Mr. J. W. Pattison Designs a Lathe

and Suggests some Gadgets for it

TO prevent any misunderstanding, as I do not wish to start any argument on lathe design, let me state as briefly as possible just why this article ever came to be written at all.

First, then, let it be said that, like many others, I am very interested in making accessories, or gadgets as they are now commonly called, to further the scope of my lathe.

To facilitate this process, I keep an exact scale drawing of my present lathe, and whenever any additional part is required which I intend to make, reference to the drawing provides all the measurements necessary and saves endless time measuring up on the actual lathe itself, which at its best can be a dirty job, and dirty hands are not very helpful on a drawing board.

Gadgets

Evidence that many more like myself are interested in gadget making, or of otherwise improving their lathes, will be found by referring to almost any back number of this journal, where a multitude of articles have been written, bringing to light many excellent ideas for our benefit.

Speaking for myself, I take great interest in these articles, and many of the ideas set forth have been adopted to my own needs ; and as to their success, I have yet to make one that had to be shelved. Added to this, many original ideas of my own have been carried out from time to time, with the result that I now have available quite a respectable accumulation of very interesting and useful gadgets, many of which are in constant use.

All of these improvements, however, have been of a minor character, and in no way alter the basic design of the lathe ; yet I have often thought, had my lathe been made of a more plastic material than cast-iron, it would, times without number, have been moulded into a variety of different shapes to further the adoption of gadgets !

A Third Hand

One such gadget which, almost of necessity, requires an alteration of the lathe bed, and one which I had often desired to make, might be described as a sort of third hand to the lathe itself. Something where one could fasten a piece of work and still have available the benefits of the wide range of movements of the slide rest on which to mount tools or appliances to carry out the necessary machining.

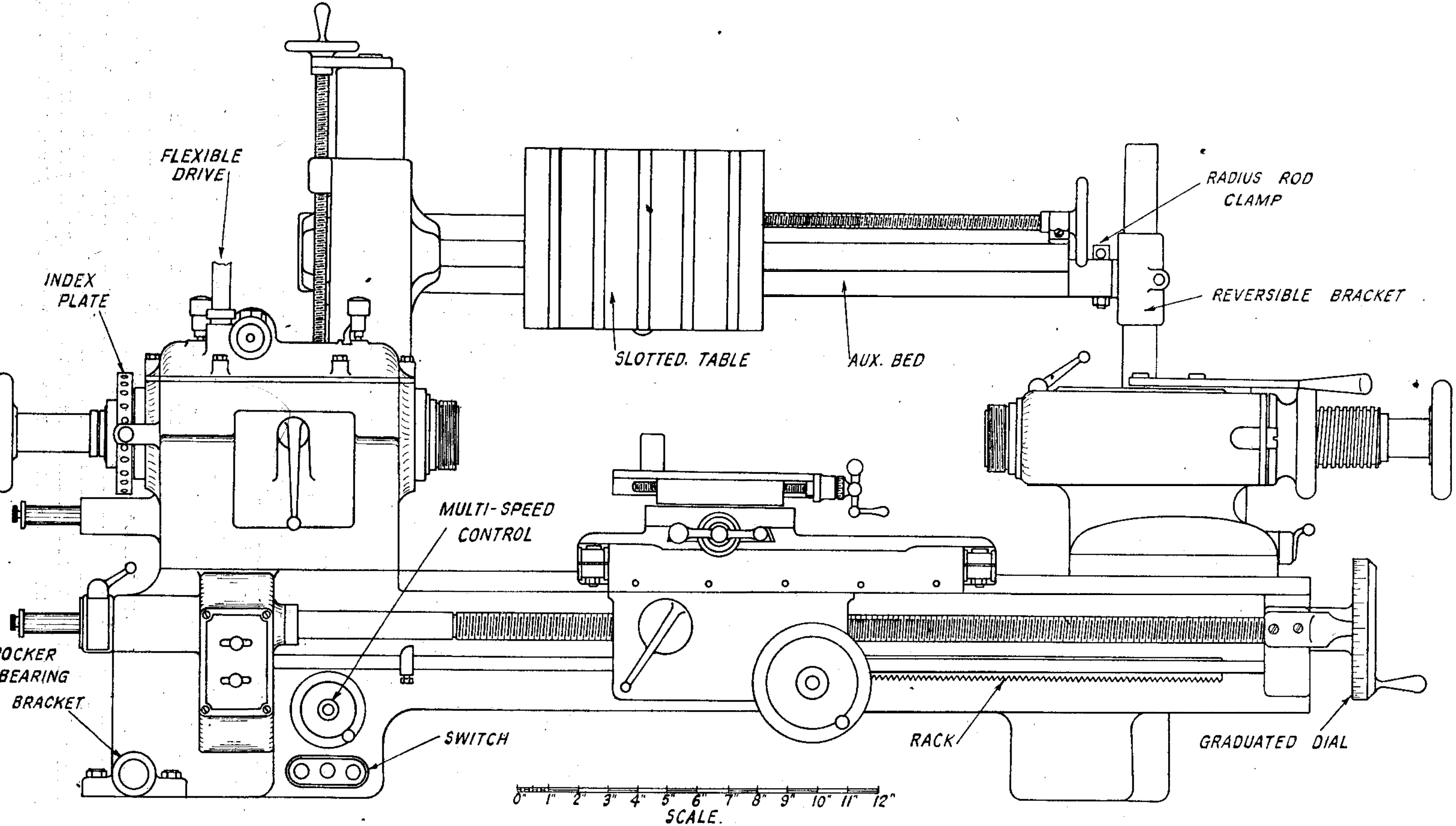
Yet another gadget desired was one to solve the difficulty that often crops up, the devising of some form of auxiliary drive, adaptable to any rotatable tool which has to travel about in a variety of directions. We all know that difficulty, and the overhead is not always an easy method of solving it.

I did get over these two difficulties on my own lathe. be it said in a somewhat nrimative way ; but it was in the process of drawing out the design that made me wish for that more plastic material already referred to.

A Pictorial Version

It was then that I decided to kill two birds with one stone, for, having taken great interest in the recent discussions on lathe design, I decided to mould my lathe into a more convenient design, at least on the drawing board, thus giving me a pictorial version of what I wanted.

