July 18, 1939. C. H. WOODCOCK 2,166,923

RECESSING DEVICE

Filed Jan. 28, 1938 2 Sheets-Sheet 1

Fig. 1.

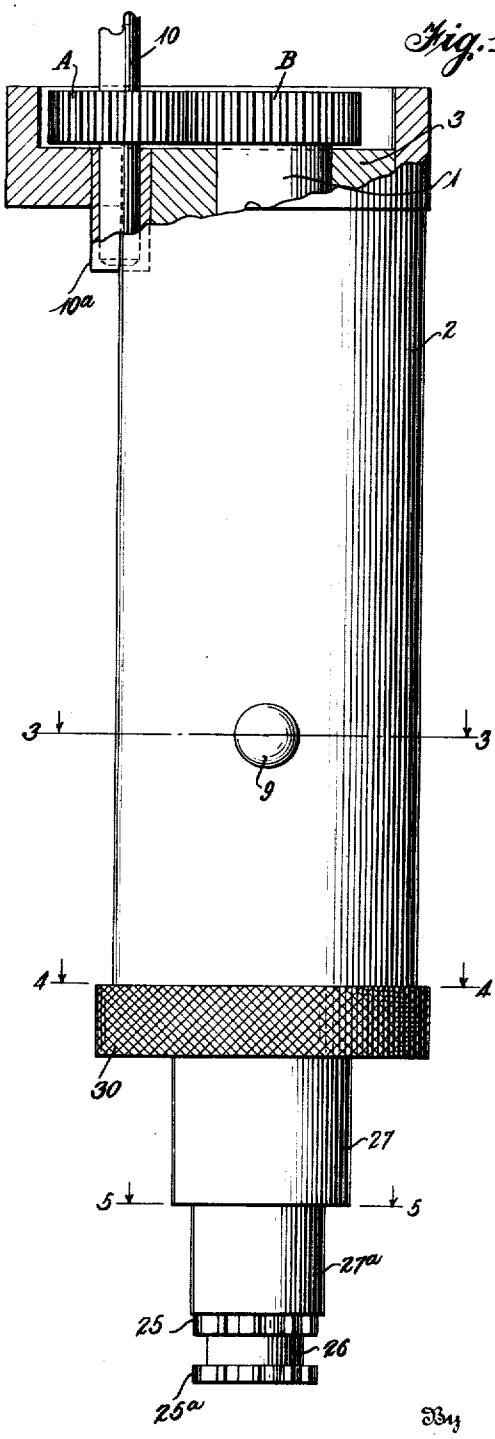


Fig. 3.

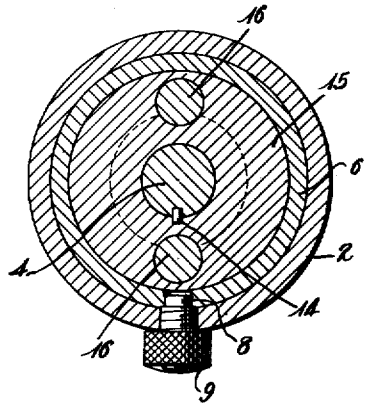
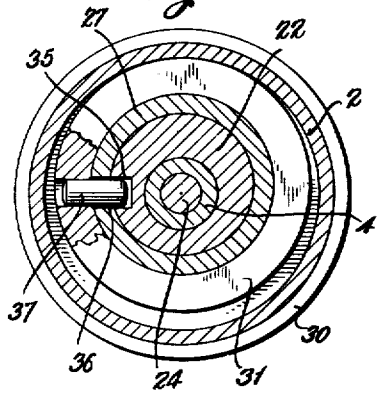


Fig. 4.



Inventor

Charles H. Woodcock

By J. Wallace Jr.

his Attorney

July 18, 1939. C. H. WOODCOCK 2,166,923

RECESSING DEVICE

Filed Jan. 28, 1938 2 Sheets-Sheet 2

Fig. 2.

