April 18, 1933. R. J. BEAVERS 1,904,848

MATERIAL WORKING MACHINE

Filed Jan. 31, 1930 3 Sheets-Sheet 1

Fig. 1.

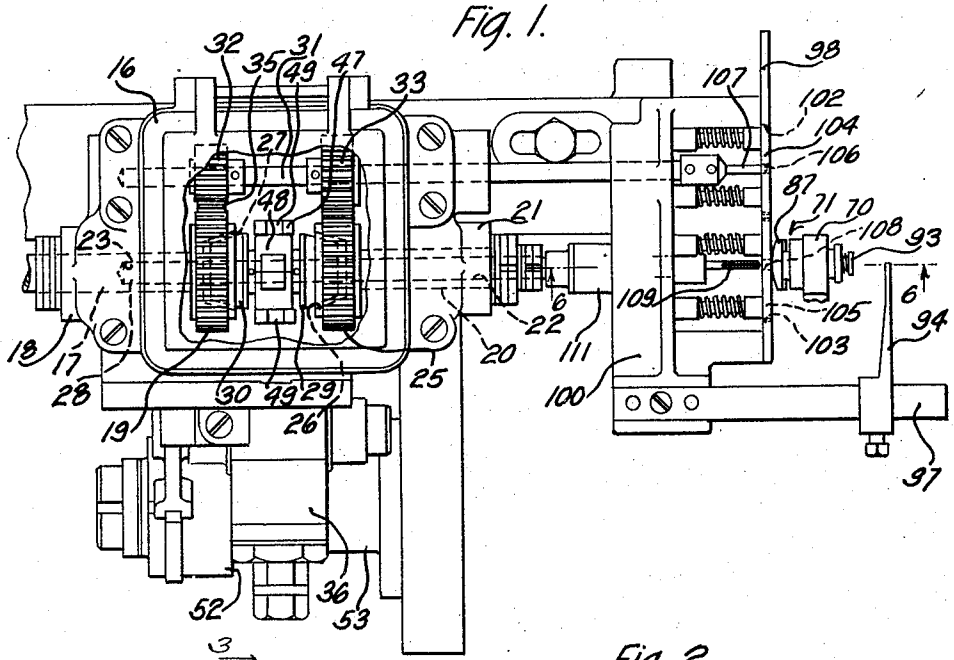
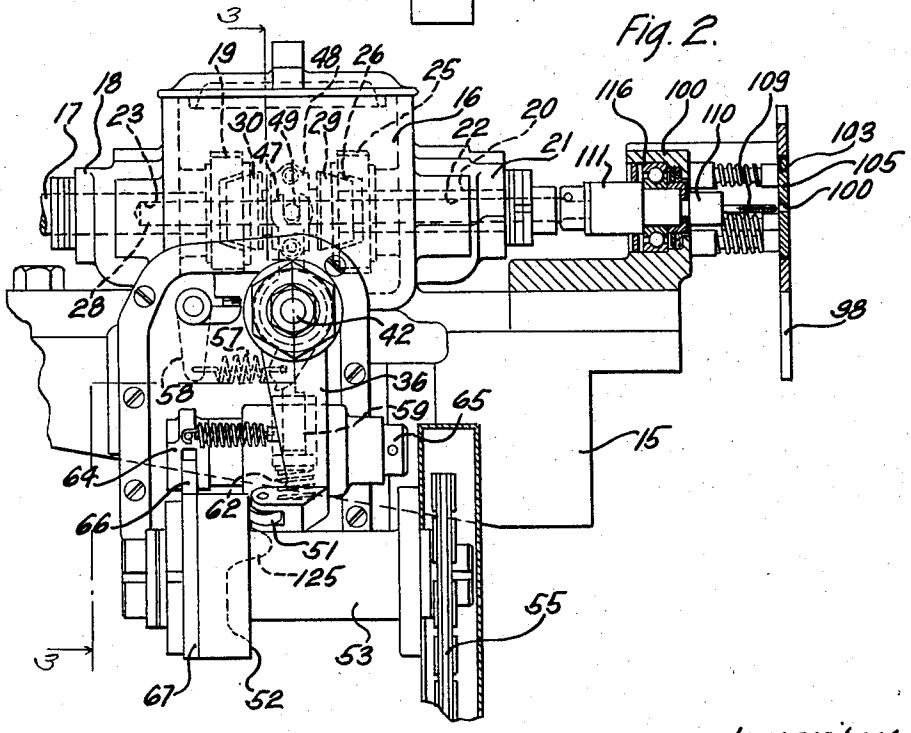


Fig. 2.



