April 15, 1941. G. F. JOHNSON 2,238,328

CHUCKLESS TURNING MACHINE

Filed Dec. 4, 1939 5 Sheets-Sheet 1

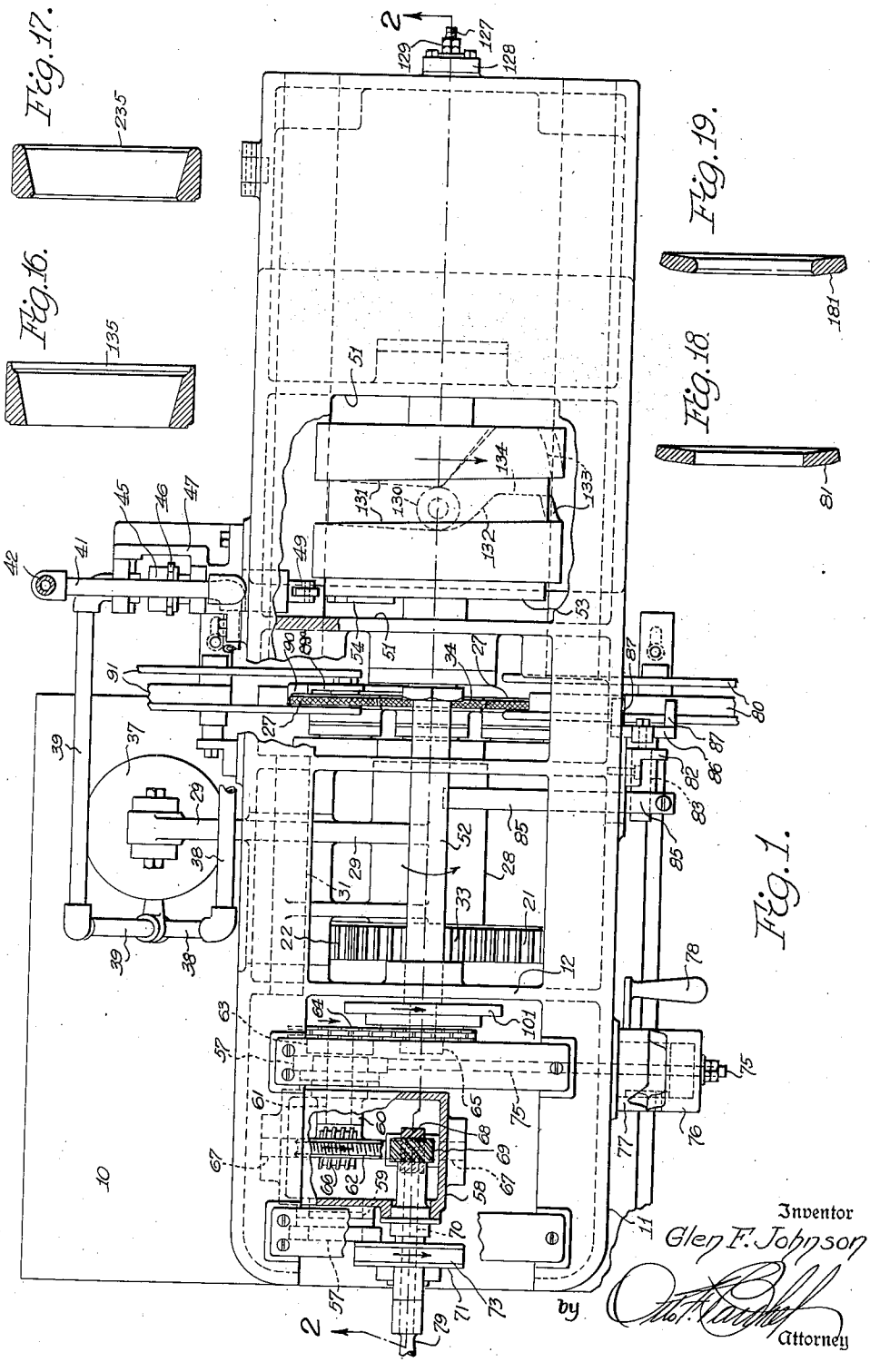


Fig. 1.

Fig. 17.

Fig. 16.

Fig. 19.

Fig. 18.

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April 15, 1941. G. F. JOHNSON 2,238,328

CHUCKLESS TURNING MACHINE

Filed Dec. 4, 1939 5 Sheets-Sheet 2

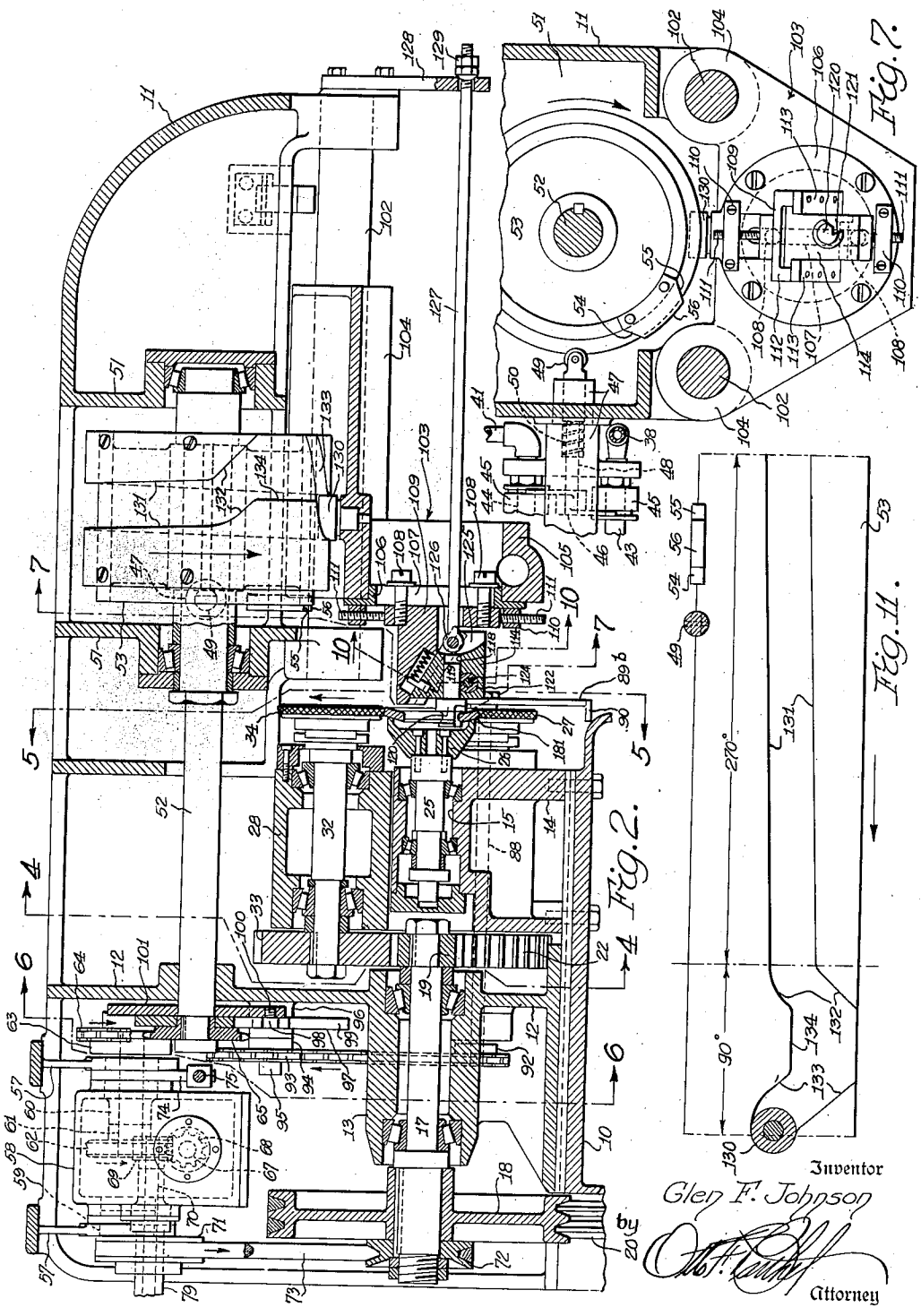


Fig. 2.

Fig. 11.

Fig. 7.