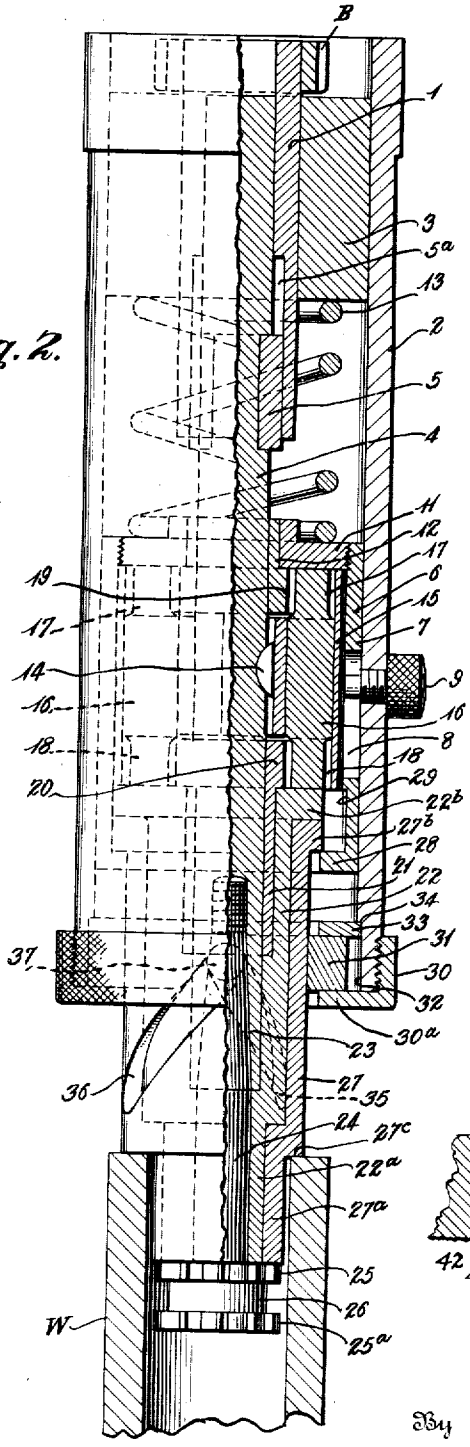


Fig. 7.

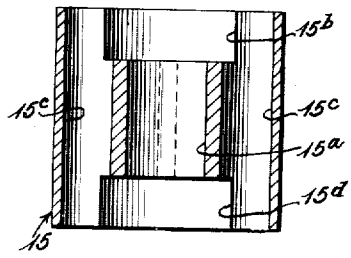


Fig. 5.

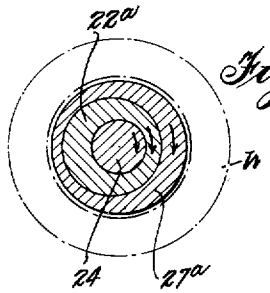


Fig. 6.

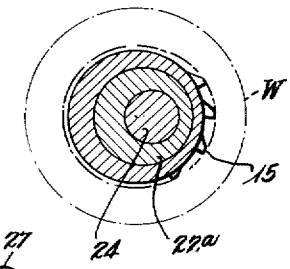
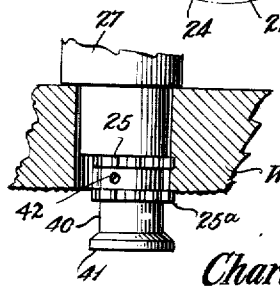


Fig. 8.



Inventor

Charles H. Woodcock

By J. Wallace Jamison

his Attorney

Patented July 18, 1939 2,166,923

UNITED STATES PATENT OFFICE

2,166,923

RECESSING DEVICE

Charles H. Woodcock, Philadelphia, Pa., assignor to The Atlantic Refining Company, Philadelphia, Pa., a corporation of Pennsylvania

Application January 28, 1938, Serial No. 187,441

17 Claims. (Cl. 90—12)

This invention relates to machines adapted to operate upon the inner surfaces of hollow bodies and more particularly to tools for cutting or forming circular recesses upon the inside of tubes or pipes.

An important object of my invention is to provide a machine of the above character in which the drive shaft carrying the rotary recessing element, such for example as a milling cutter, abrasive wheel or forming roller, is mounted within an eccentric sleeve operatively connected for rotation to and about the drive shaft, so that by introducing the recessing element within the end of the tubular work piece and urging the work piece into engagement with an abutment on or associated with the eccentric sleeve, the recessing element is caused to operate in a circular path upon the inner circumference of the work piece.

More particularly the invention has for an object the provision of a machine of the above character in which the drive shaft carrying the rotary recessing element is mounted within a pair of telescopically associated eccentric sleeves arranged for unitary rotation about the drive shaft, whereby the application of pressure during the recessing operation between the work piece and a displaceable abutment controlling the angular relationship of the sleeves serves to further uncover the recessing element to increase its depth of cut.

Another object of the invention is to provide a machine of the above character, including a pair of telescopically associated eccentric sleeves surrounding the drive shaft and unitarily rotatable thereabout, in which the lower end of the outer eccentric sleeve is provided with a cylindrical guide member adapted to fit within the end of the work piece and position it relative to the recessing element.