Having drawn it out for my own amusement, it then occurred to me that it might provide interesting entertainment for others if it was accompanied by. a description. It is not put forth, of course, as any attempt to solve the " ideal lathe " question, that would take a much more intrepid person than I, since I am inclined to regard the answer to that question as somewhat mythical, considering the wide diversity of opiiiion as to what constitutes an ideal lathe. In fact, I wonder if there can be such a thing as an ultimate ideal, since when examining my own drawing there was a great urge to alter this or that as ideas took shape. Therefore, to me at any rate, what would at one moment appear to be ideal soon disappeared, to an extent depending upon one's desire to improve on it. All this, however, is quite a different thing from saying I would not be content with such and such a lathe ; indeed, I feel quite satisfied with the one I own at present ; and although it is far from my ideal, I have no intention of changing it for any other. That being so, the design is put forth only as of general interest at the present time, though



Front elevation of Mr. J. W. Pattison's design for a model engineer's lathe, showing some of the gadgets fitted.

I do hope it will induce others to produce a scale drawing of similar interest. No doubt they will find as many snags as I did, when they come to put their ideas on paper; but, above all, let us have the original ideas included and without fixing price limits, although a measure of simplicity will have to be included, otherwise the design will surely get out of hand, as there would appear to be no limits when once a start is made_ Since no thought of production is being contemplated, there is no need to let price upset ideas. If, however, anyone does hope to see his design produced, no doubt the prospective manufacturer will whittle down the design until it reaches his price limit. Any thought of manufacture never entered my mind, so price didn't interfere, though much thought was given to simplifying the various parts. Here's hoping, therefore, that any interest taken in this article will form a bait for others to come forward with their lathe designs, not necessarily ideals, though incorporating one or two original ideas, or should I say ideas originally applied in case there is any misconception as to their origin. To this I had better add, that I claim no originality in my own drawings.

Drawings

Now *a* word about the drawings. I have given plan, elevation and end views in preference to a projected view, in case anyone wishes to read off dimensions. Sectional drawings of all the parts would take up too much space, although, of course, they had to be made before the outline drawings could be arrived at. In lieu of sections I have included a description so that readers may form an idea of what is hidden from view.

General Features of the Design

The machine was designed to mount on top of a bench, without cutting away any of the latter and to operate as a complete unit without any separate motor, belting, countershaft, or overhead gear other than that which was part of the machine itself. There had to be no belts to change, and as much as possible of the mechanism to be enclosed. Also, there would have been no gear wheels to change, but that was found to be impracticable unless some limit was set on the number of threads to be cut. After considering that the amateur uses his lathe to cut worms and spirals, the necessity of very fine feeds at times, and also, at odd times, the- driving of the leadscrew independent of the mandrel, not to mention many other uses to which loose gear wheels can be put, the adoption of the simple quadrant and standard set of change wheels was preferred to the quick-change version with limited uses. Not a convincing argument I admit, but it scores in simplicity and in its universal application, and the more universal the machine can be made the better, at least from the amateur's point of view.

Electricity being available, advantage was naturally taken of this as a source of power. Normal accessories such as chucks, faceplate, angle-plates, etc., are assumed to be available and are therefore not included in the drawings.

The Bed

This is a box form casting closed at the top and open at the bottom, well ribbed inside, and with plenty of metal in it, to ensure rigidity. Extensions cast with the bed support the motor and columns. Three-point suspension is adopted, with rockers at the headstock end and a sphere at the tail end. This form of anchorage provides a ready means of upending the machine to get at the mechanism underneath necessary, since there are no inspection plates. As, however, there is little underneath to require inspection, that task will only occur at very long intervals and would be simple enough when it did occur. Besides this, all bolting-down strains are relieved from the bed.

The axis of the mandrel is offset from the centre line of the bed, the principal object here being to get adequate support immediatelv underneath the turning tool without overhanging the front edge of the bed any more than was reasonably necessary. Added to this, the offsetting allowed for an entirely separate way to be formed, along which the saddle could travel without touching any part of the bed traversed by the tailstock.

Comparatively large wearing surfaces were provided for a lathe of this size. vet even if wear did -occur, this could not 'affect the original alignment of the head- and tailstock.

No Gap

No gap was thought necessary, since the centres were raised to 4-1/2 in. This height was adopted for two reasons, first it provides a fair maximum turning size for an amateur's lathe, although a gap could easily be got by scooping out the bed immediately underneath the faceplate, whilst still retaining the desired front way the entire length of the bed. The second and most important reason was to get ample room over the saddle. The top and vertical faces of the front shear of the bed take practically all the pressure of the turning tool, the balance being taken on a section of the bed not touched by the tailstock.

(To *be continued)*

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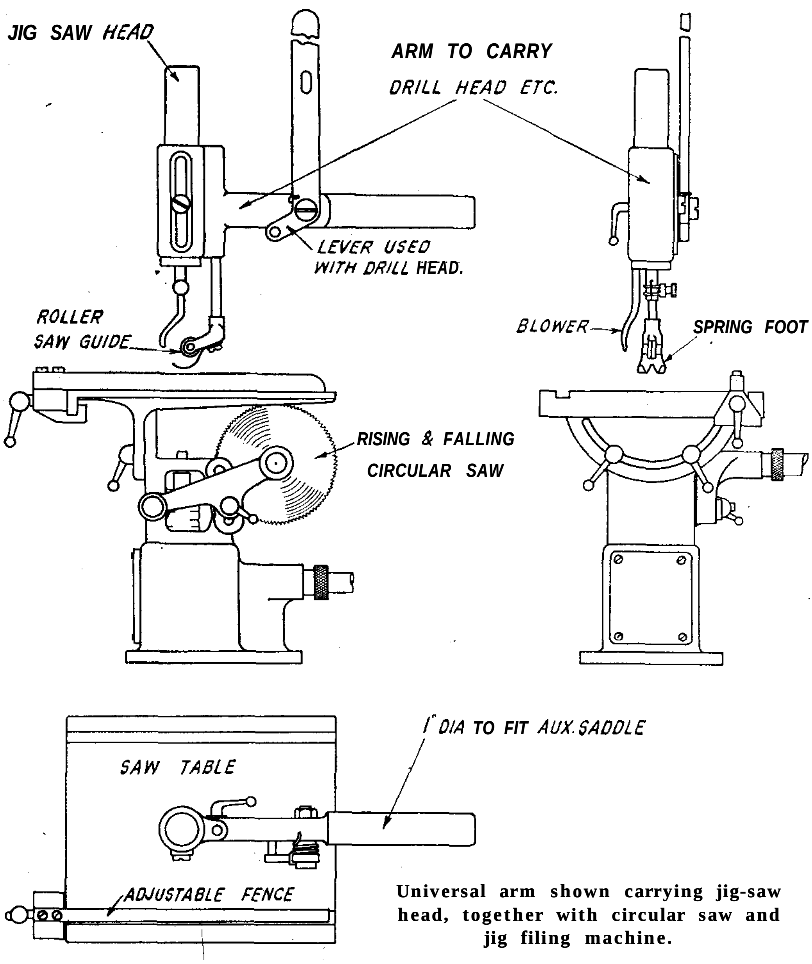
THE lower half of the jig-saw is a casting, enclosine a disc crank which imparts a 1-1/4-in. stroke "to the saw. Supported by it is a table which may be tilted and clamped at any convenient angle. The unit is secured to the lathe bed by a single bolt passing through a hole drilled therein. The upper half is brought into register with it by some definite marking on the auxiliary bed. In this way, the set-up should only be the work of a moment.

