H. L. JEFFERY & A. E. SCHUCHERT.

ATTACHMENT FOR MACHINE TOOLS.

APPLICATION FILED AUG. 29, 1913.

1,110,389. Patented Sept. 15, 1914.

5 SHEETS—SHEET 1.

Fig. 1.

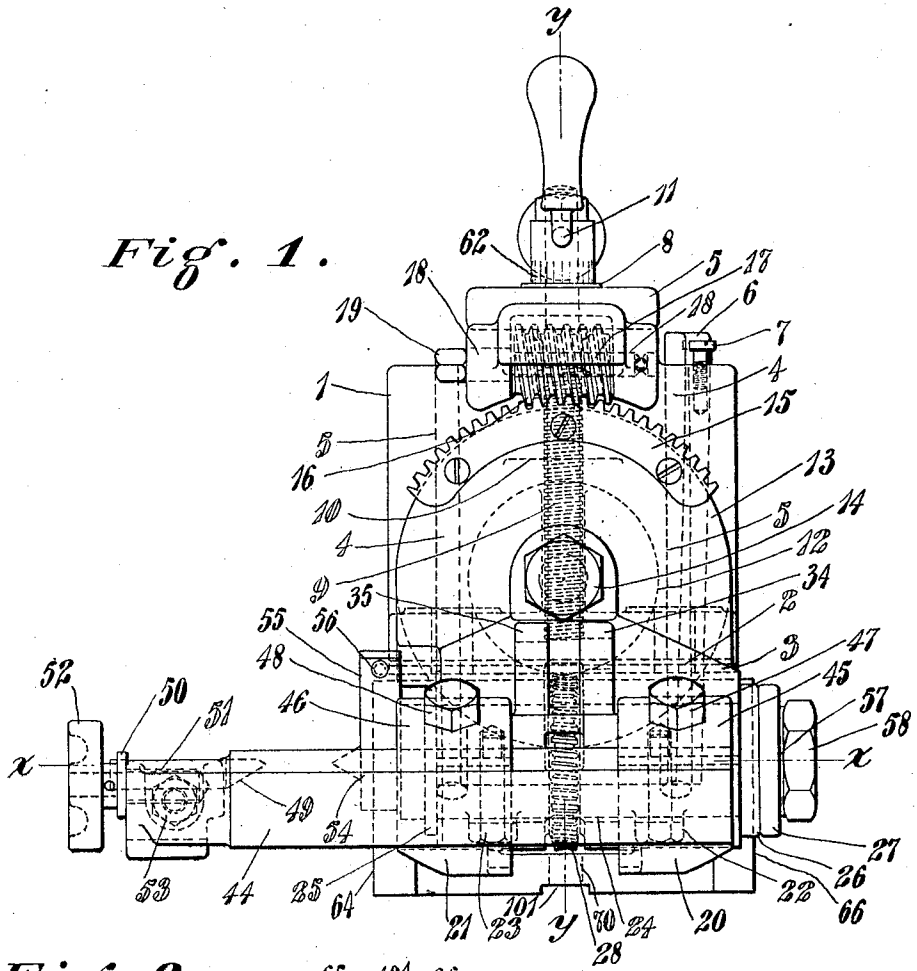

Fig. 2.

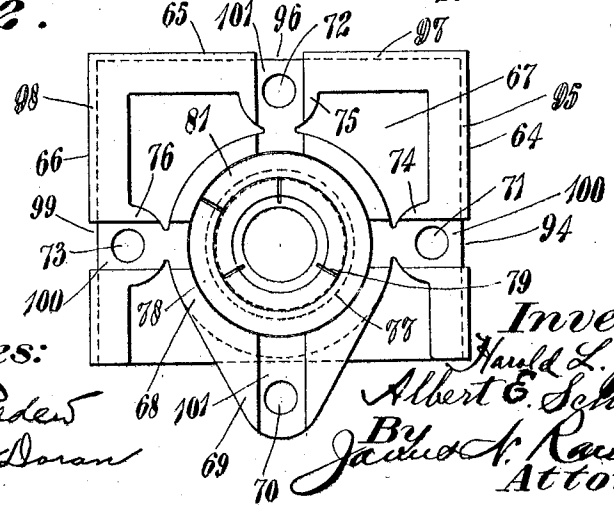

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Fig. 3.

