired, to an accompaniment of ominous noises

Thorne of the Wicksteed Club with his 3.5 c.c. *Petite* was runner-up at 26.56 m.p.h., and showed signs of being able to better this. Usually a very reliable boat, Mr. Stanworth's *Meteor IV* unfortunately broke a universal joint on his first run and was forced to retire.

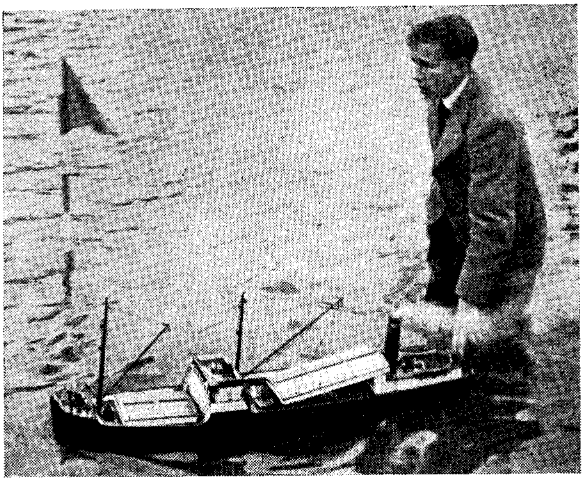
Out of an entry of six in the "B" Class event, four boats only were able to return a speed. Mr. Lines's *Sparky II* and Mr. Stalham's *Tha II* both seemed to object to the very humid atmosphere and were unable to complete a run. The event was won by Messrs. Jutton Brothers' *Vesta II* at 46.84 m.p.h. with two nice runs. Not far behind came *Sparta*, owned by Mr. Hodges, of Orpington, with a run of 42.61 m.p.h.

The Steering Competition included all boats entered in the Nomination event, but was run down wind over the same 50 yd. course. A score of 9 pts. out of a possible 15 proved enough to win this race by Mr. Rayman's *Yvonne*. Mr. Benson's *Comet*, Mr. Whiting's *Eileen* and Mr. Falconer's *Golden Maria* tied for second place with a score of 6 pts. each. This remained unaltered after each boat had had two extra runs but none was able to score.

"A" class attracted an entry of seven, but only four were able to complete a run. Mr. Williams's *Faro* once again showed it cared little for wind or rain with two steady runs, the first of which was the better at 53.27 m.p.h. *Ifit VII*, Mr. Cockman's flash steamer, however, made a valiant effort but was not quite as fast at 51.14 m.p.h. Unlucky entrants were Mr. Robinson's *Chick*, from Wicksteed, which had carburettor trouble, and from Southampton, Mr. Pilliner's *Ginger* had a mechanical breakdown on its first run.

A good day's sport was concluded as it was commenced, in rain, by Mrs. Vanner, who kindly presented the prizes to the successful competitors that so bravely defied the elements.

The Bedford Club would like to express its appreciation of the support and encouragement



Mr. Penny (Bedford) with his cargo steamer "Helena" given by so many clubs, both near and far neighbours.

Results

"*A*" *Class*, 500 *yds.*—1st Mr. Williams (Bournville), *Faro*: 53.27 m.p.h. 2nd Mr. Cockman (Victoria Park), *Ifit VII*: 51.14 m.p.h.

"*B*" *Class*, 300 *yds.*—1st Mr. Jutton (Guildford), *Vesta II*: 46.84 m.p.h. 2nd Mr. Hodges (Orpington), *Sparta*: 42.61 m.p.h.

"*C*" & "*D*" *Restricted*, 300 *yds.*—1st Mr. Ridley (South London), *Maree*; 36.96 m.p.h. 2nd Mr. Thorne (Wicksteed), *Petite*: 26.56 m.p.h. ("D" Class)

"*C*" & "*D*" 300 *yds.*—1st Mr. Phillips (South London), *Foz*: 46.66 m.p.h. (No other boat completed a run.)

Nomination—Over 50 *yds.*—1st Mr. Phillips (Victoria Park), *Kenvera*, 2 per cent. error. 2nd Mr. Duncan (Croydon), *Zoe*: 7.22 per cent. error.

Steering Over 50 *yds.*—1st Mr. Rayman (Blackheath), *Yvonne*: 9 points (possible 15). 2nd Messrs. Benson (Blackheath), *Comet*; Whiting (Orpington), *Eileen*; Falconer (Blackheath), *Golden Maria*: 6 points each.

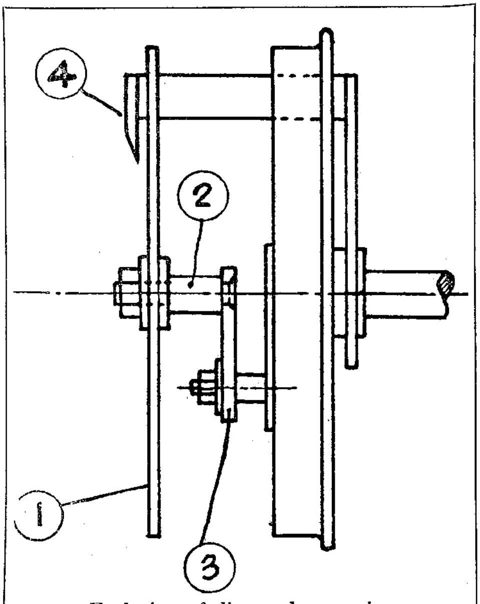
A Simple Crank-Setting Device

by W. Allen

FOR the purpose of setting the valve of a single inside cylinder gauge "1" tank locomotive fitted with slip eccentric motion, I made the device shown in sketch in order to arrive exactly at the dead centre position of the crank.

A cardboard disc (1) about the centre of which a circle is described, is mounted on a stud (2) which is fitted into a lever (3) and this in turn is secured to the coupling-rod pin already in position in the driving wheel. Lever (3) is drilled to correspond with the throw of the coupling-rods in order to allow the disc to be set concentric to the crank axle. The device is completed by the pointer (4) which is attached to the main frame of the locomotive at any convenient point.

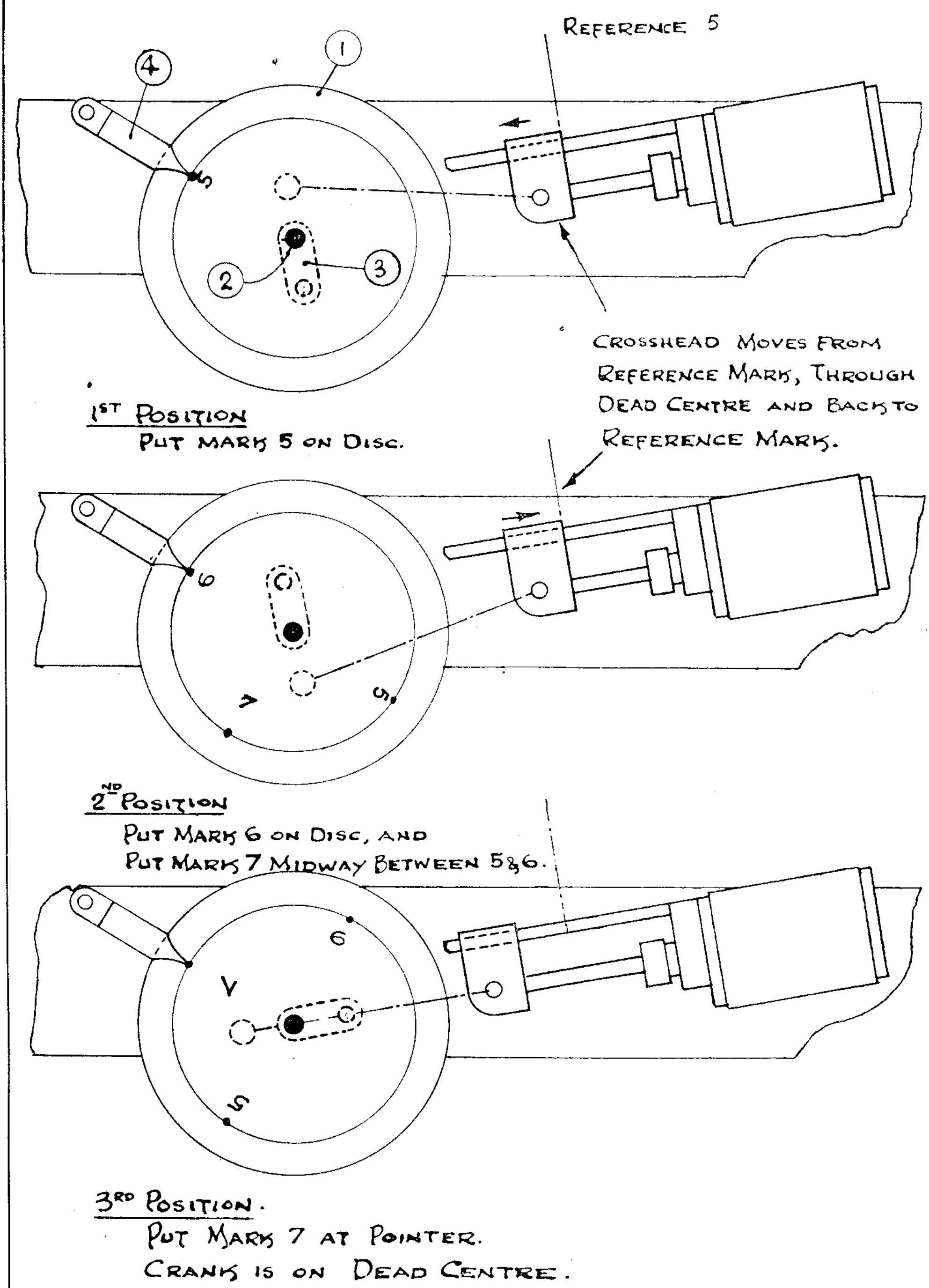
In use, the position of the *crosshead* some distance *before* the dead centre position of the crank is noted by a reference mark (5) put on the slide bar, and a corresponding mark is also made on the circle on the disc, exactly in line with the pointer. The crank is now rotated through the dead centre position until the position of the crosshead again corresponds with the reference mark on the slide bar, and at this position another mark (6) is made on the circle on the disc, and again exactly in line with the pointer. A further point (7) is now made on the disc midway between the two points thus found. The crank is now rotated until the mid point (7) is exactly in line with the pointer, and in this position the crank is in the dead centre position exactly.



End view of disc and mounting

In my particular case I got the front and back dead centre positions marked on the disc; I then removed the connecting-rod and set the valve under pressure.

No dimensions of the device are shown on the drawing; indeed, none are necessary. The device is simply applied to any particular job in the manner described. The diagrams on the opposite page show each step of the process in the order described.



Diagrams, showing the application of the crank-setting device

TESTING A "MIDGE"

by John M. Crowther

"Belinda" with a typical load

TWO years ago, after the appearance of my "Midge" type locomotive *Belinda* at the "M.E." exhibition, I promised to supply details of performance when she had been tested to her maximum capacity. It was not until a recent Sunday that I had an opportunity of making such tests, though she has run more than 160 miles in the two years, on more normal loads; incidentally, without any adjustment, not even taking up the glands since they were followed up after her first trials, and except for the regulator-rod binding in its gland because it was too good a fit, and it had to be eased.

I had intended to make coal consumption figures at ½-ton intervals over a distance of 3 miles, 24 laps on the W.R.S.L.S. track, and assembled 2 tons of 56 lb. weight for the purpose.

We started off with a gross load of 5,570 lb. behind the engine—weights, trollies, and passengers. *Belinda* was able to start that lot on the hill, which is also on a curve. A bit of jockeying into reverse, then forward again and careful use of the regulator; but she got it away unaided literally one chuff after another to the top of the grade and then she did two laps of the track with full regulator and cut-off varied between full gear and 74 per cent, the next notch. Believe it or not, the boiler—quite a small one relatively—made enough steam for that, and was actually blowing off at one time!

Previous tests had shown that a pull of 80 lb. was required to start the load. However, this was horse-work, so the load was reduced by ½-ton to 4,480 lb. and a 3-mile consumption test started on this. After three laps, rain set in and slipping prevented my carrying on; but she handled that lot nicely on full regulator and 63 per cent. cut-off. The rain continued, so we decided to try at the bottom end of the scale and cut the load to 2,282 lb.; she covered the 3 miles in 20 min. 20 sec., burnt 1 lb. 6 oz. coal and evaporated approximately 1¼-gal. water on 25 per cent cut off, but could not use full regulator.

Then the load was put up to 3,362 lb. It was still raining, but no slipping took place once under way, and we covered 23 out of the 24 laps when a trolley derailed; but adding 1/11 to the figures to bring it up to three miles, this would have been covered in 21 min. 50 sec. and the coal burnt 2 lb. 14 oz. and water evaporated approximately 2 gallons. Here, full regulator and cut-off at 25 per cent. for half the circuit and up to the next notch, 46 per cent. for the rest were used.

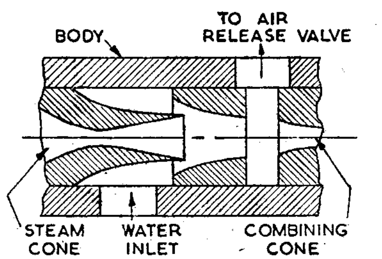
The fire was very dirty by this time, which

(*Continued on page* 714)

"L.B.S.C.'s" Lobby Chat

The Truth About Injectors

A FEW days ago, time of writing, a correspondent-friend up north, sent me an injector for examination and test. He didn't make it himself, saying that his lathe wasn't exactly of the precision variety, and he did not think it was capable of turning up the little cones; but a friend had made one for him, working to the specifications given in these notes. It was not the friend's first effort by long chalks; but previous attempts had not been successful, and the one in question also did not seem to be able to do its stuff in the approved manner. Being interested, for more than one reason, in this particular job, I had asked to see the injector that wouldn't inject, and so it duly landed on my doormat. Except that the clack-box was made with a diagonal joint, instead of being made in the way I specify, the injector looked, to all intents and purposes, as though it were made according to the "words and music." So did the cones, when I took them out, as far as personal appearance was concerned; the only departure was that the combining cone, of the Sellers pattern, had only one slot in it, as per the original "Vic" type, and therefore need not have been grooved.



How to make any injector lift water

It was when I investigated the insides of the cones, that the trouble was brought to light. Item No. 1 was that the nozzle section of the steam cone was parallel for practically its full length; there was merely a slight countersink at the extreme tip. There was no radius on the entrance of the combining cone—though that was only a minor detail, it slightly affected the flow of water—but the principal cause of the water going on the ground instead of into the boiler, was the entrance to the delivery cone. The taper was not only too obtuse, but it finished with a sharp edge between the taper and the drilled throat, sufficient to deflect the stream of water instead of guiding it into the throat. There was also a similar sharp edge at the point where the diverging of the taper on the outlet side commenced. In addition to these defects, the air-ball was not seating properly; I found a small nick in the seating, sufficient to destroy the vacuum in the combining cone.