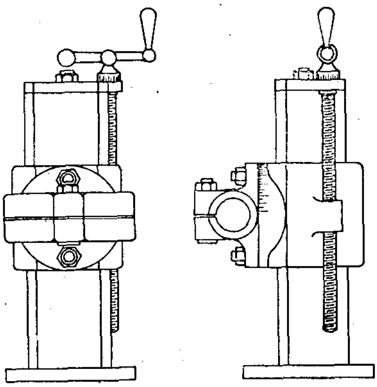
For sawing out intricate shapes in sheet metal the jig-saw is idea!, and any material may be sawn, if a suitable blade or knife is employed. Wood, bakelite, fibre, etc., may be sawn, and such material as cloth, cut with a knife blade. By using the lower half of the machine alone with a sabre saw in its chuck, intricate shapes may be cut in thicker materials and should be useful in pattern making.

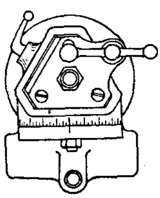
* *Continued from page 396, " M.E.," ApriE 23,* 1942.



Universal arm shown carrying jig-saw head, together with circular saw and jig filing machine.

By removing the saw clamp, the remaining exposed socket becomes available for small machine files. With the mechanism set to the bottom of its stroke. there is plentv of room to swing the circular saw into position. Either metal or woodcutting saws may be used and the swing movement of the saw arm is, the equivalent of a rising and falling table ; and added to this, there is the tilting movement of the table itself. An adiustable fence is clamped to the front edge of the table, and two slots are included for use with an angle-gauge. With a gap-piece removed from the centre of the table, it would appear possible to- attempt even surface grinding, although its scope would obviously be limited.





Universal drilling and milling machine bored to carry any of the rotatable tools. Similarly, a small faceplate or slotted table or anything fitted with a 1 in. dia. holding piece could be mounted.

The other gadget is a universal milling slide and needs little description, except to mention that the gib-piece is adjusted by four screws and may be locked by a handled clamping-screw. It will, of course, carry any of the rotatable tools, being bored out I in. diameter for that purpose. Besides the uses to which the above gadgets can be put, it would appear possible to do a little planing on anvthing mounted on the boring table, either-by moving the work mounted thereon against a tool held in the auxiliary saddle, or by swinging the auxiliary bed radially. This latter experiment suggests, also, that with a suitable clapper-box the tailstock might be used as a shaper for anything within its capacity, the large dimensions of the ram suggesting that it would be amply strong enough to perform this task.

There are numerous other uses to which the machine and its gadgets could be put,. as indeed there are-many more gadgets which could be added. until the machine became a veritable concentrated machine-shop ; but as these appear to be never-ending, imagination must be left to the reader to think them out for himself.

Amateur Toolmaking

(Continued from *page* 420)

edges just down to the cutting edges, no more and no less. Painting the " lands " with " plumbers' black " or red lead facilitates the accuracy of this filing operation. After heat treatment, touch up the cutting edge flats and the flutes with Carborundum oil slips, and again you have quite a professional-looking job.

Twist Drills

Again flute a piece of silver-steel or reduced stock of desired diameter with two flutes, as already described for taps and reamers and finish bv grinding, but flute a longer length than that-required for finishing. Grippmg the shank of the work tiehtlv in the chuck of the lathe and the other end in the tailstock chuck, form the twist, working back the tailstock to keep the work straight. Remove the damaged fluted part and, after straightening and grinding the point, the drill is-ready for hardening and tempering. Sizes between about 1/8in. and 5/16 in. can be successfully made, but the absence of lands makes these home-made drills unsuitable for very deep drilling, as they tend to bind.

Heat Treatment

A muffle furnace is a very useful adjunct for the amateur toolmaker. Procure half a dozen firebricks approximately 4 in. x 6 in. x 1 in. and secure four together with clamping straps to form a chamber approximatelv 4 in. wide, 2 in. deep and 6 in. long and secure another of the bricks to close one end of the chamber. With an old hacksaw, cut strips from the remaining brick to lay across the bottom of the chamber to support articles being treated.

Mount the whole 'on a suitable stand applicable to your gas burner or blowlamp, as the case mav be. With a half-Dint size of the latter, taps, dies, reamers, etc., up to 1/2 in. can be satisfactorily hardened and tempered, and, of course, the muffle is suitable for many other heat treatment jobs. The residual heat at the back of the muffle provides all that is required for tempering small tools at a temperature uniform throughout in their mass.