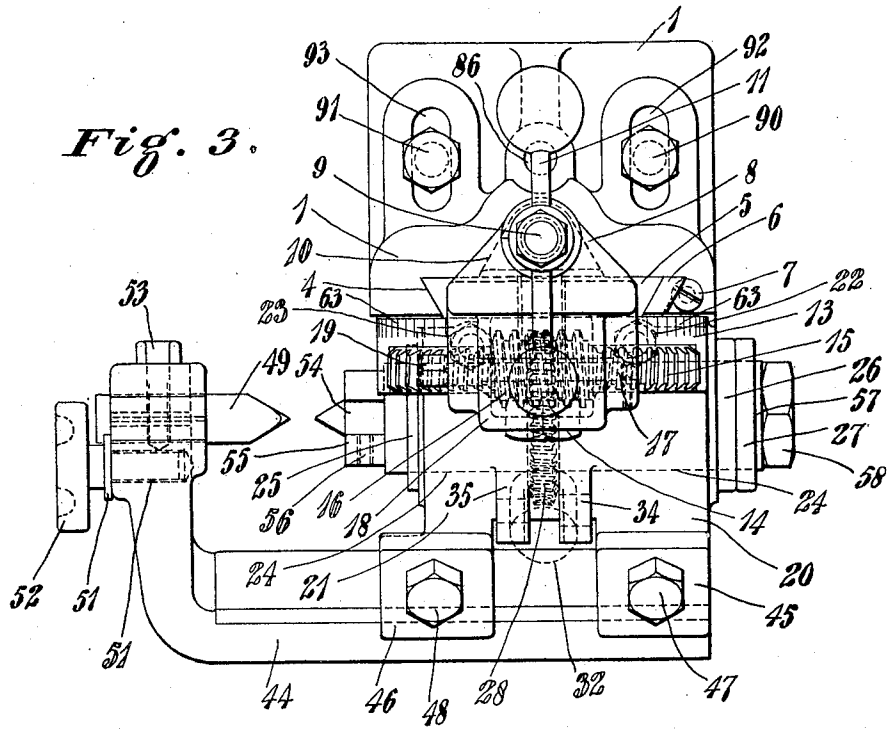


Fig. 4.

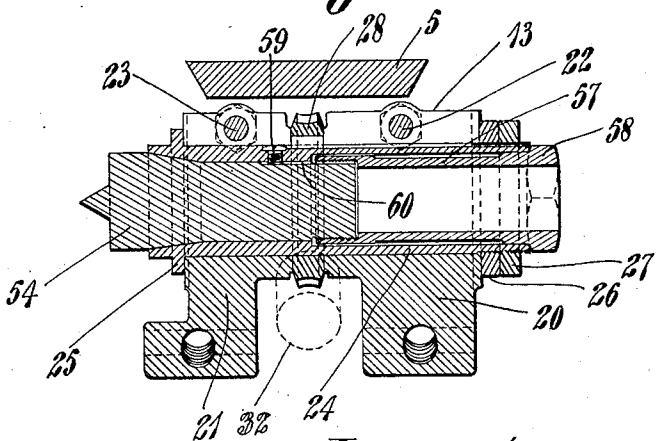
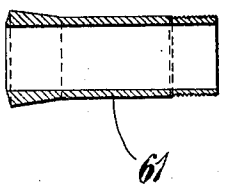


Fig. 5.



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5 SHEETS—SHEET 3.

Fig. 6.

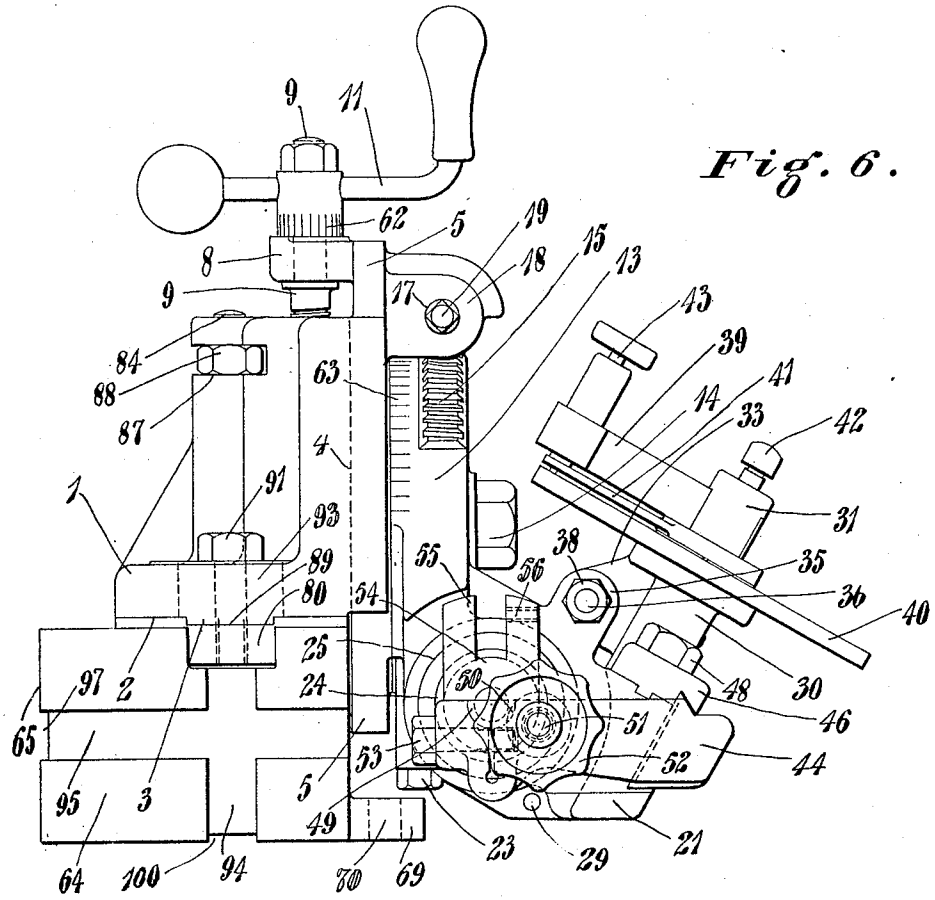
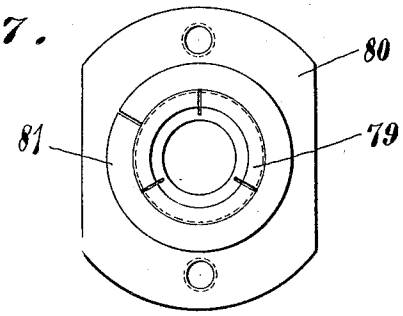


Fig. 7.