The invention has as a further object to provide in a machine of the above character a pilot member so arranged with respect to the recessing element or plurality of recessing elements that the latter may be preliminarily introduced into the opening of the work piece without danger of accidental engagement of the recessing element or elements with the work piece.

Still another object of my invention is to provide a machine of the above character which is of compact and comparatively simple construction and which is convenient and positive in operation.

Other objects and advantages will be apparent from the following detailed description of a preferred embodiment of the invention, reference being had to the annexed drawings, in which:

Figure 1 is a side elevational view with a portion broken away for clearness of a recessing tool for cutting a pair of spaced annular grooves upon the inside of tubular bodies;

Figure 2 is a side view partly in cross-section of the tool of Fig. 1 viewed at right angles thereto;

Figure 3 is a transverse cross-sectional view along the line 3—3 of Fig. 1;

Figure 4 is a transverse cross-sectional view along the line 4—4 of Fig. 1;

Figure 5 is a transverse cross-sectional view along the lines 5—5 of Fig. 1, showing the relationship of the eccentric sleeves when the recessing element is inoperative;

Figure 6 is a transverse cross-sectional view corresponding to Fig. 5 but showing the relationship of the eccentric sleeves at the conclusion of a recessing operation;

Figure 7 is a cross-sectional view of the gear pin carrier; and

Figure 8 shows the lower end of a modified form of recessing tool corresponding to that disclosed in the foregoing figures but differing therefrom by the provision of a pilot member extending below the recessing element, or plurality of recessing elements, serving to guide the latter into the opening to be recessed.

Referring to Figs. 1 and 2 which show a tool embodying the novel features of the invention for cutting a pair of spaced circular grooves upon the inside of a tubular work piece W, rotation is transmitted from any suitable source of power, through the intermediary of two speed reduction pinions A and B, to a vertically disposed hollow spindle 1 extending downwardly into an outer casing 2 through a central opening in a plug 3 force-fitted into the upper end of the casing. The lower end of the spindle telescopes over the end of a drive shaft 4, to which it is coupled by a key 5, whereby rotation of the spindle is communicated to the drive shaft. The drive shaft 4 is axially slidable within the hollow spindle 1 to the extent permitted by a longitudinal slot 5a formed upon the inner circumference of the spindle and providing a track for the key 5 fixed upon the drive shaft.

Longitudinally slidable within the outer casing 2 and providing a carriage for the drive shaft is an inner casing 6 comprising a tubular shell 7 adapted to snugly fit within the outer casing and provided with a vertically elongated slot 8 into which projects a pin 9 threaded through the

wall of the outer casing so as to permit vertical movement of the inner casing but preventing relative rotation between the casings. The top of the inner casing is closed by a disk 11 screw threaded at its outer circumference to the wall of the inner casing and centrally apertured to receive a bushing 12 tightly force-fitted into the disk. The bushing closely encircles the drive shaft but allows rotation of the drive shaft therein. A coil compression spring 13 surrounding the drive shaft bears at one end against the plug 3 and at its other end against the disk 11, thereby urging the inner casing downwardly within the outer casing.

Immediately below the disk 11 and fastened by a key 14 to drive shaft 4 so as to rotate therewith is a cylindrical gear pin carrier 15. The gear pin carrier is centrally bored as at 15a to receive the drive shaft, the bore being enlarged at its upper end, as at 15b, to provide clearance for the bushing 12. The gear pin carrier is free to rotate within the inner casing 6, and the carrier is provided at diametrically opposite points upon its circumference with longitudinally extending holes 15c each adapted to receive a gear pin 16. Each gear pin is formed at its upper and lower ends with gear teeth so as to define gears 17 and 18 of corresponding size and shape. The upper gears 17 of the gear pins mesh with teeth formed upon the circumference of the bushing 12 which thus defines a fixed gear 19; while the gears 18 on the lower end of the gear pins engage a gear 20 loosely encircling the drive shaft and housed within an enlarged portion 15d of the bore 15a opening to the lower face of the gear pin carrier. The gear 19 is provided, for example, with 36 teeth, while the gear 20 has 35 teeth.

Gear 20 is formed integral with a tubular extension 21 projecting downwardly therefrom and encircling the drive shaft, this tubular extension being press-fitted within the upper end of a cylindrical inner eccentric sleeve 22 so as to form a unitary part of the inner sleeve. The lower end of the drive shaft 4 is axially recessed, as indicated at 23, to provide a socket for receiving an elongated stud pin 24. The upper end of the stud pin is threaded into the bottom of the socket while its lower end projects a substantial distance below the lower end of the drive shaft and is provided with a pair of toothed milling cutters 25 and 25a separated by an annular hub 26 of reduced diameter.