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CHUCKLESS TURNING MACHINE

Filed Dec. 4, 1939 5 Sheets-Sheet 3

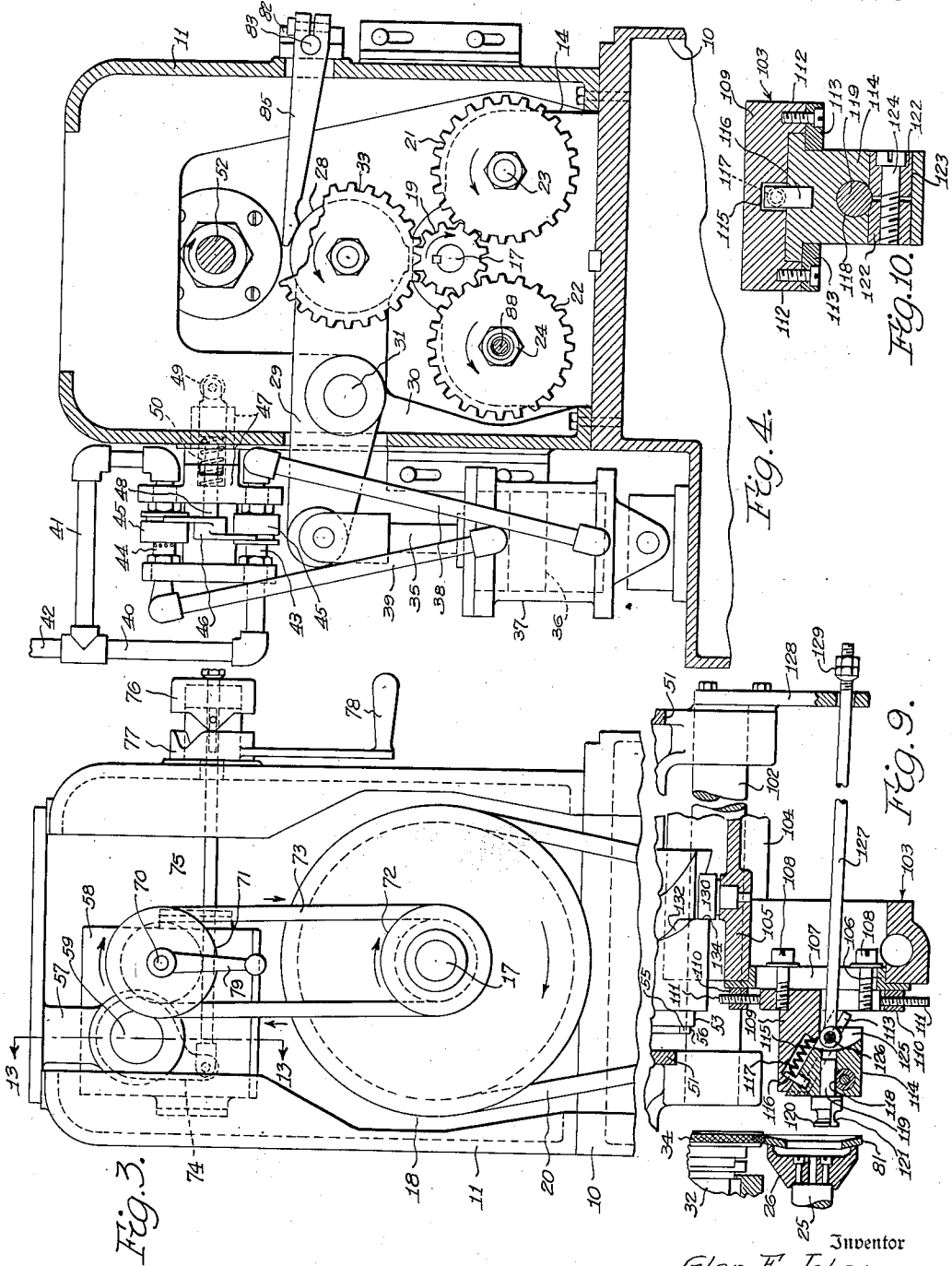


Fig. 4.

Fig. 10.

Fig. 9.

Fig. 3.

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April 15, 1941. G. F. JOHNSON 2,238,328

CHUCKLESS TURNING MACHINE

Filed Dec. 4, 1939 5 Sheets-Sheet 4

Fig. 6.

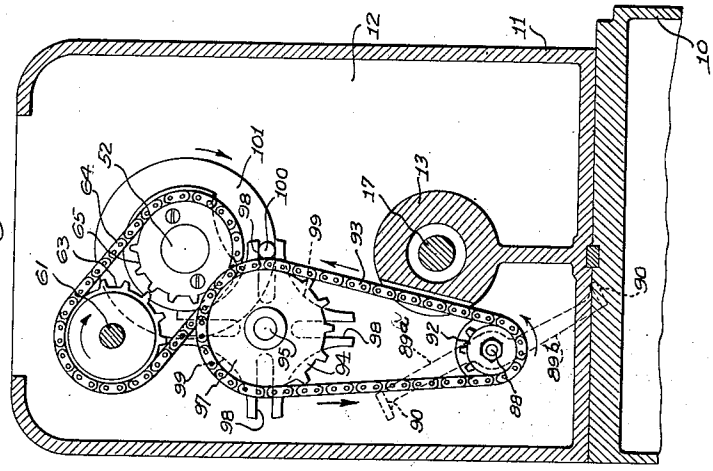


Fig. 5.

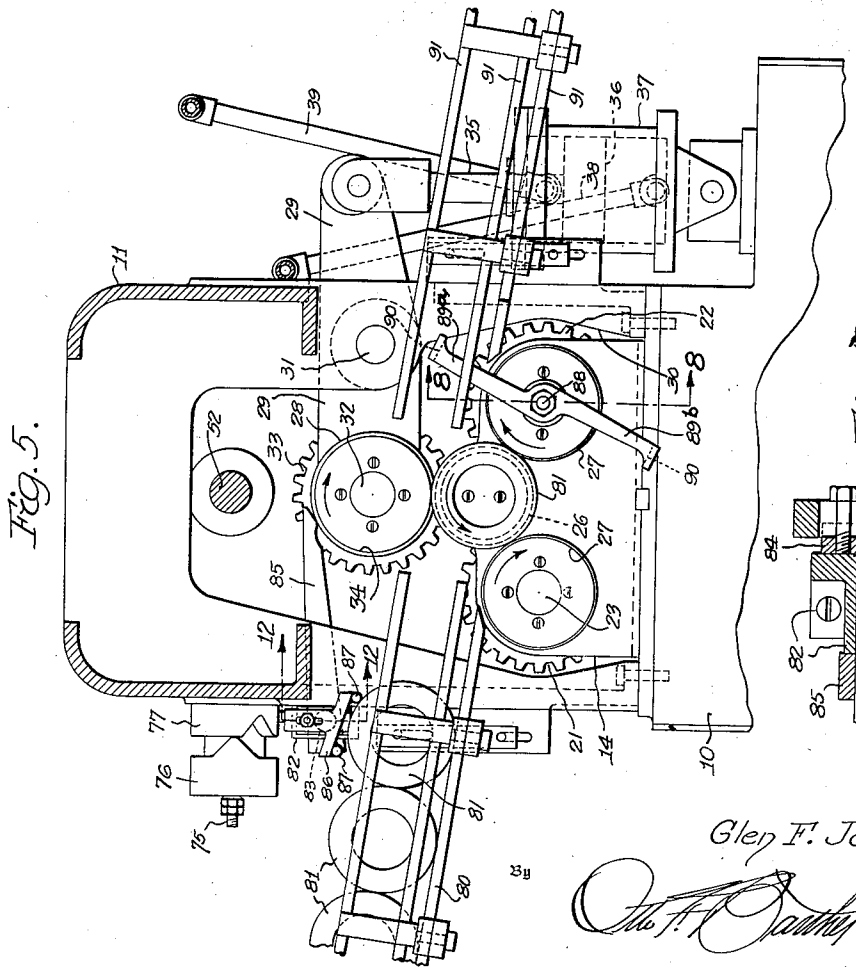
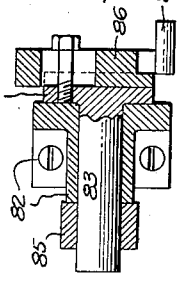


Fig. 12.



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April 15, 1941. G. F. JOHNSON 2,238,328

CHUCKLESS TURNING MACHINE

Filed Dec. 4, 1939 5 Sheets-Sheet 5

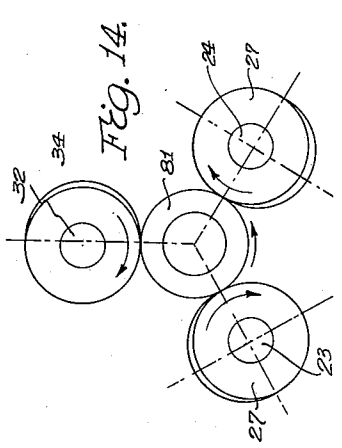


Fig. 14.

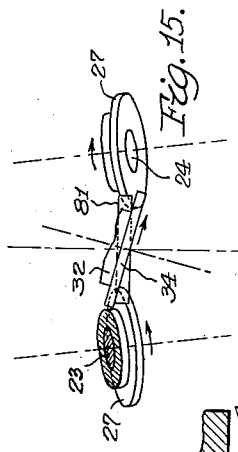


Fig. 15.

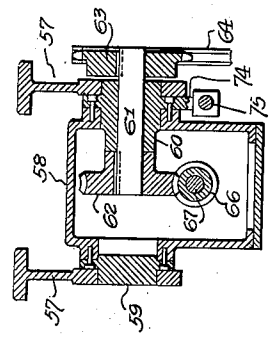


Fig. 13.