Curing the Trouble

All that our northern brother wanted, was exact information as to why the gadget failed to operate; but it came to pass that two evenings later I found that I could spare an hour, and so I got busy with a bit of 7/32-in. round brass rod and my Boley lathe, and in just over forty minutes I fitted a complete set of fresh cones to the injector body. I've made so many of the blessed things that I can do the job mechanically, without thinking, and very nearly without looking; no idle boast, as my few personal friends can testify. By the time I had finished, it was time for a bit of food and a cup of the engineman's best friend; but when that was disposed of, there was still a little daylight left, so I put one of my own clacks on the injector (I always keep a couple of "spares" for test purposes, and emergency repairs) put the whole bag of tricks on *Ayesha*, took her out on the track and got up steam.

As soon as I removed the steam-raising fan, and started the engine's own blower, the safety-valves popped; and as there was only about a quarter-of-a-glass of water, I opened the water-valve a turn and opened the steam-valve wide. There was the usual siss-phut! as the injector picked up instantly and started filling the boiler, with a perfectly dry overflow. The safety-valves stopped blowing off, but the needle of the steam gauge stayed in the place where it belonged; and as soon as I shut the injector off, she began to blow off again. Away we went, on a run of nearly two miles; the last half-mile was run after daylight had completely gone. I used my boiler-inspection torch to see the water gauge and never bothered to look at the overflow at all; as there was no dribble with the water-valve open between three-quarters and a complete turn, I just opened it that much when the water-level got low, or when she wanted to blow off, turned the steam on and left her to it until the glass was full. The steam pressure didn't fall off, and the speed remained constant. It was no more trouble to work the injector, than to turn a pump by-pass valve on and off.

I reconditioned the original clack, and enlarged the waterway; the injector has now gone back to its owner, and at time of writing, I am waiting to hear how it behaves on the $3\frac{1}{2}$-in. gauge engine to which it belongs. My friend said that he had never seen injectors work properly on $3\frac{1}{2}$-in. gauge engines, though he had seen a well-known commercial type doing the job on a $7\frac{1}{4}$-in. gauge engine. I'm going to have a word about commercial injectors in a minute or so, so sit back and hold tight, as the switchback attendant at the fair would say.

Another Case

A North London owner of a $2\frac{1}{2}$-in. gauge engine couldn't get his injector to work in the way intended; and despite information which I had given him in various letters, it continued to lose water at the overflow. He said he was certain that he had followed the instructions, so I suggested lending him an injector that was perfect, to put on his engine and try the steam, water, and delivery, in case the fault lay in the engine and not the injector. I took one off one of my own engines, which had never given the least trouble; sent it along, and waited to hear the result. Back came a letter saying that my injector worked O.K., which proved that there must have been a fault somewhere in the one made for the engine. Well, to cut a long story short, as Nat Gubbins's "Man in a Pub" remarks, several other correspondents suggested that I might include a few remarks about injectors in general, in the course of the next lobby chat; so here goes.

Commercial Injectors

From time to time, we are treated to a eulogy on the merits of one-or-another-make of commercial injector; but statements are made, which are both misleading and confusing, so let's do a little analysis. Now I have here at the present moment, three commercially-made injectors, *each of which does all the makers claim for it.* That being so, I will give them a free advertisement, by kind permission of our friend the Knight of the Blue Pencil, and say they are a Bassett-Lowke, a Linden and a Cert. Each of them has had a thorough trial under exactly the same conditions as injectors of my own make. Both the Bassett-Lowke and the Linden injectors are of the lifting type, and will suck up water from a supply below their own level. The Cert is a non-lifter, having no air valve, and has to be placed below water level; but it picks up just as quickly as the other two, when the water is turned on first, and allowed to flow into the injector. So far, so good; but there is a wasp in the jam pot!

Why on earth such a terrible fuss is made about an injector being able to lift its supply, gets me beat; not only is it unnecessary in locomotive work, but it reduces the efficiency of the injector and greatly increases the steam consumption. *It takes far less steam to force only, than it takes to lift and force as well*; therefore, if you put the injector in such a position that water is fed to it by gravity, you save steam. Full-size locomotive engineers have long since realised this, and all modern locomotives have their injectors placed below foot-plate level; there is also another reason for this, as I will explain. If you take a look at the photographs of the "mock-up" of the standard arrangement of cab and piping for future locomotive types of British Railways, lion-and-wheel brand, you will see that the injectors are placed below tank level, in a very accessible position by the side of the ashpan (exactly where I put the injector on *Tugboat Annie*) and are of the non-lifting type. I specify injectors to be fitted in the same location, or one at similar level, for the same reason that obtains in full size.

The Lifting Action Explained

Lifting injectors have been made ever since injectors first came into general use as locomotive boiler feeders, and there is nothing strange or wonderful about the action. Nobody ever tried to raise any fuss about the water lifters used "since the year dot," as the kiddies would say, on traction engines; yet some of these old crocks had a water lifter so efficient that if the driver stopped on a bridge over a river or stream, he could drop a hose in the water, and fill his tank. ANY injector can be made to lift, simply by enlarging the entrance to the combining cone (this isn't always necessary, as some are big enough as it is) reaming the nozzle of the steam cone to a diverging taper, and making a vent in the combining cone to let out the steam, and the air extracted from the feed pipe. When steam is turned on, it draws the air from the feed pipe, same as the ejector of the vacuum brake apparatus draws air from the train pipe. Water then flows into the pipe, same as it would do if you put the end of the pipe in your mouth and sucked at it. When the water arrives at the injector, the jet of steam condenses in the water, and the latter takes up the speed of the steam. The momentum thus obtained is sufficient to bump the delivery clack against the steam pressure, and so the water gets into the boiler. The sketch shows clearly, the essentials of the lifting business. What on earth there is to make a song and dance about, I fail to see, the action being so absolutely simple.

Injectors Will NOT Work when Hot

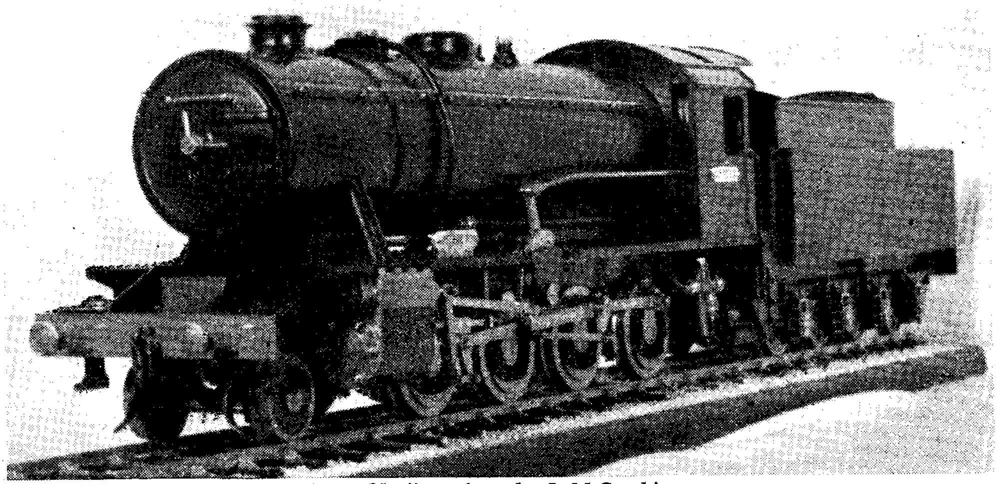
The action of an injector, as briefly explained above, depends on the condensation of the jet of steam in the water. The veriest Billy Muggins knows that steam will not condense in hot water; if the injector is hot, the water will be hot also, and the injector will not work. The Southern Railway before nationalisation, issued a handbook to their enginemen, entitled "Practical Hints for Footplate Men." On page 33, under the heading "Boiler Feeding—Injectors" is the following paragraph, which I quote in full, for the benefit of all unbelieving Thomases:—

"When the live steam and feed water meet, condensation of the steam jet occurs, and this produces a vacuum. Further condensation continues at the combining cone, and the jet then jumps the overflow gap into the delivery cone. If the injector becomes overheated from any cause, condensation, and with it a vacuum, cannot properly occur. The injector then fails to operate, and steam and water are blown out of the overflow. The remedy is to allow the injector to cool down." Surely that is explicit enough!

In the old days, on the London Brighton and South Coast Railway, if the so-and-so's **didn't** cool down quickly enough, we used to throw a pail of cold water over them, to teach them better manners; and your humble servant, for one, wouldn't have the nerve to tell Messrs. Gresham and Craven that they didn't know how to design injectors, because of that!!

The "Hot Test" Explained

The experiment made by Mr. V. B. Harrison, in which he deliberately heated a Linden injector, and then started it, is easily explained. Many injectors on American and Colonial locomotives have a drain cock on the water pipe leading to the injector; and if, for any reason—such as a leaking delivery clack allowing steam and water to blow back into the injector—it becomes overheated and will not start, the water-valve on the tender is shut off, the drain valve opened, and all water drained from the injector and the feed pipe. Cold water is then admitted to the pipe, by opening the main water valve again, and the injector is thus cooled off; the drain valve is closed, and the injector then starts readily. Certain types of vertical injectors now fitted to British locomotives, also have these drain valves. On many Belgian engines, the two injectors are interconnected in such a manner that if one becomes overheated, the other can be used to cool it off.



"Bro. Shy" prefers the L.M.S. chimney

In the case of Mr. Harrison's experiment, all that happened was simply this. As I mentioned in the paragraph on commercial injectors, the Linden will suck up water from a supply below its own level. That is exactly what it did in the experiment. The ejector action of the steam in the first half of the combining cone, exhausted the air from the feed pipe; and, of course, water then flowed into the other end. When it arrived at the injector, it cooled it sufficiently for condensation of the steam to take place; the injector, *thus cooled off*, started as easily as if it had not been "preheated." That is simple enough, sure-lie, as they say down Sussex way. Had the injector *remained* hot, no power on earth, or above or under it, could have induced the injector to feed, for the simple reason that steam won't condense in hot water. On my own engines, the injectors sometimes become overheated through dirt or scale getting under the clack balls; or maybe I don't shut off the steam valve tightly, and a dribble of live steam does the needful. In that case, all that is needed, is to wait a few seconds for the water to run through and cool it, which it will do by gravity without the necessity of turning steam through the injector, to suck air from the water pipe; although the water is hastened on its way if the steam valve is opened slightly. The injectors make a peculiar chuckling sound when this is done. Anyway, to sum up in a nutshell, any injector, big or little, MUST be cool to enable it to start; whether it is cooled externally or internally, doesn't matter a Continental, the fact remaining as stated.

The Question of Efficiency

I mentioned above, about a wasp in the jampot. Its name is "efficiency." Now without in any way intending to decry the virtues of any of the injectors mentioned, I'll tell you of a little experimenting that I carried out. For friendship's sake I did some repairs to a $3\frac{1}{2}$-in. gauge locomotive. She was fitted with a Linden injector placed above the feed supply, on the footplate. A well-known character now passed beyond the Great Divide, stated in this journal that a Linden injector could be screwed direct into the backhead (a statement that friend Linden himself would never dream of making, knowing, of course, that a clack is needed between boiler and injector) and the one in question was originally fitted that way. Naturally, as soon as cold water was poured into the boiler to fill it, it just ran out through the injector, and the necessary clack was added at once, though the injector was left in the same place. The owner of the engine complained that as soon as the injector was started, down flopped the steam pressure at an alarming rate, with the engine standing still, a good fire going, and the blower on; and it was impossible to use the injector when running, because of the drop in steam pressure directly it was put on. He said, could I do anything to reduce the steam consumption of the injector. I did so; and how

I did it, was first of all, to shift the injector to a position below water level, so that it was gravity-fed, and had no need of extra steam for water-lifting purposes. Secondly, as there was then no need for ejector action to suck air from the water pipe when starting, I made a new steam cone of a different pattern, for forcing only. This had a throat much smaller than the original. The injector, as originally made, tended to flood the boiler, and could not be regulated; with my altered steam cone, it *could* be regulated. The net result of the alterations was, that the injector did not "knock the boiler stony," as the enginemen would say, when the engine was standing, and could also be used on the run, if not left working for too long. The steam consumption was reduced almost by half, which as our cousins over the pond would say, made a whale of a difference.

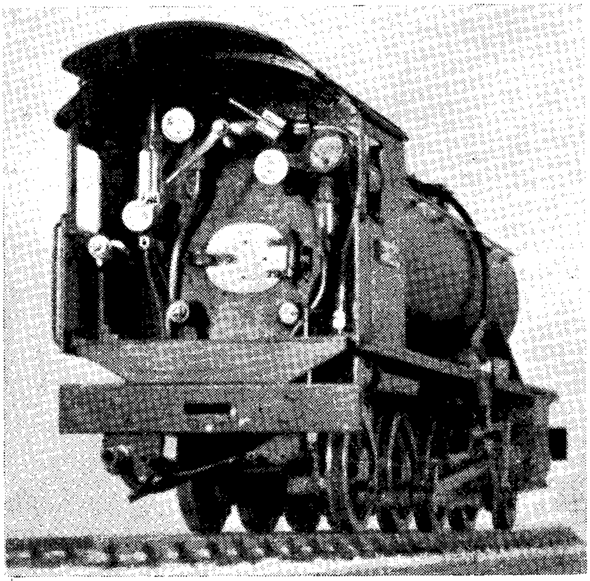
Whilst, as I said before, the injectors mentioned work excellently, and do all that is claimed for them, they take far too much steam to do it. Unless a $2\frac{1}{2}$-in. gauge engine had a roaring fire, it would be completely "killed" if the injector were left on for more than a few seconds, and the boiler would be flooded. They knock back the pressure-gauge at an alarming rate on any $3\frac{1}{2}$-in. gauge engine, and even a 5-in. gauge job has all its work cut out to hold its own; in fact, there are very few that can do even that much. Every correspondent who has written me on the subject, has found the same thing. In my own trials with them, I found that the lowest steam consumer of the three, was the Cert, and that was because it was gravity-fed. There is no harm in honest criticism based on actual experience; if nobody pointed out faults, we should get nowhere, believing we had already found perfection. In my own work, if I find any fault, I take immediate steps to eliminate it; if it won't eliminate, then the whole lot is scrapped, and a fresh start made. I couldn't tolerate inefficiency at any price!

