S. L. GARY & F. B. MOSS.

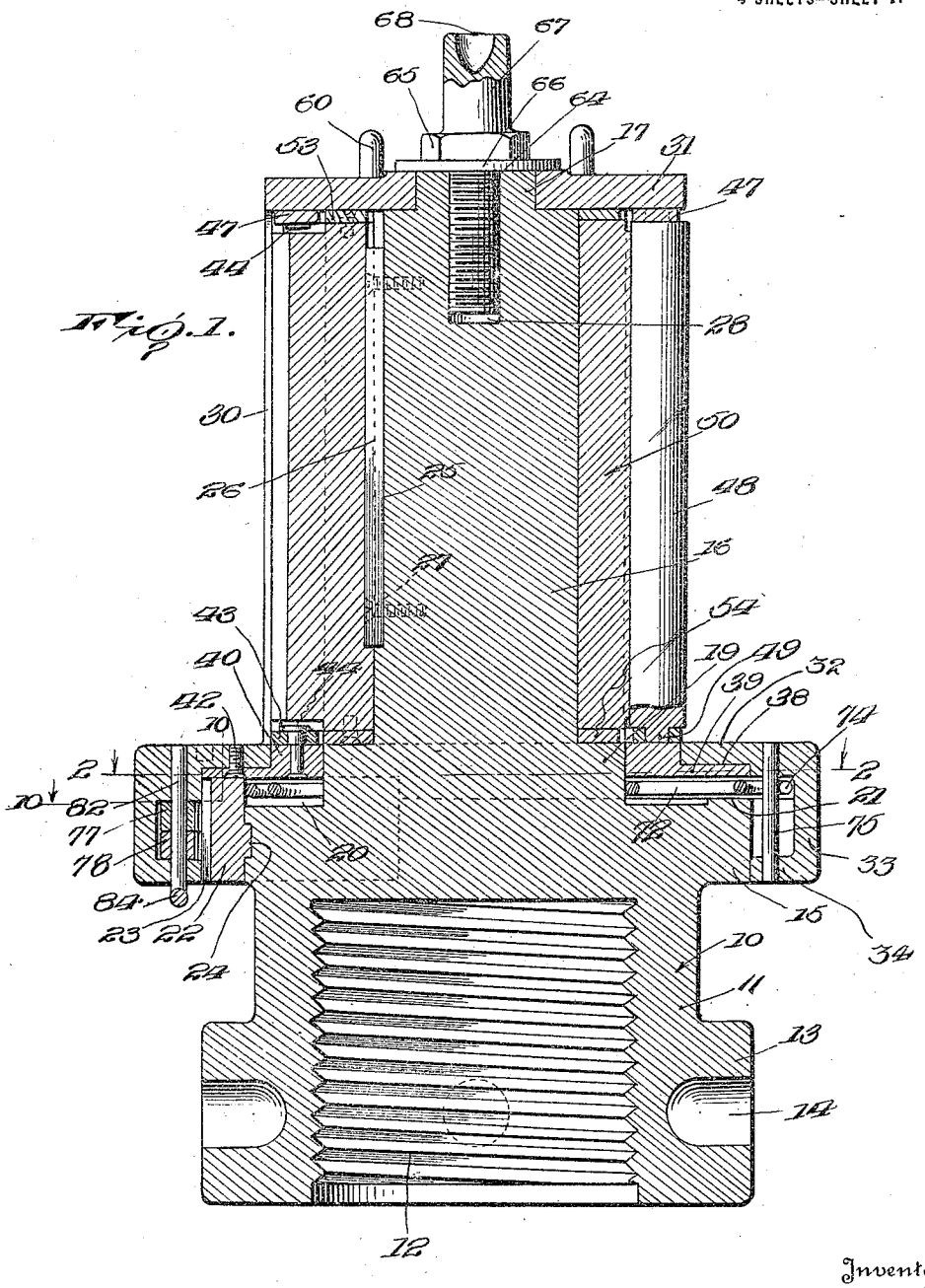
AUTOMATIC SELF LOCKING EXPANDING MANDREL.

APPLICATION FILED AUG. 21, 1917.

