Oct. 27, 1931. A. J. LEWIS 1,829,284

CHUCKING MACHINE

Filed May 14, 1929 6 Sheets-Sheet 1

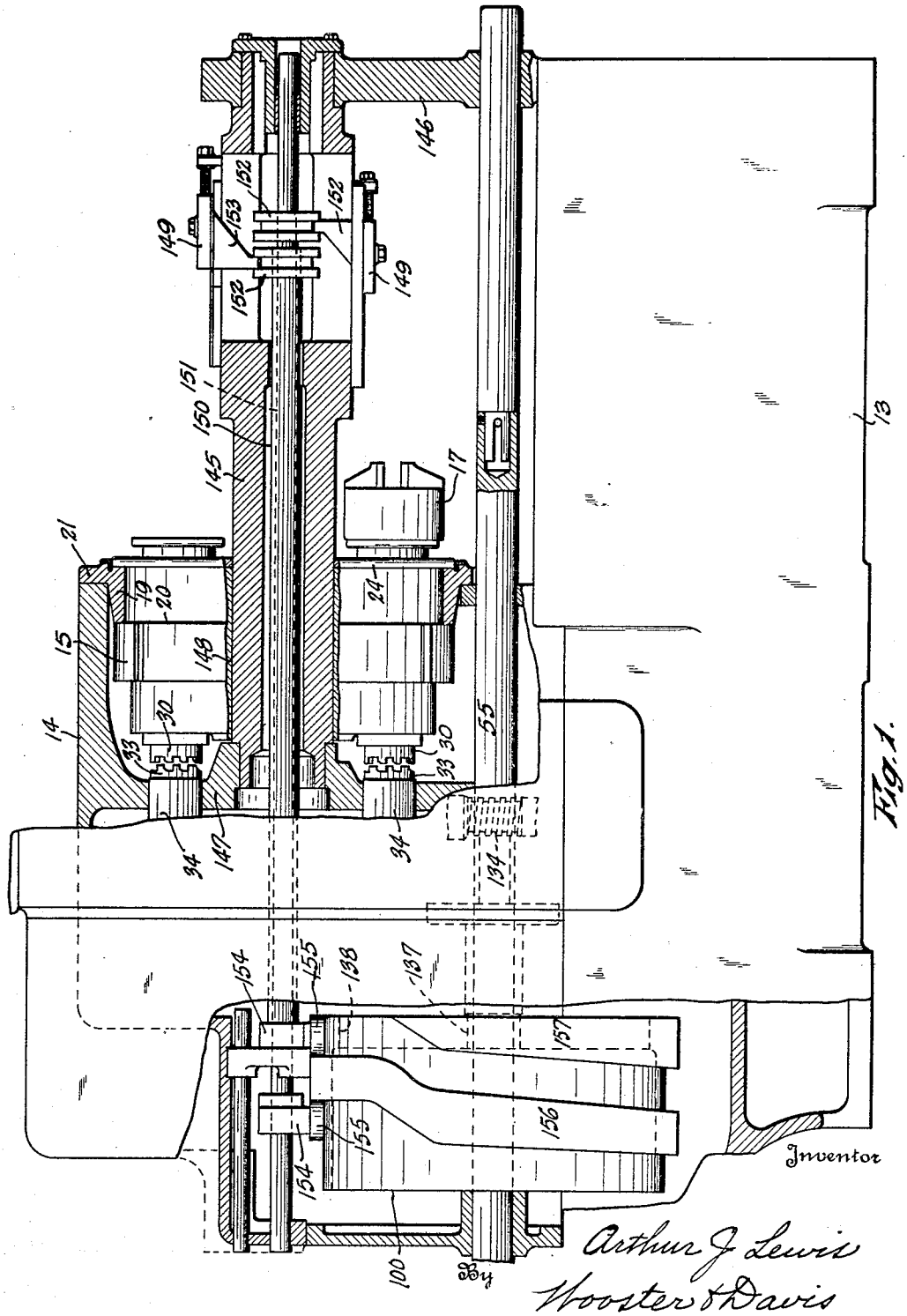


Fig. 1.

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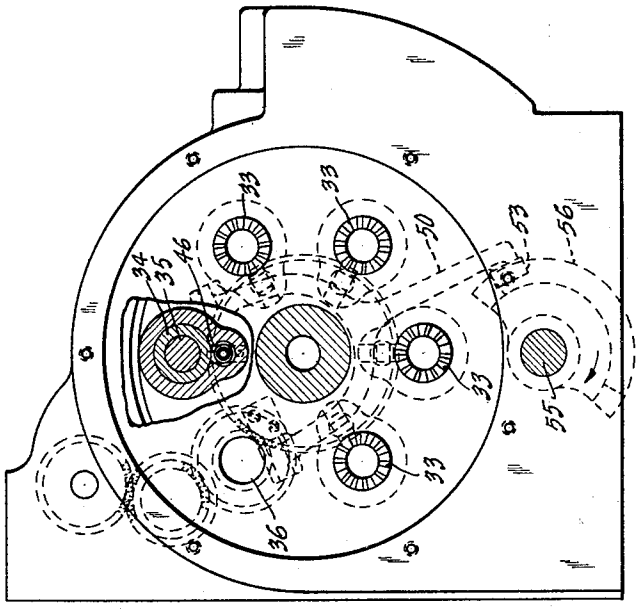


Fig. 3.