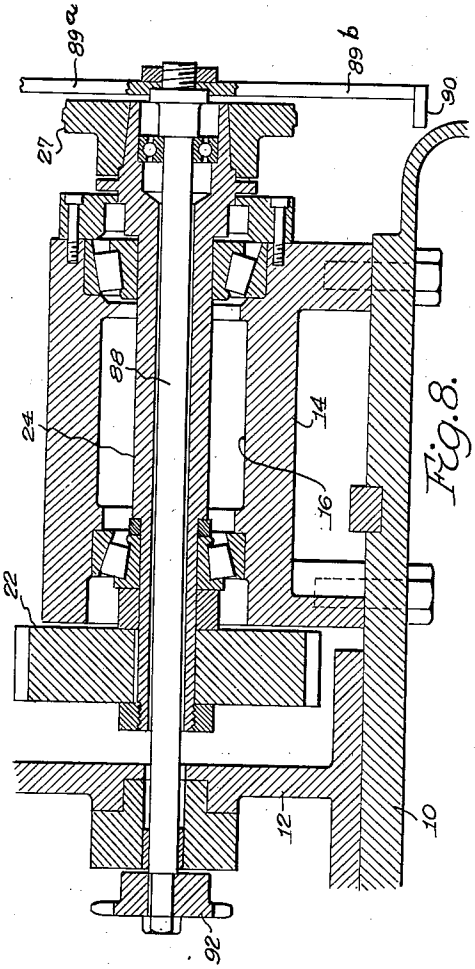


Fig. 8.

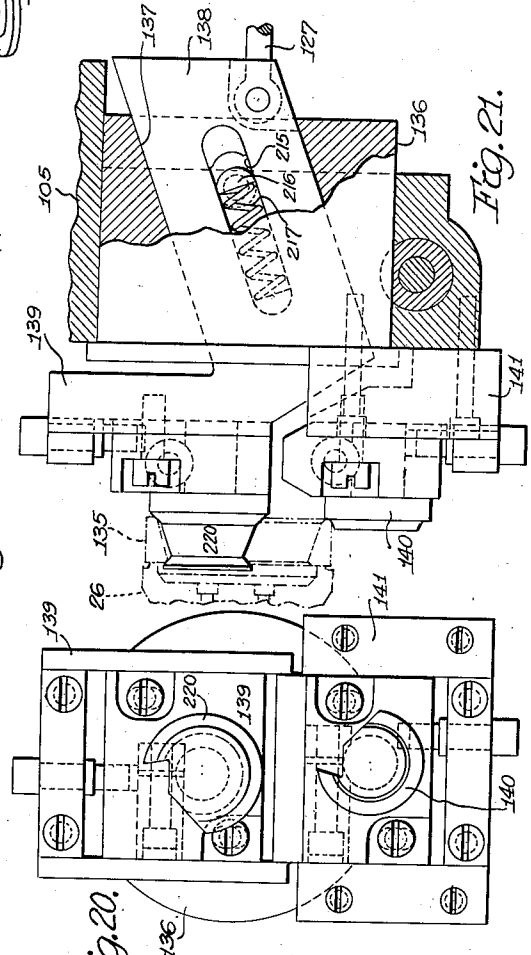


Fig. 21.

Fig. 20.

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Patented Apr. 15, 1941 2,238,328

UNITED STATES PATENT OFFICE

2,238,328

CHUCKLESS TURNING MACHINE

Glen F. Johnson, Detroit, Mich., assignor to Bower Roller Bearing Company, Detroit, Mich., a corporation of Michigan

Application December 4, 1939, Serial No. 307,399

20 Claims. (Cl. 82—2)

This invention relates, in general, to turning machines and, in particular, to a new and improved turning machine of the centerless or chuckless type.

One of the objects of this invention is to minimize the number of parts necessary for a machine of the above class and type and to improve their inter-relationship so as to maximize their operating efficiencies.

Another object is to provide a new and improved machine of the above class and type wherein the mechanism for feeding the work onto the support therefor is controlled by the mechanism for holding said work on said support and for permitting its release therefrom, whereby the possibility of said work jamming said latter mechanism is eliminated.

Another object is to provide a machine for the purposes hereinafter described with a new and improved work feed mechanism which operates exclusively in response to the operation of the work holding mechanism.

Another object is to provide a machine for the purposes hereinafter described with a new and improved work holding mechanism which operates, in addition to holding the work in place on its support, to control the work feed mechanism.

Another object is to provide a new and improved tool supporting structure for a machine capable of supporting a work piece which is reciprocable toward and from the piece along a pair of rectilinear paths which are normal to each other and the reciprocation along one of which paths determines and controls the reciprocation along the other of which paths, whereby tool operation is improved and simplified over that at present well known and in practice.

Another object is to provide a new and improved tool supporting structure for a machine capable of supporting a work piece which is simpler in construction and more efficient in operation than heretofore, readily and easily adjustable and changeable to meet conditions of varying sizes and types of work pieces, and operable over long periods without necessity for care, attention, adjustment or repair.

Another object is to provide a turning machine with a new and improved work discharging mechanism the operation of which depends upon and responds to the operation of the tool supporting mechanism whereby jamming between the tool and the finished work, in the removal of the latter from the machine, is impossible and wherein the parts of said work discharging mechanism are minimized in number and more efficiently inter-arranged with respect to each other as well as with respect to the parts comprising said tool supporting mechanism.

Another object is to provide a machine having a tool movable rectilinearly into and out of engagement with the work with a new and improved mechanism for discharging the finished work from the machine which is controlled by the tool movement and operated exclusively by, upon and responsive to the disengagement of the tool and work.

Another object is to provide a new and improved turning machine which has a rectilinearly movable tool the operation of which is either automatic or manual and the change-over from one to the other of which types of operation may be made speedily and selectively.

Other objects and advantages of the invention will become readily apparent from a reference to the following specification taken in conjunction with the accompanying drawings of which there are five (5) sheets and wherein:

Figure 1 is a plan view of the machine hereinafter described, same being shown partly broken away and in section to illustrate more clearly some of the details of its construction;

Fig. 2 is a longitudinal, vertical section taken along the lines 2—2 in Fig. 1 and showing the tool supporting structure of the machine in its operative position;

Fig. 3 is an elevational view of the left end of the machine as it is shown in Fig. 1;

Figs. 4, 5, 6 and 7 are sections taken along the lines 4—4, 5—5, 6—6 and 7—7, respectively, in Fig. 2;

Fig. 8 is a section taken along the lines 8—8 in Fig. 5;

Fig. 9 is a view similar to Fig. 2 but showing the tool supporting structure of the machine in its inoperative position;

Fig. 10 is a section taken along the lines 10—10 in Fig. 2;

Fig. 11 is a development of the peripheral surface of the cam for driving the tool and its supporting structure, said figure showing said cam and its follower in the same relative positions as they are shown in Figs. 1 and 2 and also showing the pressure roll cam and its follower in their true positions with respect to each other and to said first cam and follower;

Figs. 12 and 13 are sections taken, respectively, along the lines 12—12 and 13—13 in Figs. 5 and 3;

Figs. 14 and 15 are schematic views, taken 90° apart, of the arrangement of the work and the driving and pressure rollers therefor and showing the preferred angularity between the shafts carrying said rollers;

Figs. 16 and 17 are sections of unfinished and finished work, respectively, for which the machine herein disclosed and hereinafter described may readily be made adaptable;

Figs. 18 and 19 are sections similar to Figs. 16 and 17 but of a different type of work which is particularly adapted for the tool supporting structure in the machine shown in the figures already defined;

Fig. 20 is an elevational view of the working or front end of a modified form of tool supporting structure particularly adapted for working the work shown in Fig. 16 into the form shown in Fig. 17; and

Fig. 21 is a view taken longitudinally through the structure shown in Fig. 20 and being partly broken away and in section to set forth more clearly some of the details of its construction.

The body of the machine shown herein and to be described hereafter comprises a super-structure consisting of a base **10** and an elongated casing **11** rigidly and stationarily supported thereon. Integral with the internal walls of the casing **11**, near one end of the latter, there is a transverse, vertical wall **12** which has formed thereon a hollow boss **13** extending horizontally from each side thereof. In adjacency to the wall **12** there is fixedly mounted to the lower inner wall of the casing **11** an upstanding bearing support **14** formed with a central bore **15** in coaxial alignment with the bore in the boss **13** and with a bore **16** on each side of said bore **15** and slightly therebelow, the axes of the bores **16** being slightly out of parallelism with each other and with the axis of said bore **15** for reasons which will presently appear.