1,296,501. Patented Mar. 4, 1919.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

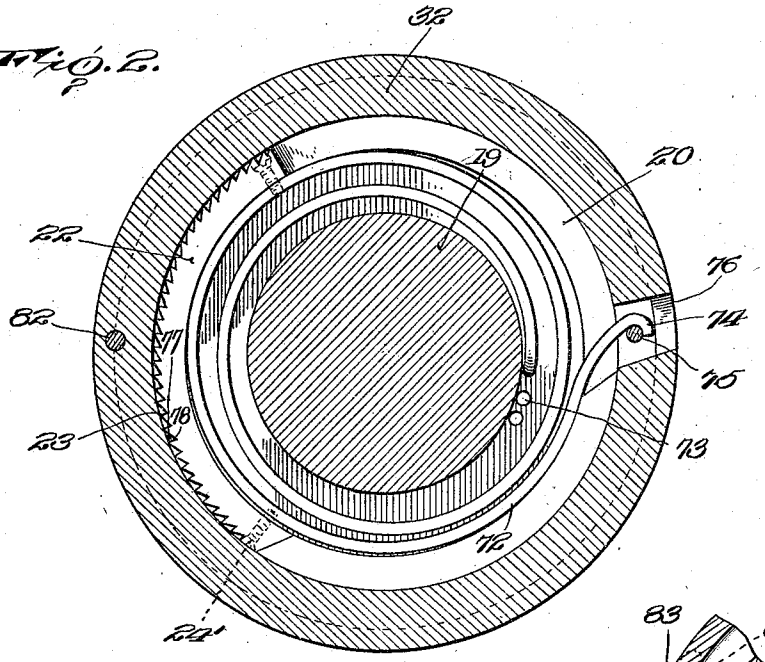


Fig. 10.

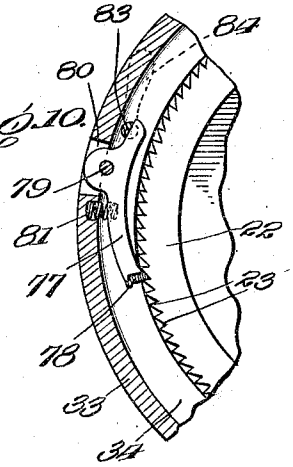
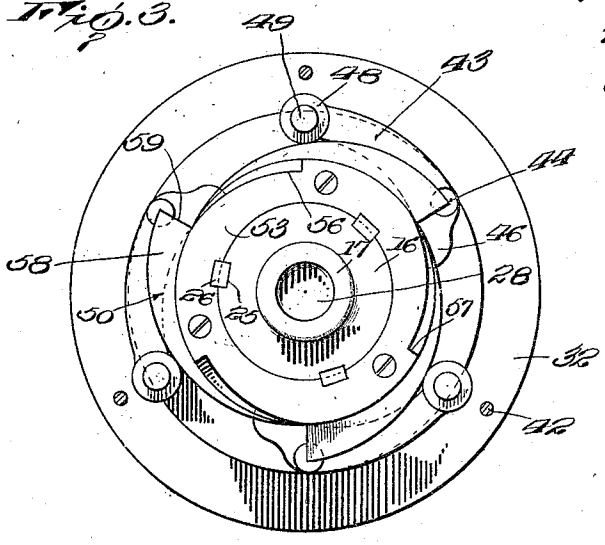


Fig. 3.



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AUTOMATIC SELF LOCKING EXPANDING MANDREL.