Inventor
R. J. Beavers
By R. B. Whitfield Att'y.

April 18, 1933. R. J. BEAVERS 1,904,848

MATERIAL WORKING MACHINE

Filed Jan. 31, 1930 3 Sheets-Sheet 2

Fig. 3.

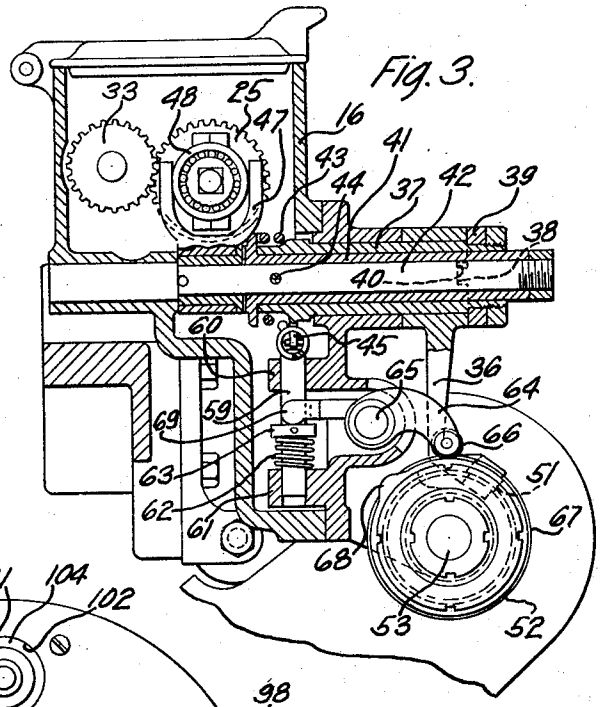
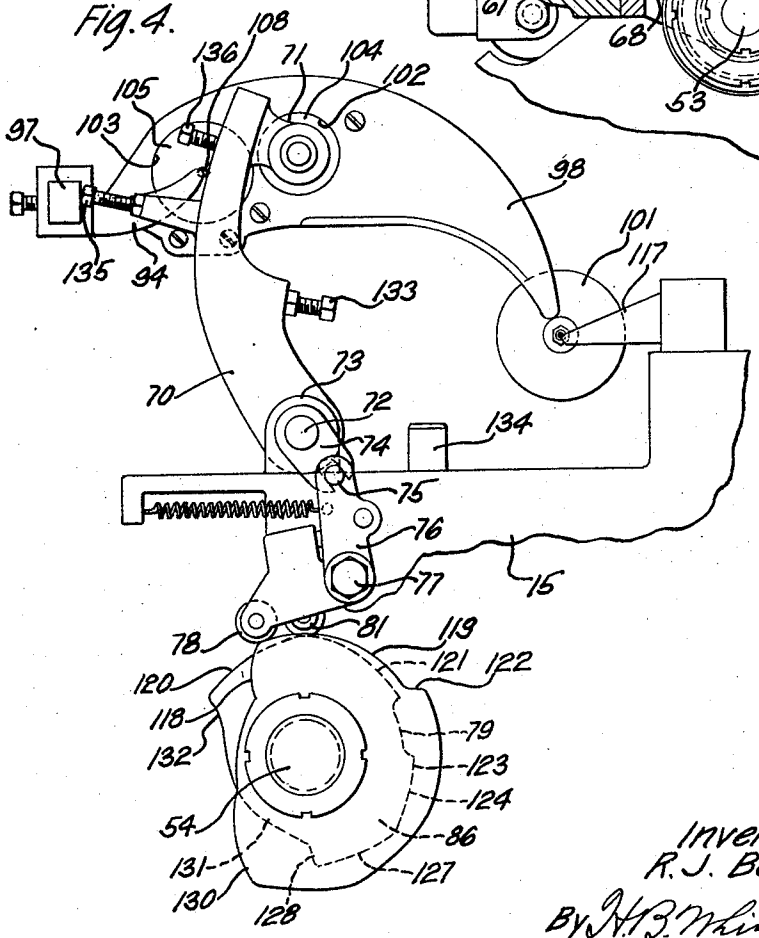


Fig. 4.



Inventor
R. J. Beavers
By H. B. Whitfield Att'y.