Throughout its length the inner eccentric sleeve 22 is eccentric to the drive shaft 4 and this sleeve terminates at its lower end in a cylindrical extension 22a of reduced diameter but preserving the same eccentricity as the upper end of the sleeve. The upper end of the inner sleeve is formed with a circumferential flange 22b providing a bearing support for the lower face of the gear pin carrier 15.

Telescopically associated with the inner eccentric sleeve 22 is a cylindrical outer eccentric sleeve 27, said outer sleeve also being concentric to the inner sleeve throughout the major portion of its length but terminating in a reduced cylindrical eccentric extension 27a surrounding the cylindrical extension 22a of the inner sleeve. The cylindrical extension 27a is of slightly greater diameter than the milling cutters 25 and 25a and is adapted to fit within and act as a guide member for positioning the tubular work piece W relative to the milling cutters. A shoulder 27c formed by the transition section between the enlarged and reduced portions of the outer sleeve 27 serves as an abutment for the upper edge of the work piece. The upper end of the outer sleeve is provided with a circumferential flange 27b, which flange abuts the flange 22b of the inner sleeve and is supported upon an inwardly directed ledge 28 at the lower end of the inner casing 6. The lower end of the inner casing is recessed, as indicated at 29, to afford clearance for permitting lateral shifting of the inner and outer sleeves therein. By reference to Figs. 5 and 6 it will be apparent that the inner and outer sleeves are so formed that by displacing these sleeves angularly of each other the geometrical center of the outer sleeve may be moved into and out of coincidence with the axis of drive shaft 4.

Threaded upon the lower end of the outer casing 2 is a cap 30 having an inturned flange 30a upon which rests a collar 31 surrounding the outer sleeve 27, the wall of the outer casing being recessed, as indicated at 32, to provide additional clearance between the collar 31 and the wall. A ring 33 overlying the collar 31 at its outer circumference and engaging a shoulder 34 at the upper limit of the recessed portion 32 upon the wall of the outer casing, resists upward movement of the collar within the outer casing but permits rotation of the collar therein. Diagonal slots 35 and 36 are cut through the walls of the inner and outer eccentric sleeves 22 and 27, these slots sloping in opposite directions and overlying each other. A pin 37 press-fitted in collar 31 extends into both slots where they cross each other, this pin serving to couple the sleeves together and likewise acting as a camming member in conjunction with the inclined edges of the slots to cause relative rotation between the sleeves when the sleeves are forced upwardly, as will be later explained.

The tool just described may be mounted upon a vertically depressible carriage, in the manner of a drill press, so as to be lowered into engagement with the work piece W, or it may be stationarily supported and a platform carrying the work piece may be raised into engagement with the tool. The tool may also be of the portable class in which case it will be manually held in engagement with the work. In any event its operation will be essentially the same. Assuming, for example, that the tool is mounted upon a vertically depressible carriage and that rotation is transmitted to the spindle 1 through the speed reduction pinions A and B connected to a suitable source of power, the operation of the tool is as follows:

The drive shaft 4 being keyed to spindle 1 will be driven at the same speed as the spindle, and in the direction indicated by the arrow in Fig. 5, thereby imparting rapid rotation to the pair of milling cutters 25 and 25a.

The coil spring 13 will normally retain the inner casing 6, which carries the drive shaft 4 and the inner and outer eccentric sleeves 22 and 27, in its lowermost position as determined by engagement of the pin 37 on collar 31 with the upper ends of the slots 35 and 36 in the sleeves. Rotation about the drive shaft will be imparted to the two sleeves through the gear pins 16 mounted in the gear carrier 15, which latter is keyed to and rotates with drive shaft 4. The arrangement is such that rotation imparted to gears 17, upon the upper end of gear pins 16, by rolling upon the stationary gear 19 causes gears 18 on the lower end of the gear pins to drive gear 20, which latter is rigidly secured to the inner sleeve 22. Since the outer sleeve 27 is coupled to the inner sleeve 22 by means of the pin 37 entering

the oppositely inclined slots 35 and 36 of these sleeves both sleeves will be rotated in unison. The speed of these sleeves, however, will be much slower than that of the rapidly rotated drive shaft because gear 18 is provided, for example, with 36 teeth, while gear 20 has but 35 teeth, which means that for every revolution of the gear pins 16 about the fixed gear 19—corresponding to every revolution of the gear pin carrier 15 with the drive shaft—the gear 20, and hence sleeves 22 and 27, will be rotated in the same direction as the drive shaft (as shown by the arrows in Fig. 5) an angular distance represented by one gear tooth. It follows, therefore, that the speed ratio between the drive shaft and inner and outer sleeves will be 36:1, so that when the drive shaft has made 36 revolutions, the sleeves will have completed only one revolution.