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5 SHEETS—SHEET 4.

Fig. 8.

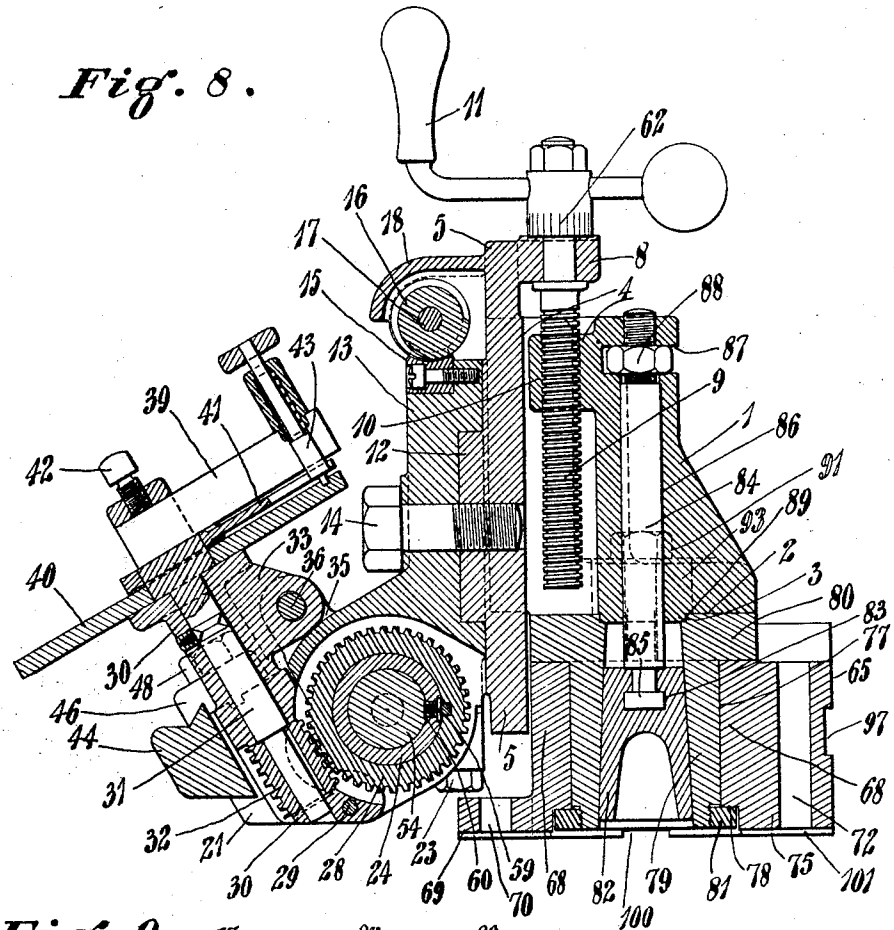


Fig. 9.

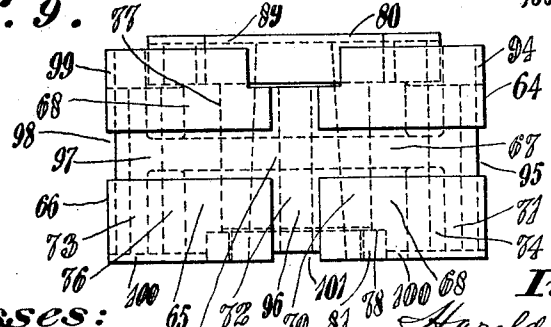
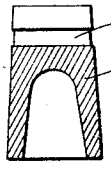


Fig. 10.



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5 SHEETS—SHEET 5.

Fig. 11.

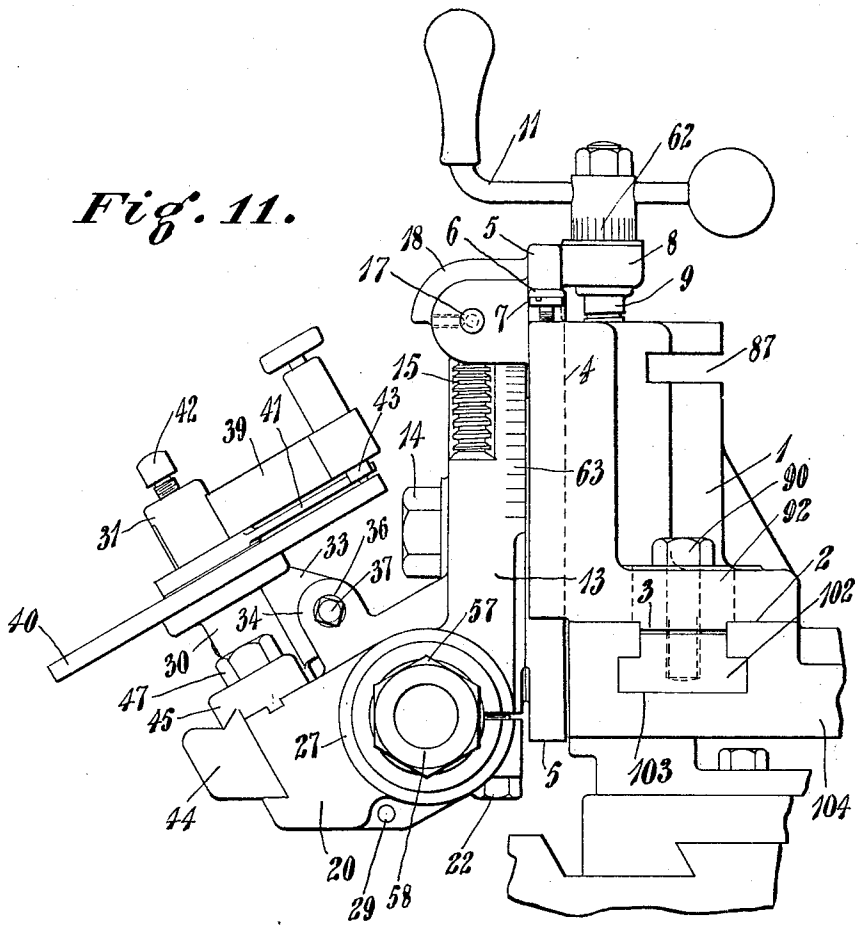
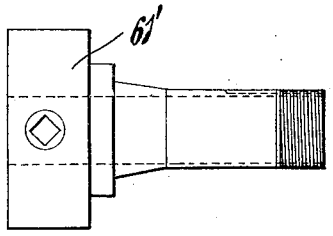