April 18, 1933. R. J. BEAVERS 1,904,848

MATERIAL WORKING MACHINE

Filed Jan. 31, 1930 3 Sheets-Sheet 3

Fig. 9.

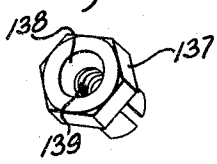


Fig. 5.

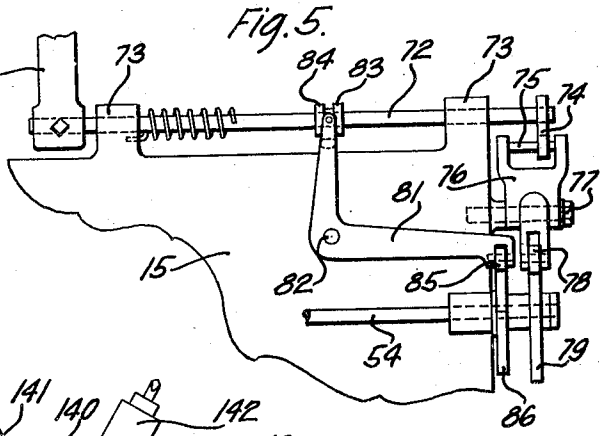


Fig. 8.

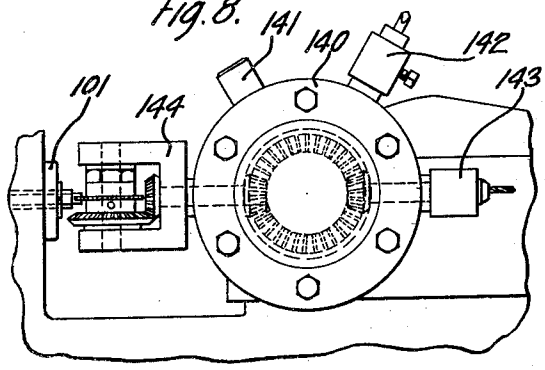


Fig. 7.

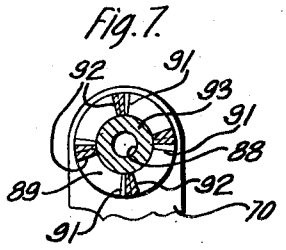
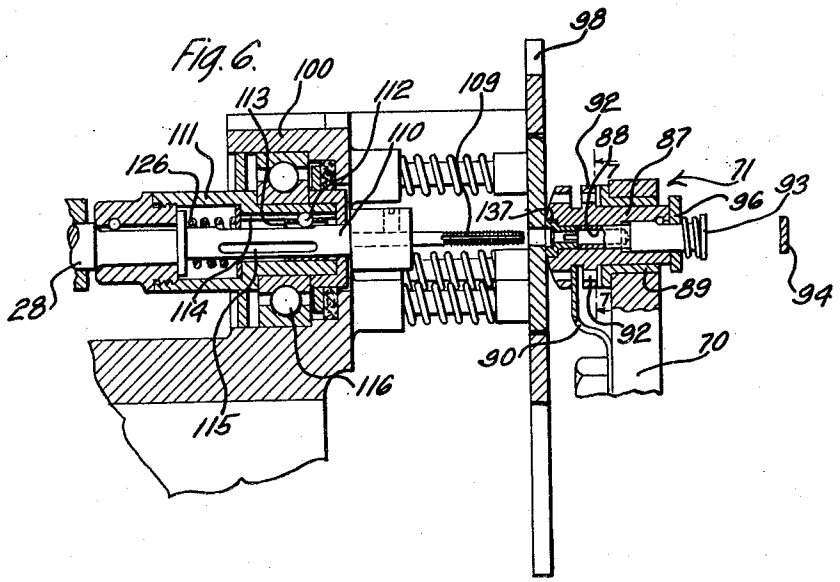


Fig. 6.



Inventor
R. J. Beavers
By H. B. Whitfield Atty.

Patented Apr. 18, 1933 1,904,848

UNITED STATES PATENT OFFICE

ROY J. BEAVERS, OF BROOKFIELD, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

MATERIAL WORKING MACHINE

Application filed January 31, 1930. Serial No. 425,050.

This invention relates to material working machine, and more particularly to automatic screw machines designed to produce piece parts.

An object of the invention is to provide an apparatus for performing rapidly and accurately in a simple and expeditious manner additional operations upon an article other than those originally performed.