In the bore of the hollow boss **13** there is rotatably mounted, within suitable bearings provided therefor, a shaft **17** on the outer end of which is keyed for rotation therewith a pulley **18** and on the inner end of which is keyed for rotation therewith a pinion **19**, said shaft being rotatably driven about its axis by means such as a belt **20** inter-engaging said pulley and another pulley (not shown) carried on the drive shaft (not shown) of a source of rotary power (not shown) disposed below the casing **11** within the base **10**. The pinion **19** is in constant, simultaneous, driving mesh with a pair of gears **21** and **22**, said gear **21** being keyed to for rotation with a shaft **23** rotatably mounted in suitable bearings provided therefor within one of the bores **16**, and said gear **22** being keyed to for rotation with a shaft **24** rotatably mounted in suitable bearings provided therefor within the other bore **16**. An idler shaft **25** is rotatably mounted in suitable bearings provided therefor within the bore **15** which is arranged intermediate the bores **16** and slightly thereabove, said shaft having fixed to for rotation with the end thereof opposite the end adjacent the boss **13** an annular, cup-shaped backing member **26**, while each of the shafts **23** and **24** has fixed thereto for rotation therewith, slightly ahead of said backing member, a knurled, work-driving roller **27**. The driving rollers **27** and the idle backing member **26** are so spaced with respect to each other that an annular work piece, which is to be presently described, is supportable upon said rollers and against said backing member with the axis of said work piece in alignment with the axis of said backing member.

Above the bearing support **14** within the casing **11** there is arranged a hollow boss **28** which is supported for pivotal movement toward and from said support **14** by means of a lever **29** which is integral at one end with said boss and pivoted to an interior web **30** of said casing by means of a pin **31**. A shaft **32** is rotatably carried within the boss **28** in suitable bearings provided therefor and its axis is slightly out of parallelism with the axis of the idler shaft **25** and with the non-parallel shafts **23** and **24**, said shaft **32** fixedly carrying on one of its ends for rotation therewith a gear **33** normally in mesh with the pinion **19** and fixedly carrying on the other of its ends for rotation therewith a knurled pressure roller **34** in normal engagement with the work piece being supported by the driving rollers **27** and the backing member **26**. With a work piece in place on the rollers **27** and against the backing member **26** and with the roller **34** in lowered and pressing position upon the piece the latter will be rotated by these unidirectionally moving rollers **27** and **34** in a direction oppositely thereto and about an axis aligned with the axis of the shaft **25**. As is described in my co-pending application, Serial No. 273,308, filed May 12, 1939, and entitled Method of and apparatus for honing roller bearing cup members, and as is shown in Figs. 14 and 15 herein, the shafts **23**, **24** and **32** are preferably angularized with respect to each other so that the rollers carried thereon produce a wiping action upon the periphery of the work piece being rotated thereby and cause the drawing of said piece into firm contact with the backing member **26**.

The lever **29** which is pivoted at **31** and is also an integral part of the boss **28** carrying the pressure roller shaft **32** extends outwardly through the rear of the casing **11** and is pivotally connected at its free end to one end of a connecting rod **35**, the other end of said rod being connected to a double-acting piston **36** reciprocably mounted within a closed cylinder block **37** therefor anchored to the base **10** rearwardly of said casing. Connected to the cylinder **37** on opposite sides of the piston **36** is a pair of pipes **38** and **39** which, in turn, communicate with another pair of pipes **40** and **41**, respectively, leading into a single supply pipe **42** connected to a source (not shown) of compressed air, steam or other high pressure fluid. Connecting the pipe **38** to the pipe **40** and the pipe **39** to the pipe **41** is a pair of pipes **43** and **44** respectively, one of which is perforated at one of its end portions and the other of which is perforated at the end portion thereof opposite said first end portion, and each of said pipes **43** and **44** having arranged thereon a reciprocable sleeve **45**. The two sleeves **45** are unitarily movable along their respective pipes **43** and **44** by means of a fork **46** interconnecting same, and it is seen, particularly in Fig. 4, that movement of said sleeves in one direction along said pipes opens the perforations in one of said pipes to the atmosphere while the perforations in the other of said pipes are simultaneously closed to the atmosphere, and that movement of said sleeves along said pipes in the opposite direction effectuates the reverse conditions with respect to the perforations in said pipes. In other words, looking at Fig. 4, the sleeves **45** are in such position that the perforations in pipe **44** are exposed and the perforations in pipe **43** are covered. This means that the fluid pressure in the pipe **41** is dissipated through the perforations in the pipe **44** and has, therefore, no effect upon

the piston 36 through the pipe 39, but that the pressure in the pipe 40 is transmitted through the closed pipe 43 and the pipe 38 into the cylinder 37 to raise said piston and thereby actuate the lever 29 about the pin 31 to lower the shaft 32 and the pressure roller 34 carried thereon relatively to the driving rollers 27, as shown in Fig. 4. On the other hand, if the sleeves 45 are moved by the fork 46 toward the left from that position thereof shown in Fig. 4, the perforations in the pipe 44 will become covered and those in the pipe 43 will become exposed, in which event the pressure in the cylinder 37 below the piston 36 and in the pipe 38 will be dissipated through the exposed perforations in the pipe 43, and the pressure in the pipe 41 will be transmitted past the closed perforations in the pipe 44, through the pipe 39 and into the upper end of said cylinder to force said piston downwardly and cause the reverse actuation of the lever 29 and the raising of the shaft 32 and the roller 34 relatively to the rollers 27.

Considering Figs. 4 and 5 momentarily, wherein the lever 29 has positioned the pressure roller 34 firmly against the work piece to be worked and the gear 33 in driven engagement with the pinion 19, it will be seen that said work piece is positively rotated about its axis from no less than three simultaneously existing sources of driving power, namely, the two driving rollers 27 and said pressure roller 34 which are unidirectionally rotated under the driving force of said pinion 19 which is transmitted to the gears 21 and 22 and said gear 33. The driving engagement between the pinion 19 and gear 33 must, of course, concur with the pressure engagement between the roller 34 and the work piece, but it is clearly not mechanically essential that the pitch diameters of said pinion and said gear be tangent in order that there be a driving relationship therebetween. As a matter of fact, though Fig. 4, purely for illustrative purposes, shows the above mentioned pitch diameters tangent, a slight spacing therebetween is highly desirable and in no sense detrimental to the driving force of the pinion 19 with respect to the gear 33 for it enables the pressure engagement between the roller 34 and the work piece to be established and maintained even when the former is in a worn condition. In other words, since the gear 33 and the roller 34 arcuately move unitarily with the lever 29 to interengage said gear with the pinion 19 and said roller with the work piece, and since the movement of said lever is limited for all practical purposes to the establishment of a pressure contact between said roller and said work piece, the existence of a spacing between the pitch diameters of said gear and said pinion, when said pressure contact is established, permits the self-adjustment of the pressure between said roller and said work piece under conditions when said roller is worn or otherwise slightly undersized.

As shown in Figs. 1, 4 and 7, a support 47 is employed for rigidifying the piping assembly previously outlined and this support is rigidly attached to and extends into the casing 11 at a position between the perforated or selectively vented pipes 43 and 44, said support reciprocably carrying the stem 48 of a cam follower 49 integral therewith and residing within said casing. The outer end of the stem 48 is fixed to for movement with the fork 46, and telescoped about said stem between the follower 49 and an abutment formed by the stationary support 47 is a spring 50 which tends to hold said fork, stem and follower in the positions thereof shown in Fig. 4, or, in other words, to arrange the valve 44—45 in open position and the valve 43—45 in closed position, under which conditions the pressure on the lower working face of the piston 36 holds the outer end of the lever 29 in raised position and the shaft 32, gear 33 and pressure roller 34 in their lowered, operative positions. It is clear that, when the follower 49 is positioned in opposition to the spring 50, the valve 44—45 will be closed, the valve 43—45 will be open, the pressure in the cylinder 37 will be acting on the upper working face of the piston 36, the outer end of the lever 29 will be lowered, and the shaft-gear-roller 32—33—34 will be raised into inoperative position. The actuating mechanism for the follower 49 is to be described presently.

The upper wall of the casing 11 is interiorly formed with a pair of depending bearing supports 51 disposed on opposite sides of the cam follower 49 and supporting, in suitable bearings therefor, a shaft 52 which extends in parallelism with the shafts 17 and 25 from one of said supports 51 through the other thereof and then through the wall 12 (see Fig. 2 particularly). A drum 53 is carried on the shaft 52 between the supports 51 and is rotatable with said shaft, one end of said drum being adjacent the follower 49 and fixedly carrying at its periphery a cam having a leading end 54, a trailing end 55 and a dwell portion 56 therebetween. As will be seen subsequently, the positioning of the cam 54—55—56 relatively to the drum 53, and the arcuate lengths of each of the three elements of said cam, are predetermined with respect to other matters to be discussed, and it suffices to point out at present that said cam engages, depresses and then releases the follower 49 once per revolution of said drum and thereby provides the control for the valves 43—45 and 44—45 for actuating the piston 36 and governing the operation of the pressure roller 34.