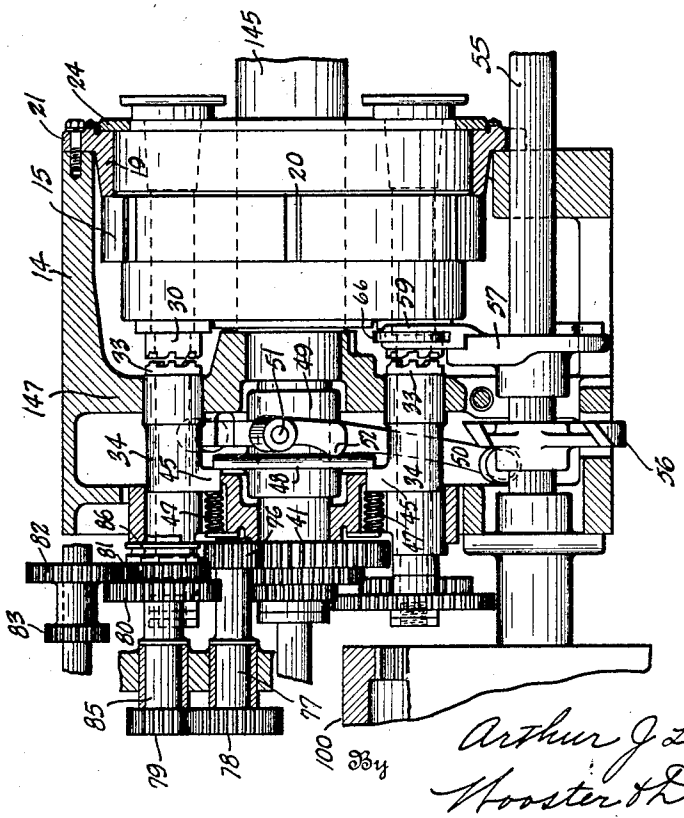


Fig. 2.

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CHUCKING MACHINE

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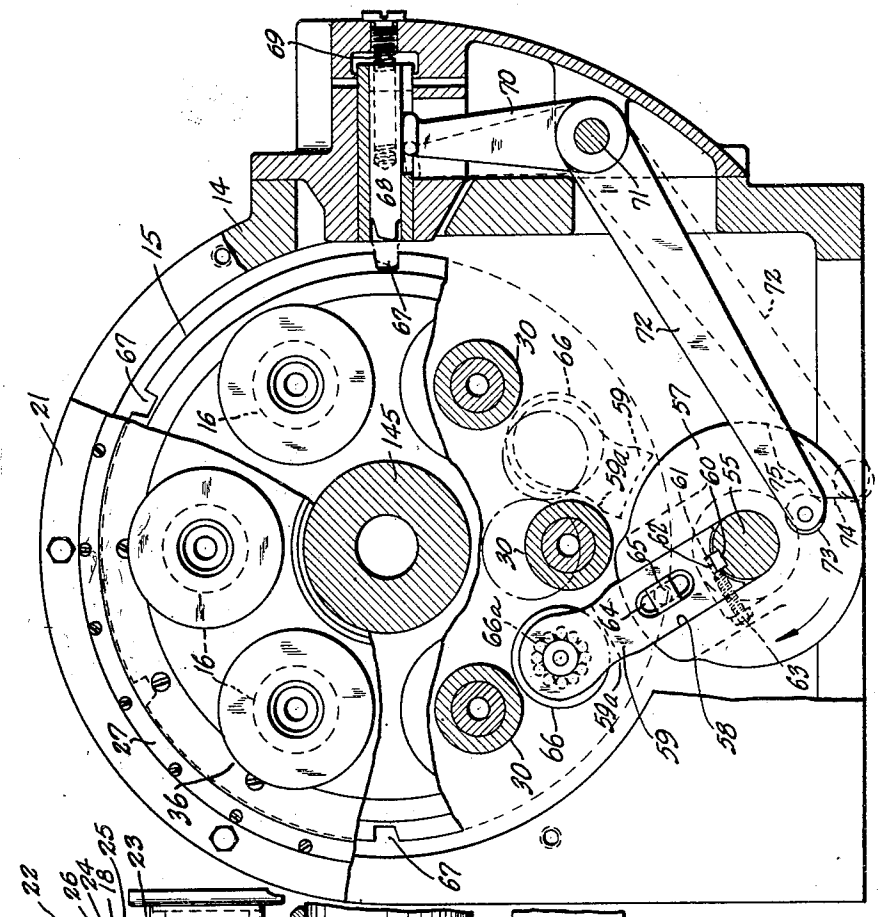


Fig. 3.

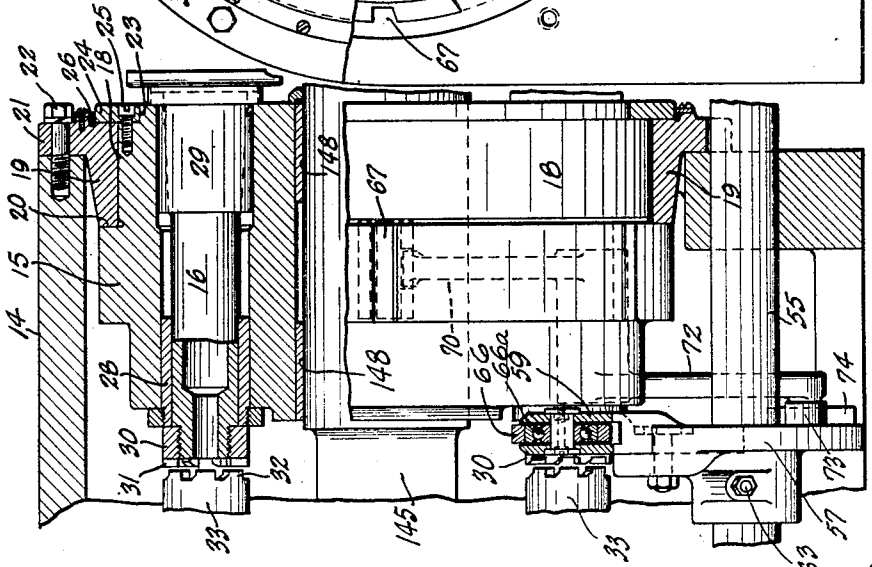


Fig. 4.

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CHUCKING MACHINE

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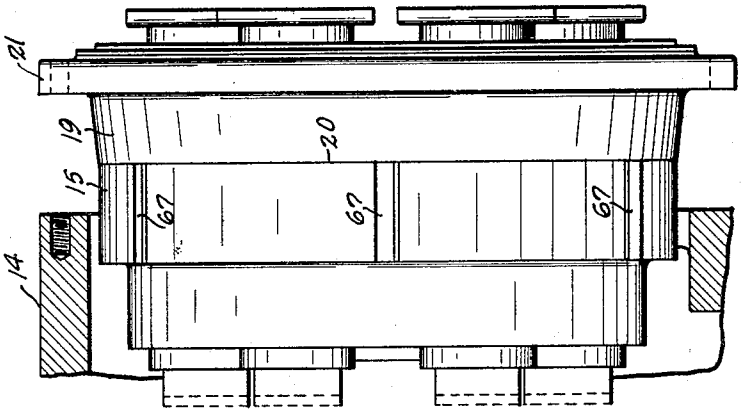


Fig. 2.