At the time the tool is lowered into engagement with the work piece W the relationship of the inner and outer eccentric sleeves will be as indicated in Fig. 5, at which time the inner casing will occupy its lowermost position with the pin 37 engaging the upper ends of slots 35 and 36. In this relative position of the sleeves the geometrical axis of the outer sleeve 27 will coincide with the axis of rotation of the drive shaft, and since the guide member 27c is of a diameter exceeding the diameter of the milling cutters 25 and 25a the latter will be fully covered and protected from engagement wtih the work. As the tool is lowered the guide member will loosely enter the work piece and position the latter relative to the tool. Continued lowering of the tool brings the abutment 27c against the upper edge of the work piece. Any further depression of the tool will cause the sleeves and drive shaft to be projected upwardly along with the inner casing 6 and, by virtue of the pin 37 engaging the edges of the oppositely inclined slots 35 and 36, to angularly shift the inner and outer sleeves relative to each other.

This has the effect of displacing the geometrical axis of the outer sleeve out of coincidence with the axis of the drive shaft, the extreme position of eccentricity being shown in Fig. 6, at which time the milling cutters will be uncovered to their maximum extent corresponding to their positions at the conclusion of a recessing operation. It will of course be appreciated that the tool will be lowered cautiously so that the uncovering of the milling cutters will take place gradually to increase their depth of cut. During the recessing operation the work will be clamped firmly in engagement with the abutment 27c so that the work piece—which will preferably be supported upon a rotary platform—will partake of the relatively slow rotation of the outer sleeve. Thus, new portions of the inner circumference of the work piece will be continuously rotated into engagement with the cutters until a pair of spaced apart recesses of desired depth have been formed upon the interior of the work piece. To release the finished work piece it is only necessary to remove the pressure from the tool, the spring 13 automatically restoring the inner casing 2 to its original lowered position and simultaneously rotating the sleeves to move the guide member into covering position with respect to the milling cutters.

In the embodiment of the invention described above the pinion A, through which motion is transmitted to the spindle 1, is mounted upon a vertical power shaft 10 the lower end of which is journaled within a sleeve bearing 10a supported in the upper end of the outer casing 2. The companion pinion B with which the pinion A meshes may be fastened to the spindle 1 in any suitable manner. The means for transmitting rotation to drive shaft 4 may be varied so as to adapt the tool to different types of driving mechanisms.

It will be apparent that the invention is susceptible of embodiment in various forms. For example, recessing elements other than the milling cutters described in connection with the foregoing embodiment may be employed for operating upon the interior surface of the hollow work piece. Abrasive wheels, forming rollers, burnishing or polishing wheels, flanging rollers or the like may be substituted for milling cutters to equally good effect, depending upon the purpose for which the tool is to be used. Nor is the device restricted for use with cylindrical tubular bodies but may also be employed for recessing the interior of hollow bodies of other shapes.

A particular advantage of the machine resides in its adaptability for performing the functions of a drill press in addition to its utility as a recessing tool, thus giving it a wide range of usefulness in a machine shop. For example by replacing the pilot by a jaw chuck threaded into the stud pin, various operating elements may be associated with the chuck and the machine may be operated in the conventional manner as a drill press for boring, grinding, serrating or knurling.

In Fig. 8 is shown a recessing tool which may correspond in all essential respects to the tool shown in Figs. 1 to 7, inclusive, but in which a cylindrical pilot 40 is provided below the lower milling cutter 25a. This pilot may be axially screwed into the lower end of the stud pin 24 and the lower end of the pilot terminates in an enlarged circular head 41 of slightly larger diameter than the milling cutters. The purpose of this pilot is to initially guide the milling cutters into the opening of the work piece to be recessed as well as to protect the cutters against accidental engagement with the upper end of the opening which would result in damage to the work piece and possibly to the cutters. The pilot may be held against rotation by a lock screw 42 threaded radially into the hub 26. Preferably the pilots will be supplied in different lengths so that a pilot appropriate to the thickness of the work may be assembled with the cutters when operating on plate stock.