In one embodiment of the invention a rotatable and reciprocable transfer arm has a spring pressed chuck in its free end to receive a part, rotate therewith during the cutting off operation, and to have the part on its return stroke, and before being subjected to a subsequent operation, cammed into firmer engagement therewith. Two additional operations are performed on the part while held by the transfer arm due to its longitudinal movement against a spring pressed collar which is individual to the particular tools at those positions and which holds the part against rotation, after which the piece part is released from the chuck into a chute, and directed to a receptacle.

The invention will be more fully understood from the following description, taken in connection with the appended drawings, in which

Fig. 1 is a top plan view of the apparatus portions thereof being shown in section;

Fig. 2 is a side elevation of the apparatus portions thereof being shown in section;

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary front elevation of the apparatus;

Fig. 5 is a fragmentary view of the arm control mechanism;

Fig. 6 is an enlarged detailed sectional view taken on the line 6—6 of Fig. 1, showing the tap holding an actuating mechanism;

Fig. 7 is a sectional view taken along the line 7—7 of Fig. 6;

Fig. 8 is a fragmentary side elevational view of the apparatus effective prior to the performance of the additional operations upon the article, and

Fig. 9 is a perspective view of the article of manufacture.

Referring now to the drawings wherein like reference numerals designate corresponding parts throughout the several views, the numeral 15 indicates a frame of an automatic screw machine upon which a housing 16 is mounted. A driving sleeve 17 is rotatably disposed in a bearing 18 in one end of the housing and has one end thereof operatively connected to a power means, such as a motor (not shown), and another end provided with a gear 19 which is keyed thereto. A driven sleeve 20 is rotatably disposed in a bearing 21 in the other side of the housing 16, in general alignment with the driving sleeve 17, and has a longitudinally extending opening 22 therethrough which is aligned with an opening 23 in the driving sleeve 17. The inner end of the driven sleeve 20 has disposed thereon a gear 25 which has secured thereto a clutch member 26. A similar clutch member 27 is carried by the gear 19. Disposed between the clutch members 26 and 27 and keyed to a stub shaft 28, which has its ends disposed in the openings 22 and 23, are integral clutch members 29 and 30 which are arranged to be moved relative to the shaft 28 and into operative engagement with the clutch members 26 and 27 respectively. The actuation of the clutch members 29 and 30 will be hereinafter described.

A driven shaft 31 is journaled in bearings in the housing 16 and has gears 32 and 33 rigidly mounted thereupon, the gear 33 being in mesh with the gear 25, while the gear 32 is operatively connected to the gear 19 through an intermediate gear 35.

The movement of the clutch member 30 into engagement with the clutch element 27 is effected by the actuation of a cam lever 36 which has one end mounted upon an outer sleeve 37 and operatively connected thereto by lugs 38 of a collar 39, which is fixed upon the sleeve 37, disposed in relatively large slots or recesses 40 in the lever 36. An inner sleeve 41 is disposed within the outer sleeve 37 concentric with a rocker shaft 42 and is operatively connected to the outer sleeve 37 by a helical spring 43 and to the shaft 42 by a pin 44. One end of the spring 43 is fixed to an annular flange 45, which is integral with the

inner sleeve 41 and disposed at the inner end thereof, and the other end of the spring extends through a lug 46 of the outer sleeve 37. A yoke 47 is rigidly mounted upon the inner end of the rocker shaft 42 and is operatively connected to the body portion 48 of the clutch members 29 and 30 by pins 49 which are carried by the body portion 48.

The free end of the actuating lever 36 is provided with a cam roller 51 which rides upon the circular cam 52. A rotative motion is imparted to the cam 52 by the operative connection of the shaft 53, upon which the cam is mounted, with a drive shaft 54 through a sprocket and chain connection 55.

A spring 57 has one end connected to a lug 46 and the other end fixed to a stationary arm 58 so as to normally rotate the shaft 42 in a clockwise direction (Fig. 2). Disposed beneath the lug 46 and arranged to engage therewith, so as to hold the lug and its cooperating parts in a predetermined position, is a latch 59 which is movable vertically in bearings 60 and 61 and which is normally moved upwardly by a spring 62, which is disposed concentric with the latch 59 between the bearings 61 and the collar 63, the latter being pinned to the latch. A releasing cam lever 64 is pivotally mounted upon a shaft 65 and has a cam roller 66 which rides upon a rotating cam 67 provided with a raised portion 68, the cam 67 being mounted upon and fixed to the shaft 54. The forked arm 69 is keyed to the shaft 65 and arranged to straddle the latch 59 so that the arcuate shaped ends thereof rest upon a collar 63.