Cutting It Fine

Your humble servant has probably made more injectors than the combined products of a goodly number of followers of these notes. I usually make a dozen at a time, and have given them away to friends all over the world, "for services rendered." Every one has been tested O.K. under service conditions, on one of my own engines, usually old *Ayesha*; and the test is about two miles non-stop run, during which the injector has to feed the boiler with all the water it needs, without knocking the pressure down. Just lately I have been trying out some different cone sizes and settings, in accordance with the latest improvements in full-size practice, and have obtained some remarkable results. I am not disclosing these at the moment, because I always reckon to keep an ace or two of trumps up my sleeve, in a manner of speaking, all ready to trot out when anybody starts "getting fresh," as our cousins over the pond would say. Some of the injectors on my own engines, work in a manner that purchasers of the usual type of commercial injector would deem impossible; even the older ones. My few personal friends can testify to that; they have seen *Olga* and other engines, standing at the water tank whilst I filled up, with the injector working, and the steam-gauge needle sticking at the proper end of the scale. About the most efficient type so far, is that I fitted to the last locomotive completed, the L.B. & S.C.R. single-wheeler *Grosvenor*. If the boiler is blowing off, and the injector is started, it uses so little steam that she keeps on blowing off, with no appreciable diminution of the amount of steam coming out of the safety-valves; that is, of course, with a normal fire. This engine also has about the most efficient feed pump that I have so far made. It is a Stroudley crosshead pump, with the valves at the gland end; the ram is only $\frac{1}{8}$ in. diameter ("scale" size; the rams of the full-sized pumps were 2 in. diameter) and the water has to pass between the ram and the pump barrel, to reach the delivery valve. It works practically frictionless, as the only place where the ram comes in contact with barrel, is about $\frac{3}{16}$ in. length directly behind the gland nut; and the gland being so small, $\frac{1}{4}$ in. $\times$ 40, it only needs about a $\frac{1}{4}$-turn beyond the finger-tight position, to remain water-tight. As there is no eccentric, friction is still further reduced; and as the end of the ram is screwed direct into the crosshead slide block, it is truly guided for its full stroke, and wear on the gland nut and the $\frac{3}{16}$ in. of bearing, is practically non-existent. When the engine is hauling a load equal to 320 tons at an equivalent speed of ninety miles per hour, the water will creep up the glass and disappear in the top nut, unless the by-pass is opened a little. The effect on the steam pressure is just nil; anyway, too small to be appreciated, like the microbe of which half-a-million can sit comfortably on the point of a pin.

Stop Press

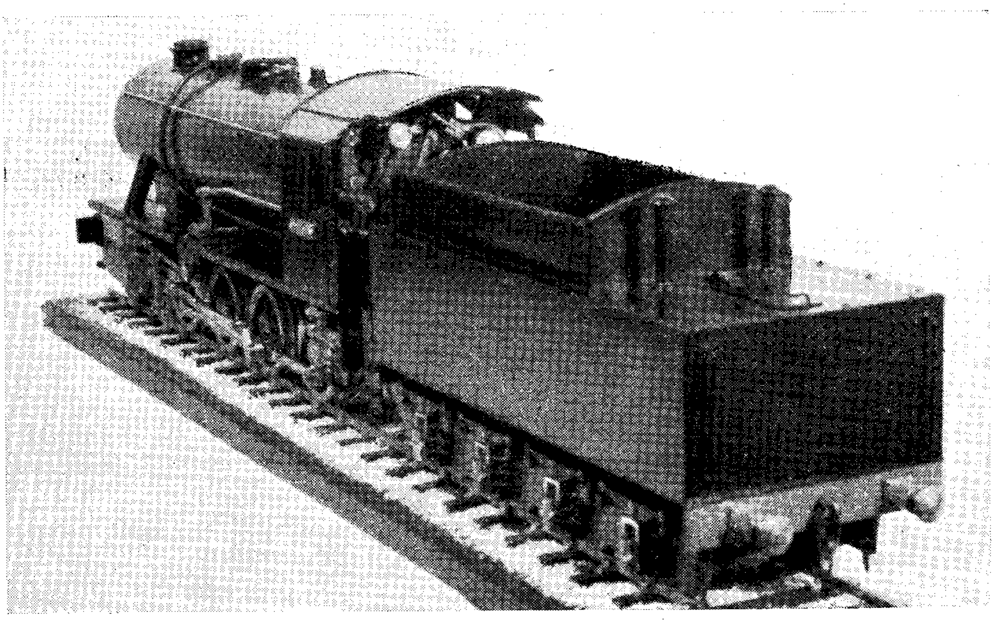
It usually takes me three or four days to complete one of these little dissertations, as I jot down the gist of them as they come to mind; and later on, have a final edit-up to put them into a form suitable for readers' edification and amusement. Since I started this one, further confirmation has come to hand concerning the steam consumption of the commercial injectors mentioned, as I have just received a letter from a correspondent at Worcester. He enclosed the reproduced photographs of a friend's $2\frac{1}{2}$-in. gauge *Austere Ada* built to my specifications, except that she has a L.M.S. type chimney, which in my humble opinion doesn't suit her, though otherwise she is O.K. She steams like a witch, and takes very little notice of a load of two adults and a kiddy. The maker was doubtful of his ability to make the injector specified for the engine, so he purchased a Linden, and fitted it; you can see it in the photographs. There is nothing whatever the matter with the working of the injector; it picks up and feeds exactly as all good injectors should do. But, alas! when the steam valve is opened, with the boiler blowing off, down flops the steam-gauge needle to 20 lb. almost before you have time to wink, and of course the injector "ceases fire"—or rather water! The finest injector ever made, won't work without steam, although more than one correspondent has confessed, with much amusement, that he has tried to get an injector to work on air pressure, clean forgetting for the moment that air won't condense in water. Incidentally, that was one of the drawbacks to the use in full size, of the Le Chatelier counter-pressure brake, which was at one time a favourite on Continental railways for controlling the speed of trains descending long inclines. The air pumped into the boiler by the cylinders, caused the injectors to go on strike.



Another neat layout

My correspondent says that he told the builder of the engine, that he had better get busy and make up the type of injector I specified for the job, and to that end, is making the necessary cone reamers himself, just to help things on a bit. He wants to know if I can give him any extra information, which will enable the steam consumption to be brought as low as possible; and I shall give him some 'ints and tipses which should have the desired result.

Correspondents frequently refer to the commercial injectors mentioned, and ask why it is that injectors made to my specifications, cannot also be obtained commercially, seeing that my pet type of boiler fittings, etc., are on the market; some of them by the way, without even a by-your-leave, or the courtesy of an acknowledgment. The usual excuse is, that the weeny-weeny squirts are too fiddling to make as a paying proposition; but I notice they are listed—with acknowledgments—in Reeves's latest catalogue, and at a reasonable price, too. Another advertiser told me he would put them on the market like a shot, if he could get somebody to make them, having no means of doing the job himself. Well, I guess that clears up all the points raised on this subject, and in conclusion, would say that I have schemed out an injector suitable for gauge "1" engines like the *Wee Dot*; details later, if all's well.



A real sturdy job

POLISHING PLASTICS

by P. W. Blandford

THE plastics of use to the model engineer or amateur mechanic—Catalin, Perspex and Casein—are all capable of receiving a high polish. This is not an applied polish as in French or wax polishing wood, but a smoothing of the surface with successively finer abrasives. The final polish is rich and lasting, and if appropriate colours are chosen, plastic parts will contribute to the first-class finish of a job, which is so much desired by the keen craftsman.

In degrees of hardness Catalin is hardest, closely followed by Casein, with Perspex rather softer. If only hand-polishing methods are available, Perspex is by far the easiest to deal with. When power is available, all are comparatively easily polished.

The ultimate finish should be borne in mind from the start and care taken not to damage the surfaces. New Perspex sheet comes with paper stuck to the already-polished surface and this should be kept on as long as possible during processing. Use card or fibre vice clamps.

After filing, turning or otherwise working to size, remove tool marks with a medium abrasive paper. All of these papers clog quickly. Common glasspaper, grade F2, is probably as good as anything. Make sure that all file marks are removed. If possible, glasspaper at right-angles to the file marks so that their disappearance can be observed.

For hand polishing, the next stage is scouring with a damp rag and pumice powder or one of the commercial cleaning powders, such as Vim or Oglo. Use plenty of water—the powder is not so effective when only damp. Wash off the surplus and dry the plastic.

The surface will now have a silky gloss, which may be acceptable for some purposes, but a much brighter shine is possible.

Follow with metal polish and plenty of elbow grease. Polishes intended for brass will be found to be coarser than those meant for silver. Lesser-known makes generally are coarser than the well-known makes. This metal polish stage can be broken down into two further stages—coarse followed by fine. If all stages are done thoroughly and all traces of the previous polishing material are removed at each stage, a very high gloss will appear after the last metal polish stage.

For Perspex the makers supply two special polishes—Perspex Polish No. 1 and No. 2—which can take the place of pumice and metal polish when dealing with that material. There is also Perspex Polish No. 3, which is anti-static, and useful for removing the tendency to attract fluff, etc., after the friction of polishing.

A polishing head used for metal will also polish plastic, but separate mops must be used. Sufficient speed to keep the mop hard is essential—about 3,000 r.p.m. for a 6 in. mop.

A stiff canvas mop (Canning B quality) with pumice composition will take care of the first stage after glasspapering. Avoid overheating, by moving the job constantly and using only moderate pressure. Experience on a few scrap pieces will tell you how hard you dare press. The effect of overheating varies—Catalin turns yellow; Casein discolours and chars, and emits a smell which reminds you of its source, sour milk; Perspex wears suddenly and the surface becomes rough. In all cases the only remedy is to glasspaper away the damage. Keeping the mop well-loaded with composition will minimise the risk of overheating.

Finish off with a soft mop (Canning C quality or Swansdown) and a very fine polishing composition (Canning White Gloss). Do not press hard, and keep moving. This will produce a high gloss on all three plastics, but because of the extra hardness of Catalin the makers recommend another step between pumice and finishing polish—Tripoli composition on a B quality mop. I have obtained good results using only the two stages, but where a large amount of Catalin is to be polished this intermediate stage is recommended.

Store plastic-working mops and material well away from those used for metal, as contamination is fatal.

Testing a "Midge"

(*Continued from page* 708)

may have accounted for the higher coal consumption, in some degree; but friction may go up in the train, and, I imagine, more heat up the chimney with the short barrel and large tubes when the boiler is pushed.

Coal consumption on the ton-mile basis works out at 0.46 in the first test and 0.58 in the second. Have any figures been given before. I'd be very interested to know them. It doesn't look too good against a full-size 0.08!

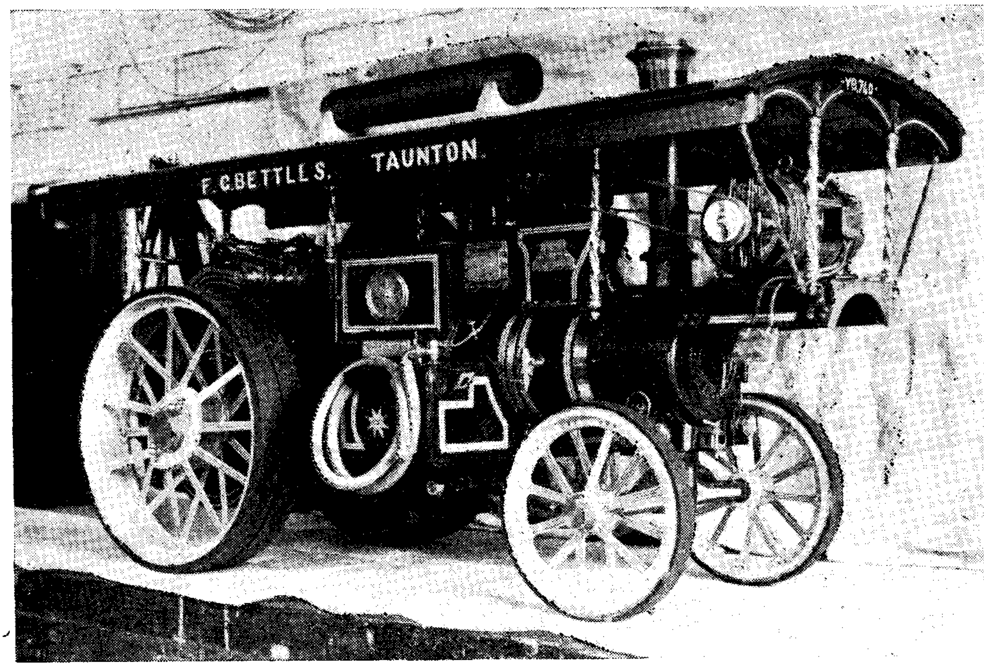
The remarkable thing was the way the boiler was equal to any demand upon it, and delightfully self-regulating in proportion to the blast. The blast-pipe orifice, by the way, is 13/32 in., at least double the considered normal area relative to the piston, and that says much for those cylinders, ports, valves and exhaust ways.

I think I have fired a few of the owners of larger engines at any rate in the W.R.S.L.S. to test their engines in this way, and no doubt we shall hear something about it from Mr. Hollings. In the meantime, if anyone has any comparable figures, I personally will be very glad to know what they are.