Fig. 12.



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UNITED STATES PATENT OFFICE.

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ATTACHMENT FOR MACHINE-TOOLS.

1,110,389. Specification of Letters Patent. Patented Sept. 15, 1914.

Application filed August 29, 1913. Serial No. 787,307.

To all whom it may concern:

Be it known that we, HAROLD L. JEFFERY and ALBERT E. SCHUCHERT, citizens of the United States, residing at Fort Thomas, in the county of Campbell and State of Kentucky, and at Norwood, in the county of Hamilton and State of Ohio, respectively, have invented certain new and useful Improvements in Attachments for Machine-Tools, of which the following is a specification.

Our invention relates to attachments for metal-working machines, the object being to provide a means for performing milling work and the like without involving the expense of providing a milling machine expressly for such work.

Another object is to provide an indexing device for grinding, drilling and milling machines.

Our invention consists in the parts and in the details of construction and arrangement of parts as will hereinafter be more fully described and claimed.

In the drawings: Figure 1 is an elevation from the work side of the attachment, only part of the indexing device being included in the view. Fig. 2 is a bottom plan view of the sub-base. Fig. 3 is a plan view of the device as shown in Fig. 1, but with the sub-base omitted. Fig. 4 is a horizontal cross section on the line *x—x* of Fig. 1, showing how the live center is held in the work spindle. Fig. 5 is a sectional detail of a collet suitable for use in the work spindle. Fig. 6 is an elevation from the tail end of the device with the complete indexing device shown. Fig. 7 is a bottom plan view of the expanding bushing that carries the attachment in the sub-base. Fig. 8 is a vertical section on the line *y—y* of Fig. 1, but including the complete indexing device. Fig. 9 is an elevation of the sub-base proper from the workman's side of the attachment. Fig. 10 is a sectional detail of the tapered plug for the expanding bushing in Fig. 7. Fig. 11 is an elevation from the head end of the attachment, with the complete indexing device shown, but with the sub-base omitted and the attachment in position in the tool block of a lathe. Fig. 12 is a detail of a chuck suitable for use in the attachment.

The nucleus of the attachment consists in a block or bracket 1 with a lower horizontal face 2 having a tongue 3 transversely of it, which tongue is adapted to fit into a corresponding groove or key-way in the surface upon which the attachment is to be mounted, as will be later described. Another face of this bracket 1 has a vertical guide-way 4 receiving a vertical slide 5. This vertical slide has the gib 6 in the guide-way, of long and moderate taper, which gib is provided with an adjusting screw 7 so that the vertical slide can be adjusted securely in the guide-way at any point. Above the bracket 1 the vertical slide 5 has a lug 8 extending over with a vertical screw 9 journaled in said lug and held against vertical movement with relation to the lug and the vertical slide. This screw 9 is threaded into a lug 10 which the bracket 1 has on its interior close to the vertical slide 5. Above the lug 8 the screw 9 has the counter-balance crank handle 11 for turning the screw.

The outer face of the vertical slide 5 has a cylindrical boss 12 and a swiveling plate 13 has a corresponding cylindrical recess by which it journals on the boss 12. A cap screw 14 concentric with said journal holds the swiveling plate 13 in position and may be loosened for rotating the swiveling plate, but tightened to clamp the plate in any adjusted position. A part of the periphery of the swiveling plate 13 is provided with a segment 15 in the form of a worm gear, and a worm 16 is journaled horizontally on a pin 18 in a hood 17 projecting outward from the vertical slide above the swiveling plate 13. This pin 18 has a squared projection 19 at one side of the hood to which a wrench may be applied for turning the worm 16.

Below its journal bearing, the swiveling plate 13 has lateral outward and downward projections 20 and 21, which are bored concentric horizontally and split on their sides in next to the vertical slide, with cap screws 22 and 23 for drawing the split parts together. These projections, thus bored and split, afford bearings for the work spindle 24 such that, when the split parts are released the work spindle may be turned, but when they are drawn together by the cap screws 22 and 23 the work spindle is held

firmly stationary. As may be best seen in Fig. 4, this work spindle 24 has the collar 25 at one end integral with the spindle, and at the other end a screw collar 26 and locking collar 27 are provided so that end play may be eliminated.