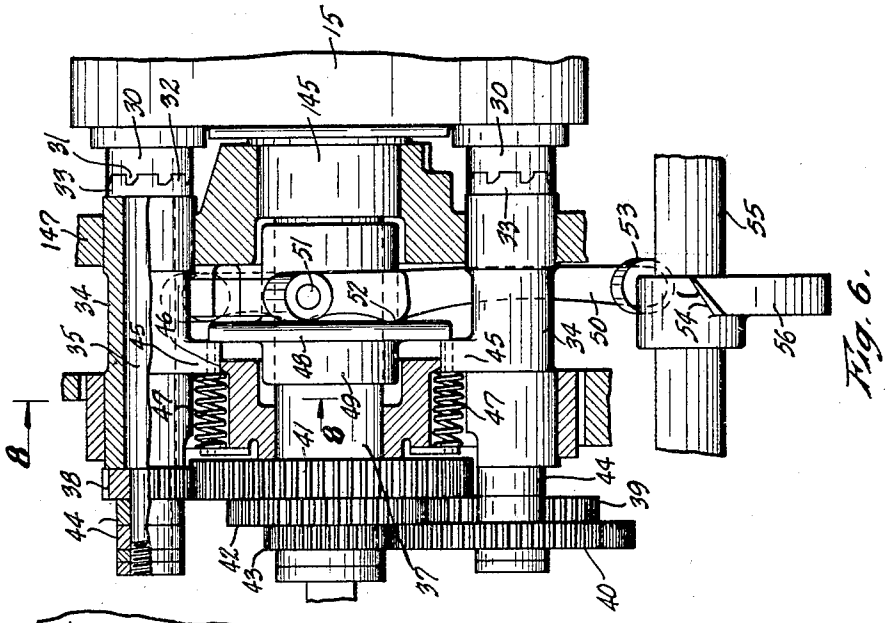


Fig. 6.

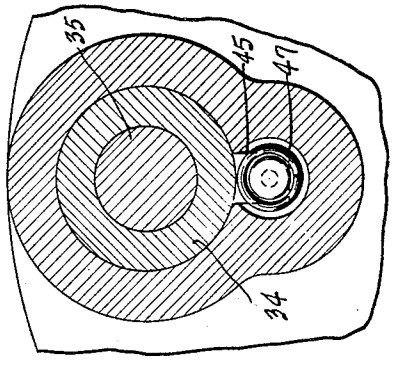


Fig. 8.

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CHUCKING MACHINE

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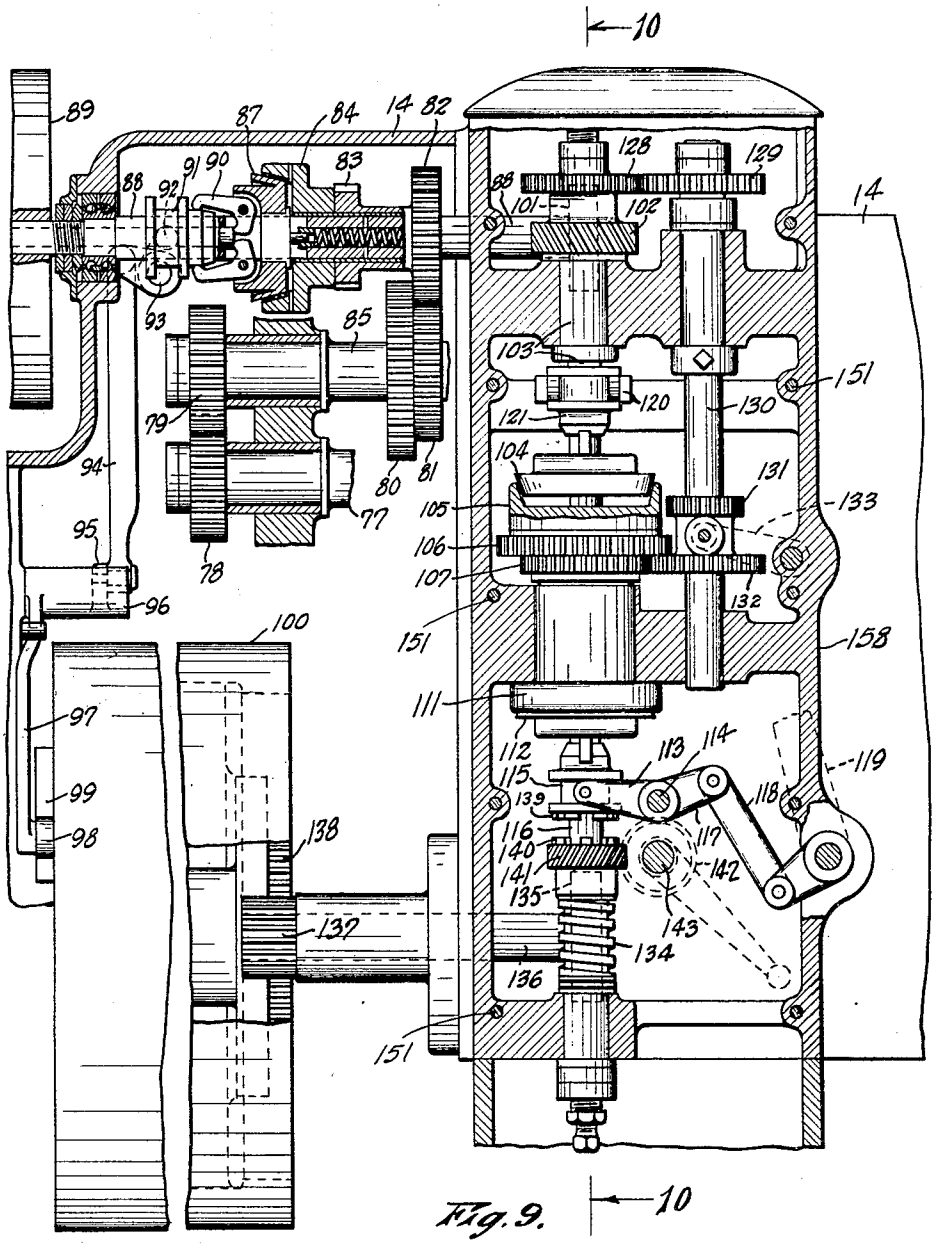


Fig. 9.