A 1½-in. Scale Showman's Engine

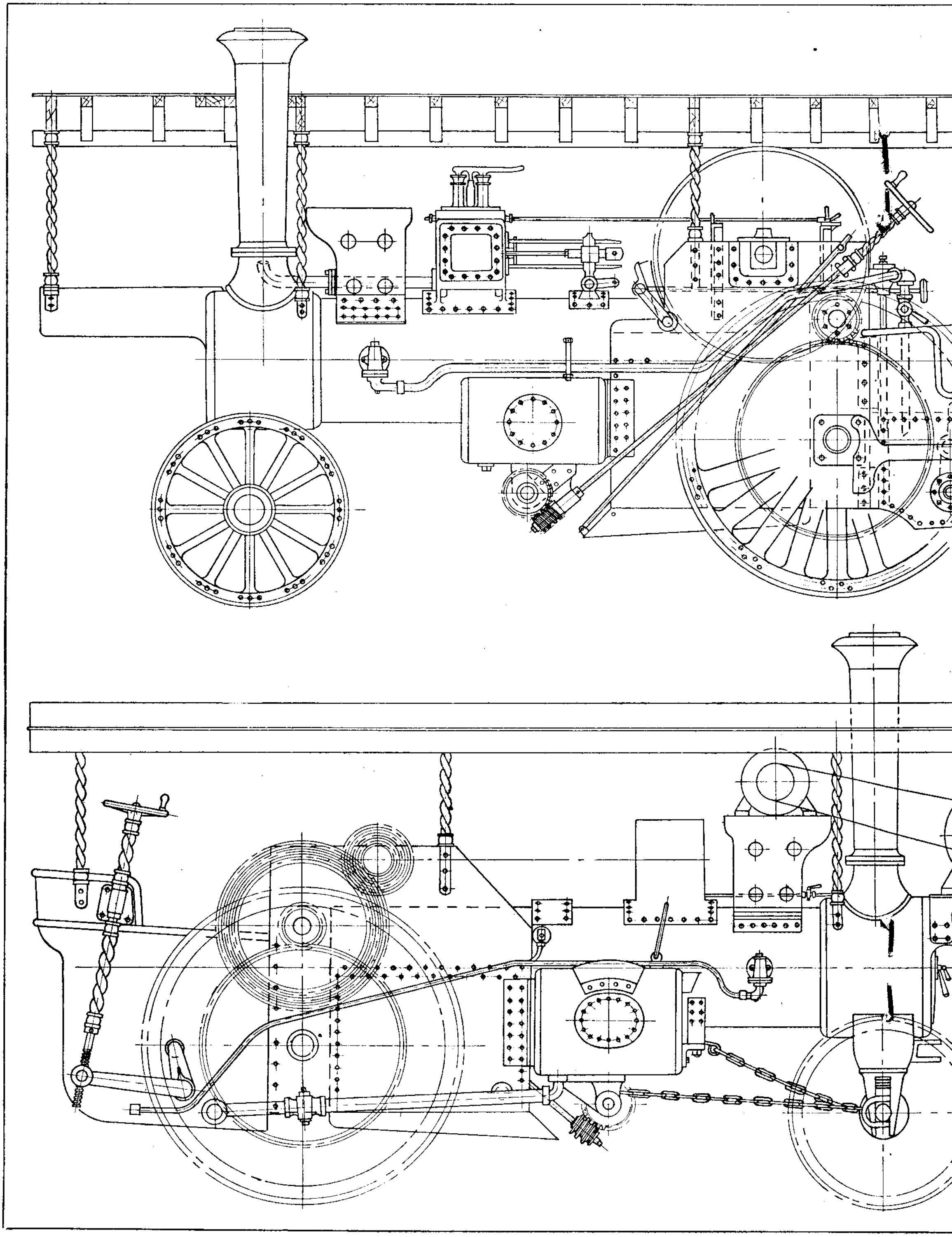
by F. G. Bettles

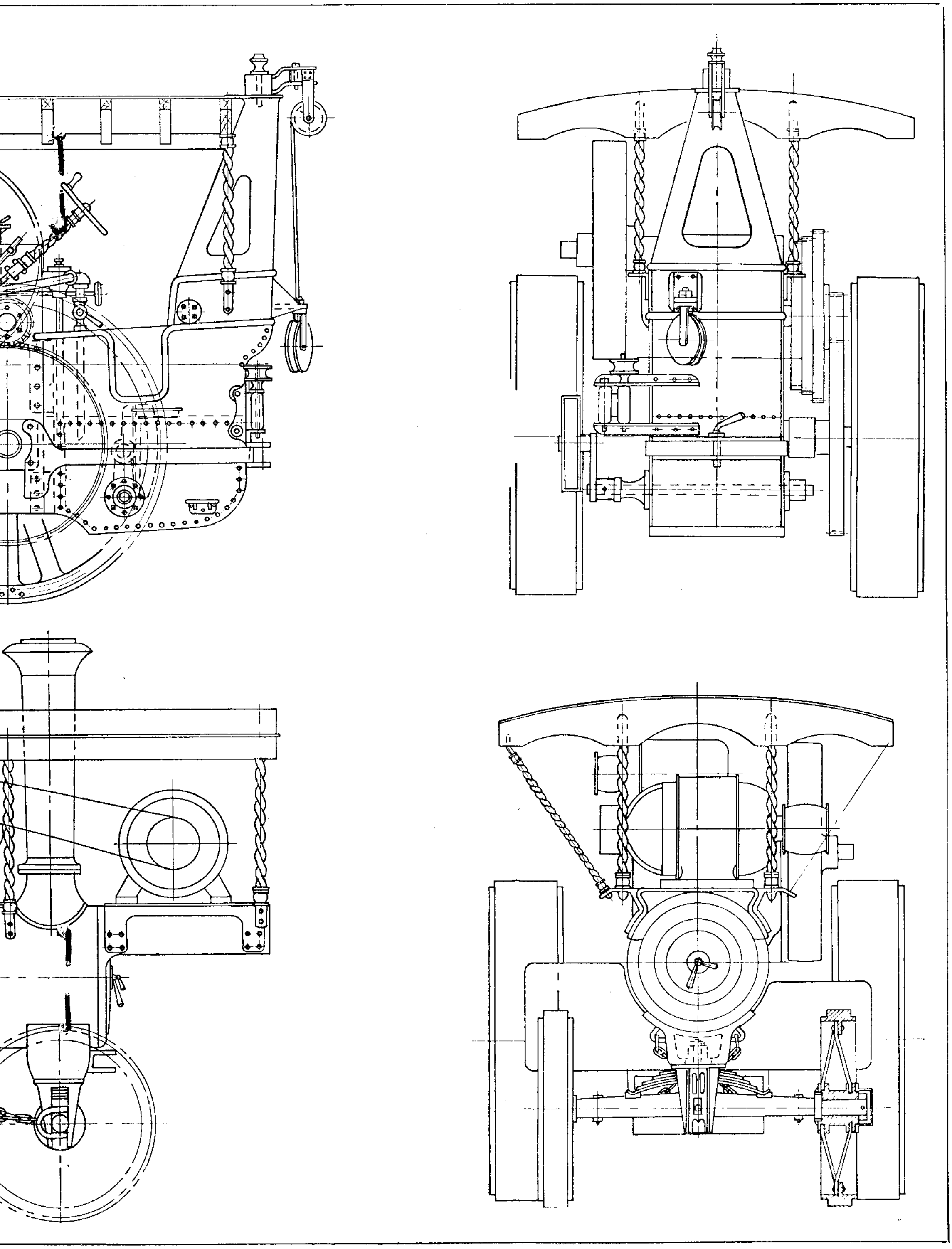
I HOPE my fellow readers will let me down lightly regarding the description of this Burrell, because on looking over three or four similar machines, I find I still do not know which was the most correct. On leaving Thetford, they differed considerably in that some had different wheels, others had direct-driven governors, countershafts, etc. Eventually, I obtained an outline drawing of the off-side and front of the engine and also a section of the transmission of a 6-h.p. double-crank engine. Later, I found a 7-h.p. engine which had finished her days about half a mile away, and had remained there for about one year. It was a great piece of luck, for I also found a Scenic Burrell under a hedge about ten miles away. It took me over six months to piece all these together, but I enjoyed every minute of it.



Now, I expect someone to write to me saying that the single-lobe wheels were "Devon Light," and that the second generator was not intended for the job I had made it, etc.; but by now I think I pretty well know the Burrell road locomotive! I always liked the Burrells, and by the number in use, they were a general favourite with the showman. It is a matter of opinion whether the Burrell or Fowler is the better engine, and I am not going to start an argument on this matter, as there are points in favour of both of them. They are, of course, not the only engines used in the fairgrounds, as there is also the Fortis, which is a fine engine.

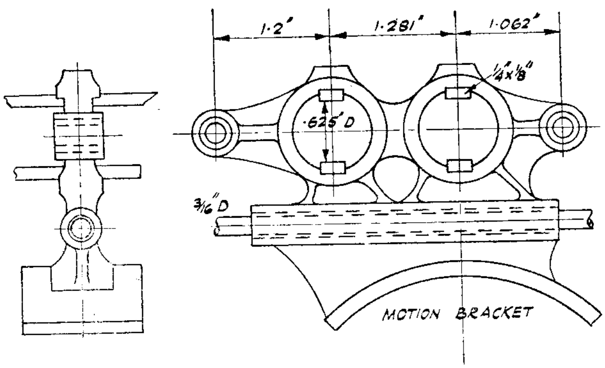
The reason I chose the Burrell for my attempt was that I considered it a more get-at-able engine than any with outside cylinders, such as the Fowler; and as I had had more experience with these, I found this helped a great deal in modelling. On the Burrells, the steam-chest covers could be taken off to look at valves with the steam up, if necessary, whereas, on the outside cylinders, it was necessary to remove the entire top of the block to get at the valves. These valves were on the slant and, to get the motion-bracket machined correctly, one had to make fixtures to machine also. Some people have overcome this by fitting valves horizontally in the top, employing some form of links, but this at once spoils the job. I have seen a section of the Fowler block (compound) and I see no reason why, if modified inside, it could not be made correctly as regards outside scale and appearance. It is necessary to modify any of these compound blocks considerably if exact outside appearance and scale are to be maintained so that the steam-chests are sticking out a mile and pipes going anywhere except where intended.





This engine is not a beginner's job unless good equipment is available and unless the builder possesses a reasonable knowledge of different trades such as blacksmithing, signwriting, turning, fitting, boilermaking, pattern-making, gear-cutting, splines and keyways, carpentering and pipe work. The finished engine goes to an exhibition, with nearly all the best work hidden away behind guards. It is no wonder that a number of people fail to realise the amount of work put into one of these engines!

It is surprising how much more additional work is required on a showman's engine than on the ordinary traction engine. After summing it up, I came to the conclusion that, unless I could make the cylinder block with proper outside appearance in every detail, the rest was useless, as far as I was concerned. I spent a lot of time drafting different methods until I was satisfied that I could make it. I came to the conclusion that it was impossible for me, at least, to make the core-boxes, to copy the large engine block, even if it could be moulded afterwards. I decided on five main castings, and to machine the remainder from the solid. Previous experience has several times shown this to be the most reliable way in the end. The amount of material removed this way is considerable, against cored castings, but the risk of blowholes in vital parts is reduced by building them up, as only one component would have to be scrapped, instead of the whole block. I leave any model engineer to please himself on this point.



Side and end elevation of motion bracket

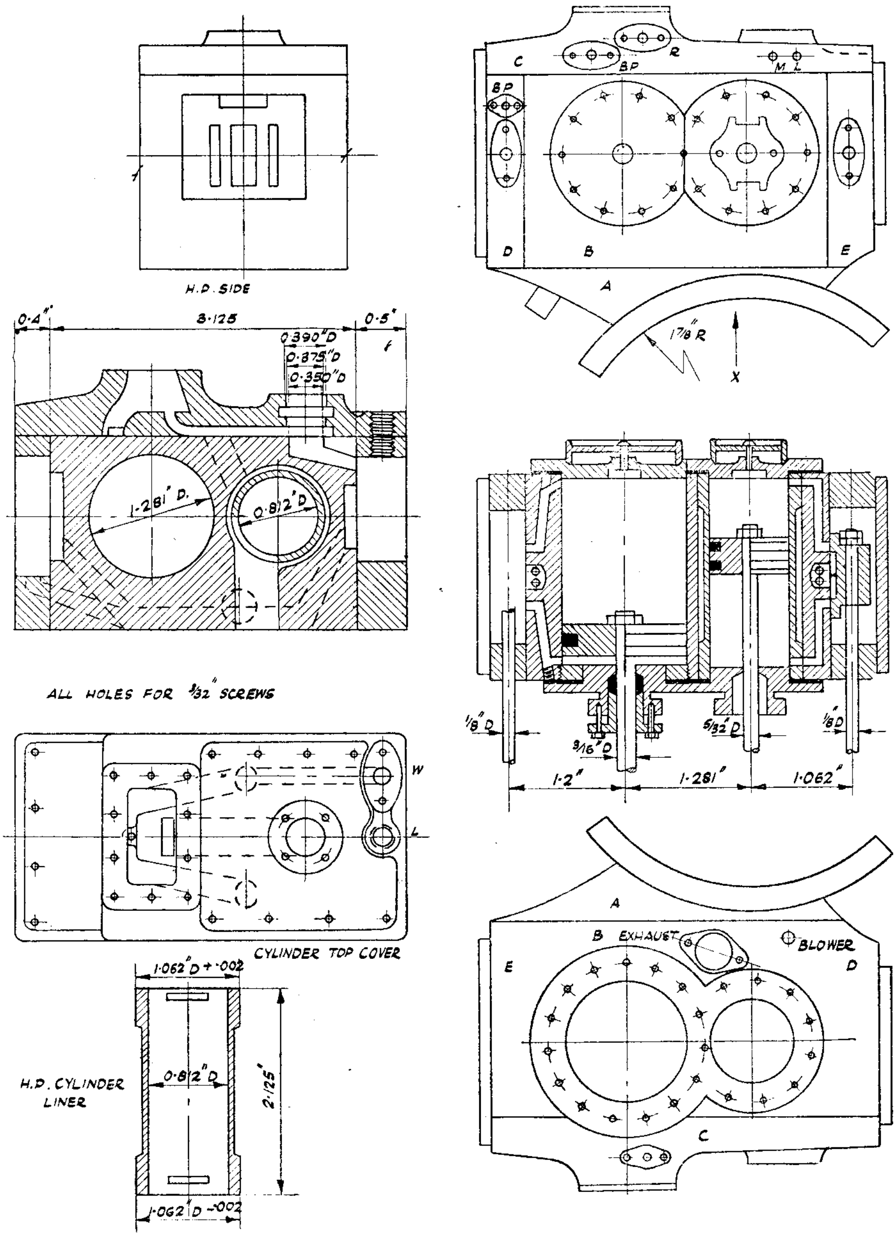
The main castings consist of the saddle, cylinder main block, the top, and the two steam-chests. There have been plenty of instructions about boring cylinders, cutting, ports, etc., so I do not intend going over all this again; but I will review the special points, as I consider them a little out of the ordinary. The saddle had to be maehined first and I went about it in the following manner: the casting was cleaned on the top with a file until flat (but not finished); after this, the main steam hole was drilled to 0.375 in. and counterbored to about 0.187 in. to hold a bolt on the angle plate. This was used to turn the curve to fit the boiler barrel. The saddle must be put on angle-plate, with the back-end outwards, as it is important that this edge is turned true when the curve is finished. Before putting the angle-plate on faceplate, turn a taper plug to fit the centre, with about $\frac{1}{4}$-in. parallel spigot. Cut out from a thin plate, a disc 3 in. diameter, slip this over the $\frac{1}{4}$-in. spigot, bring the saddle to this and bolt it. Remove the disc after a piece of odd brass has been bolted on the opposite side. The finished diameter of the saddle should then measure $3\frac{3}{4}$ in. The taper and disc should not be thrown away as they will be needed again for the motion-bracket.

After the boiler side of the saddle is finished, I advise most strongly the making of a curved angle-plate, similar to a piston-ring casting, with a flange for bolting to faceplate. The back of the flange should be turned first, six or eight holes drilled in it, and then it should be put on the faceplate. Turn the extended part down to $3\frac{3}{4}$ in. (or whatever the size of the boiler barrel) so that the saddle can be bolted to it by the holding down bolts, such as are used to place it on the boiler. About half of the extended piece should be cut away, but this should be at least $\frac{1}{8}$ in. from the flange, in order that the entire circle can be reset again. The part cut off should be filed true so that, when put on the surface-plate and a dial gauge passed over the top, it is dead true with the plate; this will serve a very useful purpose for marking-out on the block. This form of angle can be used on any traction engine cylinder block, with advantage, for boring the cylinder dead in line with the barrel.

The saddle should now be bolted on to the plate and put against another ordinary angle-plate so that the top flat part can be milled off true. The foundation of the block is now finished.

The main block *B* should be machined to size and screwed to the saddle. This can then be marked out, remounted on the circular angle-plate, and the cylinders bored. By this method, you get the bores true with the boiler barrel, even if the block or saddle is a little out. The liner for H.P. cylinder is made 0.0015 in. $\frac{5}{16}$ for pressing in, and ports are cut beforehand to correspond with holes drilled from the steam-chest ports. Face off H.P. cylinder cover flange, shift angle-plate over and line up L.P. cylinder centre.

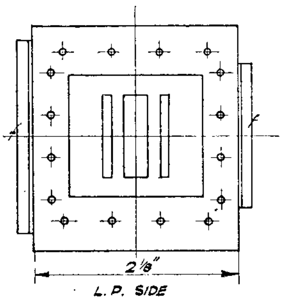
It will be noticed that a plate has to be screwed into the end to carry the back cover, so that studs can be placed to hold it together and the steam enter ports behind this. In the big engines, this plate is solid with the main casting, and ports are cored out; but unless a plate is screwed on, it is impossible to cut and drill a small job. In making this plate, one must bore it dead size with the spigot on the cylinder cover, and also cut the thread on the outside at one setting, then part-off. Otherwise, bore first, and mount on a dead true mandrel. This plate should not be finally screwed in until the cylinder has been lapped; but before doing this, the block *B* should be taken off the saddle and all the steam ways drilled, filed, and milled in. Although I have shown dotted lines

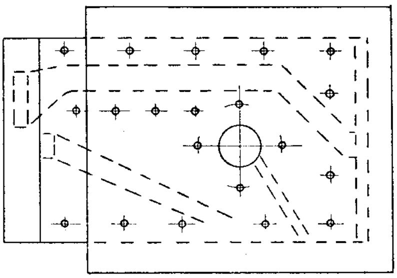


Details of cylinder block

on the saddle, this is to show the *direction only*. This is left flat and all the ways are cut on the under-side of the block.