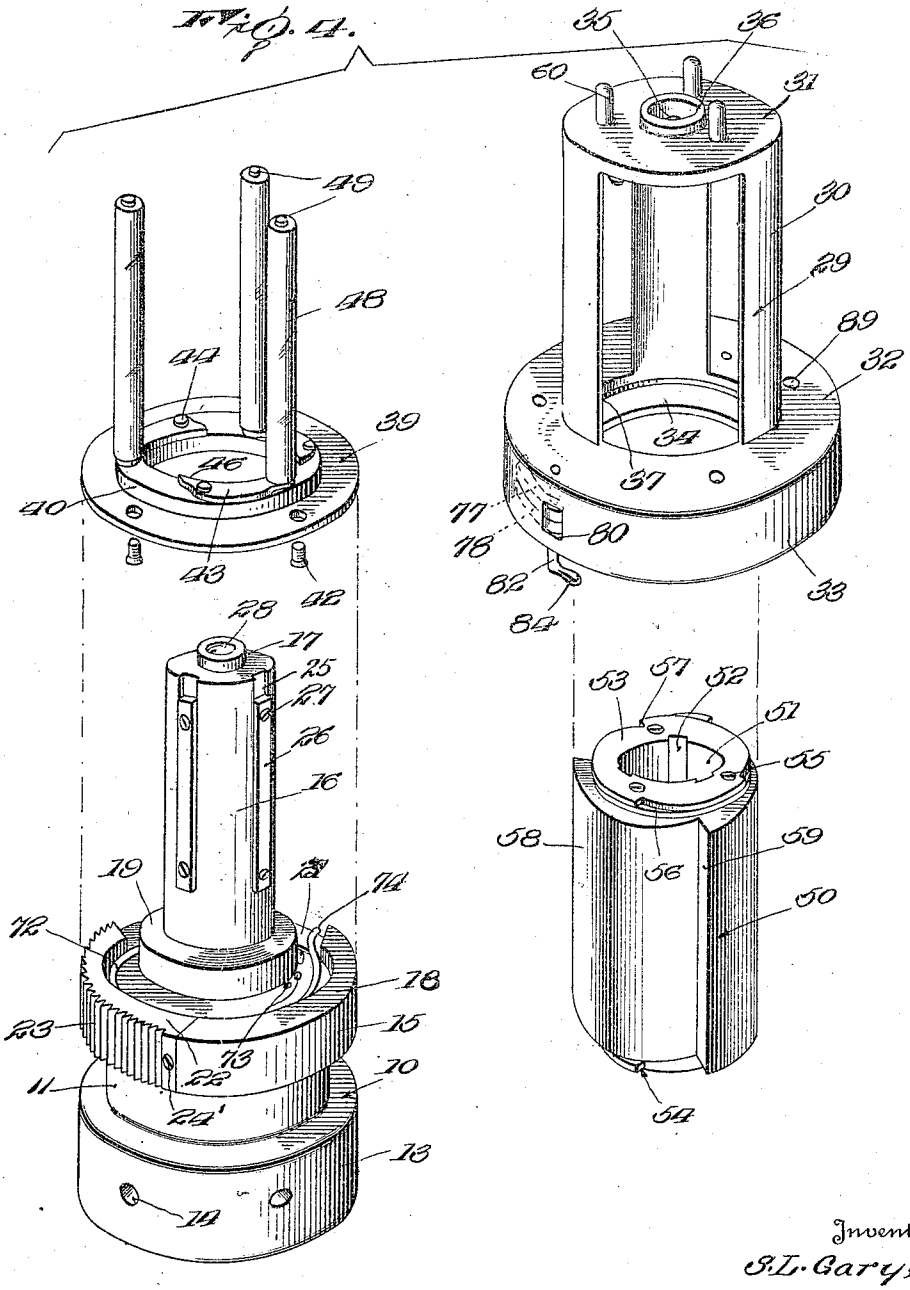
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4 SHEETS—SHEET 3.

Fig. 4.



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4 SHEETS—SHEET 4.

Fig. 8.

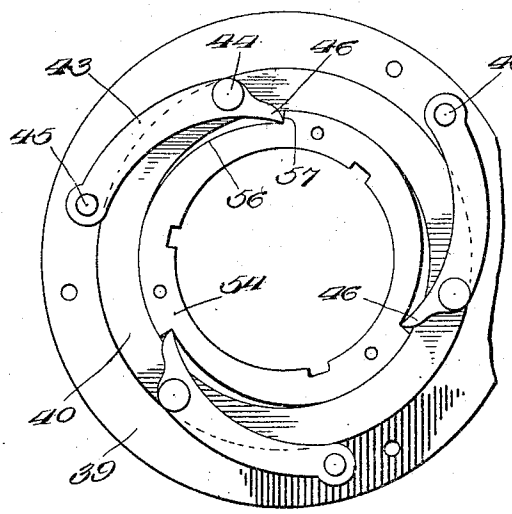


Fig. 9.

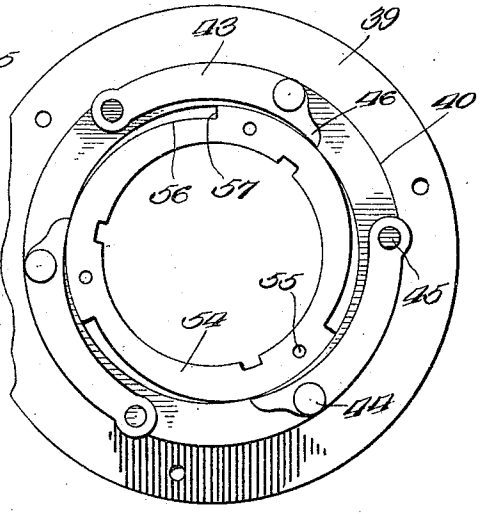


Fig. 7.