The material transferring mechanism consists of a transfer arm 70 which has an article receiving and retaining unit 71 carried by one end thereof, while the other end is fixedly mounted upon one end of a rocking and reciprocating shaft 72 which is movably mounted in bearings 73. Mounted upon the other end of the shaft 72 is a rocking yoke 74, the forks of which straddle a relatively long pin 75, which is carried by one end of the rocking cam lever 76 pivotally mounted at 77 and provided at the other end with a cam roller 78 which is disposed in engagement with a rocking cam 79, the latter being mounted upon the shaft 54. By this mechanism a rocking movement is imparted to the transfer arm 70. The rocking cam 79 is so formed in its general contour that intermittent rocking movements are imparted to the transfer arm and the transfer arm is held at rest in predetermined positions for a purpose hereinafter described.

A lateral movement is imparted to the transfer arm 70 by a rocking movement of a bell crank cam lever 81 which is pivotally mounted at 82 and has one end forked so as to straddle a collar 83, which is mounted upon the shaft 72, and operatively connected thereto by inwardly extending pins 84. The other end of the lever 81 has rotatably carried thereby a cam roller 85 arranged to ride upon a peripheral edge of a cam 86 which is mounted upon the shaft 54. The general contour of the cams 79 and 86 will be hereinafter described.

The article receiving and retaining unit 71 consists of a chuck 87 having a longitudinally extending aperture 88, the inner end thereof being shaped to conform to the article of manufacture, which in the present instance is hexagonal in general contour. A bearing 89 is disposed in the outer end of the transfer arm 70 for rotatably receiving the chuck 87 when held in its outermost position; that is, toward the work, by a resilient spring member 90 and is provided with spaced stop members 91 which are arranged to engage with stop pins 92 disposed in spaced positions in the chuck 87 for holding the chuck against rotation when in the innermost position. A knockout plunger 93 is disposed in the aperture 88 for moving the part, or article of manufacture, out of the aperture when the plunger 93 is moved inwardly due to its engagement with a knockout arm 94 against the tension of a spring 95. The plunger 93 is limited in its outer movement by a pin 96 which is carried by the chuck 87. The knockout arm 94 is adjustably carried by a stop arm 97 which is for a purpose hereinafter described.

A cam plate 98 which is arcuate shaped in general contour is rigidly mounted upon an upright frame portion 100 and has one end disposed adjacent a work receiving and rotating unit 101. Apertures 102 and 103 are provided in cam plate 98 for receiving spring pressed collars 104 and 105 respectively which are normally held within the apertures so that their outer surfaces will be flush with the outer surface of the cam plate 98. The collar 104 is provided with an aperture 106 arranged to receive a countersinking tool 107 which is secured to the adjacent end of the driven shaft 31, while the collar 105 is provided with an aperture 108 arranged to receive a tapping tool 109. The tool 109 is disposed in the outer end of the spindle 110 which is movable longitudinally in and rotatable with a casing 111. The connection between the spindle 110 and the casing 111 consists of spaced spherical or ball members 112, which are held against movement relative to each other by a collar 113 provided with spaced apertures adapted to receive the spherical members, and which are receivable in spaced longitudinally extending grooves 114 in the casing 111 and spaced longitudinally extending grooves 115 in the spindle 110, these grooves being arcuate shaped in cross section. Casing 111 is rotatably disposed in a bearing 116 in the upright frame portion 110 and is mounted upon the adjacent end of the stop shaft 28.

The apparatus shown in Fig. 8, which is effective prior to the performance of the additional operations upon the article, consists of a turret 140, which is actuated intermittently by a power means (not shown), and which is adapted to be moved relative to the rotating unit 101 to perform its desired operations. A stop member 141 is carried by the turret 140 and is adapted to be disposed in general alignment with the rotating unit 101 so as to limit the movement of the stock of material as it is moved forwardly therethrough. A centering tool 142 is carried by the turret 140 and is adapted to be disposed in engagement with the end of the material in the rotating unit 101 so as to provide a center for a drilling tool 143 which is also carried by the turret 140 and arranged to drill an opening in the end of the material. A slotting tool 144 is also carried by the turret and is operatively connected to the power means (not shown), for cutting the slot in the end of the material.