The transfer passages should be made as large as possible, but remember it carries pressure. When all is cut and drilled, the two surfaces must be scraped together to fit perfectly in order that two holes can be drilled from the top to the H.P. liner cavity to convey the steam around the H.P. liner and on to the steam dome, regulator, safety-valve, etc. The steam ways on top (except where steam comes through governor valve to H.P. steam-chest) are cut in the top only, and screwed down from the outside into block *B*, and before finally fitting this down, the two steam-chest sections must be fitted, the entire top machined off, and the top scraped together. The top must be well fitted, as it has to stand boiler pressure.





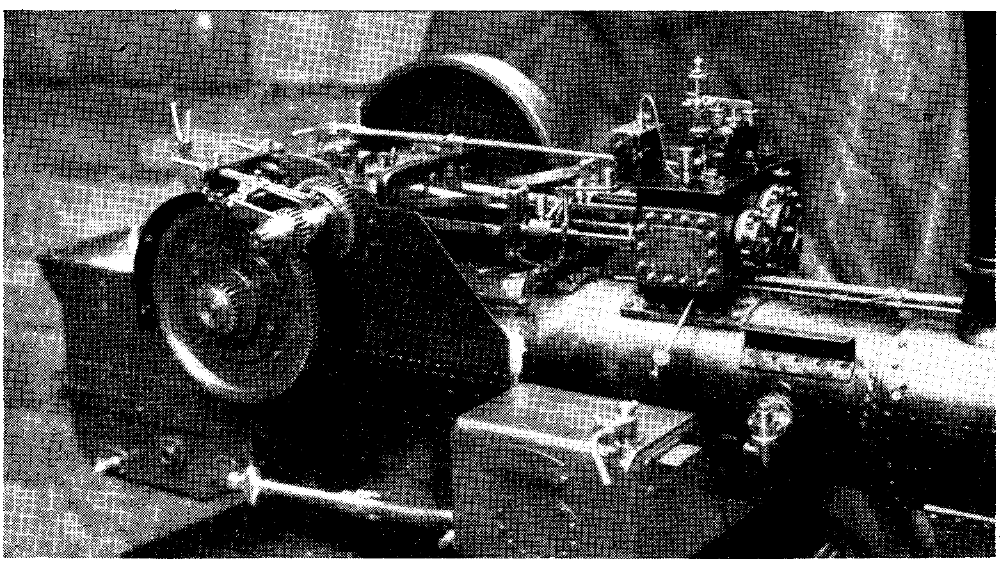
VIEW IN DIRECTION OF ARROW X SHOWING POSITION OF BOLTHOLES

For this job, I used thin tough paper for jointing, red and white lead soaked with boiled oil and left to get nearly dry. To put this in place and to hold the jointings together, I used a sharp scriber and steel rule and cut fine grooves. Screws of 3/32 in. diameter in stainless-steel are used throughout this job, on top and bottom, and these are spot-milled on every hole. The long studs used for holding the steam-chest can be mild-steel, but the studs on governor base and safety-valve core are of spring steel and, where possible, these should go right through into block *B*.

The L.P. cylinder is now lapped and the plate screwed tight in the cylinder end. The ports and steam ways must be quite clear of the end plate, then with steel ends, block in the drilled ends and clean up. When making the L.P. front, you will notice the large L.P. cover overlaps the joint top cover, so this must not be cut away. The two covers in front are in one piece and cannot be made separately. Watch the spigots when marking-out, in order to get the centres correct. Before putting in studs for front covers, the block must be set up on a 90-deg. angle-plate and the governor-valve seatings machined out in steps to the dimensions shown. There are two other items, an $\frac{1}{8}$-in. passage for the whistle, *W*, and a $\frac{1}{4}$-in. $\times$ 40 screwed bush, drilled and tapped out $\frac{1}{8}$ in. $\times$ 60 for the lubricator to H.P. chest. The openings on back-end are for regulator-valve spindle, *R*, and B.P. by-pass valve, which is depressed from the driver's end when the H.P. cylinder is off dead centre and the opening into the dome is $\frac{1}{4}$ in. diameter. The mechanical lubricator is screwed on at *ML*.

The making of this cylinder block took me four months, and it is well to study the drawing first, and if you can improve on the design, by all means do so, as long as the outside remains correct. Tighten up the screws in the base and head two or three times, as these loosen a little and the block cannot be tested until all fits well on the boiler.

(*To be continued*)



The completed cylinders, motion and gearing

PETROL ENGINE TOPICS

*A 10 c.c. Twin Four-Stroke

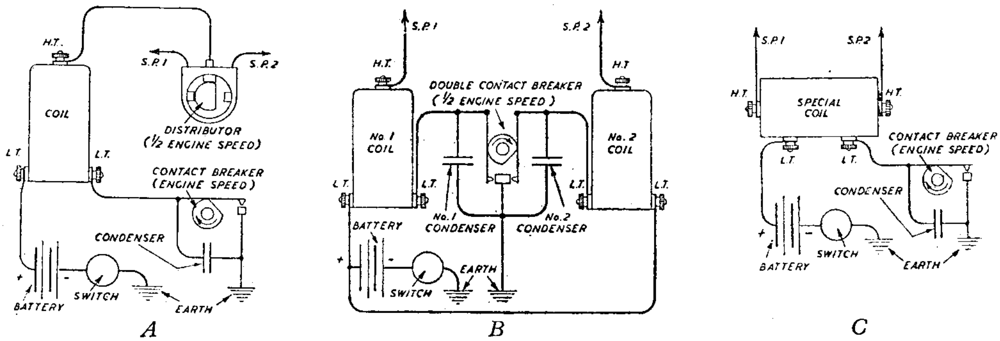
by Edgar T. Westbury

BEFORE describing the ignition equipment for the " Seagull " engine, it may be explained that there are three separate ways of arranging the wiring and accessories, to supply the necessary high-tension current to the two sparking plugs at the correct point in the cycle in each case. This matter was explained in connection with the design of the 30-c.c. " 1831 " twin engine, described during the war, but that is quite a long time ago, and many readers will not have access to this description, so no apology should be necessary for repeating it.

In modern full-size practice, the most common way of arranging the ignition system on engines of more than one cylinder is to use a single coil, which is energised from the battery through a contact-breaker having as many " breaks " as the number of cylinders. The high-tension current is then fed to each of the sparking plugs in turn, and at appropriate time, by means of a distributor, which is virtually nothing more or less than a rotary switch of specialised design, to deal with very high voltage. This is the system which was recommended for the " 1831 " engine, and also the " Seal " four-cylinder engine; it is shown in wiring diagram *A*.

The second system, illustrated at *B*, entails the use of separate coils for each individual plug, energised through separate sets of contacts, which are operated by a single-break cam, being so arranged around the latter as to produce the required angular spacing or " phasing " for the timing of the respective plugs, which are in this case connected directly to the h.t. terminals of the coils, without using a distributor.

In the third system, *C*, which is only applicable to twin-cylinder engines (or pairs of cylinders in a multi-cylinder engine) which are directly opposed in timing, a single coil, of special type capable of giving two sparks simultaneously, is employed, and this is controlled by a single contact-breaker, operated by a double-break cam. This results in firing both plugs each time the contact-breaker operates, but only one spark at a time is effective in producing ignition. In four-stroke engines of the vertical synchronised-piston, or horizontally opposed types, the " idle " spark is fired at the end of the exhaust stroke, when there is nothing in the cylinder capable of being ignited. This is the simplest system, both mechanically and electrically, and though it might logically be considered bound to be somewhat heavier on current than the other two, it is not necessarily so in actual practice. Its only disadvantage is that it calls for a specially made form of ignition coil, which may not always be very readily available.



Alternative wiring diagrams for twin-cylinder engines

It may be mentioned that either of these three systems of battery-coil ignition systems has its counterpart in magnetos, which can be designed to produce the same order of results; also, incidentally, the coils may be of either the trembler or non-trembler types, though the former hardly have any practical advantages unless very low engine speeds are contemplated.

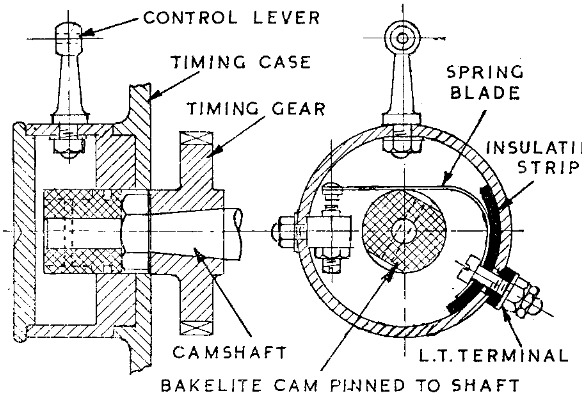
In the present case, the third system, *C*, is recommended, and the reason for this is not that there was anything wrong with the *A* system used on the " 1831 " engine, but that there is now at least one dual-spark coil available on the market; and for those enterprising souls who are prepared to take on the job of winding their own coils, a design for a very efficient coil of this type was given in my articles on " Ignition Equipment " published just after the war, and now available in book form, under the same title. The " Atomag Minor " magneto is also adaptable

*Continued from page 646, " M.E.," October 26, 1950.

to work as a dual-spark type, and has, in fact, been very successfully used on the "Craftsman Twin" simultaneous-firing two-stroke. It is also possible to use two matched coils of the orthodox type, with a single contact-breaker, for this system of ignition.

Contact-breaker

For use with the above system, the contact-breaker differs essentially only in one detail from that used on a single-cylinder engine; namely, in respect of the cam, which is designed to make and break the circuit twice per revolution. Even this could be avoided by mounting the component on the crankshaft, which is actually done in the case of the "1831" engine, in which the contact-breaker and distributor are separate components, the object being to simplify construction. But in this engine, when no distributor is used, there is little point in fitting the contact-breaker on the crankshaft, as it can be accommodated better on the face of the timing case, where it is more readily accessible, and incidentally, a little further away from bilge-water when the engine is in a boat. These "whys and wherefores" are given with a view to anticipating a few of the numerous queries which are invariably encountered on particular features of design; I always claim that every feature in any one of my engine designs has a definite and logical purpose, and am always prepared to submit evidence to that effect.

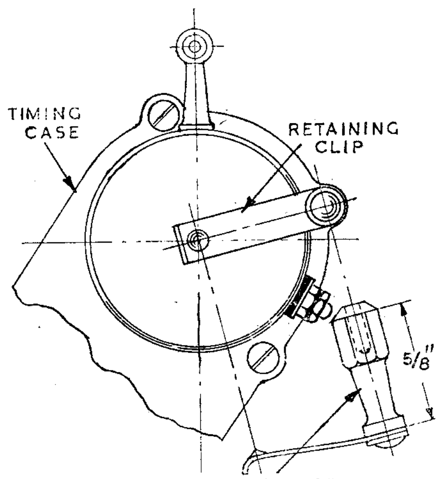


General arrangement of contact-breaker

The particular design of contact-breaker has been selected after a number of experiments with other types, which, while generally satisfactory for their intended purpose, have not satisfied me on points of detail. Some are too complicated, or difficult for the average constructor to make, assemble or adjust; others tend to look big and clumsy for the size of the engine, or are not well protected against oil, water or dirt. In spite of the number of small petrol engines which have been built, both commercially and by amateurs, it is still rare to find one in which the design of this simple but vital component has been really well carried out. Perhaps this is one of several reasons why glow plugs and "diesels" have become popular!

I have always been keen on the idea of enclosing the contact-breaker, but it is not easy to do this while keeping it compact and reasonably accessible; and in cases where I have been to great pains in enclosing the breaker, I generally find that users almost invariably throw the cover away or neglect to fit one at all. Well, here is a simple enclosed breaker, so designed that you *cannot* discard the cover without altering the entire assembly, as it is an integral and essential part of the design.

Both the "live" and "earthed" contacts in the breaker are attached to the inside of the casing, the former being insulated by a backing strip of fibre or similar material having just sufficient flexibility to bend to the curve of the inside surface of the casing, and the bolt holding the contact blade, which forms the L.T. terminal, is insulated by means of a fibre, ebonite or bakelite bush. The spring blade is bent to increase its length, and thereby its resilience, enabling a fairly stiff spring to be used without causing too much friction on the cam. It will be noted that the rather unusual feature of a bakelite cam is adopted, and an obvious reason will no doubt occur to readers, in that a metal cam would short-circuit the contact points; but another and equally important reason is that this material is practically self-lubricating, and in cases where the cam rubs directly on the contact spring, it will help to reduce wear of the latter. Should the constructor prefer to use a metal cam, case-hardened steel is recommended, and insulation may be preserved either by riveting a thin strip of Tufnol or Paxolin strip to the underside of the spring, or the "live" and "earthed" contacts may be changed over, the spring being attached

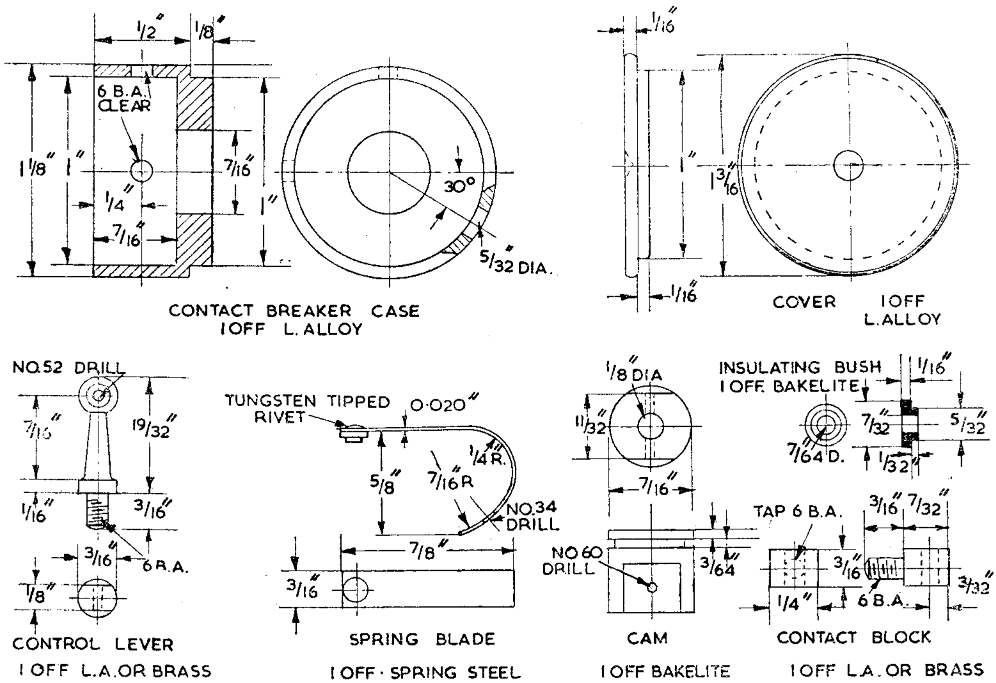


Face of contact-breaker, showing stud and clip directly to the casing, and the contact block insulated therefrom by fitting fibre bushes both inside and out.