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CHUCKING MACHINE

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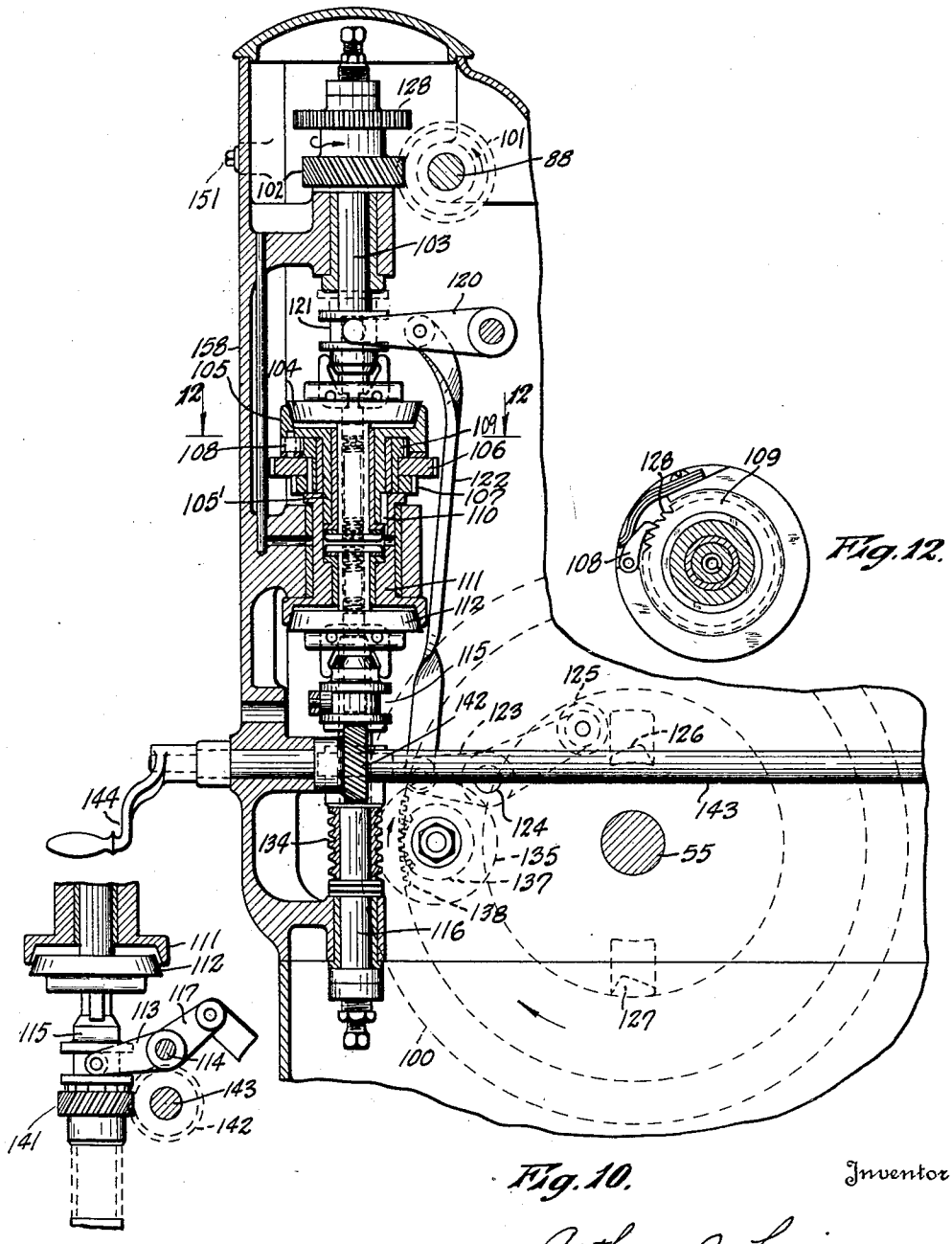


Fig. 11.

Fig. 12.

Fig. 10.

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UNITED STATES PATENT OFFICE

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CHUCKING MACHINE

Application filed May 14, 1929. Serial No. 362,974.

This invention relates to metal working machines and more particularly to a so called chucking machine in which there are a plurality of work carrying spindles mounted in a rotatable turret with means for indexing the turret to bring the work carried by the respective spindles successively into cooperative relation with different tools for successively performing different operations on the work.

It is an object of the invention to provide an improved construction for the turret and the means for mounting it in the frame of the machine, and to provide a construction whereby the turret and associated spindles may be assembled as a unit, and mounted as such in the machine.

It is also an object of the invention to provide improved means for driving the work spindles, and also improved means for mounting and operating the spindle driving means.

It is another object of the invention to provide an improved indexing mechanism for the rotatable turret which will be reliable in operation and which will be much simpler in construction than the indexing means now generally employed.

It is an another object of the invention to provide an improved and simplified driving mechanism for the tools, and a feed drive mechanism which may be assembled as a unit and applied as such to the mechanism.

It is still another object of the invention, to provide an improved automatic control to synchronize the various operations.

With the foregoing and other objects in view, the invention consists in certain novel features of construction, combinations and arrangements of parts as will be more fully disclosed in connection with the accompanying drawings.

In these drawings

Fig. 1 is a partial side elevation and partial longitudinal vertical section of the machine.

Fig. 2 is a partial elevation and partial vertical section of the driving mechanism for the work spindles and indexing mechanism for the turret.

Fig. 3 is an end view looking from the right of Fig. 2 with the turret removed and with one of the drive spindles in section.

Fig. 4 is a partial side elevation and partial longitudinal section of the turret and mounting means therefor.