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WHEN the drawings were completed, these surfaces came in for a lot of criticism from myself. Particularly, they did not achieve one of the objects desired, that being slides which would remain entirely free from chips or, even worse, grit if grinding was to be attempted. Any attempt to eliminate this disadvantage appeared to bring in even greater troubles. An open-top bed would do little to relieve the situation, as the slides would still remain exposed. Transferring the slides to the front and rear face of the bed was thought of, but this meant no end of troubles, such as leadscrew mounting, tail-stock fixing, etc. On the whole, therefore, it was thought better to leave it alone, and possibly provide some form of telescopic apron to cover the exposed parts ; but whether this would be worth the trouble, however, is doubtful.

It is assumed that the bed would be ground, and its accuracy would depend upon the parallelism of the vertical faces of the front and back shears of the bed, and, of course, the flatness of the top surface. As the head and tailstock are both located against the rear vertical face, and, as already mentioned, the saddle is located against the vertical face of the front shear, alignment should be preserved at all times.

The Headstock

First in importance is the mandrel. It had to be large because I particularly wanted 1-in. collet capacity : therefore. the minimum diameter had to be 2 in.

Only when it was drawn out did I fully realise why a large mandrel would be expensive, for almost everything else in the headstock had to be increased in like proportion. Just imagine what diameter pinion is required and you will soon realise what dimensions a 6 to 1 back gear will assume. Also, one cannot mount standard-size change wheels direct on so large a mandrel, assuming it is to be bored out maximum diameter as in this case. Quite a lot of scheming had to be employed to keep everything within reasonable dimensions and yet provide large wearing surfaces.

Everyone appears to be in general agreement that plain bearings are best for lathe mandrels, and as I have no fault to find with phosphor-bronze carrying a hardened and ground mandrel, that is what is suggested. No doubt, cast-iron is equally good. though I have never worked a lathe so fitted long enough to form any opinion of my own. Personally, I would favour ball-bearings. but dread the warnings of others.

I have experienced some of the troubles attributed to ball-bearings, but as these bearings had seen a lot of service I was not convinced that the faults could not be rectified. Whatever the reason, it still remains a mystery to me why the makers of some of the finest precision lathes employed on the production of delicate work, such as instrument making, use ball-bearing headstocks and expound their virtues as though they were the main reason for the accurate work produced. Will some-one with experience of these small modern machines let us have some facts ? It would appear to me that many of the troubles of the earlier machines must have been over-come in the modern type. However, hard phosphor - bronze adequately lubricated, appears satisfactory enough to specify in this case, These bearings are coned on the outside for adjustment and are of square dimensions as regards length to diameter. Both front and rear bearings are of the same size. A ball-thrust washer takes the end pressure on the mandrel.

The drive enters the headstock by a vertical shaft, thence to a two-speed gear through a worm and wheel. A 5/8in. face is allowed on all gears in, the headstock. The gear change is affected bv a lever on the outside of the head, giving high, neutral and low, the neutral position allowing the motor to be run without turning the mandrel.

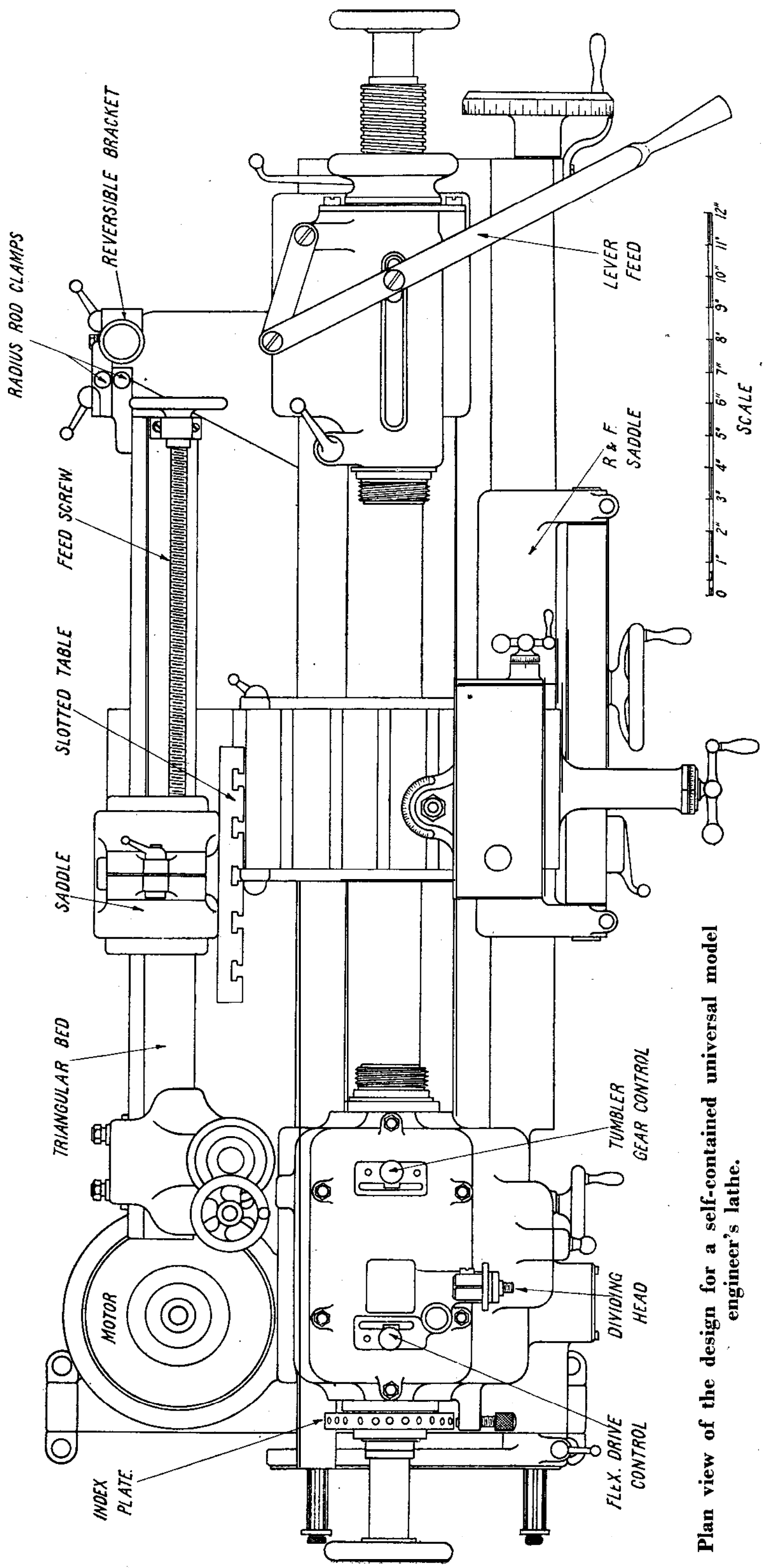
From the top of the vertical shaft the auxiliary drive is taken through a clutch, controlled by a small spring-loaded lever placed near the rear bearing. A correspond-ing lever near the front bearing works the tumbler gears.