The disc cover is held in place by a spring clip, which resembles that used to retain the contact-breaker of an orthodox magneto, and may be made in the form of an extension to one of the studs in the timing case, as shown in the drawing. I have not given a detail drawing of this stud, but this should not be necessary; the spring clip is attached by riveting over the shouldered

is liable to discolour badly in the presence of oil, and may also warp, while vulcanised fibre is not only prone to both faults, but is also hygroscopic, and may become a poor insulator when damp. The most suitable material is a fine-grade laminated fabric bakelite such as Tufnol or Paxolin.

The control lever, and also the contact block, have screwed ends, and are attached to the casing by a 6-B.A. nut in each case. It is desirable to spot face the outside of the holes, and an inverted cutter may also be used on the inside to produce



Details of contact-breaker components

end, with a washer interposed, to produce a smooth working action when the riveted end is tightened just sufficiently to take up play. The spring should be about $\frac{3}{16}$ in. wide by 0.020 in. thick, with the outer end turned up to facilitate operation, and a "dimple" formed in it to coincide with the centre of the cover, by punching from the outside with a blunt centre-punch.

Machining of the casing and cover disc is quite straightforward and presents no difficulties. Light alloy, such as duralumin, is specified for these parts, but brass is mechanically just as good, especially if its somewhat inappropriate colour is camouflaged by dull plating. Some constructors may prefer to use insulating material, which is quite satisfactory if an earth lead is taken from the contact block, and can be very effective in appearance if highly polished black or coloured material is used. But there are snags in obtaining the right material; ebonite

a flat face here also; alternatively, a convex-faced washer may be fitted. The contact block is cross-drilled and tapped to take a 6-B.A. contact screw. Small headless screws with tungsten tips, and also tipped rivets for attaching to the spring blade, are available from Craftsmanship Models Ltd. Do not attempt to improvise substitutes for proper contact materials, or it will surely lead to much grief and pain sooner or later. I have had contact-breakers submitted to me for inspection, which have been fitted with contact tips of brass, nickel, silver-steel, silver-solder (occasionally soft solder !), and one constructor was quite sure he had done the right thing by making the contacts, with great difficulty, from tungsten *steel*!

With the exception of platinum-iridium alloy, which is very expensive, the only material I can confidently recommend as suitable for ignition contacts is *pure* tungsten. I have gone to great pains to put the suppliers of parts for my

(*Continued on page* 726)

Removing Broken Taps

by A.E.V.

HAVE you ever envied those legendary fitters who never seem to break taps? Well, they don't exist! We all break taps at some time or other, but the good fitter knows how to get them out (most of them, anyway), and so, of course, no one is any the wiser and the fitter's reputation grows. The following notes are intended as a guide to our less fortunate brothers in the model making fraternity, as obviously no hard and fast instructions can be laid down and each case must be dealt with individually.

Before you attempt to shift a broken tap, these questions should be answered :—

(1) Is it worth getting out ; can you remake the part with less bother than getting the tap out?

(2) Why did it break? If for example, you were tapping too vigorously, the tap may have "bottomed" in a blind hole, in which case once it is started it should screw out easily. Or you might have pulled on the tap and broken the shank off, but may not have jammed the business end of the tap. This breakage is most common with taps from $\frac{3}{16}$ in. down and normally can be shifted relatively easily. A blunt tap is usually very tight in the hole, and presents a difficult job, but as most breakages of this nature occur with taper taps, they can usually be driven out from the back of the hole ; in the case of blind holes, it is necessary to drill a hole from the opposite side to be able to drive it out. Of course, this method will damage the few top threads. If the tap is choked with swarf, it is usually aluminium or cast-iron ; in the case of the last mentioned, rock the tap a little and blow the swarf out or knock it out on the edge of the bench. The tap should then come out easily. In aluminium the problem is more involved. Treat as for cast-iron first and if the swarf does not come out we are left with two alternatives :—

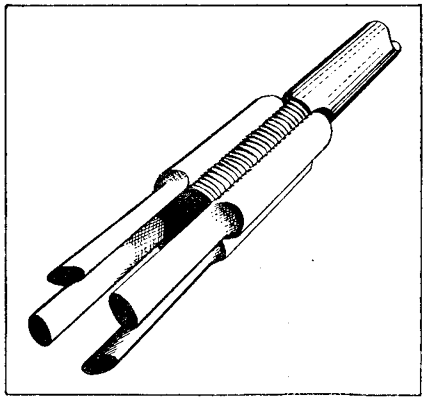
(a) To let down the tap and drill it out (this can only be done with carbon steel taps in aluminium).

(b) To drill down the flutes of the taps so as to clear the swarf (this method is most effective if the hole can be made larger).

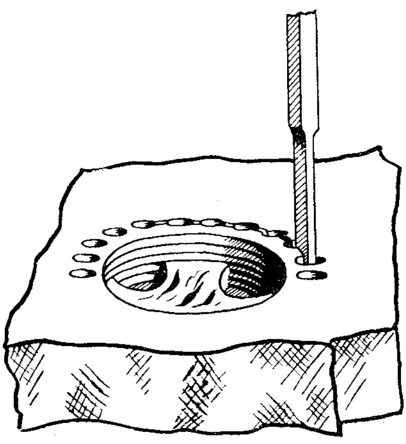
(3) Can you use oversize holes or plug the hole and start again?

(4) How can you get it out? Can you knock it out of the hole from underneath (best used on tapers or taps just started). Can you screw it out? Will the job stand heating sufficiently to soften the tap so as to be able to drill away the core of the tap and collapse the flutes into the centre of the hole, thus enabling you to pick out the pieces? Or can you drill a ring of holes round the tapped hole, just touching each other, so that when the circle of holes is joined by drifting, the tap and "tapped hole" can be withdrawn and the hole plugged?

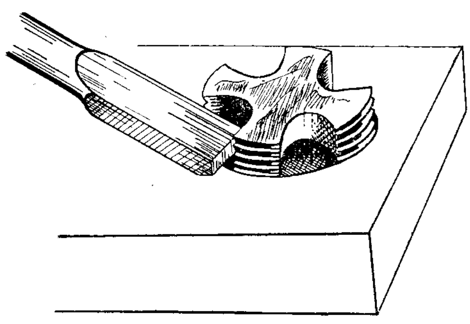
Only after the previous questions have been answered should any attempt be made to get the



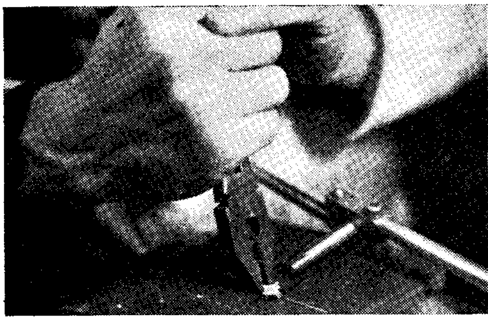
Home-made tap extractor. Use clamps or wrenches to hold blades to tap used as centre



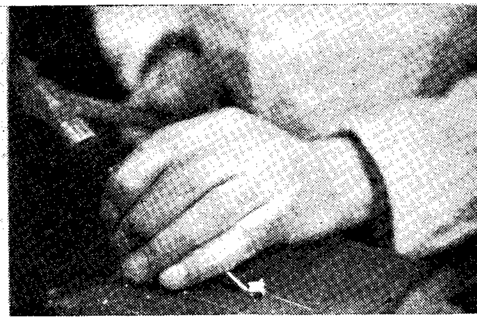
Chain drilling and drifting



A chisel makes a good drift. Remember to keep direction of force at 90 deg. to line drawn through centre of tap and point of impact



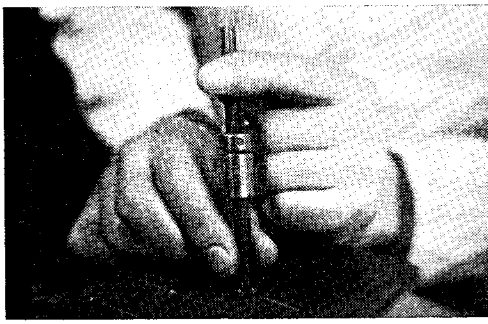
Trying tap with pliers to see how tight it is



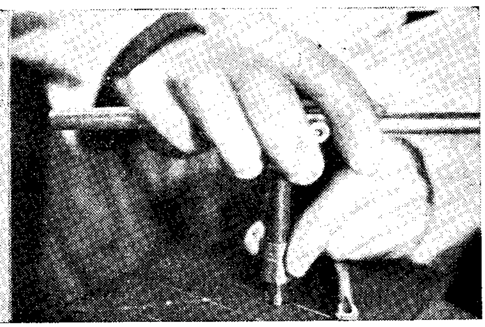
Attempting to start tap when jammed in hole (Gentle taps only)

tap out. Always try to remove the swarf first, then attempt to turn the tap back with pliers or, if obstinate, gently exert force by means of a drift and hammer to the projecting flutes. This only applies when the tap is projecting above the surface. If the broken tap is below the surface, long-nose pliers are sometimes effective, but normally a tap remover is necessary. The blades should be slid down the flutes and very gently eased out. If the tap is fractured, i.e. is broken in several pieces, the tap remover is a good method to use, as the blades of the remover help to keep the pieces together ; but it is essential to take it easy, as the broken pieces will tend to tip and jam against the sides of the hole. So remember, gently does it. If the fracture is very bad and consists of a lot of small pieces, it may be possible to pick out the pieces with tweezers and scriber ; if you have to break any of the pieces to get them out, use discretion and light taps, or you might wedge it tighter or mutilate the top edge of the hole. If the tap is stuck fast and the job will stand heat, the tap should be let down.

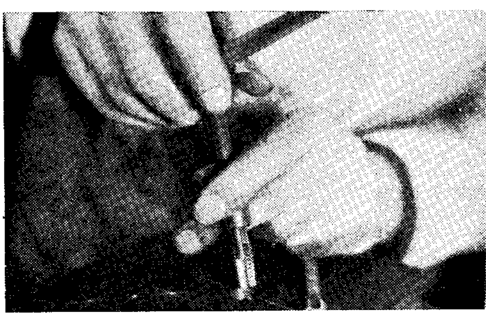
For carbon-steel taps, heat until the tap turns black and cool slowly ; for high-speed steel taps, heat to cherry red and then cover with dry lime and allow to cool off. (If you aren't certain as to the nature of the steel, try letting down the shank



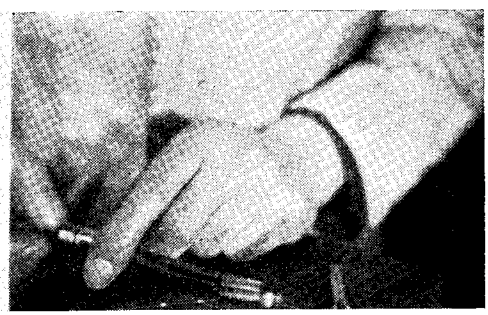
Inserting blades of tap extractor in flutes of tap



Sliding collar down close to broken piece to support extractor blades

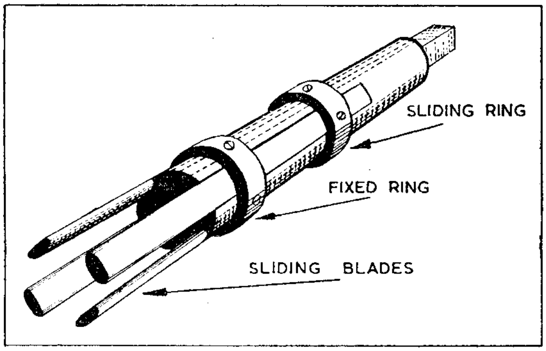


Removing broken piece from hole



"Journey's end"

first.) If the holes go right through, the tap can be drilled out with a tapping size drill from the back. For blind holes, spot the top of the tap with a tapping drill size and then drill a small hole right through the tap and follow up with a drill large enough to just remove the core of the tap and leave the flutes, which can now be picked out. When drilling out taps, take it gently or the flutes may jam the drill as it breaks through the end of the tap.



Commercial tap extractor

The best policy with regard to broken taps is, of course, not to break them. Breakages can be kept to a minimum by using a tapping drill to give between 75 per cent. to 80 per cent. thread unless a full thread is necessary. Always drill tapping holes right through wherever possible and avoid bottoming and swarf choking; also, it will be easier to drill out taps. Blind holes should be drilled deeper than required, so as to obviate the use of plug taps and to allow the swarf to drop clear of the tap.

To make tap removers, file some pieces of silver-steel as per sketch and toughen (harden in oil or warm water and temper to blue). A convenient way to hold them is to use the broken shank or another tap as a centre, and clamp the blades to it. Tap removers can be obtained from tool shops, but for the amount you will require them, the money is better spent on ground thread taps which stand up to greater use, as they do not bind so readily in the threads.

Petrol Engine Topics

(*Continued from page* 723)

engines in touch with manufacturers of suitable material for contacts, and there is no excuse whatever for playing around with substitutes.

If desired, a hole may be drilled in the casing, immediately under the end of the contact screw, so that the latter may be adjusted *in situ* with a watchmaker's screwdriver. But it will usually be found easier and quicker to take off the casing, remove the contact block, and get at the screw and lock-nut in comfort, with the opportunity of inspecting the contact face at the same time. This operation only needs to be carried out at very infrequent intervals, anyway.

The spring blade is made of $\frac{3}{16}$ in. by 0.020 in. spring steel, the same as that for the retaining clip, and is best fitted by the "cut, bend and try" process. Its shape when free should be approximately the same as shown in the drawing, so that it bears hard on the fixed contact when secured in place in the casing; the exact position for the rivet should be found by trial, as it is very difficult to mark dimensions accurately on a bent, flexible strip. The holes may be punched, using methods described recently in "Novices' Corner," but semi-hard commercial spring strip, which is quite suitable for this job, can be drilled quite easily. When riveting the contact, use a block of copper or aluminium to support the rivet, to reduce the risk of cracking the contact tip. The shank should be a neat fit in the hole, and the length allowed for heading should not be greater than that necessary to ensure a firm hold. Incidentally, ignition trouble is sometimes traceable to poor contact between the rivet and the blade, generally the result of insecure riveting.

The insulating backing strip for the spring blade should be cut practically to the full width which can be accommodated in the casing, allowing for the spigot of the cover. This strip is not shown in detail drawings; the material may be fibre, paxolin, presspahn, leatheroid, celluloid or any other insulation recognised in the electrical industry.