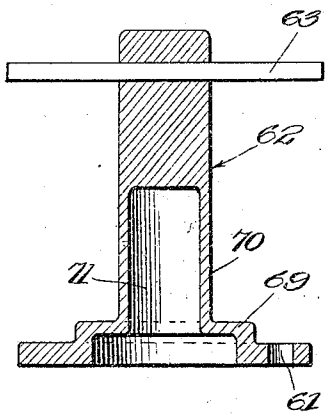
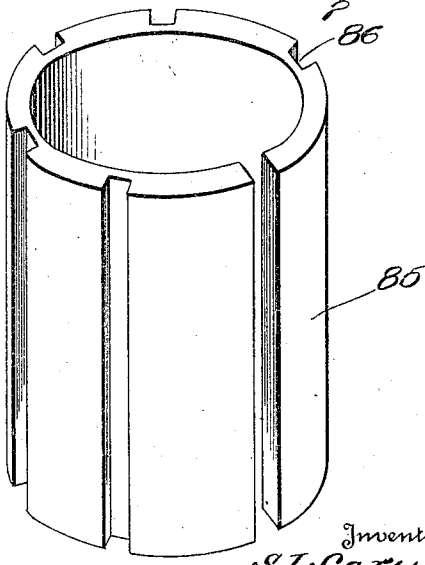


Fig. 5.



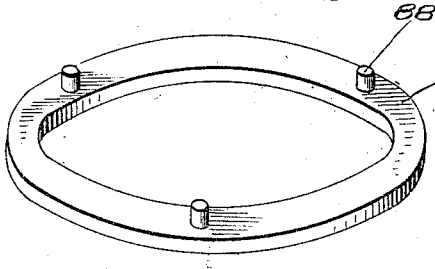


Fig. 6.

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AUTOMATIC SELF-LOCKING EXPANDING MANDREL.

1,296,501. Specification of Letters Patent. Patented Mar. 4, 1919.

Application filed August 21, 1917. Serial No. 187,409.

To all whom it may concern:

Be it known that we, SHIRLEY L. GARY and FRANK B. MOSS, citizens of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Automatic Self-Locking Expanding Mandrels, of which the following is a specification.

Our invention relates to new and useful improvements in metal working tools and more particularly to a mandrel for holding bushings and other tubular work while their ends are being trimmed or their outer faces are being trued, the primary object of our invention residing in the provision of an automatic self-locking expanding mandrel which may be employed on lathes or other machine.

A still further object of our invention resides in constructing the mandrel in such a manner that the work may be readily secured thereon or freed for removal to insure high efficiency as regards labor saving.

An object which we have in view is the construction of the mandrel in such a manner that automatic and accurate centering of the work is insured and in such a manner that any tendency for turning movement of the work about the mandrel will only act to cause a firmer clamping of the work by the mandrel.

Another object which we have in view is the provision of clamping sleeves and supporting rings coöperating with the mandrel proper so that it may be employed for work of different lengths and different diameters.

More specifically, our improved mandrel includes a body or chuck portion adapted for attachment to a lathe or other machine and carrying a compound cam member which coöperates with a plurality of clamping rollers carried by a hood rotatably mounted with respect to the body in such a manner that turning of the hood will cause radial outward swing of the rollers to engage work positioned about the hood.

In this connection a still further object of our invention consists in the provision of means not only supporting the rollers and governing their outward swinging movement but also acting to automatically return the rollers to released position when the hood is counter-turned.

Still another object resides in constructing the compound cam member that supports the rollers in such a manner that a relatively slight turning of the hood is all that is required to fully expand the rollers.

With these and other objects in view our invention will be more fully described, illustrated in the accompanying drawings and then particularly pointed out in the claims which form a part of this application.

In the drawings:

Figure 1 is a central vertical sectional view taken through the device,

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1, looking in the direction of the arrows,

Fig. 3 is a top plan view of the mandrel with the hood removed but showing the rollers and lower roller carrying plate in place,

Fig. 4 is an unassembled perspective view of the main elements of the mandrel, illustrating the manner of assemblage,

Fig. 5 is a perspective view of a clamping sleeve forming an attachment for the mandrel,

Fig. 6 is a perspective view of a supporting ring also forming a mandrel attachment,

Fig. 7 is a central vertical sectional view of the chuck wrench employed in operating the mandrel,

Fig. 8 is a plan view of the lower roller supporting plate and roller arms, showing the arms in projected position,

Fig. 9 is a corresponding view showing the arms in retracted position,

Fig. 10 is a fragmentary sectional view taken on the line 10—10 of Fig. 1, looking in the direction of the arrows.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

Our improved mandrel includes a body or chuck 10 having a substantially cylindrical base portion 11 formed in one end with an axial threaded bore or socket 12 to permit its application to a lathe or other machine and about such end with a thickened hub 13 provided with radial spanner receiving portions 14. The hub portion 11 at its opposite end is formed with an annular flange 15 and with an axially disposed spindle or shaft 16 having a reduced terminal 17 at its free end.