Provision is made for dividing-plates at the front of the head. The protruding shaft carries at its rear end a steel worm 1-1/8 in. in diameter, which meshes with the mandrel

* *Continued from page 355, " M.E.," April 9, 1942.*

gear. This shaft is housed in an eccentric sleeve bearing to allow for the worm being taken in and out of mesh, and for adjustment of backlash. The front end of the shaft carries the quadrant-arm and spring plunger, whilst changeable dividing-plates and sectors are carried on the front end of the bearing. It is also possible to fix a handle in place of the quadrant and plunger and thus form a hand drive to use in conjunction with the permanently attached plate situated at the rear end of the mandrel. This latter plate is 1/2 in. thick and 4 in. diameter, drilled around its edge with 24 holes, 1/4 in. diameter, which are entered at right-angles by an equal number of 1/8 in. tapped holes located around the side face of the plate. Being permanently fixed, it is always available for the direct dividing of work into squares, hexagons, etc., the locking plunger being a 5/16-in. knurled-headed screw, turned 1/4 in. to enter the holes in the plate, and working in a lug cast in the head. Check counting may be done by inserting set-screws in the tapped holes corresponding to those required for indexing.

Two adjustable stops, having 1/4-in. turned legs, may be



Plan view of the design for a self-contained universal model engineer's lathe.

entered into any of the holes in the plate and locked by set-screws. Set tangentially on the plate, they come up against the cast lug which acts as a stop. Thus by using the handle on the other dividing gear to turn the mandrel, end-milling of an arc, or any similar work, may be performed on anything held on the chuck, the positive stops presentmg the rotation of the work beyond a predetermined distance.

This idea is similar to one seen at the " M.E." exhibition some years ago, and I trust the originator of this useful device will pardon my having used it here.

The only other item in the headstock is a clutch which connects the start of the screw-cutting train. Thus, everything is completely enclosed and runs in oil, adequate lubrication being vitally necessary with such a large mandrel running in plain bearings at high speeds. A cover-plate is provided for inspection and assemblv. The headstock is bolted down to the lathe bed and occupies the full width of the latter.

From the headstock the vertical shaft extends doivnwards into the bed, and expanding Vee-pulleys connect it to the motor. This form of drive is a similar arrangement to that found on the old Zenith and Rudge motor-cycles. The former employed an expanding pulley on the engine shaft, and the back wheel with its belt rim was moved in or out to preserve the tension on the belt. The Rudge was similar, only here both pulleys expanded and contracted alternately to get the variable ratio and maintain the tension on the belt at the same time. It is this latter arrangement which is used here.

Two 6-in. pulleys give an infinitely variable speed between 30 and 2,200 r.p.m. to the mandrel, the two-speed gear in the head giving a slight overlap in the middle of this range. Variation of speed is controlled by turning the hand-wheel placed conveniently at the front of the bed.

The motor is mounted vertically on an extension of the lathe bed, and thus exposes the free end of its shaft, which is equipped with a pulley for use at any time should an extra auxiliary drive be required. To mention one example, should it be necessary to drive the leadscrew independently of the mandrel, a belt could be taken from here to a worm drive, connecting with the gear train.

The main auxiliary drive is by flexible cable taken off the top of the vertical shaft in the headstock. Judging from my own short experience of a home-made version of this type of drive, it should be a real boon. It certainly is more adaptable than any overhead, and standard cable of no more than 5/8-in. outside diameter is quite capable of taking care of all the power likely to be found in an amateur's lathe motor.

Among other reasons, it was to exploit this form of drive fully that l-in. collet capacity was wanted in the mandrel and tailstock, since it was thought that if a well-made head of l-in. diameter carrying screw on collet chucks was attached to this drive, this head could be slipped into- the mandrel and some quite delicate work turned with it. To go a step farther and get down to work of the watch-making variety, possibly a further head would be required, together with a bar bed, this latter fitting into a hole bored in the headstock casting. Whether the necessary accuracy could be attained, however, is quite another matter. In any case, such an arrangement is only mentioned as a possibility, and no provision is made for anything of the sort here.

The speed range available from the flexible shaft is variable between 480 and 4,350 r.p.m.

The Tailstock

In capacity, this could duplicate the headstock, when all accessories would be interchangeable. A solid tailstock is to be preferred to ensure preservation of the original alignment, as it may well be called upon to perform other jobs than that usually associated with a tailstock. Slight taper turning could be accomplished by using an adjustable offset centre, or by disengaging the slide nut and using the auxiliary bed, set at an angle, as a saddle guide. The tailstock spindle, is equipped with the usual screw and hand-wheel, which may be disengaged and a lever brought into use. This lever could be swung out of the way when not in use. Rotation of the mandrel is prevented by a block, sliding in a machined slot in the casting. The tailstock assembly is held firmly against the vertical rear face of the bed. being drawn up tight and clamped to the top surface at the same time by a cam, operated by the lever at the rear end of the casting.

The Saddle

It was desired here to have as large a range of movements as possible, since full use-w uld be made of this fitment for boring and m ling. The longitudinal motion along the lat e bed was of first importance. No less than 14 in. of sliding surface is used, and as this is onlv 2 in. wide. perfect sliding motion should be obtained, the rear of the saddle merely acting as a steady to keep it level. Adjustment is by gib-piece along the front, whilst a stiff gib holds the rear of the saddle up to its work.