Between the two projections 20 and 21 the work spindle 24 is provided with a worm gear 28 keyed thereon. Below and somewhat outside the vertical center line of the work spindle, the projections 20 and 21 receive a transverse pin 29 upon which the indexing worm bracket 30 is pivoted. This bracket 30 extends upward and somewhat outward past the worm gear 28 on the work spindle and has an indexing spindle 31 journaled longitudinally in it with a worm 32 keyed on said spindle and meshing with the worm gear 28 on the work spindle. Above the worm gear 28, extending inwardly, the bracket 30 has a lug 33 coming between lugs 34 and 35 on the upper parts of the projections 20 and 21, respectively. These lugs 34 and 35 have concentric journal bearings, but the lug 33 has an opening through it in the form of a slightly elongated slot with semi-circular ends. A transverse pin 36 is journaled in the lugs 34 and 35 with an eccentric part bearing in the slot of the lug 33. This pin has a squared projection 37 outside the lug 34 and its other end has a lock nut 38. By turning this eccentric pin 36 by means of a wrench applied to the projection 37 the indexing worm bracket may be drawn toward the work spindle worm gear or forced away from it, thus taking up any wear that may occur.

The upper end of the indexing spindle 31 has an arm 39 extending radially outward over an index disk or plate 40 secured on the indexing worm bracket 30. A sector arm 41 also turns concentric with the spindle 31 and a set screw 42 in the upper end of the spindle 31 clamps the arm 39 in the spindle 31. The outer part of the arm 39 has the spring pressed plunger 43 which may enter any one of the series of holes in the indexing plate 40.

Just outside the indexing worm bracket 30, a bar 44 extends across and is clamped in the two projections 20 and 21 by means of caps 45 and 46 clamped on to the upper sides of said projections by cap screws 47 and 48. This bar 44 extends some distance past the projection 21, in the position illustrated, and then bends inward across the center line of the work spindle where it carries the dead center 49 with its point concentric with the work spindle. As best shown in Figs. 3 to 6, this dead center has, where it projects outside its bearings in the curved-in part of the bar 44, a lateral slot in which the annular flange 50 of a screw 51 engages. This screw 51 is parallel with the dead center 49 and when the screw is screwed inward or outward in the bar 44 it moves the dead center correspondingly. The screw 51 has a hand wheel 52. The part of the arm 44 forming the bearing for the dead center is split for some distance downward from the bearing region, and a cap screw 53 passes transversely across the split part, so that if this screw is loosened the dead center 49 will be free for longitudinal adjustment by the screw 51, or when the screw 53 is tightened the dead center will be held firmly in its adjusted position.

Again referring to Fig. 4, the work spindle 24 is hollow, and, at the end having the integral collar 25, has an outwardly increasing taper on its hollow interior which will receive a corresponding external taper on such a part as it is desired to carry in the work spindle. In Fig. 4 the mandrel 54 is shown in position in the work spindle, having the live center, and having, just outside the end of the work spindle, a radially slotted upward extension 55, as seen in Fig. 6. This slotted extension serves the purpose of a face plate for engaging with a dog or other clamping means to hold work between the centers. One side of this extension 55 has a threaded transverse opening 56 which may receive a clamp screw, if such be needed. This mandrel 54 has the tapered part to fit into the interior taper of the work spindle, and, past that, is cylindrical, extending about half the length of the work spindle. Near its inner end it is threaded and a sleeve 57 has threads receiving the threads of the mandrel 54, this sleeve fitting closely in the interior of the work spindle which is somewhat enlarged to receive it in this region. This sleeve extends outside the other end of the work spindle where it takes the form of a hexagonal nut 58 to which a wrench may be applied for turning it, thereby drawing the mandrel 54 inward by the action of the threaded connection between the mandrel and the sleeve, so that said mandrel is tightly clamped in the tapered part of the interior of the work spindle. To reinforce this clamping engagement, the wall of the work spindle has a small set screw 59 passing through it and engaging in a shallow key-way 60 of the mandrel, the outer surface of the work spindle being countersunk to take in the head of the screw 59, and preferably being located just at the inner end of the key-way for the worm gear 28 that is keyed on the work spindle.

Where it is desired to hold a plain cylindrical mandrel in the work spindle, a collet 61 similar to that shown in Fig. 5, may be substituted for the mandrel 54, or, for holding stock of different diameters to extend through the work spindle, different collets may be used. A vise or chuck, like the chuck 61′ in Fig. 12, may be held in the work spindle in the same manner as the

mandrel 54 or collet 61, or a vise or chuck with an ordinary straight shank may be held by means of a collet as described.

The work spindle may be readily removed entirely and a vise with a round shank inserted in its place, if it is desired to do milling work requiring this kind of a holder, and not requiring all the adjustments possible when using the work spindle.