For the cam, fine-graded Tufnol is recommended, using material with the laminations at right angles to the axis to obtain maximum mechanical strength. A groove is turned near the inner end of the cam to retard oil creeping along it into the breaker casing. The flats should be exactly opposite each other and exactly the same radial depth. Drill and ream the centre hole to a wringing fit on the camshaft extension, and after timing, the cam is pinned in position. A small brad or panel pin, filed in the drill chuck to a tight fit in the hole, may be used, and after insertion, it is filed flush with the flats at each end. The position of the cam is not critical, as a fair latitude of timing adjustment can be obtained on the control lever.

(*To be continued*)

Novices' Corner

Studs

STUDS are used for securing components to castings, or for fixing together two parts which would be damaged by the repeated removal of screws, and in circumstances that preclude the use of bolts and nuts. An example, which will be familiar, is the fixing of the engine crankcase sump on a motor car.

Fixing Studs

A typical arrangement of a stud set in a casting is shown in Fig. 1. It will be seen that the stud is screwed in until it bottoms in the tapped hole : this ensures that the stud will remain firmly set and will not tend to unscrew when the nut is undone. If a stud is set in a casting so that it does not bottom, the locking of the two parts will rest

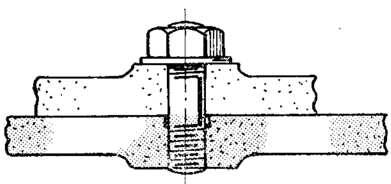


Fig. 2. Stud set in a flange

upon the engagement of the threads at the mouth of the hole with those which complete the threading on the stud. At best, even when the stud is fitted in hard material, this arrangement gives but a poor hold. When the stud is set in a comparatively soft material, such as aluminium, the hold is negligible, for the metal around the area of contact will be pushed away.

It is sometimes necessary to set studs in the flange of a casting of insufficient thickness for the bottoming method to be used. The end of the stud projects through the flange, as shown in

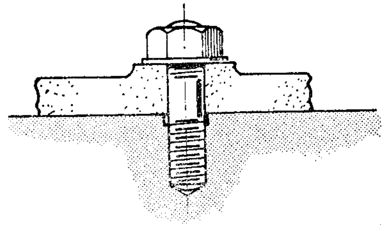


Fig. 1. Stud set in a casting

Fig. 2, and the necessary grip is afforded by making the threaded standing portion of the stud a firm fit in the hole. The nut is made a normal fit, so there will be no likelihood of the stud withdrawing when the nut is undone.

It is sometimes desirable to fix studs positively so that they cannot be withdrawn. The first method of providing a positive lock is shown diagrammatically in Fig. 3 where it will be seen that the end of the stud is centre-drilled and is screwed down on to a steel ball. This has the effect of expanding the stud and causing it to bind in the tapped hole. This method is quite satisfactory when used in a comparatively hard metal such as cast-iron, but it may not prove completely successful if employed with the softer materials such as aluminium.

If it is necessary to secure large and medium nuts, the cross-pinning method shown in Fig. 4 is best employed.

Tools for Setting Studs

The simplest tool for setting studs is a spanner which may be used to turn a pair of nuts which have previously been locked rogether on the stud, as shown in Fig. 5. This very simple method has the advantage that it may also be used to remove a stud if necessary.

A somewhat more elaborate device for stud-setting is the tool known as a stud box. Three of these tools are illustrated in Fig. 6 and a section of one of them is shown in Fig. 7. When using a stud box, the central screw is adjusted to engage the top of the stud, which must not be allowed to enter the box fully but should have some two or three threads remaining outside. A spanner is

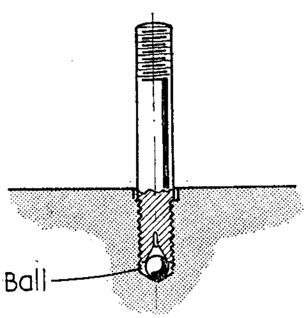


Fig. 3. Locking a stud by expanding it with a ball

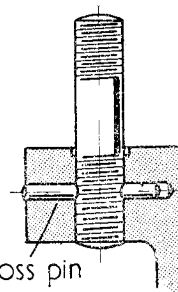


Fig. 4. Locking a stud with a cross-pin

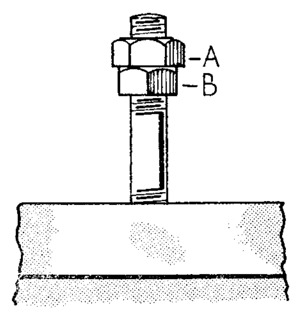


Fig. 5. Using two nuts to set a stud. Turn nut "A" to set stud. Turn nut "B" to remove stud

then applied to the hexagon body of the box and used to screw the stud home. The box is released from the stud by loosening the central screw and running the device off the stud.

Some mechanics assert that a stud box of this type will also remove studs. This has never been our experience, for the design of the device is against removal. If studs have been withdrawn by this means, it seems certain that they cannot have been firmly set in the first place.

it is possible to buy such chucks complete with a parallel arbor, the making of the tool is an easy matter, for it is only necessary to saw the arbor to a convenient length and fit the T-handle, which may be made from a short length of ¼-in. mild-steel rod.

Making Studs

Studs should be made from a good quality mild-steel. For heavy duty, however, high-

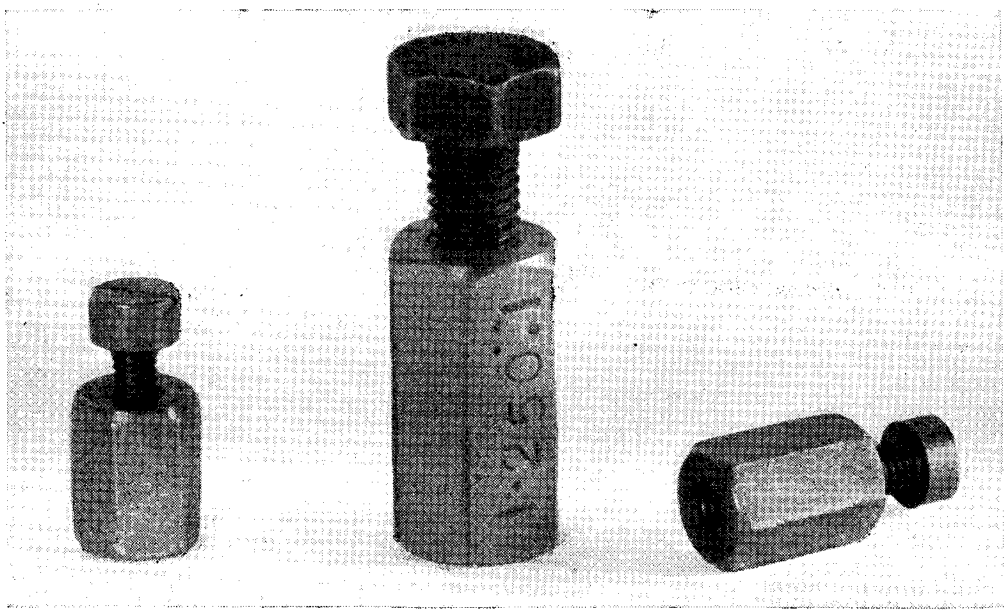


Fig. 6. Stud boxes

Stud boxes are very simple to make, for any odd piece of hexagon material will serve to form the body, while a standard screw can be used for purposes of adjustment. The material only needs to be drilled and tapped, work which is best carried out in the lathe so as to ensure concentricity, and the two ends require chamfering in order to present a finished appearance.

If stud boxes are to be put to much use it is advisable to case-harden them, otherwise the bodies will tend to be bruised by the spanner. The central screw should also be hardened, for not only will its head become damaged if this is not done, but the end of the screw which makes contact with the stud will tend to become mushroomed.

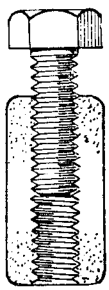
These devices are suitable for setting-studs of any size ; however, when they are used with small studs it is advisable to use a box spanner to avoid bending the stud.

The hand chuck illustrated in Fig. 8 has been found very useful for inserting small studs within its capacity. It will hold studs up to $\frac{3}{16}$ in. dia. and has sufficient gripping power to set them firmly.

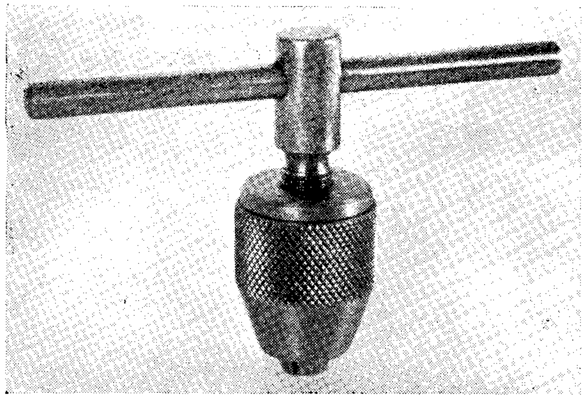
The chuck itself is of the three-jaw spring type and has been fitted on a T-handled arbor. As

tensile steel is essential, and such studs may be made, most conveniently, from motor-cycle wheel spokes when small sizes are needed, or from high-tensile bolts if medium to large sizes are required. On no account should silver-steel be used, for it has insufficient tensile strength and will prove unreliable.

In order to give adequate hold, the threaded portion of the stud which screws into the casting should have a length from one-and-a-half times to twice the stud's diameter. The pitch of the thread is chosen to suit the material into which the stud is to be set. Thus, for aluminium a coarse pitch should be used, while for brass and steel, fine-pitch studs may be employed with safety. The use of fine-pitch threads in cast-iron calls for some comment. Studs threaded British Standard Fine Thread are quite satisfactory in the larger sizes ; in the smaller diameters, however, and threaded British Association for example, the forming of the requisite fine threads in iron castings is not always attended by success. A coarse pitch is not practicable, as the studs become unduly weakened owing to the narrowness of the core diameter of the thread, so it is best, therefore, to use a fine pitch increasing the thread length to, say, three times its diameter in



Above—*Fig.* 7. *Section of stud box*



Right—*Fig.* 8. *A hand chuck for setting small studs*

order to offset trouble which might arise from weak threads in the casting.

The threads cut on the upper end of the stud are, of course, made to suit the nuts that it is intended to use.

The length of a stud should be calculated so as to ensure that, when the parts are firmly nutted together, the chamfered end of the stud finishes flush with the top of the nut, as shown on the left in Fig. 9, and does not protrude in the unsightly manner shown on the right in the same figure.

There is but little work in making studs, but what has to be done should be done well, especially when a number of exactly similar studs has to be made. Before commencing any work at all, it is advisable to make a pencil sketch of the stud itself, marking upon this drawing the salient dimensions and, in particular, the length of the threaded portion. This procedure will enable the correct length of the stud blank to be fixed, and will help to avoid disappointments which may subsequently arise if memory is relied on to supply working information.

Studs of small to medium sizes may be made entirely in the lathe. The first operation is to part off, from suitable sized steel rod, lengths which will form the stud blanks. A satisfactory limit stop, which will enable a succession of blanks of the correct length to be cut off, is to hand if a drill chuck is mounted in the tailstock and is used to grip a piece of round bar which has had its end machined square. The tailstock may then be adjusted and locked so that the distance between the side of the parting tool and the face of the stop is equal to the length of the finished stud. The stud material is then fed through the headstock until it engages the improvised stop, and the chuck is then tightened on the work. A parting tool, having its cutting edge ground at a slight angle to avoid leaving a pip on the end of the stud blanks, is now mounted in either the back or front toolpost and fed into the work. If, immediately after the blank has been parted off, tool feeding is continued, the pip which remains on the parent material will also be removed. This procedure is essential, otherwise the finished lengths of all successive stud blanks will be short.

When sufficient blanks have been prepared, they are held, one at a time in the self-centring chuck so that they may be chamfered at each end. Both this operation and the preceding one are best carried out with a pair of appropriate tools mounted in the back toolpost turret. For this involves no tool changing ; all that is necessary is to unlock the turret, reverse it and lock it again.

The stud blanks must now be threaded. If they are sufficiently long, both ends may be dealt with by holding the plain portion of the stud in the self-centring chuck and using a die mounted in the tailstock die holder. Here again a limit stop is to hand by using the face of the jaws themselves. If the work is set to project from the jaws a distance equal to the length of the thread

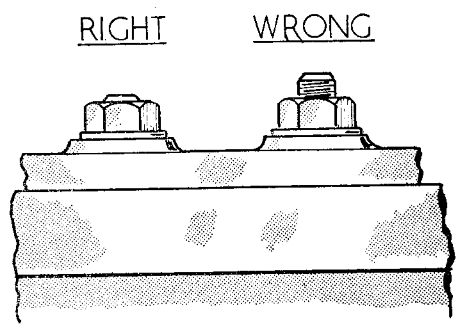


Fig. 9. *Studs of correct and incorrect length*

required, then, when the die makes contact with the chuck jaws the work will have been threaded to the correct length, but allowance must be made for the lead formed at the entry of the die itself and it will therefore be necessary to allow the work to project somewhat more than the exact threaded length to compensate for this.

Very short studs may be threaded at one end when held in the chuck. But it is seldom possible to treat the opposite end in this way, for the plain portion remaining between the threads is insufficient for a good hold. In these circumstances it is best to mount the work in a stud box which may, itself, be gripped in the chuck, and to confine threading operations to those ends of the studs where the length of thread is not important.

When it is essential that both ends of the stud should be accurate as to thread length, a special stud box must be prepared. This will have its thread removed for a distance equal to rather more than the plain portion of the stud. The stud can then enter the box for the greater part of its length and the stud box can be adjusted so that its face can be used as a limit stop for the die.

Before leaving the subject of studs, reference must be made to a type which is used with wheel hubs. As will be seen from the illustration Fig. 10, these studs are shouldered and are secured in recesses machined in the hub flange. The studs are made a good fit but, to avoid any possibility of them turning while being pulled into place, a snug is fitted into their shanks and this snug engages with slots formed in the flange itself.

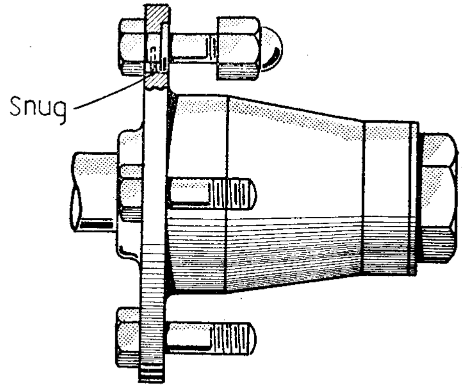


Fig. 10. Wheel hub studs

In order to prevent the lock-nuts coming undone the stud ends are usually riveted over.