(To be continued)

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DUE to the exceptional length of the front slide, the rear of this saddle is not called upon to take any of the side thrust occasioned in use ; therefore, binding and chatter should not occur. Long cross-traverse was required to provide for milling long lengths at one setting. A small table did not provide facilities for holding long work and traversing past the mandrel, with a full length bearing all the way, hence the adoption of an extremely long table. Almost 12 in. of traverse can be obtained with full bearing all the way, and to attain this, the angle of the slides would have to be reversed so as to retain a reasonable sized gib strip. For normal turning, this slide would be well back out of the way, and would not appear to have any disadvantage, therefore.

Another necessity is some form of rising movement to bring the work to centre height and put on cuts. To achieve this, the saddle has a false base and that part containing the slide can be raised by hand-wheel and securely locked at the rear, to form a variable triangle with the bed. The bearings which form the axis of this rising and falling movement are 7/8 in. diameter and are adjustable.

The feed screw has a bearing at both ends and a graduated dial at the front end, which can be set at zero. This feed screw can be instantly disengaged from its gunmetal nut by giving a few turns to the set-screw, set in the right-hand side of the saddle. By releasing this nut, and with a piece of 1 in. diameter rod bolted vertically on top of the table, to engage a corresponding hole provided in the saddle of the auxiliary bed: then if this latter is set to a predetermined angle, the tool will follow this angle in taper turning. Another addition to the slide rest which would be useful when milling would be an adjustable stop. Though not shown in the drawing, its fitting should be obvious to anyone.

The Apron

Simplicity is in evidence here, as no provision is made for automatic feed, except that normally obtained by change-wheels and the leadscrew. Rack-and-pinion is added for quick traverse along the bed and is assisted by a large hand-wheel. Two half-nuts, each 3 in. long, are used to engage the leadscrew, but they are mounted on rockers instead of slides. Although this does not give a true up and down movement, the error is so slight, and the advantages so great, that it was adopted. The difficulty here was to get a long bearing surface, and as the lead-screw was to be tucked away well up under-neath the front shear of the bed, long slides were impracticable, due to the height available ; thus, rockers with long shafts appeared to be a much better arrangement. Engagement would be facilitated by the adoption of an Acme threaded leadscrew. A projection cast flush with the forward edge of the apron engages the automatic trips.

The Leadscrew

This is substantial, being 7/8 in. diameter, and has an Acme thread, 8 per inch. The adoption of 8 t.p.i. is open to criticism, but it nevertheless has many advantages. All thrust is taken at the headstock end, where the plain portion runs in a bronze bush and has an adjustable thrust-washer. The drive can be put in and out of engagement by a dog clutch, operated by a small knob at the front which has a snap action so that it remains positively in or out. The shaft on which this knob is carried is extended along the bed, and thus can be set to operate automatically. The main purpose of this clutch is to have the leadscrew entirely free from the gear train so that it can be operated manually by the graduated wheel at its far end without dismantling the gear train. The single-toothed dog clutch in the headstock, which works at the beginning of the screwcutting train, also has its control brought to the front of the lathe and operated similarly. The more normal method of screwcutting could be used by disregarding this last clutch and fitting an indicator at the end of the saddle apron. Either method, however, requires only a simple fitment.

The Gear Train

This is a standard arrangement whereby loose change-wheels are mounted on a quadrant. A single slot is all that is required,

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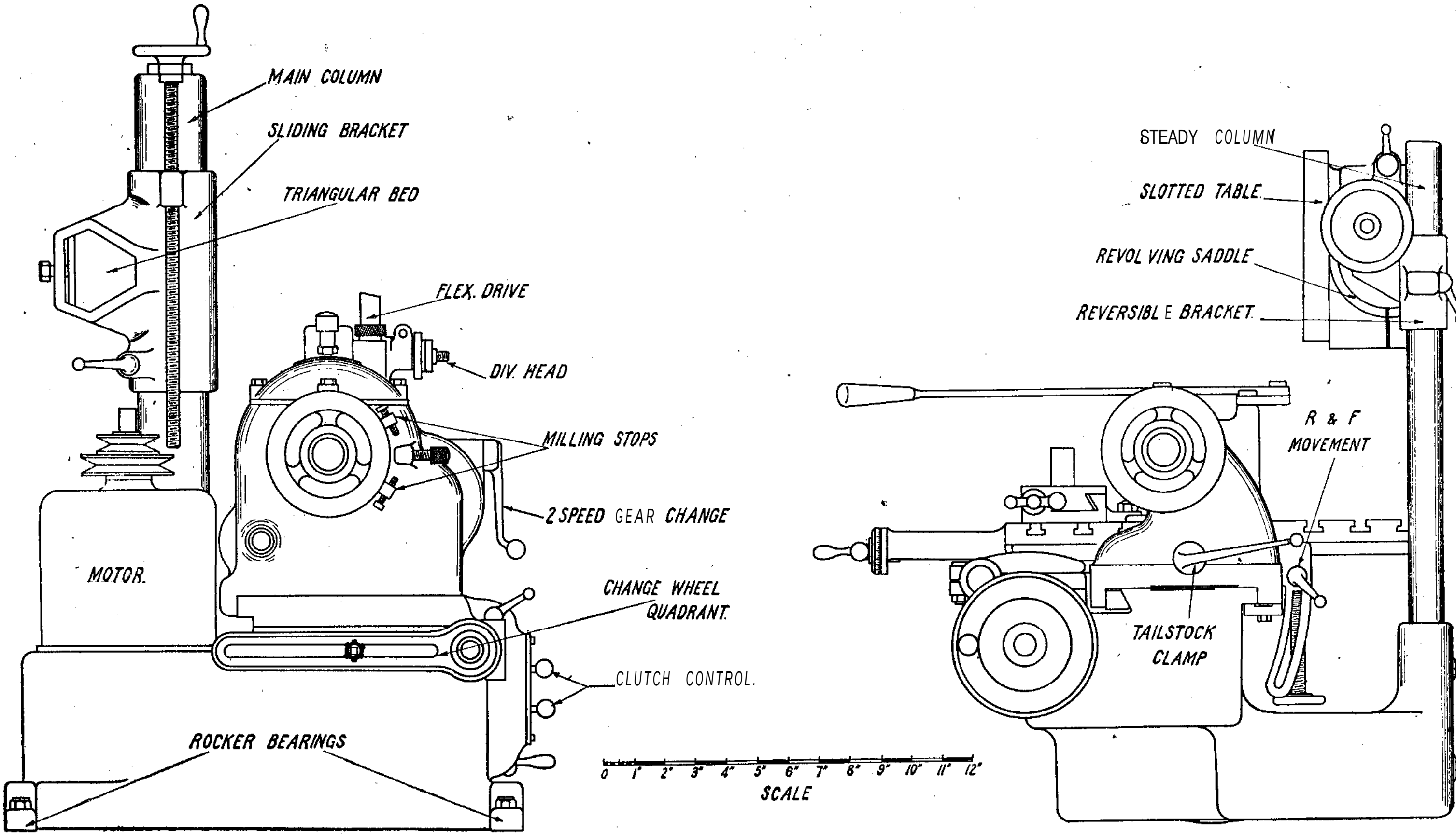
* Continued from page 378, " M.E.," April 16, 1942.