From the foregoing description of the various parts of the apparatus, the operation thereof will be more clearly understood. After the material has been moved forwardly, the predetermined distance governed by the stop member 141, received the centering operation with the centering tool 142, and received the drilling and slotting operations by the drilling tool 143 and the slotting tool 144 respectively, the portion of the material free of the revolving unit 101 is served therefrom. As the portions are severed from the material by a cutting tool 117, the transfer arm 70 is positioned adjacent the rotating unit 101 so that the aperture 88 of the receiving unit 71 would be in general alignment with the material for receiving the severed portions. The unit 71, while in this position, is free to rotate with the material and in this manner the unit is allowed to receive the end of the material before it is severed from the main body thereof.

After the portion or article is severed, a counterclockwise motion is imparted to the transfer arm 70 (Fig. 4), thus moving the article along the cam plate 98 to a position in engagement with the collar 104 adjacent the aperture 106. During the movement of the article into this position the engagement thereof with the cam plate 98 forces the article into the chuck 87 so that the circular reduced portion of the article will be received in the circular portion of the aperture 88 and the hexagonal portion of the article will be received in the hexagonal portion of the aperture 88 of the chuck 87. This swinging movement of the transfer arm 70 is brought about by the roller 78 of the rocking cam lever 76 riding upon the lifting portion 118 of the cam 79, thus moving the lever 76 above its pivot 77 and rotating the shaft 72 in a counterclockwise direction due to the operative engagement of the shaft 72 with the lever 76; namely, the yoke 74 and the pin 75. As the transfer arm 70 is rigidly mounted upon the shaft 72, any motion imparted to the shaft 72 will also be imparted to the transfer arm 70. The transfer arm 70 and unit 71 will be held against a lateral swinging movement at this position while the roller 78 rides upon the cam surface 119. However, during the rest of the transfer arm against a lateral swinging movement, an inward movement is imparted thereto so as to move the article into operative engagement with the countersinking tool 107 and to move the spring pressed collar 104 inwardly. The purpose of the spring pressed collar 104 is to hold the stop pins 92 into engagement with the stop members 91 and thus hold the chuck against rotation. This inward movement of the transfer arm, together with the cooperating parts for moving the article into engagement with the countersinking tool, is imparted thereto by its operative engagement with the cam 86, which when rotated, moves the cam roller 85 upwardly over the lifting surface 120, thus swinging the lever 81 about its pivot 82 and moving the shaft 72 together with the transfer arm 70 inwardly. The countersinking tool 107 is continuously rotated as heretofore described.

The article is then moved away from the countersinking member 107 while the transfer arm, and the cooperating parts for holding the article, remain in the rest position against swinging movement during the movement of the roller 85 over the cam surface 121 of the cam 86. The exposed surface of the article is again disposed flush with the engaging surface of the cam 98 and is next moved along the engaging surface and into engagement with the collar 105 adjacent the aperture 108. This movement is imparted to the article by the continued rotation of the cam 79 causing the cam roller 78 to ride up the lifting surface 122 to the cam surface 123 and by this movement a further rocking movement is imparted to the lever 76 about its pivot 77 so as to rock the shaft 72 and the transfer arm 70 in a counterclockwise direction. The article is held against swinging movement at this position but is moved inwardly into engagement with the tapping tool 109 during the movement of the roller 85 over the cam surface 124 of the cam 86.

Prior to the engagement of the article with the tapping tool 109, the cam lever 36 is actuated due to the engagement of the cam roller 51 with the lifting portion 125 of the cam 52 so as to move the clutch member 30 into operative engagement with the clutch socket 27, thus operatively connecting the stub shaft 28 with the power means (not shown), through the driven sleeve 17 and rotating

the casing 111 (Figs. 2 and 6). A rotation of the casing 111 will impart a rotative movement to the spindle 110 due to the operative engagement therewith through the spherical members 112 thus imparting a rotative movement to the tapping tool 109. This rotation of the tapping tool 109 and its cooperating rotating members is in a counterclockwise direction, thus causing the tapping tool 109 to cut threads in the article. This operative engagement of the spindle 110 with the casing 111 allows the spindle to move relative to the casing so that the tapping tool 109 may move relative to the article as it is drawn therein by the tapping thereof. When the tapping tool has moved a predetermined distance relative to the article, the releasing cam lever 64 will be actuated during the movement of the cam roller 66 over the raised portion 68 of the cam 67 thus moving the latch 59 downwardly against the tension of the spring 62 and releasing the lug 46, allowing the spring 57 together with the spring 43 to rotate the outer sleeve 37, the inner sleeve 41 and the shaft 42, thus moving the clutch member 30 out of engagement with the clutch socket 26 so as to operatively connect the stub shaft 28 with the driven sleeve 20.