Fig. 5 is a partial end elevation and a partial transverse section looking from the right of Fig. 4.

Fig. 6 is a partial elevation and partial longitudinal section of the driving means for the work spindles.

Fig. 7 is a side elevation of the turret showing how it may be mounted or removed as a unit.

Fig. 8 is a detail section substantially on line 8—8 of Fig. 6.

Fig. 9 is a partial vertical section and partial elevation of the main drive and the feed drive for the control drum and tool feed.

Fig. 10 is a transverse section substantially on line 10—10 of Fig. 9 with certain elements shown in elevation, and with the feed drive clutch in a different position.

Fig. 11 is a detail of one of the drive clutches and its control means showing the clutch released, and

Fig. 12 is a detail section substantially on line 12—12 of Fig. 10.

Turret.—The machine in general includes a bed 13 mounted on any suitable supports, not shown, and a frame 14 carried by the bed. This frame is open at its forward end to receive the rotatable turret 15 which carries a plurality of work carrying spindles 16 mounted for rotary movement in the turret and each carrying at their forward end any suitable chuck 17 for holding the work to be operated upon. In the present instance there are six of these work spindles carried by the turret, but it will, of course, be understood that there may be more or less as is found desirable. The turret is of general circular shape in cross section and has an external bearing 18 fitting in an internal bearing in a bearing ring 19. The inner end of this ring is engaged by an annular shoulder 20 and the ring has a flange 21 by means of which it may be secured to the front face of the frame 14 by any suitable means, such as the screws 22.

The front face of the turret is rabbeted at 23 to receive a retaining ring 24 secured to the turret by any suitable means, such as screws 25. This retaining ring engages the outer end of the bearing ring 19 and therefore, the turret is retained in this bearing ring by the shoulder 20 and the ring 24 and is at the same time free to turn in the ring 19. A packing 26 may be placed at the outer end of the ring 24 and held there by a ring 27 to prevent entrance of dirt to the bearing for the turret.

The work carrying spindles 16 are preferably hollow and are mounted in suitable bearing bushings 28 and 29 mounted in the turret, and at their inner ends each spindle carries a collar 30 which forms one member of a clutch for driving the spindles. In the present instance these collars carry teeth 31 adapted to mesh with similar teeth 32 on the driving clutch member 33.

Spindle drive.—The drive mechanism for the work spindles is shown more clearly in Figs. 2, 3, 6 and 8. Mounted for longitudinal sliding movement in frame 14 are sleeves 34 in each of which is mounted a driving shaft or spindle 35. There are, however, only five of these driving spindles, one less than the number of work spindles, so that the work spindle at one of the stations, in the present drawing the spindle at the station 36, is not driven and this, therefore, forms a loading station at which a finished piece of work may be removed and a new or unfinished piece of work placed in the chuck on the spindle while the other spindles are operating, and the tools are performing certain operations on the work carried by the spindles at the remaining stations. Each work spindle 35 is driven by a gear meshing with a gear on a central drive shaft 37. In order that the work spindles may be driven at different speeds, the spindles 35 are of sufficient length to receive anyone of a number of spur gears 38, 39 and 40 of different diameters adapted to mesh with the gears 41, 42 or 43 respectively, on the central shaft. The gears 38, 39 or 40 are located on their respective spindles by suitable spacing collars 44 to mesh with the proper gear 41, 42 or 43. It will, of course, be understood as these gears are of different diameters, a spindle 35 will be driven at its highest speed when the smaller gear 38 is on the spindle to mesh with the larger driving gear 41, the spindle is driven at its lowest speed when the larger gear 40 is on the spindle to mesh with the smaller driving gear 43, and an intermediate speed will be given by gears 39 and 40. However, after the gears are once set up these speeds of the spindles are maintained the same, unless the gears on the spindles are removed and gears of different diameters substituted.

As indicated above these sleeves 34 are mounted for longitudinal sliding movements in the frame 14 and they each carry a driving spindle 35. Each spindle 35 carries at its outer end one of the clutch members 33, which when the turret is stationary is adapted to have driving engagement with the clutch member 30 on the work spindle in alignment therewith, as indicated in Fig. 6. The sleeves 34 however, may be shifted longitudinally to carry the clutch member 33 away from the clutch member 30 to disconnect the driving connection between the driving spindle and the work spindle to permit indexing of the turret for bringing the next work spindle into alignment with any given driving spindle. For this purpose each sleeve 34 is provided with a lateral lug or ear 45 which is guided in a suitable notch or recess 46 in the frame to thus prevent turning of the sleeve in the frame. A compression spring 47 engages one side of this lug and tends to shift the sleeve and the driving spindle 35 toward the work spindle to cause the clutch members 33 and 30 to engage. At its opposite side each lug 35 is engaged by a flange 48 on a sliding block or sleeve 49 supported on the shaft 37. A forked lever 50 embraces this shaft and the block or sleeve 49 and is pivoted in the frame at 51. It has a lug 52 engaging the flange 48 on the opposite side from the lugs 45, and the free end of the lever carries a roller 53 adapted to engage a cam 54 on the feed and indexing shaft 55, which is driven by means which will later be described. As the cam 34 engages the roller 53 on rotation of the shaft 55, it may shift the lever 50 to the left as viewed in Fig. 6 and shift the flange 48 to the left, and with it all of the sleeves 34 and driving shafts 35 against the action of the springs 47, to thus simultaneously disconnect all the clutches 33, 30 and thus permit indexing of the turret. It will, of course, be understood the elements are held in this position by the block 56 of the cam during the indexing operation and then the lever 50 is released permitting the springs 47 to shift the sleeves 34 and driving shafts 35 to the right to permit engagement of the clutch members 33 and 30 to drive the work spindles for the next working operation.