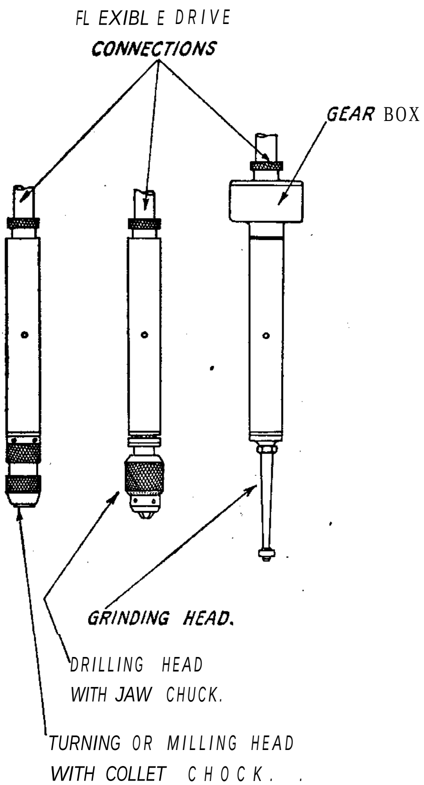


Two end views : Left, headstock ; Right, tailstock of the self-contained universal model engineer's lathe.

due to the long length of the quadrant. It might be advantageous to have the studs milled to slide in this slot, to prevent the tendency to revolve when being tightened up. Splined sleeves are suggested, and a square-holed washer and knurled-headed screw would appear to be as good a method as any other, to secure the wheels. A ball-handled screw is used to lock the quadrant.

Gadgets

The " third hand " arrangement, previously referred to, could take the form of



Drilling, milling and grinding heads adopted for universal mounting on the lathe.

an auxiliary bed mounted at the rear of the lathe and normally parallel to it.

A truncated triangular bar is suggested, clamped in a suitable bracket and mounted on a substantial vertical column, the latter being rigidly fixed to the main bed casting. A similar column fixed at the tail end of the bed would act as a steady, keeping the auxiliary bed normally parallel with the lathe bed, yet allowing it to be set to any angle and clamped in position. Clamping would be affected bv a locking bolt on the main column, assisted by a radius-rod extending from the remote end of the bed to the other column. A screw and hand-wheel are provided to assist in raising and lowering the bed on the column. On this triangular bed slides a saddle, traversed by another screw and hand-wheel. The outer part of the saddle is capable of moving around its base and can be clamped in position. It has a l-in. diameter hole bored in it to take any of the other accessories, including a slotted table. Work may be bolted to this table, or, alternatively, a tool may be mounted here. It does not require much imagination to realise the amount of work that could be accomplished by the aid of the flexible drive and with work mounted in full view.

Little need be said of the flexible drive, as it simply consists of a 3/8-in. diameter multi-stranded steel wire core, enclosed in an outer flexible casing which is oil tight, and having suitable solid splined ends to take up the drive.

Drilling, Milling and Grinding Heads

Three heads for attachment to this drive are shown in the drawings, one geared for internal grinding, as this requires an extremely high rate of revolutions ; another for general work, such as drilling up to 1/2 in. capacity, and yet another, this time fitted with collet chucks, to be used for fine turning or to carry small milling cutters. All are 1 in. outside diameter and their mounting is almost universal. Like the other gadgets, they will fit into the auxiliary saddle, the collet chuck in head or tailstock, or the universal milling and drilling attachment. Hand drilling, sanding, buffing, polishing, etc., can be done, either on the lathe or at a limited distance from it.

A Metal-cutting Jig-saw

Another gadget is the drill-arm which has a lever feed, the lever remaining out of the way when the arm is used for other purposes. A further gadget, fitting into this arm is the upper half of a metal-cutting jig-saw, where it is secured by a set-screw. Adjustable tension on the saw blade can easily be obtained by raising or lowering the auxiliary bed. This head contains the spring which preserves the tension on the saw blade during its return stroke. It also has a plunger which provides a blast of air at the point of sawing, thus keeping the work clear of cuttings. An adjustable rod, carrying a spring foot and roller saw guide, is inserted in the bracket, immediately alongside the head.

(To be continued)