Another very important possibility due to our invention is the reversal of the work spindle 24, bringing the tapered end around on the other side of its bearings in the swiveling plate 13, to allow work to be done close up to the chuck or spindle of the lathe, where the tools used or the nature or the work demands this and in connection with which an indexing head is required. Thus, all that is necessary is to remove the screw collar 26 and locking collar 27, withdraw the work spindle 24 from its bearings in the swiveling plate 13 and from the worm gear 28, as permitted by the keyway in the work spindle extending clear to the threaded end thereof, and then reversing the work spindle and inserting it the other way in the bearings, with its keyway again receiving the key of the worm gear, bringing the integral collar 25 up against the side of the bearing which before received the screw collar 26, and then screwing the screw collar 26 and locking collar 27 on the threaded end of the work spindle, to bear against the other side of the bearing where the integral collar 25 was before. It will thus be seen that the worm gear making the operative connection with the indexing means will not have its position changed, but its key will simply bear in the keyway of the work spindle at a different location therealong, and the operation of the entire device will be the same as with the work spindle in its previously described position, and allow all of the other adjustments of the work spindle, as before.

The screw 9 may have graduations 62, similar to those of a micrometer collar, to gage the vertical adustment of the slide 5; and the swiveling plate 13 may have graduations 63, to gage its angular adjustment.

The sub-base, shown in detail in Fig. 9, is a block with three vertical sides 64, 65 and 66 meeting at right angles, with a median interior horizontal web 67 joining all of the sides. The fourth side of this block is substantially open, but a cylindrical hub 68, seen in Fig. 2, extends above and below the web 67 and is located substantially tangent to the exposed edge of the web 67 on the open side of the block. The lower part of this hub 68 has an extension 69 out from the open side of the block with a vertical bolt-opening 70 through it. The lower edges of the sides 64, 65 and 66 and the lower side of the hub 68 and of its extension 69 are all finished in a single plane. This bottom side of the block and the three vertical sides constitute four accurately finished plane faces. Three other vertical bolt openings 71, 72 and 73 are located at equal intervals around the hub 68, with relation with the bolt opening 70. These latter three bolt openings pass through the vertical sides 64, 65 and 66 and adjacent enlargements 74, 75 and 76, provided interiorly of these sides adjacent to the hub 68. These sides and their corresponding enlargements are recessed at the upper termination of the bolt openings.

The hub 68 does not extend up as high as the upper edges of the three sides of the block, but is finished on its upper face and it has a cylindrical bore 77 down from this finished upper face to near its lower termination in the bottom of the hub, where the bore is somewhat enlarged, forming a shoulder 78. Within this cylindrical bore 77, a split bushing 79 is journaled, having an upper head 80, the lower face of which bears on the upper face of the hub 68. The lower end of the split bushing 79 is somewhat reduced and is threaded, and receives a split threaded collar 81 which may be drawn up against the shoulder 78 of the rub 68.

The split bushing 79 has its interior taper increasing from top to bottom, and a corresponding tapered plug 82 fits therein. This plug 82 has a T-slot 83 passing transversely through its upper part and open on its upper end, and a bolt 84 has a head 85 fitting into the T-slot 83 and with such a bearing against the tapered plug 82 that the bolt may push the plug downward or pull it upward in the tapered interior of the split bushing 79. This bolt fits into and is guided by a vertical bore 86 in the bracket 1 of the attachment somewhat to the rear of the vertical screw 9 of the attachment. Near the upper end of the bracket 1 this bracket has a transverse slot 87 cutting through the bore 86 and the bar is reduced in the part of the bracket above the slot 87. The upper end of the bolt 84 is reduced and threaded and passes across the slot 87 and occupies the reduced part of the bore 86 above the slot. A nut 88 is screwed on to this threaded part of the bolt and occupies the slot 87 fitting therein so as to be held against upward or downward movement, so that when it is turned it will move the bolt 84 up or down and move the plug 82 accordingly. The tongue 3 of the bracket 1, before mentioned, here fits into a groove or key-way 89 across the upper face of the head 80 of the split bushing 79, the tongue and groove fitting accurately so that when the bracket 1 is secured on the split bushing by means of lateral cap screws 90 and 91 passing through slots 92 and 93 in the lower part of the bracket 1 and screwed into the head 80, the

bracket will be firmly held against turning with relation to the head. Furthermore, when the tapered plug 82 is drawn up, expanding the bushing 79 out against the walls of the bore 77 of the hub in the sub-base 63, said split bushing 79, and with it the bracket 1 and all of the other parts which said bracket carries, will be held against turning with relation to the sub-base. For angular adjustment of the attachment on the sub-base in a horizontal plane, the nut 88 is turned, pushing the tapered lug 82 downward, releasing the bushing 79 from the bore 77 and allowing the entire fixture to swivel on the sub-base 63.

The three vertical faces 64, 65 and 66 of the sub-base have vertical and horizontal key-ways 94 and 95, 96 and 97, 98 and 99, respectively, and the bottom face has transverse and longitudinal key-ways 100 and 101, respectively. These key-ways may receive keys fitting into corresponding key-ways of the beds or tables of various machines upon which it may be desired to use the attachment, such as drill presses, shapers, milling machines or grinders. For thus mounting the sub-base on the table of a machine with one of its vertical sides against the table, a C-clamp may be conveniently used, engaging interiorly of the side of the sub-base, as is permitted by having the upper and lower sides of the sub-base open and binding it transversely by the horizontal median web 67 before described. Where the sub-base is to be clamped to a machine with its bottom side against the table of the machine, the bolt openings may be utilized.