This figure also illustrates how the tool may be operated to spot face the surface of a plate surrounding an opening therein. In the example shown in this figure the guide member 27a has been introduced in the opening of a plate W' with the upper face of the plate bearing against the abutment 27c and the lower roughened face of the plate being disposed substantially in the plane of the upper face of the lower milling cutter 25a. Movement of the inner casing 6 upwardly within the outer casing 2 causes uncovering of the cutters, as has previously been explained, so that the milling cutter 25 operates to produce an annular recess upon the inner circumference of the opening while the lower cutter 25a acts to trim away a thin layer of metal upon the roughened under surface of the plate to provide a smooth area surrounding the opening.

By the terms "recessing machine", "recessing tool" and "recessing element" as used throughout this specification and claims is meant not only a machine, tool or element capable of forming grooves within the opening presented by a work

piece but also a tool or element capable of performing other operations, such as the spot facing operation just described, either within or externally of the opening.

I claim:

1. An internal recessing machine comprising a drive member, a recessing element mounted on said drive member, an eccentric member surrounding said drive member, said drive member and eccentric member being rotatable about a common axis, means operatively connecting said drive member with said eccentric member for insuring relative rotation between the drive member and eccentric member and means for rotating one of said members.

2. An internal recessing machine comprising a drive member adapted to rotate about a fixed axis, a recessing element mounted on said drive member, an eccentric member surrounding said drive member and rotatable about the axis of the drive member, means operatively connecting said drive member with said eccentric member for insuring relative rotation between the drive member and eccentric member and means for rotating one of said members.

3. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted upon said drive shaft, a sleeve surrounding said drive shaft and eccentric thereto, said sleeve being arranged for co-axial rotation about the drive shaft, means operatively connecting said drive shaft with the sleeve for insuring rotation of the sleeve about the drive shaft and means for imparting rotation to the drive shaft.

4. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted upon said drive shaft, a sleeve surrounding said drive shaft and eccentric thereto, said sleeve being arranged for co-axial rotation about the drive shaft, means operatively connecting said drive shaft with the sleeve for insuring rotation of the sleeve about the drive shaft, means for changing the eccentricity of the sleeve relative to the drive shaft and means for rotating the drive shaft.

5. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted upon said drive shaft, a sleeve surrounding said drive shaft and eccentric thereto, said sleeve being arranged for rotation about the drive shaft, means operatively connecting said drive shaft with the sleeve for insuring rotation of the sleeve about the drive shaft, means including an abutment on said sleeve engageable with the work being operated upon for changing the eccentricity of the sleeve relative to the drive shaft and means for rotating the drive shaft.

6. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted upon said drive shaft, a sleeve surrounding said drive shaft and eccentric thereto, said sleeve being arranged for rotation about the drive shaft, means operatively connecting said drive shaft with the sleeve for insuring rotation of the sleeve about the drive shaft, means including an abutment on said sleeve engageable with the work being operated upon to angularly shift the sleeve for changing the eccentricity of the sleeve relative to the drive shaft and means for rotating the drive shaft.

7. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted on said drive shaft, an inner sleeve and an outer sleeve surrounding said drive shaft and both eccentric thereto, said sleeves being arranged for unitary rotation about the drive shaft, means for rotating said drive shaft and sleeves and means for angularly shifting said sleeves relative to each other to change the eccentricity of the outer sleeve relative to the drive shaft.

8. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted on said drive shaft, an inner sleeve and an outer sleeve surrounding said drive shaft and both eccentric thereto, said sleeves being arranged for unitary rotation about the drive shaft, means for rotating said drive shaft and sleeves and a projection held against movement longitudinally of the sleeves engageable with an inclined surface upon one of the sleeves for causing relative angular displacement of said sleeves to thereby change the eccentricity of the outer sleeve relative to the drive shaft.

9. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted on said drive shaft, an inner sleeve and an outer sleeve surrounding said drive shaft and both eccentric thereto, said sleeves being arranged for unitary rotation about the drive shaft, means for rotating said drive shaft and sleeves, one of said sleeves being longitudinally slidable, and a projection held against movement longiudinally of said last-mentioned sleeve and engageable with an inclined surface movement longitudinally of said last-mentioned sleeve to thereby change the eccentricity of the outer sleeve relative to the drive shaft.