The end of the casing 11 opposite the end supporting the drum 53 has stationarily fixed thereto a pair of spaced, internally depending hangers 57 between which hangers and within which casing there is suspended a second and smaller casing 58 which, as a result, resides in the neighborhood of the free end of the drum shaft 52, such suspension of said casing 58, as shown particularly in Fig. 13, being accomplished by means of a pin 59 pivotally interconnecting one of said hangers and the end of said casing 58 more remote from said shaft and also by means of a hollow boss 60 pivotally interconnecting the other of said hangers and the end of said casing 58 more adjacent said shaft, the axes of said pin and said boss being aligned so that said casing 58 may, under conditions to be explained, be moved thereabout. The boss 60 rotatably carries a shaft 61 to the inner end of which shaft there is keyed for rotation therewith a worm wheel 62 and to the outer end of which shaft there is also keyed for rotation therewith a sprocket 63. In driven engagement with the sprocket 63 is a chain 64, and driven by said chain there is another sprocket 65 which is keyed to for rotation with the free end of the drum shaft 52. The worm wheel 62 on the shaft 61 is in constant driven mesh with a worm 66 formed on a transverse shaft 67 which is journaled for rotation about its axis in the front

and rear walls of the tiltable casing 58, and on said shaft 67 forwardly of said worm 66 there is fixed thereon for rotation therewith a spiral gear 68. In constant driving mesh with the gear 68 there is a spiral 69 mounted for rotation on and with the inner end of a shaft 70 which projects into and is rotatably supported by the casing 58 from without the casing 11, the outer portion of said shaft fixedly carrying a pulley 71. About the pulley 71 which is keyed to the shaft 70 and another pulley 72 which is keyed to the shaft 17 (see Figs. 2 and 3) there is arranged a belt 73 which is driven by the rotation of said shaft 17 for rotating said shaft 70 when the casing 58 is in its normal position, that is, un-tilted.

It is clear from the foregoing that the shaft 52 which carries the drum 53, the rotation of which drum not only controls the lowering and raising of the pressure roller 34 but also has other functions to be presently described, is rotatably empowered by the rotation of the shaft 17 through the consecutive agency of the shafts 70 and 61 which are carried by the casing 58 and are, therefore, tiltably movable therewith, the axis of said shaft 61 being the axis of such tiltability. As seen in Fig. 1, the shaft 61 is well behind the center of the casing 58 while the shaft 70 is well ahead of said center so that, if the lower end of said casing is moved rearwardly about the axis of said shaft 61 (which would also be about the axis of the pin 59), said shaft 70 would be lowered with respect to the shaft 17 and the result would be the discontinuance of the driving force of the belt 73 upon the pulley 71, the drive between the shafts 61 and 52, obviously, not being affected by such casing movement. So, to enable the casing 58 to be moved to effectuate the above results, the shaft-carrying boss 60 (see Fig. 13), which is pivotally supported on one of the hangers 57 and is fixedly attached to said casing, has formed thereon at its lower end and between said casing and said hanger a flange 74 to which is connected the inner end of a rod 75 extending forwardly from said flange through the front of the casing 11. On the outer end of the rod 75 there is fixedly attached a jaw clutch member 76, and freely mounted on said rod between said member and the front wall of the casing 11 is an opposing and mating jaw clutch member 77 provided with a handle 78. The normal position for the clutch 76—77 is disengagement, that is, when the jaw of the member 76 is disengaged from the recess provided therefor in the member 77, for, in this position the rod 75 is outermost and the casing 58, as a result, uppermost and forwardmost and the pulley 71 in driven engagement with the belt 73. To disengage the pulley 71 from the belt 73, the handle 78 on the free clutch member 77 is turned until the jaw on the member 76 is in position for entering the recess in said member 77, whereupon the weight of the casing 58 itself, because of the offset position of the shaft 61 with respect to the center of said casing, will cause said casing to move downwardly and rearwardly about said shaft to disengage said pulley from said belt and draw said jaw into engagement with said recess.

After the shafts 70, 61 and 52 have been disengaged from the drive shaft 17 by means of the engagement of clutch 76—77, it may be desirable to drive the drum 53 manually. For this reason, the outer end of the shaft 70 has fixedly connected thereto a handle 79 whereby said shaft 52 may be rotated through the agency of said shafts 70 and 61 independently of said shaft 17.

A downwardly, transversely extending runway or trough 80 is supported intermediate its ends by the front wall of the casing 11, the inner and lower end of said runway residing directly above and in substantially the same vertical plane as the front driving roller 27 (see Fig. 5), and said runway as a whole being open at its top and preferably adjustable in a vertical direction with respect to said casing. The runway 80 is slightly wider than the axial length of a single work piece, such as a ring blank 81, so as to provide a proper guide therefor into the machine, and is as long as desired so as to support enough pieces to enable the machine to be operated for a reasonable length of time without re-filling said runway. Secured to the front wall of the casing 11, slightly above the runway 80, is a bearing 82 in which there is rotatably supported a horizontal pin 83 one end of which is formed with a head 84 and the other end of which carries one end of a lever 85, said lever rotating with said pin and extending transversely through said casing into permanent resting position upon the top of the movable boss 28. The head 84 of the pin 83 carries for rotation or oscillation therewith an escapement member 86 consisting of a body directly overlying the runway 80 and slanting in the same direction thereas, said body carrying on its under-surface a pair of abutments or stops 87 longitudinally spaced in the direction of the length of said runway. It will be noted in Fig. 5, wherein the boss 28 is lowered and the pressure roller 34, therefore, in operative position, that the lower stop 87 is in abutment with a front portion of the lowermost blank 81 in the runway 80, thereby preventing further downward movement of said blank. It will be appreciated that the raising of the lever 85 by the raising of the boss 28 and pressure roller 34 will move the pin 83 and member 86—87 about the axis of said pin and thereby raise the lower stop 87 out of the path of the lowermost blank 81 in the trough 80 and lower the upper stop 87 into the path of the blank 81 next in line, the lowermost blank, therefore, being permitted to roll from said trough onto the driving rollers 27 and the next blank rolling down into position against the lowered upper stop 87 to remain there until the pressure roller 34 is again lowered into operative position, whereupon the lowered upper stop 87 will be raised to release the last mentioned blank and the raised lower stop 87 will be lowered to prevent said blank from rolling therepast. As shown in Fig. 5, the escapement member 86—87 may be vertically adjustable with respect to the casing 11 so as to vary the normal distances between the stops 87 and the rolling surface of the runway 80, thereby permitting the accommodation in said runway at different times of blanks 81 having different outer diameters. Also, the distance between the axis of the pin 83 and the point of contact between the boss 28 and the lever 85 is seen to be greater than the distance between said axis and the point of contact between the lower stop 87 and the lowermost blank 81 in the feed trough 80, this meaning that the arcuate movement of said lever is greater than the arcuate movement of said stop so that said blank is not released from said stop until after there has been a substantial raising of said lever.

Referring now particularly to Fig. 8, the rear shaft 24, which is driven through the gear 22 by the pinion 19 and carries one of the driving roll-

ers 27 (the other being carried by the shaft 23 which is driven by the gear 21), is hollow throughout its length and carries therewithin a shaft 88 which extends outwardly from both ends of said shaft 24, that is, from the end carrying the roller 27 and from the end carrying the gear 22, the latter corresponding end of said shaft 88 being suitably supported by the wall 12 of and within the casing 11. On the end of the shaft 88 immediately adjacent the roller 27 on the shaft 24 there is fixedly carried for rotation therewith a centrally arranged, double-armed lever the two arms 89*a* and 89*b* of which are 180° apart and radially disposed with respect to the axis of said shaft 88. The distance (see Fig. 5) from the axis of the shaft 88 to the end of either of these lever arms, at each of which ends there is integrally formed a flange 90 extending in the direction of rotation of said shaft as well as in parallelism therewith and toward the plane of the adjacent roller 27, is less than the distance between the axis of said shaft and the nearest point on the circumference of the other roller 27 and is greater than the distance between the axis of said shaft and the axis of rotation of the blank 81 rotated by said rollers, so that rotation of said lever arms with said shaft will cause the flange 90 on either one or the other of said arms to contact said blank from below and remove same from its driving rollers 27 and direct it rearwardly onto a transversely slanting discharge trough or runway 91 supported by the rear wall of the casing 11 with its upper and front end residing slightly above and in substantially the same vertical plane as the rear roller 27. The runways 80 and 91, therefore, serve as a track for the blanks 81 before and after the grinding or turning operations thereon and cooperate with the rolling surfaces of the rollers 27 to effectuate the continuity of said track, said rollers receiving one of said blanks from said runway 80 when the lever 85 is raised but not until the blank already on said rollers has been worked and removed therefrom onto said runway 91 by the action of one of the lever arms 89*a* or 89*b*. The cooperation between the levers 85 and 89*a*—89*b*, and the means for effectuating same, are to be discussed presently.