The driven sleeve 20, due to its operative connection with the drive sleeve 17, through the gears 19, 35 and 32, the shaft 31 and the gears 33 and 25, will be rotated in a clockwise direction, thus imparting a similar rotative movement to the tapping tool 109 through the casing 111 and the spindle 115. During this movement of the tapping tool 109 in a clockwise direction, a spring 126 which is disposed concentric with the spindle 110 will move the tapping tool out of the article as it is freed by the threaded connection. During this outer movement of the tapping tool 109, the cam roller 85 is moving over the cam surface 127 of the cam 86, thus gradually moving the article outwardly. After the article is free from the tapping tool 109 and before the transfer arm is again moved into the receiving position, the cam roller 85 is allowed to pass over the cam surface 128 of the cam 86, thus moving the transfer arm 70 so that the knockout plunger 93 will engage with the knockout arm 94, thus moving the plunger relative to the clutch 87 so as to force the article therefrom and allow the article to drop into the chute 129 where it is directed into a receptacle (not shown).

The transfer arm 70 and the unit 71 are then moved into the receiving position adjacent the rotating unit 101 as the cam roller 78 rides over the cam surface 130 of the cam 79 and the cam roller 85 rides over the cam surface 131 of the cam 86. The chuck 87 is held in its outwardly rotatable position as it is moved in to receive the next portion which is to be severed from the material during the movement of the cam roller 85 over the cam surface 132 of the cam 86.

During the operation of this apparatus the chuck 87 is moved in to receive the article, which is severed from the material, and allowed to rotate during the severing operation, after which it is moved with the article along the outer surface of the cam 98 where the article is forced more firmly into the chuck and the chuck is moved relative to the transfer arm 70 so as to move the stop pins 92 adjacent the stop members 91 for locking the clutch 87 against rotative movement. In this manner the article is held against rotation as it is moved with the spring pressed collar 104 to receive the countersinking operation and subsequently moved into engagement with the tapping member 109 for the tapping operation. The various movements imparted to the article are effected by the rotation of the cams 79 and 86 for actuating, at predetermined periods of time, the mechanism for operatively connecting these cams with the transfer arm. Furthermore, adjustable stop members (Fig. 4) are provided for assuring correct positions of the transfer arm 70. An adjustable stop 133 is carried by the transfer arm 70 and arranged to engage with the stationary stop plate 134 for aligning the aperture 88 of the chuck 87 with the material in the rotating unit 101. An adjustable stop member 135 is carried by the transfer arm 70 and arranged to engage with the stop arm 97 for aligning the article in the chuck 87 with the aperture 106 in the collar 104, and a stop member 136 is adjustably carried by the transfer arm 70 and arranged to engage with the stop arm 97 for aligning the article in the chuck 87 with the aperture 108 in the collar 105.

In Fig. 9 the perspective view of the article 137 is shown illustrating the countersunk portion at 138 and a tapped opening at 139. These operations are completed with the apparatus subsequent to the other forming operations, while these other forming operations are being made upon the body of material in the rotating unit 101 so that the next article will be ready to be severed from the material when the chuck 87 is disposed in engagement therewith.

Although the invention has herein been described in connection with one particular type of article and two specifically disclosed operations, it is to be understood that the invention may be applied to different articles for completing different operations without departing from the spirit and scope of the invention.

What is claimed is:

1. In a material working apparatus, a transfer arm, means for holding material carried by said transfer arm, a cam member, means for swinging said transfer arm for

moving said material holding member relative to said cam member whereby the material may be moved into said material holding member, a processing member, a collar for said processing member disposed in said cam member, and means for imparting a lateral movement to said transfer arm for moving said material holding member and the material with said collar to move the material into engagement with said processing member.

2. In a material working apparatus, means for holding material, means whereby said material holding means may be rotated with said material, a cam member, means for moving said material holding member relative to said cam member for locking said material holding member against rotation, a processing member, a spring pressed collar for said processing member, means for moving said material holding member and the material with said collar for moving the material into engagement of said processing member.