10. An internal recessing machine comprising a casing, a drive shaft journaled within the casing and adapted to rotate about a fixed axis, said drive shaft extending beyond an end of the casing, a recessing element mounted upon the extended end of said drive shaft, an inner eccentric sleeve and an outer eccentric sleeve surrounding said drive shaft, said sleeves being arranged for unitary rotation about the drive shaft, the end of the outer sleeve providing a guide member of slightly greater diameter than the recessing element and adapted to enter and position the work being operated upon, means within said casing extending between the sleeves for causing relative angular displacement of the sleeves to thereby change the eccentricity of the outer sleeve relative to the drive shaft and means for rotating said drive shaft and sleeves.

11. An internal recessing machine comprising a casing, a drive shaft journaled within the casing and adapted to rotate about a fixed axis, said drive shaft extending beyond an end of the casing, a recessing element mounted upon the extended end of said drive shaft, an inner eccentric sleeve and an outer eccentric sleeve surrounding said drive shaft, said sleeves being longitudinally slidable within the casing and arranged for unitary rotation about the drive shaft, the end of the outer sleeve providing a guide member of slightly greater diameter than the recessing element and adapted to enter and position the work being operated upon, means within said casing extending between the sleeves for causing relative angular displacement of the sleeves upon longitudinal sliding movement of the sleeves to thereby change the eccentricity of the outer sleeve relative to the drive shaft, an abutment engageable by the work for imparting sliding movement to said sleeves and means for rotating the drive shaft and sleeves.

12. An internal recessing machine comprising

a casing, a drive shaft journaled within the casing and adapted to rotate about a fixed axis, said drive shaft extending beyond an end of the casing, a recessing element mounted upon the extended end of said drive shaft, an inner eccentric sleeve and an outer eccentric sleeve surrounding said drive shaft, said sleeves being longitudinally slidable within the casing, the end of the outer sleeve providing a guide member of slightly greater diameter than the recessing element and adapted to enter and position the work being operated upon, overlying slots on said sleeves disposed at relatively different inclinations, a pin within the casing retained against movement longitudinally of the sleeves, said pin entering said slots and keying the sleeves together for unitary rotation about the drive shaft, the arrangement being such that upon longitudinal sliding movement of the sleeves said pin cooperates with the slots to change the angular relationship between the sleeves and the eccentricity of the outer sleeve relative to the drive shaft, an abutment upon the outer sleeve engageable by the work for imparting longitudinal movement to the sleeves, and means for rotating the drive shaft and sleeves.

13. An internal recessing machine comprising a casing, a drive shaft journaled within the casing and adapted to rotate about a fixed axis, said drive shaft extending beyond an end of the casing, a recessing element mounted upon the extended end of said drive shaft, an inner eccentric sleeve and an outer eccentric sleeve surrounding said drive shaft, said sleeves being longitudinally slidable within the casing, the end of the outer sleeve providing a guide member of slightly greater diameter than the recessing element and being of such a size and shape as to loosely fit within and position the work being operated upon, means extending between and keying said sleeves together for unitary rotation about said drive shaft, said last-mentioned means being so constructed and arranged upon longitudinal sliding movement of the sleeves within the casing to cause a change in the angular relationship of said sleeves and thereby a change in the eccentricity of the outer sleeve relative to the drive shaft, an abutment upon the outer sleeve engageable by the work for imparting longitudinal movement to the sleeves and means for rotating the drive shaft.

14. An internal recessing machine comprising a casing, a drive shaft journaled within the casing and adapted to rotate about a fixed axis, said drive shaft extending beyond an end of the casing, a recessing element mounted upon the extended end of said drive shaft, an inner eccentric sleeve and an outer eccentric sleeve surrounding said drive shaft, said sleeves being longitudinally slidable relative to the casing, the end of the outer sleeve providing a guide member of slightly greater diameter than the recessing element and adapted to enter and position the work being operated upon, overlying slots on said sleeves disposed at relatively different inclinations, a pin within the casing and retained against movement longitudinally of the sleeves, said pin entering the slots and keying the sleeves together for unitary rotation about the drive shaft, the arrangement being such that upcn sliding movement of the sleeves said pin cooperates with the slots to change the angular relationship between the sleeves so as to move the center of the outer sleeve out of its normal position of coincidence with the axis of rotation of the drive shaft, means operatively connecting the sleeves with the drive shaft for rotation about the drive shaft, an abutment upon the outer sleeve engageable by the work for imparting longitudinal movement to the sleeves and means for rotating the drive shaft.