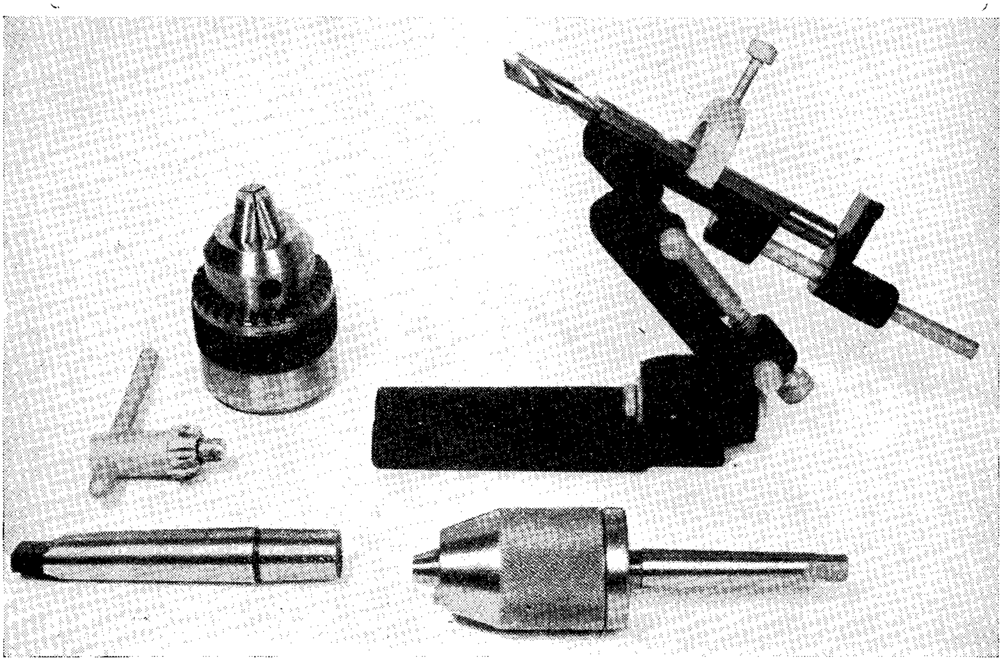
Useful Workshop Attachments

The accompanying photograph illustrates a number of tools manufactured by Messrs. H. D. Murray, of Queensway, Ponders End, Enfield, Middlesex. These have all been tested in the "M.E." workshop, and we can thoroughly recommend them to readers.

The Reliance drill-grinding jig, top right, will enable those not so versed in hand-grinding, to obtain first-class points, without unnecessarily shortening the life of the drill by over-grinding.

For normal lathe-drilling operations, or for use in the drilling machine, the Reliance 0-$\frac{1}{4}$ in. chuck, bottom right, with No. 1 Morse taper shank will be found to possess all the qualities expected of a first-class tool, the knurled barrel effecting a quick and efficient means of closing the jaws.

The 0-$\frac{1}{2}$ in. chuck, left, shown with key and No. 2 Morse taper shank, is a robust and beautifully finished article, which will answer the requirements of those who demand something larger for heavier work.



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. 9855.—Truing up the Headstock
R.P. (Porthcawl)

Q.—The headstock of my Myford $3\frac{1}{2}$-in. lathe is out of alignment with the lathe bed to the extent that work turned in the chuck or between centres always results in a taper amounting to approximately 0.008 in. dia. per inch of length. The headstock is secured to the bed casting by means of three studs and nuts and, when these are loosened, the headstock can be moved about the centre position very freely. I would be grateful if you will advise me on how the headstock may be accurately lined-up with the lathe bed. I possess a dial indicator calibrated in 0.0005 in.

R.—The most satisfactory way of truing up your headstock, in view of the fact that you have a dial test indicator available, is as follows: First of all, obtain a parallel mandrel which can either be set up in the four-jaw chuck or tapered to fit the headstock socket, in such a way that it runs quite truly. Next, mount the dial test indicator on the cross-slide of the lathe with the contact point placed horizontally against either the front or back of the mandrel. The bolts holding the headstock are then loosened, and the headstock adjusted so that the reading of the indicator is the same on any part of the length of the bar when the lathe saddle is traversed along it. Without a dial indicator it is practicable to use a test bar in the toolpost, and check with feeler gauges at various points along the bar, and a further alternative is to take trial cuts on a bar, which must be rigid enough to eliminate spring. The latter method is nearly always used as a final check in any case.

No. 9858.—Camera Remote Control
J.R.G. (Keighley)

Q.—Could you advise me on a method of working the catch of a vest pocket Kodak camera ? What I had in mind was something to work off a battery, or mains, with a long flex enabling the switch to be held in the hand. The camera needs one movement, about $\frac{1}{8}$ in., for a snapshot and two for a time-shot. I would prefer to work it off batteries so that it could be used out of doors.

R.—Several devices for this purpose have been produced by photographic accessory manufacturers, though most of them work mechanically through a delayed-action device, and not electrically. Two forms of the device are commonly known, one being in the form of a dash-pot device, in which a spring-loaded piston operates against air pressure, and the rate of leakage from the cylinder is regulated to time a delay of a definite number of seconds before the shutter works. The other uses a clockwork train with a governor or fan to control the rate at which the spring runs down. It is, however, quite possible to operate a shutter electrically by means of an electro-magnet or solenoid. We have described devices of this nature in past volumes of THE MODEL ENGINEER, but we regret we have no data immediately available on the design of such a device. We suggest, however, that the electro-magnet of a fairly large electric bell or similar mechanism might be adapted, and the voltage will be that which was originally required for the purpose for which the magnet is used. It would be necessary to experiment in obtaining just the right leverage to operate the shutter, but there is certainly no insurmountable difficulty in getting this to work properly.

No. 9843.—The Heywood Compressor
E.G.C. (Southampton)

Q.—Would you kindly suggest the approximate size and weight of suitable flywheel to fit to the Heywood compressor, to run at 700 r.p.m. from $\frac{1}{4}$ h.p. a.c. electric motor. Would the " M.E." spray gun be suitable for use with this machine ?

R.—We suggest that an iron or steel flywheel about 9 in. diameter and having a rim of not less than about 1 sq. in. cross section, preferably more, should be quite suitable for running this compressor, and the recommended bore sizes " M.E." spray gun will work quite well with this compressor, and the recommended bore sizes of air jet and front cone could be increased if it is desirable to cover large areas with the spray gun, as the compressor has an ample output capacity for this work.

No. 9844.—A De-magnetiser
H.N. (Normanton)

Q.—Would you please let me have details of a de-magnetiser. This is required for de-magnetising small tools.

R.—The de-magnetiser is a device consisting simply of an open coil of wire which is energised by alternating current. The articles to be de-magnetised are passed through the magnetic field of the coil, and in doing so are magnetised in alternate directions, so that their gradual withdrawal from the field will practically cancel out all residual magnetism. There are specialised types of de-magnetisers for various purposes, some being in the form of an iron core electro-magnet, but the principle is the same in all cases. We have no exact details of the windings of such a de-magnetiser, but an old transformer coil wound for the voltage of the supply could be tentatively tried out. No circuit diagram, of course, would be necessary, as the terminals of the coil are just simply connected to the mains, but it might be advisable to put a lamp in series as a safeguard against excessive current passing through the coil.

No. 9852.—Driving Small Blowers
A.A.B. (Walsall)

Q.—I have a BTH compressor which I have tried using for a low pressure spray gun, but without success. High speeds and large volume of air receiver have been tried with 40 in. × 15 in. compressor running at 1,350 r.p.m. I am now considering the purchase of a rotary sliding-vane blower as advertised by Messrs. K. McGrath, but should like to know whether in your opinion it would be suitable. I require to use it for a small Fletcher Russell gas blow-pipe, and also for domestic spraying. Its specification stated 7 cu. ft. per min. at 1,200 r.p.m., 10 lb. per sq. in. So, briefly, I would like to know:

(1) H.P. required to drive it, and would it be suitably driven if direct coupled?
(2) Must I stick to the stated r.p.m., if not, what is the maximum?
(3) Would an air receiver be necessary?

R.—The BTH compressor would be quite unsuitable for use with such a spray gun but the rotary type mentioned should be quite suitable for your purposes. It should be possible to drive this compressor by means of a $\frac{1}{4}$ h.p. motor, which would be quite suitable direct coupled. The speed of most small workshop motors is 1,425 r.p.m. which would be quite satisfactory for driving the blower. It would probably be possible to run it at speeds up to about 2,500 r.p.m., though at the higher speeds, there is a possibility that there may be some difficulty with lubrication. An air receiver is not absolutely necessary with a rotary type of blower, but it is very often useful to prevent pressure fluctuations, and also to act as a collector of water and oil, which may be discharged from the compressor, and this may be drained off from the bottom of the receiver. It is, of course most essential that clean air should be supplied for paint-spraying purposes, and in this respect, the designed lubrication system for this type of blower cannot generally be used. The blower would also be suitable for working a Fletcher Russell gas blow-pipe, but it may be found desirable to fit a relief valve to avoid excess pressure, especially when the blow-pipe is shut down, or reduced in intensity.

No. 9851.—Printing on Glass
E.L.D. (Moreton)

Q.—Could you please advise me as to the method and materials used to print on glass.

R.—There are several methods employed for printing on glass, including the use of transfers having vitreous paint or ink, which after application can be "fired" so as to sink into the substance of the glass. Another very common method is to etch the glass with hydrofluoric acid, using a stencil or some form of resistant varnish to protect the parts which are not to be etched, and using the frosted surface as a ground for the adherence of a pigment or ink. We regret that we cannot give you more complete details of the processes employed, which in either case we think would call for special equipment and could hardly be applied efficiently in a small workshop.

No. 9868.—Fitting the Pratt Four-jaw Chuck
J.G.P. (Gatley)

Q.—I intend to fit a Pratt four-jaw chuck, 8 in. dia. to my "Little John" lathe, the mandrel nose of which is $1\frac{3}{4}$ in. dia. and projects $1\frac{3}{16}$ in. The recess in the back of the chuck is $4\frac{3}{4}$ in. dia. There are four $\frac{7}{16}$-in. Whit. bolts and nuts provided for fixing. Will you please tell me:

(a) What diameter should the backplate be?
(b) What thickness should the backplate be (when machined)?
(c) Should the bolts be screwed into the backplate and locked with the nuts or should they go through clearance holes?

R.—(a) The diameter of backplate required depends on the particular method of fitting recommended by the makers. In large chucks, it is very common to use a small diameter backplate which fits only in the inner register of the chuck body. In such cases, the outer flange of the backplate is redundant. We note that the chuck is making contact both on the inner register and on the outer edge of the chuck body, but this is not the usual practice; either the outer edge or the inner edge, but not both, should be in contact, and in this particular case, we think it should be the inner register.

(b) The thickness of the backplate you suggest, that is $\frac{1}{2}$ in. or slightly over where the bolts pass through, would appear to be about correct.

(c) The usual method of fitting the bolts is to tap the backplate, and screw them in from the front of the chuck body, but other methods can be used, provided that they give the necessary security.

PRACTICAL LETTERS

Light and Colour

DEAR SIR,—I should like to say how greatly I enjoyed the article on the above-named subject, by G. W. Allinson. It is a fact that in the decoration of schools, the use of pastel shades, with contrasting splashes of strong colours, has been found to be beneficial, and only a couple of days ago I read in the local paper of a factory where a similar scheme had improved output by ten per cent.

But apart from the substance of what Mr. Allinson said, I think one of the most enjoyable things was his manner of saying it—vigorous and swashbuckling like the colours he advocates! Though really I must take him gently to task for his mention of a "swashbuckler, swashing buckles like mad."

Surely, surely, a swashbuckler is a man who *buckles swashes*! If he swashed buckles he would be a *buckle-swasher*, wouldn't he? So it seems to me!

Yours faithfully,
"THE DOMINIE."

P.S.—Wouldn't that last paragraph make a lovely test-piece for anyone who was tight-ish?

P.P.S.—Whose eyes *wouldn't* rest gratefully on a girl with a red head? I ask you.

Model Power Boat News from Switzerland

DEAR SIR,—The Swiss model power boat racing team, of the "Model Racer Club," Geneva, Switzerland, which entered last August 12th and 13th the two-day regatta at Derby would like to thank everybody in England for the kindness and sportsmanship given to the Chevrot bros. by all the English enthusiasts. To all the members of the different clubs which were represented at Derby, and especially to our friends of the Derby's model racing club, you did a lot to make our travel so nice and enjoyable, too. Be sure that the impression that we have taken back from England is more valuable than the cups that we won. We will never forget the words told during the night, at the Midland, as well by your dear Sir Robert Bland Bird, Bt., M.R.I.—who gave us such a fine reception—as by the Mayor and the other officials, including the voice of the M.P.B.A., by the Hon. Sec. J. H. Benson. We are certain that this first attempt will be followed each year in the future. It would be a very convenient arrangement to the "Hispano-Suiza" and "Ford" cups, because, as you know, these prizes have been in existence for a very short time, and the more the cups cross the Channel, the more valuable they should be.

Now, you will probably be interested in our latest success. On Sunday, September 11th last, our club held its yearly open event for the 10 c.c. class. The weather was the finest we had ever seen, and things seemed to be fast.

Twelve boats were on the starting line, and a terrific and very close fight followed.

The race was under International Model Power Boat regulations. Timing was provided by the Longines's watches factory, and accurate to 1/100 of a second.

I think that the results are expressive enough to show that perhaps the world's record will be broken sooner than expected. I think, too, that this race was the first one, in the history of model power boating, in which at least 25 per cent. of the competitors did more than 60 m.p.h.

Results are the following :—

1st Jean-Louis Chevrot, *Folbrise 7*, 10 c.c. Hornet, 79.05 m.p.h.
2nd Marcel Altenbach, *Atou III*, 74.44 m.p.h.
3rd Pierre Chevrot, *Be-Bop II*, 73.98 m.p.h.
4th François Chevrot, *Zi-Zi*, 60.31 m.p.h.
5th Richard Leuba, *Ariel II*, 60.05 m.p.h.

As you can see, with our pals the "Hornet" 10 c.c. engines, we did not do so badly this season. We are waiting for your visit next year, and wishing you good luck.

Yours faithfully,
Geneva. PIERRE CHEVROT

Why Only Two Cylinders?

DEAR SIR,—I am building "L.B.S.C.'s" *Hielan' Lassie*, and I have the main frames together, coupling-rods and cylinders fitted, and I am about to start on the valve-gear which is the Baker type.

In THE MODEL ENGINEER of 14/9/50, I read with great interest the article on "A Fitter's *Hielan' Lassie*" by Mr. S. Plummer and this locomotive appears to be a very nice job indeed, but I note with disappointment that Mr. Plummer has fitted only two cylinders.

Perhaps Mr. Plummer would explain why he has omitted to fit the inside cylinder, as I think this omission spoils what appears to be a good job of work.

It is a very nice locomotive and I am looking forward to the day when mine gets as far advanced as Mr. Plummer's, but I am very short of spare time.

Yours faithfully,
Burton-on-Trent. J. L. HARTSHORNE.

Tap Wrenches

DEAR SIR,—With reference to "Yorkie's" tip for longer living taps (September 28th issue), I feel compelled, with all due respects for his idea, to point out the equivalent control and sensitivity which can be obtained with a very reasonably-priced tap wrench of the chuck type. I recently purchased one of those well-finished wrenches (4s. 6d.) and immediately realised that it is "the goods" when tapping 3 B.A. or smaller. The knurled body, of goodly proportions, gives a wonderful "feel" and grip.

"Yorkie's" remarks on the lack of balanced control afforded by the standard wrench are fully agreed with; mention should also be made of the lack of rigid fixing unless more than finger-tight force is used in clamping the tap.

Yours faithfully,
Orpington. G. J. GABLE.