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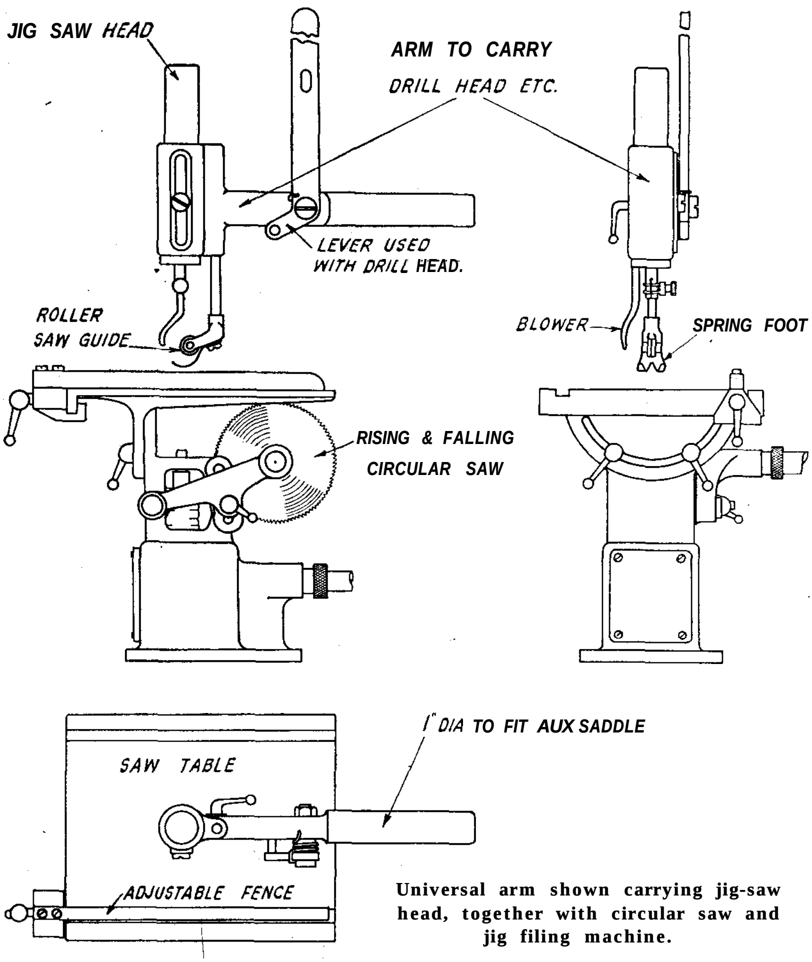
Designs a Lathe —

and some Gadgets for it

THE lower half of the jig-saw is a casting, enclosing a disc crank which imparts a 1-1/4-in. stroke “to the saw. Supported by it is a table which may be tilted and clamped at any convenient angle. The unit is secured to the lathe bed by a single bolt passing through a hole drilled therein. The upper half is brought into register with it by some definite marking on the auxiliary bed. In this way, the set-up should only be the work of a moment.

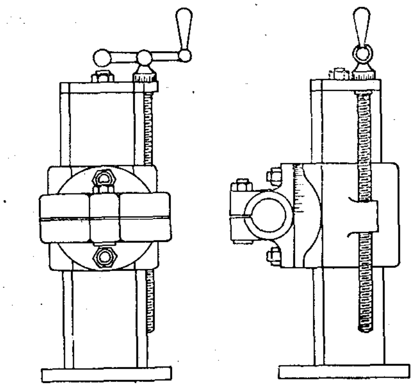
For sawing out intricate shapes in sheet metal the jig-saw is idea!, and any material may be sawn, if a suitable blade or knife is employed. Wood, bakelite, fibre, etc., may be sawn, and such material as cloth, cut with a knife blade. By using the lower half of the machine alone with a sabre saw in its chuck, intricate shapes may be cut in thicker materials and should be useful in pattern making.

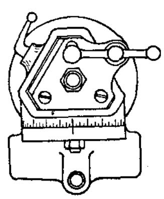
* ***Continued from page 396, “ M.E.,” April 23,*** 1942.



Universal arm shown carrying jig-saw head, together with circular saw and jig filing machine.

By removing the saw clamp, the remaining exposed socket becomes available for small machine files. With the mechanism set to the bottom of its stroke. there is plenty of room to swing the circular saw into position. Either metal or woodcutting saws may be used and the swing movement of the saw arm is, the equivalent of a rising and falling table ; and added to this, there is the tilting movement of the table itself. An adiustable fence is clamped to the front edge of the table, and two slots are included for use with an angle-gauge. With a gap-piece removed from the centre of the table, it would appear possible to attempt even surface grinding, although its scope would obviously be limited.





, **Universal drilling and milling machine bored to carry any of the rotatable tools. Similarly, a small faceplate or slotted table or anything fitted with a 1 in. dia. holding - piece could be mounted.**

The other gadget is a universal milling slide and needs little description, except to mention that the gib-piece is adjusted by four screws and may be locked by a handled clamping-screw. It will, of course, carry any of the rotatable tools, being bored out I in. diameter for that purpose. Besides the uses to which the above gadgets can be put, it would appear possible to do a little planing on anvthing mounted on the boring table, either-by moving the work mounted thereon against a tool held in the auxiliary saddle, or by swinging the auxiliary bed radially. This latter experiment suggests, also, that with a suitable clapper-box the tailstock might be used as a shaper for anything within its capacity, the large dimensions of the ram suggesting that it would be amply strong enough to perform this task.

There are numerous other uses to which the machine and its gadgets could be put,. as indeed there are-many more gadgets which could be added. until the machine became a veritable concentrated machine-shop ; but as these appear to be never-ending, imagination must be left to the reader to think them out for himself.

Amateur Toolmaking

(Continued from *page* 420)

edges just down to the cutting edges, no more and no less. Painting the " lands " with " plumbers' black " or red lead facilitates the accuracy of this filing operation. After heat treatment, touch up the cutting edge flats and the flutes with Carborundum oil slips, and again you have quite a professional-looking job.

Twist Drills

Again flute a piece of silver-steel or reduced stock of desired diameter with two flutes, as already described for taps and reamers and finish by grinding, but flute a longer length than that-required for finishing. Gripping the shank of the work tiehtlv in the chuck of the lathe and the other end in the tailstock chuck, form the twist, working back the tailstock to keep the work straight. Remove the damaged fluted part and, after straightening and grinding the point, the drill is-ready for hardening and tempering. Sizes between about 1/8in. and 5/16 in. can be successfully made, but the absence of lands makes these home-made drills unsuitable for very deep drilling, as they tend to bind.

Heat Treatment

A muffle furnace is a very useful adjunct for the amateur toolmaker. Procure half a dozen firebricks approximately 4 in. x 6 in. x 1 in. and secure four together with clamping straps to form a chamber approximatelv 4 in. wide, 2 in. deep and 6 in. long and secure another of the bricks to close one end of the chamber. With an old hacksaw, cut strips from the remaining brick to lay across the bottom of the chamber to support articles being treated.

Mount the whole 'on a suitable stand applicable to your gas burner or blowlamp, as the case mav be. With a half-Dint size of the latter, taps, dies, reamers, etc., up to 1/2 in. can be satisfactorily hardened and tempered, and, of course, the muffle is suitable for many other heat treatment jobs. The residual heat at the back of the muffle provides all that is required for tempering small tools at a temperature uniform throughout in their mass.