15. An internal recessing machine comprising an outer casing, a drive shaft journaled within the outer casing and adapted to rotate about a fixed axis, said drive shaft extending beyond an end of the outer casing, means for rotating said drive shaft, a recessing element mounted upon the extended end of said drive shaft, an inner casing longitudinally slidable within the outer casing, telescopically associated inner and outer eccentric sleeves surrounding said drive shaft and supported upon said inner casing, a gear pin carrier fixed to said drive shaft for rotation therewith, gear pins carried by said gear pin carrier, a stationary gear upon said inner casing and a gear having a different number of teeth from said stationary gear upon one of said sleeves, both of said gears engaging the gear pins whereby motion is transmitted from the drive shaft to said last-mentioned sleeve, means keying the sleeves together for unitary rotation about the drive shaft and arranged to cause relative angular displacement between the sleeves upon longitudinal sliding movement of the sleeves, a spring urging the inner casing within the outer casing in a direction such as to project the sleeves and drive shaft outwardly thereof, said outer eccentric sleeve being coaxial with the inner sleeve for the major portion of its length but terminating in an eccentric guide member of slightly greater diameter than the recessing element adapted to enter and position the work being operated upon and an abutment upon said outer sleeve engageable with the work for imparting longitudinal movement to the sleeves and inner casing, whereby the center of the outer sleeve is moved out of its normal position of coincidence with the axis of rotation of the drive shaft.

16. An internal recessing machine comprising an outer casing, a drive shaft journaled within the outer casing and adapted to rotate about a fixed axis, said drive shaft extending beyond an end of the outer casing, means for rotating said drive shaft, a recessing element mounted upon the extended end of said drive shaft, an inner casing longitudinally slidable within the outer casing, telescopically associated inner and outer eccentric sleeves surrounding said drive shaft and supported upon said inner casing, a gear pin carrier fixed to said drive shaft for rotation therewith, gear pins carried by said gear pin carrier, a stationary gear upon said inner casing and a gear having a different number of teeth from said stationary gear upon one of said sleeves, both of said gears engaging the gear pins whereby motion is transmitted from the drive shaft to said last-mentioned sleeve, overlying slots on said sleeves disposed at relatively different inclinations, a pin within the outer casing and retained against movement longitudinally of the outer casing, said pin entering the slots and keying the sleeves together for unitary rotation about the drive shaft, a spring urging the inner casing in a direction within the outer casing such as to project the sleeves and drive shaft outwardly thereof, said outer sleeve providing a guide member of slightly greater diameter than the recessing element and adapted to enter and position the work being operated upon and an abutment upon said outer sleeve engageable with the work for im-

parting longitudinal movement to the sleeves and inner casing, whereby said pin cooperates with the slots to change the angular relationship between the sleeves to move the center of the outer sleeve out of its normal position of coincidence with the axis of rotation of the drive shaft.

17. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted on said drive shaft, an inner sleeve and an outer sleeve surrounding said drive shaft and both eccentric thereto, said sleeves being arranged for unitary rotation about the drive shaft, means for rotating said sleeves relative to each other to change the eccentricity of the outer sleeve relative to the drive shaft, and a pilot member coaxial with and disposed below the recessing element, said pilot member being of slightly greater diameter than the recessing element.

CHARLES H. WOODCOCK.

CERTIFICATE OF CORRECTION.

Patent No. 2,166,923. July 18, 1939.

CHARLES H. WOODCOCK.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 22, for "collar 37" read collar 31; page 3, first column, line 31, for "wtih" read with; page 4, second column, line 31, claim 9, for "longiudinally" read longitudinally; line 33, same claim, for "movement longitudinally of" read thereon for angularly shifting; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of September, A. D. 1939.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

parting longitudinal movement to the sleeves and inner casing, whereby said pin cooperates with the slots to change the angular relationship between the sleeves to move the center of the outer sleeve out of its normal position of coincidence with the axis of rotation of the drive shaft.

17. An internal recessing machine comprising a drive shaft adapted to rotate about a fixed axis, a recessing element mounted on said drive shaft, an inner sleeve and an outer sleeve surrounding said drive shaft and both eccentric thereto, said sleeves being arranged for unitary rotation about the drive shaft, means for rotating said sleeves relative to each other to change the eccentricity of the outer sleeve relative to the drive shaft, and a pilot member coaxial with and disposed below the recessing element, said pilot member being of slightly greater diameter than the recessing element.

CHARLES H. WOODCOCK.

CERTIFICATE OF CORRECTION.

Patent No. 2,166,923. July 18, 1939.

CHARLES H. WOODCOCK.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 22, for "collar 37" read collar 31; page 3, first column, line 31, for "wtih" read with; page 4, second column, line 31, claim 9, for "longiudinally" read longitudinally; line 33, same claim, for "movement longitudinally of" read thereon for angularly shifting; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of September, A. D. 1939.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)