The flange 15 upon its upper face and its outer edge has an upwardly directed annular shoulder 18 which, with a shoulder 19 surrounding the base portion of the spindle 16, provides an annular chamber 20. The shoulder 18 along one side is cut away as shown at 21, for reasons which will be hereinafter apparent and a portion of the peripheral face of the flange 15 adjacent one end of this cut-away portion of the shoulder is cut away to provide an arcuate seat receiving a rack 22 which in effect forms a continuation of the flange and which has inclined rack or ratchet teeth 23. Screws 24′ or other suitable fastening means serve to hold this rack member in place and the inner face of the rack member may be provided with a shoulder 24 seating in a channel formed in the body 10 whereby it will be additionally supported in place.

The spindle 16 is formed at spaced intervals with a plurality of longitudinally extending key-ways 25 opening through its free end, three of these key-ways being preferably provided and keys 26 are removably secured in these key-ways by screws 27, the heads of which are countersunk in the outer faces of the keys. The free end of the spindle is also formed with an axial threaded bore 28, for a purpose later explained. The construction of this body portion of the mandrel is best shown in Figs. 1 and 4 of the drawings.

Coöperating with the above described chuck or body is a roller carrying hood, indicated as a whole by the numeral 29. This hood includes a cylindrical body portion 30 having a top 31 and open at its bottom. At its bottom this cylindrical body portion 30 is formed with an annular outwardly directed flange 32 provided at its marginal edge with a depending wall or flange 33 which in turn is formed with an inwardly directed flange or shoulder 34 whereby the flanges 32, 33 and 34 provide an annular chamber. The top 31 of the hood is formed with a central opening 35 adapted to seat about the reduced terminal 17 of the spindle, as shown in Fig. 1, and about this opening with a reinforcing bead or shoulder 36. When the hood is positioned about the spindle, the inner edge of the flange or shoulder 34 rests lightly against the peripheral face of the flange 15 of the hub 11 near the lower edge of such flange, while the inner face of the flange 32 is spaced slightly above the upper face of the flange 15. The wall 30 of the hood is formed with spaced longitudinal openings 37, three of these being preferably provided. These openings extend from the flange 32 to the top 31 and are considerably greater in width than the width of the remaining portion of the wall between them so that the hood in effect forms a sort of cage.

The inner face of the flange 32 is recessed to provide an annular seat 38 surrounding the opening in the bottom of the hood and adapted to receive a roller supporting ring 39 which is formed with an upwardly directed annular shoulder 40 projecting through the opening in the bottom of the hood and having its upper face flush with the upper face of the flange 32. A plurality of screws 42 or other suitable fastening means serve to hold this ring in place. A plurality of roller supporting arms 43 are pivoted near one end for free swinging movement upon the upper face of the shoulder 40 of the ring 39 by shouldered rivets 44, the arms being identical in shape and size and equally spaced from each other. Three of these arms are preferably employed and, as shown in Fig. 4 and also in Figs. 8 and 9, they correspond in curvature to the curvature of the shoulder 40 upon which they rest. Each of these arms at its end more remote from its pivot point, is formed with a circular bore or opening 45 and at its opposite end is formed with a nose or pawl 46 which tapers inwardly. Corresponding roller supporting arms 47 are similarly supported upon the lower face of the top 31 of the hood 29, being identical in shape and size and disposition with the arms 43 and being disposed in vertical alinement above such arms when the parts are assembled. A plurality of cylindrical rollers 48 are formed at their ends with reduced trunnions 49 to seat in the openings 45 of the upper and lower roller arms 47 and 43.