Where the attachment is to be used on a lathe, the bracket 1 is removed from the head 80 in the sub-base, and the cap screws 90 and 91 are used to attach to the bracket to a yoke piece 102 fitting into the T-slot 103 of the tool block 104 of the lathe, from which the tool post has been removed. In removing the bracket 1 from the sub-base, the nut 87 was also removed and the bolt 84 remained with the sub-base.

The spindle of a lathe is generally very substantial and constructed like a milling machine spindle, with threaded nose and tapered hole to receive milling cutters, arbors, and end mills. Thus, by the provision of our invention to hold the work in any desired position with respect to such cutting tools carried by the lathe, work that would ordinarily require a milling machine may be performed at short notice by simply applying our invention to the lathe.

The cross slide of the lathe is used for all motions and adjustments necessary at right angles to the lathe spindle, and the attachment itself provides all required vertical motions. The longitudinal slide of the lathe is used for locating the work in relation to the cutter and also for feeding the work parallel to the cutter axis. The attachment itself provides all required angular adjustments in vertical planes, and, if angular adjustment in a horizontal plane is required, the compound slide or rest of the lathe may be used for a horizontal swivel instead of the sub-base, which is intended for use with machines other than lathes, as before described.

As shown in the drawings the swivel plate 13 may be rotated in a vertical plane parallel with the axis of the work spindle through an angle of approximately 45° in either direction from vertical, and be locked in any adjustment within those limits. The work spindle may of course be rotated to any extent by means of the indexing worm so that an infinite number of successive angular adjustments of the work in a plane at right angles to the axis of the work spindle are possible. Further, since the indexing device is located intermediate of the ends of the work spindle and not at one end thereof, the work spindle may be taken out of the projections 20 and 21, the indexing worm gear 28 being removed, and replaced therein in reverse position with said worm gear replaced thereon, thus presenting the work on the other side of the attachment, as may be required in connection with the machine the attachment is used upon. All of the adjustments are provided with manipulative means permitting great precision in the adjustment, while the locking means for each adjustment insures that the precise adjustment will be maintained throughout the operation. This is also true of the straight-line adjustment of the vertical slide 5 in the bracket 1 with its vertical screw 9 and gib 6.

The attachment and its sub-base may be transferred with its work from one machine to another and all the different operations performed without resetting, with the attendant inaccuracies usually involved where only the work is transferred from one machine to the other for the successive operations. Where necessary, an angle plate may be used for setting the sub-base of the attachment upon a machine bed or table, the sub-base being readily secured to such angle plate by the means described.

The attachment is not only intended to be used on lathes, drill presses, shapers or grinders, and like machines; but may be used as well on a milling machine in the same manner as an ordinary indexing head would be used on such a machine, and more advantageously, owing to the novel arrangement of the indexing means of this attachment. In case adjusting bar 44 is too short a suitable tail stock may be used. Com-

bined with the lathe, many operations heretofore possible only with the use of the milling machine are possible upon the lathe.

While we have illustrated and described specifically an example of construction of our invention, it will be understood that we are not limited to such specific illustrations and description, except as defined by the following claims:

1. In a device of the character described, a work spindle, means comprising separate journals for the work spindle, adjusting means fixed on the work spindle between the journals, and means limiting the work spindle against end play in its journals but removable to allow the work spindle to be reversed in said journals and in its fixed relation with said adjusting means.

2. In a device of the character described, a work spindle, means comprising separate journals for the work spindle, adjusting means adapted to be fixed on the work spindle in different locations therealong and located between the journals of the work spindle, and means on said work spindle for limiting end play thereof, one of the means being removable to allow the work spindle to be reversed endwise in its bearings and in its fixed relation with said adjusting means.

3. In a device of the character described, a work spindle, means comprising separate journals for the work spindle, a worm gear fixed on the work spindle concentric with it between said journals for adjusting said work spindle angularly and capable of being fixed on said work spindle at different locations therealong, and means on said work spindle bearing against opposite sides of the means comprising the journals to limit end play of the work spindle in its journals, one of said means being removable and allowing withdrawal of the work spindle from its journals and from the worm gear between the journals, whereby the work spindle may be reversed endwise in its journals and its fixed relation with said worm wheel.

4. In a device of the character described, a work spindle, means for mounting said spindle on a machine whereby said spindle is angularly adjustable around its axis, means for holding work in said work spindle, and an arm having a projection across the axis of said spindle and capable of adjustment parallel with said axis.

5. In a device of the character described, a work spindle, means for mounting said spindle on a machine whereby said spindle is angularly adjustable around its axis, means for holding work in said spindle, an arm parallel to the axis of said spindle having a projection across said axis, means permitting adjustment of said arm parallel to said axis, a center carried in said projection concentric with said axis, and means for adjusting said center in said arm parallel with said axis.

6. In a device of the character described, a bracket, a work spindle carried thereby, means for angularly adjusting said spindle in a plane parallel to its axis, means for angularly adjusting said spindle in a plane at right angles to its axis, supporting means for said bracket, means for angularly adjusting said bracket on said supporting means in another plane parallel to the axis of the work spindle, said supporting means for said bracket having a plurality of plane faces each capable of attachment to a correspondingly faced machine apart.

7. In a device of the character described, a bracket, a work spindle adjustably carried thereby, supporting means for said bracket, and means for angularly adjusting said bracket thereon, said supporting means for said bracket having a plurality of plane faces each capable of attachment to a correspondingly faced machine part.