On the end of the shaft 88 immediately adjacent the wall 12 on the side of the latter opposite the gear 22 there is keyed thereto for rotation therewith a sprocket 92 about which is mounted a chain 93, said chain being driven by a sprocket 94 keyed to the end of for rotation with a stub shaft 95 journalled in a boss 96 (see Fig. 2) provided therefor on said wall below the drum shaft 52 (see Fig. 6). The shaft 95 also carries for rotation therewith an annular member 97 formed at its periphery with a plurality of radial sockets 98 spaced 90° apart and a concave, arcuate surface 99 between each pair of adjacent sockets, said surfaces having centers of curvature equally spaced from the axis of said shaft and residing on radii centrally between said sockets at points radially outwardly of said surfaces. For alternately engaging the sockets 98 and surfaces 99 to give to the shaft 95 an interrupted rotary motion, such as is known as a "Geneva" motion, there is provided a driving pin 100 carried on and movable with the side and at the periphery of an annular disc 101 mounted for rotation on and with the drum shaft 52 between the wall 12 and the sprocket 65. It will be noted in Fig. 6 that during one revolution of the drum shaft 52 the pin 100 on the disc 101 is caused to engage one socket 98 and its trailing surface 99, thereby moving the shaft 95 one-quarter revolution, the movement of said shaft 95 being effectuated entirely by and during the inter-engagement of said socket and said pin because the inter-engagement of said pin and said trailing surface creates merely a dwell in the movement of said shaft 95. As usual, the movement of the shaft 95 is not as rapid during the entrance and exit of the pin 100 into and out of the socket 98 as it is when said pin is well within said socket and actually driving the member 97 at that time.

It is evident by now that the interrupted rotation of the shaft 95 is employed for the purpose of giving to the shaft 88 a corresponding rotary movement, said shaft 88 being that shaft which carries the work-ejecting lever 89*a*—89*b*. This lever, as shown and as described, has two arms 89*a* and 89*b*. The member 97, as shown and as described, has four sockets 98. The effective diameter of the sprocket 94, as shown, is twice that of the effective diameter of the sprocket 92. Therefore, one revolution of the drum shaft 52 brings about a quarter-revolution of the shaft 95 and a half-revolution of the shaft 88. In other words, one revolution of the drum 53 (which causes the lever 85 to raise once and to lower once) causes the lever 89*a*—89*b* to move 180° while the shaft 88 is so moving. As shown in Fig. 5, the provision of more than two arms on lever 89*a*—89*b* would interfere with the blank 81 residing on the rollers 27, while less than two arms would give rise to such a high speed of work ejection from said rollers as to be unsatisfactory. Also, as shown in Fig. 6, the provision of a greater ratio than two-to-one between the diameters of the sprockets 94 and 92 would be impractical. Therefore, the choice of a double-armed lever, as shown, the choice of a two-to-one sprocket ratio, as shown, and the choice of a four-socketed member (97), as shown, are best in view of the results desired, but it is clear that these choices may and will be modified, and such modifications are contemplated.

This point in the discussion marks the completion of the description of the work supporting section of the machine or apparatus, and a brief resume follows. Power enters the drive shaft 17 through the belt 20 and pulley 18 and is distributed through the pinion 19 to the gears 21, 22 and 33 and through the pulley 72 and belt 73 to the pulley 71. The preferably non-parallel shafts 23, 24 and 32, which carry the driving rollers 27 and the pressure roller 34, respectively, are rotated by the gears 21, 22 and 33, respectively, and the shaft 70, which carries the spiral gear 69, is rotated by the pulley 71. The rotative power of the shaft 70 is transmitted through the gear 69 to the spiral gear 68 on the transverse shaft 67, from said shaft 67 to the worm 66 thereon, from said worm to the worm wheel 62 on the shaft 61, from said shaft 61 to the sprocket 63 thereon, from said sprocket through the chain 64 to the sprocket 65 on the drum shaft 52, from the pin 100 on the disc 101 on said shaft 52 to the individual sockets 98 in the member 97 on the shaft 95, and from the sprocket 94 on said shaft 95 through the chain 93 to the sprocket 92 on the shaft 88. The drum shaft 52, though rotated with the roller shafts 23, 24 and 32, does so at a much reduced rate because of the reduction gearing residing between said shaft 52 and the shaft 17.

The rotation of the drum shaft 52 controls the

feeding of the blanks 81 onto the rollers 27 and also the discharging of said blanks from said rollers. To explain, rotation of the shaft 52 causes cooperation between the cam 54—55—56 and the cam follower 48—49, contact between said follower and the leading end 54 and dwell portion 56 of said cam closing the valve 44—45 and opening the valve 43—45 to raise the pressure roller 34 and permit a blank 81 to roll from the feed trough 80 onto the rollers 27 against the backing member 26, and contact between said follower and the trailing end 55 of said cam opening said valve 44—45 and closing said valve 43—45 to lower said pressure roller into engagement with said blank and maintain said engagement until said leading end re-engages said follower upon the next revolution of said shaft. On the other hand, rotation of the shaft 52 causes, for each full revolution thereof, a quarter-revolution of the shaft 95 and a resulting half-revolution of the shaft 88. Since this half-revolution of the shaft 88 is for the purpose of ejecting the blank 81 from the rollers 27 into the discharge trough 91 through the agency of the lower arm 89*b* of the lever 89*a*—89*b* on said shaft, such shaft movement must be effectuated while the pressure roller 34 is elevated from said rollers 27. This means that care must be taken in the relative positioning of the cam 54—55—56 (see Fig. 7), the pin 100 (see Fig. 6) and the lever 89*a*—89*b* (see Fig. 5) so that the lower arm 89*b* of said lever is ready to eject the blank 81 from the rollers 27 by about the time the distance between the rising roller 34 and the rear roller 27 is not much greater than the outer diameter of said blank, for, at this time, said blank may be ejected from said rollers 27 by said lower arm 89*b* before the next blank 81 in the trough 80 has begun its downward travel past the rising, lower stop 87.

Referring to Fig. 2, the left support 51 and the right end wall of the casing 11 carry therein the opposite ends of a pair of horizontal, parallel guide rods 102 upon which is reciprocably mounted a tool carrying structure, generally indicated at 103. Structure 103 comprises a pair of elongated bosses 104 operable for receiving or being received by the guides 102 and being integrated by means of the body of said structure itself, said bosses being shorter than the distance between the above mentioned support 51 and end wall of casing 11 to allow for reciprocation of said structure therebetween and along said guides, and said body being integrally formed at the end thereof adjacent said support 51 with an annular head portion 105 arranged centrally between and below said guides and bosses and in alignment with the axis of the backing member 26 which axis, incidentally, is coincident with the axis of the work when same is being supported by the rollers 27 and 34 against said backing member. The annular nature of the head portion 105 of the structure 103 enables the fixed connection to the end thereof adjacent the work of a plate 106 in which there is formed a vertical slot 107 passing through the axis of said portion 105, said slot receiving the stems of bolts 108 to which is connected a block or head member 109. Bolts 108 are spaced from each other a distance less than the length of the slot 107 so that the block or head member 109 can be selectively moved vertically with respect to the plate 106 for the sake of adjustment of said block, said plate having secured thereto on opposite vertical sides of said block, and in spaced relation to said sides, a pair of screw supports 110, and said screw supports carrying vertically adjustable set screws 111 cooperable with said block for maintaining any selectively adjusted position of the latter.

The block or head member 109 of the reciprocable structure 103 is integrally formed at its front and rear sides with a pair of depending walls 112 the under-surfaces of which are in a single plane which slants upwardly at an angle of approximately 45° to the horizontal and in the general direction of the work supporting structure of the machine (see Figs. 2 and 9), said under-surfaces of said walls carrying elongated plates 113 which extend transversely inwardly toward the longitudinal center of said block to define thereabove and therebetween a guideway for a T-shaped tool carrier 114 (see Figs. 7 and 10). It is clearly shown that the upper surface of the carrier 114 has the same angle of inclination as that of the lower surface of the block 109 which forms part of the guideway for said carrier, in other words, that said surfaces are complementary and movable one relative to the other, or together, as the case may be. The inclined undersurface of the block 109 is centrally formed with an elongated slot 115 which extends in the direction of travel of said block for a distance less than the length of said surface so that the ends of said slot are defined by the body of said block itself, and the inclined upper surface of the carrier 114 supports an upstanding arm 116 which projects into said slot and is in contact with one end of a spring 117 residing in said slot and abutting at its opposite end the lower end of said slot, said spring thereby permanently urging said carrier in an upward direction relatively to said block along the T-shaped guideway in the latter and said arm toward the upper end of said slot.

As pointed out, the normal position for the carrier 114 is that whereat the arm 116 is in contact with the upper end of the slot 115 (see Fig. 9), that is, when said carrier is uppermost and outermost with respect to the block 109, and in this normal position a longitudinal bore 118 formed in said carrier will support the shank 119 of a turning tool 120 so that the cutting edge 121 of said tool will be residing above and axially outwardly from the point occupied by said edge during the turning operation. Since it is not intended to rotate the tool 120, said tool and its shank 119 are integral with each other and said shank is removably held in the bore 118 against inadvertent axial and/or rotary movements by means of a pair of lock nuts 122 carried within a transverse bore 123 formed directly below the bore 118 and held against said shank by a bolt 124 (see Fig. 10). Also, since the tool is to be limited to two movements, one a purely axial movement when the block 109 and carrier 114 move together during the movement of the structure 103 along the guides 102, and the other a vertical movement when said block and said carrier move relatively one to the other, said tool is arranged so that its cutting edge 121, which is shaped so as to turn the inner periphery of the blank 81 shown in Fig. 18 into the surface formation of the blank 181 shown in Fig. 19, is positioned substantially symmetrically with respect to a vertical plane which passes through and includes the axis of the backing member shaft 25.