Indexing mechanism (Figs. 2, 4 and 5).—Carried on the shaft 55 is a block or collar 57 provided with a radial groove 58 in which is adjustably mounted a lever 59. The block 57 is keyed to the shaft by a key 60 which is also adjustable longitudinally of the shaft and is inclined at one end as indicated at 61 to engage the bottom 62 of a notch in the arm 59 and form a wedge by which the radial position of the arm 59 may be adjusted. The key and wedge may be secured in an adjusted position by the set screws 63. The arm 59 also has an elongated slot 64 to receive the head 65 of a clamping bolt to secure the arm in adjusted position. The arm carries a rela-

tively large roller 66 to engage the side of the collar 30 to rotate the turret with a step by step movement as indicated by dotted lines in Fig. 5. At the beginning of the indexing movement the work spindles have not stopped rotating although their driving clutches have been disconnected. The roller 66 is therefore, so mounted that it engages the member 30 and prevents the arm 59 engaging this member. The roller 66 is an antifriction member and prevents the arm 59 digging into member 30 as it would be likely to do if this arm engaged this member direct. It is preferable to mount the roller 66 on roller bearings as indicated at 66*a*. Of course, between the indexing movements the turret should be locked in proper position with the work spindles 16 in alignment with the driving spindles 35. This is done by means of notches 67 suitably spaced throughout the periphery of the turret and adapted to receive the end of a locking bolt 68 slidably mounted in the frame. A compression spring 69 tends to force the locking bolt 68 toward the turret and holds its end in one of these notches during the working portion of a cycle. The bolt is retracted at the proper time to unlock the turret by means of an arm 70 pivoted in the frame at 71, and having another arm 72 carrying a roller 73 to cooperate with the cam 74 on the block 57, and so arranged as to retract the bolt 68 and unlock the turret just prior to the indexing operation, and also having a surface 75 to retain it unlocked until the indexing is completed. Of course, as the block 57 and the cam 56 are on the same shaft 55, the clutches 33, 30 are engaged and released in certain timed relation with the indexing operation. The roller 66 and the arm 59 are so proportioned and shaped as to properly position the turret at the end of the indexing operation to permit proper locking of the turret for engagement of the clutches 30, 33. As shown in dotted lines Fig. 5 the roller 66 moves the member 30 together with the turret to a position to bring a notch 67 in alignment with the locking bolt 68. The side of the arm 59 is shaped to prevent the turret going too far and thus not properly locking. The side 59*a* of this arm is so shaped that when in the dotted position of Fig. 5 side 59*a* is immediately in front of the member 30 on the lower spindle and thus prevents the turret turning too far.

Driving mechanism.—Gears 41, 42 and 43 are driven by pinion 76 meshing with the gear 41. Pinion 76 is mounted on a shaft 77 which is driven by gears 78 and 79 through the gear train 80, 81, 82 and 83. The gears 82 and 83 are integral and are driven through the clutch 84. They are, however, of different diameters, and gears 81 and 80 are of different diameters to mesh respectively with the gears 82 and 83. The gears 81 and 80 are connected together and are slidable on the shaft 85 so that either gear 81 may mesh with gear 82 to give one speed to the driving shaft 77 or gear 80 may mesh with gear 83 to give another speed to this shaft. The gears 81 and 80 may be shifted through a suitable collar 86 by any suitable means as a lever, not shown. The other member 87 of the clutch 84 is mounted on a shaft 88 driven from any suitable source of power such as a counter shaft or an electric motor through a pulley 89. Clutch member 87 is movable to and from engagement with the member 84 by the means of levers 90 cooperating with the groove collar 91 slidable on the shaft 88 by means of a bell crank lever 92 pivoted at 93 and connected by link 94 with the arm 95 of a lever pivoted in the frame at 96 and having another arm 97 carrying a roller 98 to cooperate with a cam 99 on the control drum 100, which thus releases and engages the clutch 84 in certain timed relation with the other operations. It will be understood that the clutch member 84 is secured to the gears 83 and 82, but this clutch member and the gears are free to rotate on the shaft 88 so that when the clutch 87, 84 is released the shaft may be driven or rotate without driving the gears 83 and 82.

The shaft 88 carries a spiral gear 101 meshing with a similar gear 102 upon an upright shaft 103 for driving this shaft. The member 105 is keyed by the key 110 to the member 111 of a lower clutch cooperating with a movable clutch member 112 controlled by a lever 113, pivoted at 114, and cooperating with the grooved collar 115 for shifting the clutch member 112. This clutch member 112 drives the shaft 116. The other arm 117 of the lever 113 is connected by link 118 with a handle lever 119. The crank arm 120 for operating the upper clutch 104 through the grooved collar 121 is connected to a link 122 with a bell crank lever 123, pivoted at 124, and carrying on its other arm a roller 125 adapted to cooperate with cams 126 and 127 mounted on the shaft 55 for shifting the clutch 104 in opposite directions in certain timed relation with the other operations of the device. The upright shaft 103 also carries a spur gear 128 meshing with the gear 129 on a second upright shaft 130. Splined to this shaft 130 so as to rotate therewith, but slidable longitudinally thereon is a pair of connected gears 131, 132, gear 131 being adapted to mesh with the gear 106, while the gear 132 is adapted to mesh with the gear 107, and the gears 131, 132 may be shifted by a hand lever 133. It will be apparent that when the gear 131 is in mesh with the gear 106 the member 111 will be driven at a less speed than when the gear 132 is in mesh with the gear 107, and therefore, the speed of the feed of the tools may be varied. Gears 106 and 107 are keyed to the collar 109 which may turn on the sleeve 105′ of the member

105, and the collar 109 has ratchet teeth 128 to cooperate with the pawl 108 carried by the member 105. Thus during normal feeding operations, that is during the work cycle the shaft 116 is driven through the gears 101, 102, 128, 129, shaft 130, gears 131 or 132 to 106 or 107, the ratchet 109, 108, member 105 to member 111 and clutch 112. Of course, with this drive the clutch 104 is released. Now, at the end of the working period of the tools the cam 126 cooperating with the roller 125 shifts the clutch member 104 to the position of Fig. 10 to engage the clutch 105, the drive from the shaft 103 to the shaft 116 is now direct and the shaft 116 is driven at a higher speed than when it is driven through the reducing train 128, 129, shaft 130 and 131, 132, 106, 107. The ratchet and pawl 108, 128 permits the member 105 to rotate at a more rapid speed than the member 109 carrying the gears 106, 107. This permits the speeding up for the return movements of the tools and the indexing operation, reducing the time lost between the work operations. The shaft 116 carries a worm 134 meshing with a worm gear 135 on the shaft 136 which carries a pinion 137 meshing with an internal gear 138 in the control drum 100 mounted on the shaft 55. This drive mechanism, it will be seen from the drawing, is assembled in a casing 158 which is secured to the frame 14 by any suitable means as screws 151. Thus this drive can be assembled in the casing and the whole assembled in the machine as a unit.