Coöperating with these rollers and inclosed in the hood and fixed upon the spindle is an expander 50 in the form of a compound cam. This expander includes a cylindrical body portion proper formed with an axial bore 51 channeled to provide key-ways 52 so that the expander may be locked upon the spindle 16. Cam rings 53 and 54 are secured by screws 55 to the upper and lower ends of the expander 50 and have their outer or peripheral edges cut away at spaced intervals to provide arcuate cam faces 56 which, at their outer ends, merge into the respective peripheral edges and at their inner ends terminate in radial stop shoulders 57, the cam faces being properly spaced and proportioned to be engaged by the pawls or noses of the roller supporting arms.

The expander 50 is also provided at peripherally spaced intervals with cam blades or wings 58 which extend throughout the entire length of the member and which have arcuate faces merging at their inner ends with the main body of the expander and terminating at their outer ends in radial stop shoulders 59.

As best shown in Figs. 3, 8 and 9, the rollers engage against the arcuate faces of

the cam blades 58 and the cam blades are so formed with respect to the cam seats 56 of the rings 53 and 54 that when the rollers engage against the stop shoulders 59, the noses of the roller carrying arms engage the outer portions of the cam seats 56, while when the rollers engage the high portions of the cam faces 59, the noses of the arms carrying the rollers engage against the stop shoulders 57 of the cam seats.

As a means for turning the hood relative to the spindle, we provide the top of the hood with a plurality of concentrically disposed upwardly directed pins 60 adapted to seat in openings 61 of a chuck wrench 62 having a cross handle 63. A locking bolt 64 having a bolt head 65 is threaded into the bore 28 of the spindle and engages against a washer 66 which engages both the reduced shoulder 17 of the spindle and the rib or shoulder 36 of the hood. The engagement between this latter rib or shoulder 36 and the washer, however, should not be close enough to prevent free turning of the hood. This bolt head 65 is formed with a cylindrical axial extension 67 provided at its free end with a conical seat 68 in order that it may be engaged with the centering pin of a lathe or other machine, when desired. The spanner wrench 62 has its base 69 and shank portion 70 bored out to provide a chamber 71 to receive the bolt head and washer 66 when it is applied to the pins 60.

Obviously, if the rollers are in retracted position, the wrench may be applied to the pin 60 and the hood may be turned to cause the rollers to ride out over the cam blades 58 of the expander. Of course, reverse turning of the hood will bring the rollers opposite the lower portions of the cam blades so that they may be retracted. This retraction of the rollers is automatic and due to the fact that the noses of the roller supporting arms during the counter-turning of the hood ride from the low to the high portions of the cam faces 56 to swing the free ends of the arms inwardly. This movement of the arms will be readily appreciated by reference to Figs. 8 and 9 of the drawings.

The normal position of the hood is that in which the arms and rollers are in retracted position, as shown in Fig. 9, and we prefer to provide means for normally holding the parts in this position and for returning them to such position, together with means for locking them in any other adjusted position. For this purpose, we provide a coil spring 72 which we dispose within the annular chamber 20. One end of this spring has a down-bent terminal which seats in any one of a series of sockets 73 formed in the upper face of the flange 15 and the other end projects through the space 21 provided by cutting away the shoulder 18 and has a hooked terminal 74 which engages about a pin 75 passed through the flanges 32 and 34 of the base of the hood. The peripheral wall or flange 33 of this hood base is preferably formed with a slot 76 permitting access to the pin 75 and hook 74 so that the spring may be released when desired. Obviously, the tension of this spring may be varied by positioning its inner terminal in different sockets 73. This spring is so wound as to normally hold the hood in a certain position which is the position in which the rollers will engage against the stop shoulders 59 forming the terminals of the outer ends of the cam blades 58, it being obvious, of course, that the hood could not be turned further in the direction in which the spring is urging it due to such engagement of the rollers and stop shoulders.

As a means for holding the mandrel in locked position, we provide a pair of pawls 77 and 78 which we mount upon a common pivot pin 79 extending through the upper and lower flanges 32 and 34 of the hood base, the pawls being located within the annular chamber formed between these flanges and the flange 33 being preferably slotted as shown at 80 to accommodate the intermediate or hub portions of the pawls. Springs 81 serve to normally urge the active ends of the pawls into engagement with the ratchet teeth 23 and it should be noted, that the active terminals of the pawls are spaced one in advance of the other a distance substantially equal to one-half the length of the teeth. By this arrangement, a much more delicate adjustment is obtained than would otherwise be possible without making the rack too fine and the pawls too small to insure efficient and lasting service. With the pawls mounted and proportioned as described, it will be clear that the hood need be turned only through one-half the length of a tooth in order to have it again locked to the body of the machine. A pin or shaft 82 is journaled in the upper and lower flanges 32 and 34 and intermediate its length is a cam portion 83 which engages the opposite ends of the pawls 77 and 78 so that turning of the pin or shaft 82 may swing the pawls out of engagement with the rack or permit the springs to move them into engagement, as the case may be. The lower end of the pin or shaft carries a laterally directed arm or handle 84 by which it may be turned.