3. In a material working apparatus, means for holding material, means whereby said material holding means may be rotated with said material, a cam member, means for moving said material holding member relative to said cam member for locking said material holding member against rotation, a processing member, a spring pressed collar for said processing member, means for moving said material holding member and the material with said collar for moving the material into engagement of said processing member, and means for removing the material from said material holding member.

4. In a material working apparatus, means for holding material, a processing member, power means for rotating said processing member, means for operatively connecting said power means with said processing member whereby said processing member may be rotated in one direction relative to the material, means for locking the operative engagement of the power means with said processing member, means for releasing said locking means, and means whereby said power means may be operatively connected to said processing member for rotating said processing member in the opposite direction.

5. In a material working apparatus, a chuck for receiving material while rotating, means for rotatably supporting said chuck, a stop member carried by said supporting member for holding said chuck and material against rotation, a processing member, and means for moving said chuck in the direction of its axis while held against rotation to bring the material into engagement with said processing member.

6. In a material working apparatus, a chuck for receiving material while rotating, means for supporting said chuck, a stop member carried by said supporting means, a cam, means for moving said material in engagement with said cam for moving said chuck into engagement with said stop member for holding said chuck against rotation, a processing member, and means for moving the material into engagement with said processing member.

7. In a material working apparatus, a chuck for receiving material while rotating, means for supporting said chuck, a stop member carried by said supporting member, a cam, means for moving the material into engagement with said cam for holding the material in said chuck and for moving said chuck into engagement with said stop member for holding said chuck and the material against rotation, a processing member, and means for moving the material into engagement with said processing member.

8. In a material working apparatus, a chuck for receiving material while rotating, means for supporting said chuck, a stop member carried by said supporting member, a cam, means for moving the material relative to said cam for moving said chuck into engagement with said stop member for holding said chuck against rotation, a processing member, and resilient means disposed adjacent said processing member for holding said chuck in engagement with said stop member during the actuation of said processing member for processing the material.

9. In a material working apparatus, a chuck for receiving material while rotating, means for supporting said chuck, a stop member carried by said supporting means, a processing member, and resilient means disposed adjacent said processing member for moving said chuck into engagement with said stop member for holding said chuck and the material against rotation during the actuation of said processing member in engagement with said material.

10. In a material working apparatus, a chuck for receiving material, a transfer arm for supporting said chuck, a plurality of processing members, a positioning member, means for moving said transfer arm for moving the material toward said processing members, and means carried by said transfer arm for engaging said positioning member for positioning the material in proper alignment with said processing members.

11. In a material working apparatus, a chuck for receiving material while rotating, means for supporting said chuck, a stop member carried by said chuck, a cam having an aperture therein, means for moving the material into engagement with said cam for moving the chuck into engagement with said stop member for holding the chuck against rotation, a processing member, a resilient member disposed in the aperture in said cam for holding the chuck in engagement with

said stop member during movement of the material toward said processing member, and means for moving the material into engagement with said processing member.

12. In a material working apparatus, means for holding the material, a processing member, power means for rotating said processing member, means for operatively connecting said power means with said processing member whereby said processing member may be rotated in one direction relative to the material, means for locking the operative engagement of the power means with said processing member, means for releasing the locking means whereby said power means may be operatively connected to said processing member for rotating said processing member in the opposite direction, and yieldable means included in the means for operatively connecting said power means with said processing member for permitting longitudinal movement of said processing member.

13. In a material working apparatus, a chuck for receiving materal, means for moving said chuck in one direction, an apertured cam positioned to engage the material in said chuck while being moved, a processing member having a movable portion disposed in the aperture of said cam for engaging the material in said chuck, and means for moving said chuck in another direction for moving the material with said movable portion to move the material into effective engagement with said processing member.

14. In a material working apparatus, a cam having an aperture therein, a resilient means disposed in said aperture and movable relative to said cam, a chuck for receiving material while rotating, means for moving said chuck relative to said cam with the material in said chuck engaging said cam, means for holding said chuck against rotation, a processing member positioned adjacent said resilient means, and means for moving said chuck with the material to move the material into engagement with said processing member.

15. In a material working apparatus, a chuck for receiving material, means for rotatably supporting said chuck, a cam for moving said chuck relative to said supporting means, means for holding said chuck against rotation when moved by said cam, a processing member, means for moving said supporting means for moving said chuck with the material to move the material into engagement with said processing means, and means for maintaining said holding means effective.

In witness whereof, I hereunto subscribe my name this 29th day of January A. D., 1930.

ROY J. BEAVERS.