Means is provided for operating the control drum 100 and the indexing mechanism by hand if desired to facilitate setting up the machine. For this purpose and disconnecting the power drive the clutch 112 is provided, and it is operated by the grooved collar 115 slidable on the shaft 116. This collar has clutch teeth 139 on its lower end adapted to mesh with clutch teeth 140 on a spiral gear 141 rotatable on the shaft 116 and meshing with a spiral gear 142 on a shaft 143. Shaft 143 may be rotated by a hand crank 144. If now, the operator when setting up the machine wishes to operate it by hand, he pulls forward the hand lever 119. This slides the collar 115 downwardly, releases clutch 112, and brings the teeth 139 on the collar 115 into mesh with the teeth 140 on the gear 141. If now the operator turns the handle 144, he will rotate the shaft 116 through the gears 142, 141 and the collar 115 as this collar is splined to the shaft 116. It will be noted from this construction and arrangement that at no time can the hand drive and the automatic drive be connected to the shaft 116 at the same time. That is, shifting of the member 115 to engage the clutch 139, 140 will necessarily disengage the clutch 112, and shifting of the member 116 to engage the clutch 112 will necessarily disengage the clutch 139, 140.

Tool carrier.—Referring more particularly to Fig. 1, the tool support is a bar 145 supported at both ends in the frame of the machine. At its outer end it is supported in the upright portion of the frame 146, while at its inner end it is supported in the upright wall 147. This support is therefore, very rigidly mounted at spaced points directly in the frame and it has a bearing 148 in the turret so that the turret not only has a bearing and turns in the ring 19, but it also has a bearing 148 on the support 145, and it is therefore, very rigidly mounted in a manner which will reduce to a minimum lateral play of the turret, and the liability of its work spindles getting out of alignment with the driving spindles or failing to be in proper relation with respect to the tools. The tools for each station may be mounted to slide longitudinally of the support 145. Holder carriers for these tools are indicated diagrammatically at 149, there being a tool carrier for the work spindle at each station except the spindle at the loading station 36 so that there is one less tool carrier than work spindles. The tool carriers are slid longitudinally of the support 45 by means within the support similar to that shown in my prior patent 1,689,440, October 30, 1928 and comprises concentric shafts 150 and 151 mounted for longitudinal movement within the support 145 and each carrying blocks 152 for connection with the arms 153 on the tool slides. These shafts are connected to blocks 154, carrying rollers 155, cooperating with cams 156 and 157 on the control drum 100 to regulate the movement of the tools in certain timed relation with the indexing of the turret and the other operations as above described.

The operation will be clear from the foregoing description. During the work period, the work spindles 16, except the one at the loading station 36, will be driven by the driving shafts or spindles 35 through the clutch drives 33, 30, and during this time the tools will be advanced toward the work through the feed mechanism within the tool support 145 and the cam on the control drum. This drum is driven as indicated above through the mechanism as shown in Figs. 9 and 10. When the work has been completed the clutch 104 is engaged speeding up the operation of the drum 100 for rapid movement of the tools away from the work. The main drive clutch 84, 87 is also released, and the driving connection between the driving shafts 35 and the work spindles 16 is disconnected by shifting of the drive shafts to the position of Fig. 2 by means of the cam 56 and lever 50. The indexing mechanism now functions to first unlock the turret and then turn the turret one-sixth of a revolution to advance each work spindle to the next succeeding station, after which the turret is

again locked, the drive shafts 35 may be permitted to be shifted back to the driving position and the operation repeated. The operator may stop the operation of the feed and associated operations at any time, by releasing the clutch 112 through the hand lever 119.

Having thus set forth the nature of my invention, what I claim is:

1. In a machine of the class described, a frame having an opening therein, a bearing member having an extension removably mounted in said frame opening, said member having a shoulder to engage a shoulder on the frame to position the member, a turret rotatably mounted in said member, a central support passing through the turret and having a central bearing therefor, the central bearing and the external bearing member forming the sole support for the turret, a plurality of work holders mounted in said turret, and means for rotating the turret with a step by step movement.

2. In a machine of the class described, an upright frame open at one vertical side, a bearing ring removably mounted in the frame at said open side, a turret mounted to rotate in said ring about a horizontal axis, a horizontal support forming a central bearing for the turret, said bearing ring and central forming the sole support for the turret, a plurality of work holders carried by the turret, and means for rotating the turret with a step by step movement.

3. In a machine of the class described, a frame, a rotatable turret, a plurality of work holders carried by the turret, a supporting bar supported in the frame on opposite sides of the turret, said turret having a bearing on said bar, a bearing member embracing the turret and forming an external supporting bearing therefor, means for removably mounting said member in the frame, and means for rotating the turret with a step by step movement.

4. In a machine of the class described, a frame having spaced upright portions, a horizontal supporting bar mounted in said portions and extending between them, an upright turret mounted to rotate on said bar, a bearing member embracing the turret and forming an external bearing therefore, said bearing member being removably mounted in the frame and said member and the suuporting bar forming the support for the turret, a plurality of work spindles carried by the turret and extending parallel to said bar, and means for rotating the turret with a step by step movement.

5. In a machine of the class described, a frame having spaced upright portions, a hollow horizontal tool support extending between said portions and supported thereby, a rotatable work carrying turret mounted to turn on a central bearing on said support, an external supporting bearing for the turret removably mounted in the frame, a tool slide mounted on the support forwardly of the turret, means in the support for operating the tool slide, and means to the rear of the turret for operating the tool operating means.

6. In a machine of the class described, a frame having spaced upright portions, a horizontal supporting bar mounted in said portions and extending between them, a rotatable work carrying turret mounted to turn on a central bearing on said bar between said frame portions, and an external bearing for the turret removably mounted in the frame, said external and internal bearings forming the support for the turret.