The end of the carrier 114 opposite the end from which the tool 120 projects is bifurcated, as at 125, and receives between such bifurcations, by means of a transverse pivot pin 126, the inner end of an elongated rod 127 the outer end

of which projects beyond the opposite end wall of the casing 11 and through a plate 128 secured to said wall of said casing, said outer end of said rod being threaded and adjustably receiving thereon a nut 129. The properly adjusted position of the nut 129 with respect to the rod 127 as well as to the plate 128 is shown in Fig. 2, this figure showing the structure 103 in fully protracted position with respect to the work 81 and the resulting protraction and lowering of the carrier 114 and engagement of the tool 120 with said work. The attainment of the positions shown in Fig. 2 of the structure 103, carrier 114 and tool 120 draws the rod 127 to the left and thereby determines the proper positioning of the nut 129 thereon, this latter position being that whereat said nut abuts the plate 128. As distinguished from the positioning of the elements shown in Fig. 2, attention is directed to Fig. 9 wherein the structure 103, carrier 114, tool 120 and rod 127 are fully retracted and said carrier and tool are fully raised.

Referring to Fig. 9, the structure 103 is in its retracted position. In this position, the rod 127 is idle and the carrier 114 is free to be acted upon by the spring 117 and moved upwardly and outwardly relatively to the block 109 until the arm 116 engages the upper end of the slot 115. The positions shown in Fig. 9 of these elements are, as will be seen, the same directly before the tool 120 is lowered into contact with the work and directly after said tool has performed its turning operation thereon. In other words, there is full protraction of the carrier 114 and tool 120 before said carrier is lowered and said tool positioned on the work and there is full raising of said tool and said carrier before the retraction thereof is commenced. Leftward movement of the structure 103 and carrier 114 from their positions shown in Fig. 9 is unitary until the stop nut 129 contacts the plate 128, at which time the cutting edge 121 of the tool 120 is directly above working position. Continued protraction of the structure 103 is individual and in opposition to the spring 117, the nut 129 preventing any further protraction of the carrier 114, and this protraction of said structure drives said carrier and the tool 120 downwardly because of the wedging action created between said carrier and the block 109 by the inter-engaging inclined surfaces thereof, the result being the inter-engagement of the cutting edge 121 and inner annular surface of the blank 81, as shown in Fig. 2.

Now referring to Fig. 2, and assuming the turning of the blank 81 has been completed, the initial phase of the retraction of the structure 103 will be individual with respect to the carrier 114 because of the compressed state of the spring 117 and the dwell created or established by the spacing between the arm 116 and the upper end of the slot 115. In other words, until this spacing has been eliminated by the necessary amount of retraction of the structure 103, there will be no retraction of the carrier 114 but there will be a raising thereof, again because of the inclination of the surfaces of the block 109 and said carrier. However, when the arm 116 engages the upper end of the slot 115, further retraction of the structure 103 will cause and be unitary with the retraction of the carrier 114 into the positions thereof shown in Fig. 9.

The means for protracting and retracting the tool supporting structure 103 to obtain the above outlined results consists of a cam surface formed in the periphery of the drum 53 and followed by a follower 130 carried by the upper surface of the head portion 105 of said structure, a development of the surface providing said cam being shown in Fig. 11. Looking at Figs. 1, 2 and 11 simultaneously, the cam surface on the drum 53 has a run 131 which extends for substantially three-fourths of the entire circumferential length of said drum in the direction of rotation thereof and with a gradual slope toward the right end (as viewed in Figs. 1 and 2) of said drum. The leading end of the run 131 is headed by a short run 132 more sharply sloped and directed toward the right end of the drum 53 than said run 131, and the trailing end of said run 131 is followed by a short run 133 sloped and directed just as sharply as said run 132 with respect to said run 131 but toward the left end of said drum, said runs 132 and 133 being interconnected by a non-sloping run 134 and comprising the other fourth of the circumferential length of said drum. In Figs. 2 and 11, the drum 53 is momentarily in such position that the trailing end of the run 131 and the leading end of the run 133 are engaging the follower 130, the tool 120 at this time being in turning position on the blank 81 but ready to be elevated therefrom. Retraction of the structure 103 and elevation of the tool 120 occur during the travel of the run 133 along the follower 130 and such retraction is complete upon the engagement of the leading end of the run 134 with said follower, as shown in Fig. 9. A dwell in the movement of the structure 103 exists while the run 134 is in engagement with the follower 130 and exists until the leading end of the run 132 engages said follower. The engagement of the run 132 with the follower 130 and the duration thereof cause the unitary protraction of the structure 103 and carrier 114 to the point where the stop nut 129 engages the plate 128, whereafter the engagement of the run 131 with said follower and the duration thereof cause the further but individual protraction of said structure 103 and the resulting lowering of said carrier. In short, the extent of the run 131 between its leading and trailing ends represents the period during and after which the tool 120 is being and has been lowered from a position directly above the rotating surface of the blank 81 into turning position thereon as shown in Fig. 2; the extent of the run 133 between its leading and trailing ends represents the period during which the tool is raised from the turned surface of the blank 181 and the entire tool supporting structure is retracted into the position shown in Fig. 9; the extent of the run 134 between its leading and trailing ends represents the period during which the tool supporting structure is perfectly idle (the reason for which follows); and, the extent of the run 132 between its leading and trailing ends represents the period of unitary protraction of the structure 103 and carrier 114 during the take-up between the nut 129 and plate 128 immediately prior to the lowering of said carrier by the continued protraction of said structure.

As shown in Fig. 11, the run 133 is about to begin its travel along the follower 130, while at the same time the leading end 54 of the cam 54—55—56 is approaching, though spaced from, the follower 49. This means that the tool 120 is about to be raised and the structure 103 is about to be retracted, but that the valves 44—45 and 43—45 are to remain open and closed, respectively, until the leading end 54 reaches the follower 49. The time elapse for the travel of the drum 53 from the position whereat the follower

130 and the leading end of the run 133 are inter-engaged to the position whereat said follower and the trailing end of said run are inter-engaged is approximately the same as the time elapse for the travel of the cam 54—55—56 from the position thereof shown in Fig. 11 to the position whereat the leading end of the run 56 and the follower 49 are inter-engaged. In other words, the raising and retraction of the tool 120 together with the retraction of the tool supporting structure 103 are completed, or substantially so, before the pressure roller 34 is raised and the worked piece 181 is ejected by one of the arms 89a—90 or 89b—90. It will be noted that the dwell 56 is of shorter duration than the dwell 134, which means that the half-revolution of the ejector arm is completed before the pressure roller 34 is lowered and that said roller is lowered before the protraction of the structure 103—114 is commenced, the tool 120, therefore, offering no resistance to the operations of either said pressure roller or the lever of which said arm is a part.

The showing in Figs. 20 and 21 is a modified tool supporting structure which may be substituted for the structure supported by the reciprocable head portion 105 of the structure 103 already described, thereby enabling the machine to perform turning and flash removing operations on roller bearing cups, such as 135, rather than the operations already described and relating to ring blanks, such as 81, out of which such cups are formed, the operations on the cup which are desired to be performed being the turning of the inner front and rear edges and the removal of the flash at the larger end of said cup. So, in the bore of the head portion 105 there is clamped or fixed for movement therewith a block 136 having a sloping bore 137 formed therethrough and extending downwardly and generally toward the work supporting structure of the machine, said bore 137 having the same purpose as the sloping guideway formed in the head member 109 already described. In the bore 137 there is mounted for reciprocation with as well as relatively to the block 136 and head portion 105 the stem 138 of a tool carrier 139 extending into position between said block 136 and backing member 26. The rod 127, instead of being connected to the carrier 114, is connected to the stem 138 of the carrier 139 so that movement of the latter carrier 139 is identical to the movement of the former carrier 114, except that the vertical movement of the carrier 139, during the introduction of its non-rotatable tool 220 to the work 135, is upward rather than downward, as is the case with the carrier 114, the tool 220 thereby engaging the work at an upper point thereon instead of at a lower point, as is the case with the tool 120. A slot 215, a pin 216 and a spring 217 in the stem 138 and block 136 cooperate and function similarly as the slot 115, arm 116 and spring 117 in the head 109 and carrier 114 already described. The tool 220 is operable, as shown in Fig. 21, for turning the two opposite inner, annular edges of the cup 135 into the form 235 shown in Fig. 17.

Still referring to Figs. 20 and 21, flash removal is performed by means of a tool 140 which is carried by a support 141 residing below the carrier 139 and fixed to the head portion 105 and block 136. The tool 140 has pure horizontal movement with the portion 105 and block 136 because any vertical movement thereof, such as is the case with either the tool 120 or tool 220, is unnecessary. The tool 140 cooperates with the flash on the larger and nearer end of the cup 135 and completely removes same by the time the tool 220 has performed its two operations.