8. In a device of the character described, a bracket, a work spindle adjustably carried thereby, supporting means for said bracket, and means for angularly adjusting said bracket thereon, said supporting means having a plane face opposite to the mounting of said bracket on said supporting means and parallel with the plane of angular adjustment of said bracket, having two other plane faces at right angles to the first face and opposite to each other, and having a fourth plane face at right angles to said two faces and to the first face, each of the four plane faces being adapted for attachment to a correspondingly faced machine part.

9. In a device of the character described, a bracket having faces at right angles to each other, one of the faces having a guide-way extending across it at right angles to the plane of the first face, a slide mounted in said guide-way, a substantially cylindrical boss on said slide, a plate having a recess fitting on said boss whereby the plate is journaled on the slide, a screw passing through said plate and threaded into said slide and engaging against said plate to hold it against turning on its journal bearing, a segment in the form of a worm gear on said plate concentric with the journal bearing of the plate, a worm journaled on said slide and in mesh with said segment, a screw engaging with said bracket and with said slide to move the slide in the guide-way, a work spindle carried by said plate, means for holding work in said work spindle, and means for angularly adjusting said work spindle around its axis.

10. In a device of the character described, a bracket having faces at right angles to

each other, one of the faces being adapted to coöperate with other parts for mounting the device on a machine, and the other face having a guide-way extending across it at right angles to the plane of the first face, a slide mounted in said guideway, a substantially cylindrical boss on said slide, a plate having a recess fitted on said boss whereby the plate is journaled on the slide, a screw passing through said plate and threaded into said slide and engaging against said plate to hold it against turning on its journal bearing, a segment in the form of a worm gear on said plate concentric with the journal bearing of the plate, a worm journaled in said slide and in mesh with said segment, a screw engaging with said bracket and with said slide to move the slide in the guide-way, a work spindle carried by said plate, means for holding work in said work spindle, and means for angularly adjusting said work spindle around its axis.

11. In the device of the character described, a bracket having faces at right angles to each other, one of the faces having a tongue extending across it, and the other face having means for adjustably mounting the work spindle on it, a head having a face to engage with the face of the bracket that has the tongue, and having a groove into which said tongue fits, said bracket having an opening through it at right angles to these faces, and said head having means with an opening through it with a taper increasing in diameter downward from said face, said means being split for expansion, a tapered plug fitting in the taper of the opening, means engaging with said plug and extending up into the opening in the bracket, means engaging with the bracket and with the means that engages with the plug for moving said plug up or down, and a sub-base member having an opening receiving the split means of said head within which said means may engage when expanded, to lock the bracket stationary on said sub-base member, said means being adapted to turn in the opening of the sub-base member to allow said bracket to be angularly adjusted on said member when the means is not locked by such expansion.

12. In a device of the character described, a bracket having faces at right angles to each other, one of the faces having a tongue extending across it, and the other face having means for adjustably mounting a work spindle on it, a head having a face to engage with the face of the bracket that has the tongue, and having a groove into which said tongue fits, said bracket having an opening through it at right angles to these faces, said head having means with an opening through it with a taper increasing in diameter downward from said face, said means being split for expansion, a tapered plug fitting in the taper of the opening, means engaging with said plug and extending up into the opening in the bracket, means engaging with the bracket and with the means that engages with the plug for moving said plug up or down, a sub-base member having an opening receiving the split means of said head within which said means may engage when expanded to lock the bracket stationary on said sub-base member, said means being adapted to turn in the opening of the sub-base member to allow said bracket to be angularly adjusted on said member when the means is not locked by such expansion, said sub-base member having a plurality of differently directed plane faces each capable of attachment to a correspondingly faced machine part.

13. In a device of the character described, a work spindle, a plate having projections forming journals for the work spindle, a worm gear fixed on the work spindle concentric with it, between said projections, a worm bracket pivotally mounted between said projections to swing in a plane at right angles to the axis of the work spindle, and a worm journaled in said worm bracket and meshing with said worm gear.

14. In a device of the character described, a work spindle, a plate having projections forming journals for the work spindle, a worm gear fixed on the work spindle concentric with it, between said projections, a worm bracket pivotally mounted between said projections to swing in a plane at right angles to the axis of the work spindle, a worm journaled in said worm bracket and meshing with said worm gear, and means for swinging said bracket toward or away from said worm gear.

15. In a device of the character described, a work spindle, a plate having projections forming journals for the work spindle, a worm gear fixed on the work spindle concentric with it, between said projections, a worm bracket pivotally mounted between said projections to swing in a plane at right angles to the axis of the work spindle, a worm journaled in said worm bracket and meshing with said worm gear, juxtaposed lugs on the respective projections, a pin journaled in said lugs and having the part between the lugs concentric to its journals, and a lug on said worm bracket having a slot within which said eccentric part of the pin engages, whereby turning said pin in one direction or the other swings said worm bracket and the worm carried thereby away from said worm gear or swings said bracket toward said worm gear and adjusts the worm with respect to the worm gear.

16. In a device of the character described, a work spindle, a plate having projections forming journals for the work spindle, a worm gear fixed on the work spindle concentric with it, between said projections, a worm bracket pivotally mounted between said projections to swing in a plane at right angles to the axis of the work spindle, a worm journaled in said worm bracket and meshing with said worm gear, a spindle for said worm extending up from the worm bracket, an index plate on the worm bracket around the spindle, and an arm with which the spindle turns, and means on said arm for engaging with said index plate.

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Witnesses:
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