In operation, with the mandrel assembled in the manner shown in Fig. 1, the bushing or other tubular work to be operated upon is positioned about the hood and the rollers carried thereby. The chuck wrench 62 is

then applied to engage the pins 60 and turned to turn the hood in a counter-clockwise direction. Under these circumstances, the cam blades 58 of the expander 50 forces the rollers outwardly into engagement with the inner face of the bushing or other work to wedge it in place and hold it aganst turning. The pawl controlling pin or shaft 82 during this operation should be so set that the pawls are free for movement under the action of their springs so that they may automatically lock the hood in adjusted position.

At this point it should be noted, that any tendency of the work to turn about the mandrel will act to cause turning of the rollers such as would roll them farther out upon the cam blades so that any such turning will only act to move the rollers into closer engagement with the work and cause the mandrel to more firmly grip the work.

In order to release the work from the mandrel, it is only necessary to swing the handle 84 of the shaft 82 to lock the pawls in inactive position, when the spring 72 will immediately return the hood to normal position, automatically retracting the rollers and freeing the work which may then be lifted from the mandrel.

In some instances, the diameter of the work may be too large for the particular mandrel to be employed and for this reason we preferably provide each mandrel with an attachment in the form of split resilient sleeves, such as that shown at 85 in Fig. 5. These sleeves should be of a diameter to be engaged by the mandrel and of varying thicknesses so that when they are sprung open upon being engaged upon the mandrel they may be forced into engagement with work of varying internal diameters. To insure sufficient resiliency, the outer faces of these sleeves are preferably castle-cut or channeled longitudinally at spaced intervals, as shown at 86.

Our improved mandrel is particularly adapted for use in holding bushings, etc., while their ends are being trued or cut off and in order to prevent injury to the mandrel, the end of the work should project beyond the outer ends of the rollers. In order to insure this, we provide another attachment consisting of a series of supporting rings such as that shown at 87 in Fig. 6, of varying thicknesses adapted to be seated upon the flange 32 of the hood and having centering pins 88 projecting from their lower faces which are adapted to seat in openings 89 formed in the flange 32.

From the foregoing description, it will be apparent that our improved mandrel is practically automatic in its action, as a slight turn of the wrench 62 is all that is necessary to secure the work in place, while a mere swing of the handle 84 is sufficient to cause release of the work. Because of this, rapid and accurate application of the work to the mandrel may be made and a great saving in time may be had. At the same time, there are no delicate parts to become injured or worn through use and all parts are readily accessible in case repairs are necessary. Furthermore, all duplicate parts, such as the rollers, roller supporting arms, cam rings 53 and the like, are identical in construction and interchangeable so that new parts may be readily applied.

Although we have illustrated and described our invention in detail, it will be understood that any changes which may be found advantageous either in structure or in proportion or arrangement of parts, may be made providing they fall within the scope of the claims.

Having thus described the invention, what is claimed as new is:

1. An expanding mandrel comprising a body, a hood mounted thereon and movable relative thereto, clamping elements carried by the hood, means whereby movement of the hood will project or retract the clamping elements, means for locking the clamping elements in an adjusted position, and yieldable means tending constantly to hold the clamping elements retracted.

2. An expansible mandrel comprising a body, a hood mounted thereon and turnable about the same, work-engaging elements mounted in the hood and movable to project therefrom or be housed therein, means whereby turning of the hood will cause the said elements to be projected or retracted, means on the hood and the body to lock the hood against turning from a set position, and means acting on the body and the hood to hold the hood constantly in normal position with the work-engaging elements retracted.

3. An expanding mandrel including a body formed with a spindle, keys engaging the spindle, a compound cam member mounted about the spindle and locked thereto by the keys, radially curved cam blades carried by the cam member, a hood mounted for turning movement about the cam member, swngingly mounted arms carried by the hood, rollers journaled in the arms and engaging the arcuate cam faces whereby turning of the hood with respect to the cam member will cause projection of the rollers, and means coöperating between the arms and the compound cam member whereby counter-turning of the hood will cause retraction of the rollers.