7. In a machine of the character described, a frame, a rotatable turret having a bearing on its outer surface, a shoulder at the inner end of said surface, a ring bearing enclosing said bearing on the turret and engaging said shoulder at one side, a retaining member secured to the turret and engaging said bearing ring on the other side, means for mounting said bearing ring in the frame, work carrying means mounted in the turret, and means for indexing the turret.

8. In a machine of the character described, a rotatable turret, a plurality of work carrying spindles mounted in said turret and projecting from one end thereof, an indexing mechanism including a rotating member and means to rotate said member completely in one direction about its axis, and an arm carried by said rotating member arranged to engage said projecting portions in succession to turn the turret with a step by step movement, said arm being mounted to operate from outside the turret and to extend inwardly between two adjacent spindles.

9. In a machine of the character described, a rotatable turret, a plurality of work carrying spindles mounted in said turret, a driving clutch member secured to the inner end of each spindle, driving spindles having clutch members to engage those on the work spindles, means for shifting the driving spindles toward and from the work spindles to engage and disengage said clutches, an indexing mechanism including a rotatable member, an arm on said rotatable member adapted to engage the clutch members on the work spindles to index the turret, and means for rotating said arm and shifting the driving spindles in certain timed relation.

10. In a machine of the character described, a rotatable turret, a plurality of work carrying spindles mounted in said turret, a driving clutch member secured to the inner end of each spindle, driving spindles having clutch members to engage those on the work spindles, means for shifting the driving spindles toward and from the work spindles to engage and disengage said clutches, a rotatable member, an arm carried by said

rotatable member adapted to engage the clutch members on the work spindles in succession to rotate the turret with a step by step movement.

11. In a machine of the character described, a frame, a rotatable turret, work spindles carried by the turret each having a clutch member at its inner end, driving spindles in alignment with the work spindles, sleeves forming bearing mounts one for each driving spindle and mounted to slide in the frame toward and from the work spindle, a clutch member on each driving spindle complementary to those on the work spindles, means for driving the work spindles, means for shifting the driving spindle sleeves, and means for indexing the turret in timed relation with the operation of the latter means.

12. In a machine of the character described, a frame, a work spindle, a clutch member carried by said spindle, a bearing sleeve mounted in the frame in axial alignment with said spindle to slide longitudinally toward and from the spindle, means on the sleeve to prevent it turning in the frame, a spring tending to shift the sleeve toward the spindle, a driving shaft carried by the sleeve, and a clutch member on said shaft to engage that on the spindle.

13. In a machine of the character described, a rotatable turret, a plurality of work spindles in said turret, a plurality of driving shafts in alignment with the spindles, complementary clutch members on the opposed ends of the shafts and spindles, a plurality of sleeves in each of which a driving shaft is mounted, said sleeves being slidable longitudinally to connect and disconnect said clutch members and provided with shoulders, a slidable member having a flange to engage said shoulders to shift the sleeves to disconnect the clutches, springs to shift the sleeves to engage the clutches, and automatic means for shifting the slidable member.

14. In a machine of the character described, a frame, a rotatable turret in the frame, work spindles in the turret, a plurality of driving spindles in alignment with the work spindles, supporting bearing sleeves for the driving spindles mounted to slide longitudinally in the frame, complementary clutch members on the work and driving spindles, springs tending to shift the sleeves toward the work spindles, lugs on said sleeves, a slidable member having a flange to engage said lugs, a lever for sliding said member, a control shaft, means operated by said shaft to shift said lever and indexing means for the turret controlled by said shaft.

15. In a machine of the character described, a main drive shaft, a main feed shaft including two aligned sections, a driving connection between the drive shaft and one of said sections, a disconnectable clutch drive between the two sections, a reducing driving connection between the two sections, a driven shaft, and a driving connection from the second section to the driven shaft.

16. In a machine of the character described, a main drive shaft, a main feed shaft including two aligned sections, a driving connection between the drive shaft and one of said sections, a disconnectable clutch drive between the two sections, a reducing driving connection between the two sections including a one way drive, a control shaft driven by the second section, and means controlled by the control shaft for controlling the clutch.

17. In a machine of the character described, a main drive shaft, a plurality of work spindles, a driving connection from said shaft to said spindles including a releasable clutch, a shaft comprising a pair of aligned sections, a clutch drive between the two sections, a driving connection from the main shaft to one of said sections, a control shaft, a driving connection from the second section to the control shaft, a reducing driving connection between the two sections including a one way driving means, and means controlled by the control shaft for controlling said clutches.

18. In a machine of the character described, a main drive shaft, a control shaft, a driving connection between the two shafts including a clutch having a shiftable member, and a hand operated drive including a clutch member adapted to cooperate with said shiftable member only when it is released from the first drive.

19. In a machine of the character described, a main drive shaft, a control shaft, a driving connection between the two shafts including a shaft and a slidable clutch member splined to said shaft, a clutch member on one side of the slidable member driven by the main drive and adapted to be engaged by the slidable member, a gear on the other side of the slidable member, releasable cooperating driving clutch means on said gear and the slidable member, a manually operated means for driving the gear, and means for shifting the sliding member to engage either clutch.

20. In a machine of the character described, a frame, a rotatable turret mounted in the frame, a plurality of work spindles in said turret, an indexing arm mounted to rotate in a single plane, a roller carried on said arm to engage said spindles in succession to turn the turret with a step by step movement.

21. In a machine of the character described, a rotatable turret, a plurality of work spindles mounted in the turret having exposed portions, an indexing mechanism including a rotating member mounted to ro-

tate in one direction only, an arm carried by said rotating member, and a roller carried by the arm in position to engage said exposed portions in succession to index the turret with a step by step movement.

22. In a machine of the character described, a rotatable turret, a plurality of work spindles mounted in said turret and projecting from one end thereof, means for locking the turret in different positions, an indexing mechanism including a rotating member, an arm carried by said rotating member, a roller on the arm to engage said projecting portions in succession to rotate the turret with a step by step movement, said arm being so proportioned as to cooperate with the next projective portion to position the turret in the succeeding position, and means for operating the arm and the locking means in timed relation.

In testimony whereof I affix my signature.

ARTHUR J. LEWIS.