Although the invention has been described with some detail it is not intended that such description is to be definitive of the limits of the inventive idea. The right is reserved to make such changes in the details of construction and arrangement of parts as will come within the purview of the attached claims.

What I claim is:

1. A machine having, a work support, a pressure roller movable toward said support for holding a work piece in place thereon and movable away therefrom to enable the piece to be removed therefrom, and a feed mechanism for controlling the feeding of the work onto the support and operable responsive to the movements of said roller.

2. A machine having, a work support, a pressure roller movable toward said support for holding a work piece in place thereon and movable away therefrom to enable the piece to be removed therefrom, a feed mechanism for controlling the feeding of the work onto the support, and means operatively interconnecting said mechanism and said roller for controlling said mechanism by and in accordance with the movements of said roller.

3. In a machine having a work support and a tool movable away from the support as well as into an operative position on the work, means operable while the tool is away from the support for introducing to the support a work piece to be worked, means movable into engagement with the piece for holding the latter on the support during tool operation and movable out of engagement therewith thereafter, and means controlled by the latter movement of said second means for controlling the operation of said first means.

4. In a machine having a work support and a tool movable away from the support as well as into an operative position on the work, a reservoir for work pieces to be operated upon by the tool and having an outlet therefor in communication with the support, a control for restricting the discharge of the pieces through said outlet to periods when the tool is away from the support, means operable when the pieces are on the support for establishing a clamping engagement therebetween during tool operations and operable for releasing said engagement to enable the discharge of the pieces from the support, and means effectuated by and dependent upon said releasing operations of said first means for controlling said control.

5. In a machine having a work support and a tool movable into and out of operative position with respect to work on the support, a supply reservoir for work pieces to be operated upon by the tool and having an outlet in communication with the support, a control cooperable with the pieces within said reservoir and being alternately movable in one direction between predetermined limits therefor to release one of the work pieces through said outlet into the support and in the opposite direction between said limits to oppose the release of any of the remaining pieces within said reservoir, means movable into engagement with the released piece on the support to hold the piece in place during tool operation thereon and movable out of engagement therewith to enable the removal thereof subsequent to said operation, and means driven

by said first means to move said control in said work-releasing direction upon said work-disengaging movement of said first means and to move said control in said release-opposing direction upon said work-engaging movement of said first means.

6. In a machine having a work support and a work reservoir with an outlet therefor in communication with the support, means operable upon release of work through the outlet onto the support for holding the released work in position for being worked and for discharging said work from the support subsequent to the working thereof, a work-releasing member associated with the outlet for effectuating and ineffectuating the latter with respect to the releasing therethrough of the work within the reservoir onto the support, and means actuated by and dependent upon the operation of said first means for controlling the operation of said member.

7. In a machine having a work support and a supply reservoir for work pieces with an outlet therein for the pieces and in communication with the support, pressure actuated means operable for alternately exerting pressures in opposite directions toward and from the support, a control associated with the outlet and operable for releasing a work piece therethrough onto the support during the exertion of said pressure by said means away from the support and for opposing the release of another work piece through the outlet during the exertion of said pressure by said means toward the support, and means operated by said first means for operating said control.

8. In a machine having a work support, rotatable drive means, means movable toward the support and simultaneously into operative engagement with said first means for rotating and holding work in place on the support and movable away from the support and simultaneously out of said operative engagement to enable the release from the support of the work, a piston in communication with a source of pressure therefor, a valve for controlling said pressure to control said piston, and means interconnecting said second means and said piston for controlling the movement of said second means.

9. In a machine having a work support, rotatable drive means, means movable toward the support and simultaneously into operative engagement with said first means for rotating and holding work in place on the support and movable away from the support and simultaneously out of said operative engagement to enable the release from the support of the work, a piston movable in one direction by pressure for moving said second means in one of its directions and movable in another direction by pressure for moving said second means in its other direction, and a pair of valves movable together in one direction to effectuate the pressure for moving said piston in one of its directions and to ineffectuate the pressure for moving said piston in its other direction and movable together in another direction to reverse the pressure conditions on said piston for moving the latter in its other direction.

10. In a machine having a work support and a work reservoir in communication therewith, a member movable toward the support for holding the work in place thereon and movable away from the support to enable the removal therefrom of the work, a pressure actuated piston in driving relationship with said member for moving the latter toward and from the support, and means operable responsive to the movement of said member for controlling the supply of work from the reservoir to the support.

11. In a machine having a work support and a work reservoir in communication therewith, a member movable toward the support for holding the work in place thereon and movable away from the support to enable the removal therefrom of the work, a pressure actuated piston in driving relationship with said member for moving the latter toward and from the support, means operable responsive to the movement of said member for controlling the supply of work from the reservoir to the support, and means for controlling the operation of said piston with respect to a predetermined relationship between the operations of said member and said first means.

12. In a machine having a work support, a structure comprising, a pair of body members unitarily movable toward and from the support between predetermined limits of relative adjacency and remoteness with respect to the support, means operable for extending the movement of one of said members relatively to the other of said members beyond one of said limits, and means operable responsive to said extended movement of said first member for moving said second member in a path normal to the path of said extended movement.

13. A machine comprising, a support for a work piece, a tool for the work piece, rotatable drive means for said tool and operable for reciprocating the latter into and out of operative engagement with the work piece, ejector means operable for ejecting the work piece from said support, and means driven by said drive means for rotating said ejector means in a single direction and intermittently with respect to the rotation of said drive means and in accordance with a predetermined relationship with respect to the reciprocation of said tool to eject the work piece from said support while said tool and the work piece are disengaged.

14. A machine comprising, a support for a work piece, a tool for the work piece, drive means continuously rotatable in a single direction and operable for rectilinearly moving said tool into and out of operative engagement with the work piece, a shaft rotatably driven by said drive means in a single direction, and means carried on said shaft for rotation therewith and operable for ejecting the work piece from said support in response to the disengagement of said tool and the work piece.

15. A machine comprising, a support for a work piece, a tool for the work piece, drive means continuously rotatable in a single direction and operable for rectilinearly moving said tool into and out of operative engagement with the work piece, a shaft rotatably driven by said drive means in a single direction and intermittently with respect to the rotation thereof, and means carried on said shaft for rotation therewith and operable for ejecting the work piece from said support in response to the disengagement of said tool and the work piece.

16. A machine comprising, a support for a work piece, a tool for the work piece, drive means continuously rotatable in a single direction and operable for rectilinearly moving said tool into and out of operative engagement with the work piece, a shaft having fixed thereon for movement

therewith an ejector member operable for ejecting the work piece from said support, and means operatively interconnecting said shaft and said drive means for providing intermittent, uni-directional rotation of said shaft with respect to the rotation of said drive means to effectuate the ejection of the work piece from said support by said ejector member while said tool is disengaged from the piece.

17. A machine having a support for holding a work piece in place thereon during operative engagement of the piece with a tool and a support for the tool reciprocable toward and from the piece to engage and disengage the tool therewith comprising, a rotatable camshaft operatively connected to the tool support for controlling the engagement and disengagement of the tool with the piece, a second shaft carrying an ejector member operable for ejecting the piece from its support, and means operatively interconnecting said shafts for intermittently and uni-directionally rotating said second shaft relatively to said first shaft and responsive to the disengagement of the work piece and said tool.

18. A machine comprising, a rotatable camshaft operatively connected to a tool for rectilinearly moving the latter, a drive shaft, a driving mechanism arranged between said shafts for rotating said first shaft by said second shaft, and means arranged between said shafts for ineffectuating said second shaft with respect to said first shaft to accommodate manual operation of said latter shaft through said mechanism.

19. In a turning machine, a work support comprising, a pair of shafts supported for rotation about laterally spaced axes and each having a driving element therefor mounted thereon for rotation therewith, a rotatable drive member arranged in permanent driving relationship with said elements for rotating said shafts together, a third shaft supported for rotation about an axis spaced from said other shafts and having a driving element therefor mounted thereon for rotation therewith, means for unitarily moving said third shaft and its driving element toward and away from said first two shafts to interengage and disengage said element and said driving member, and a roller carried on each of said shafts for rotation and movement therewith for rotatably supporting a work piece therebetween.

20. In a turning machine, a work support comprising, a pair of shafts each carrying at one of its ends for movement therewith a driving element therefor and at the other of its ends for movement therewith a work driving roller, said shafts being supported for rotation about laterally spaced, fixed axes, a rotatable driving member for said elements and supported in permanent driving engagement therewith, and a third shaft supported for rotation and for movement toward and away from said first two shafts, said third shaft having a third work driving roller and a third driving element mounted thereon for rotation and movement therewith, said third driving element and said third roller being simultaneously engageable with said driving member and a work piece supported on said first two rollers, respectively, upon the movement of said third shaft toward said first two shafts to effectuate the rotatable driving of said third roller and the exertion of a pressure upon the work piece.

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