4. An expanding mandrel including a body formed with a spindle, keys engaging the spindle, a compound cam member mounted about the spindle and locked there-

to by the keys, radially curved cam blades carried by the cam member, a hood mounted for turning movement about the cam member, swingingly mounted arms carried by the hood, rollers journaled in the arms and engaging the arcuate cam faces whereby turning of the hood with respect to the cam member will cause projection of the rollers, and means coöperating between the arms and the compound cam member whereby counter-turning of the hood will cause retraction of the rollers, said means including cam seats at the ends of the cam member cooperating with the arms to cause swinging of the arms during turning of the hood.

5. An expanding mandrel including a supporting body, a hood mounted on the body, rollers carried by the hood and movable toward and away from the body, means for moving the rollers toward and from the body as the hood is rotated about the body, and interengaging means on the hood and the body for locking the rollers in any adjusted position.

6. An expanding mandrel including a spindle, a member fixed to the spindle and having radially curved longitudinally extending cam blades, rings secured to the ends of the member and formed with corresponding cam seats, a hood surrounding such member, a plurality of arms pivoted to the hood adjacent its ends and having pawl portions engaging the cam seats, and rollers journaled in the arms and engaging the cam blades whereby turning of the hood relative to the spindle and member mounted thereon will act through the engagement of the rollers with the cam blades and of the arms with the cam seats to project and retract the rollers through swinging of the arms.

7. An expanding mandrel including a spindle, a member fixed to the spindle and having radially curved longitudinally extending cam blades, rings secured to the ends of the member and formed with corresponding cam seats, a hood surrounding such member, a plurality of arms pivoted to the hood adjacent its ends and having pawl portions engaging the cam seats, rollers journaled in the arms and engaging the cam blades whereby turning of the hood relative to the spindle and member mounted thereon will act through the engagement of the rollers with the cam blades and of the arms with the cam seats to project and retract the rollers through swinging of the arms, and means normally tending to hold the hood in a predetermined position relative to the spindle and to automatically return it to such position when moved to another position.

8. An expanding mandrel including a spindle, a member fixed to the spindle and having radially curved longitudinally extending cam blades, rings secured to the ends of the member and formed with corresponding cam seats, a hood surrounding such member, a plurality of arms pivoted to the hood adjacent its ends and having pawl portions engaging the cam seats, rollers journaled in the arms and engaging the cam blades whereby turning of the hood relative to the spindle and member mounted thereon will act through the engagement of the rollers with the cam blades and of the arms with the cam seats to project and retract the rollers through swinging of the arms, means normally tending to hold the hood in a predetermined position relative to the spindle and to automatically return it to such position when moved to another position, and means for locking the hood against such return movement.

9. An expanding mandrel including a body, a hood mounted for turning movement about the body, clamping elements, means operable upon turning of the hood for projecting and retracting the clamping elements through the hood, a spring normally tending to hold the hood in a predetermined position with respect to the body, a plurality of ratchet teeth formed upon the body, spring pressed pawls carried by the hood and engaging the teeth, and means for swinging the pawls out of engagement with the teeth.

10. An expanding mandrel including a body, a hood mounted for turning movement about the body, clamping elements, means operable upon turning of the hood for projecting and retracting the clamping elements through the hood, a spring normally tending to hold the hood in a predetermined position with respect to the body, a plurality of ratchet teeth formed upon the body, spring pressed pawls carried by the hood and engaging the teeth, and means for swinging the pawls out of engagement with the teeth, one pawl projecting in advance of the other a space equal to substantially one-half the length of a tooth whereby turning of the hood with respect to the body through a distance equal to one-half the length of a tooth where one pawl was acting will render such pawl inactive and the other pawl active.

11. An expanding mandrel comprising a body, a compound cam about the body, a hood rotatably mounted on the body, pivotally mounted arms carried by the hood, and rollers supported by said arms and extending longitudinally of the hood, said arms and rollers bearing upon the cam whereby rotation of the hood will project or retract the rollers.

12. An expanding mandrel comprising a body, a compound cam about the body, a

hood rotatably mounted on the body, pivotally mounted arms carried by the hood, rollers supported by said arms and extending longitudinally of the hood, said arms and rollers bearing upon the cam whereby rotation of the hood will project or retract the rollers, and means housed between the hood and the body tending constantly to rotate the hood in one direction whereby the rollers will be held normally retracted.

In testimony whereof we affix our signatures.

SHIRLEY L. GARY. [L. S.]
FRANK B. MOSS. [L. S.]

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."