F. H. KIND.

AUTOMATIC THREAD TAPPING MACHINE.

APPLICATION FILED MAR. 22, 1920.

1,403,170.

Patented Jan. 10, 1922.

3 SHEETS—SHEET 1.

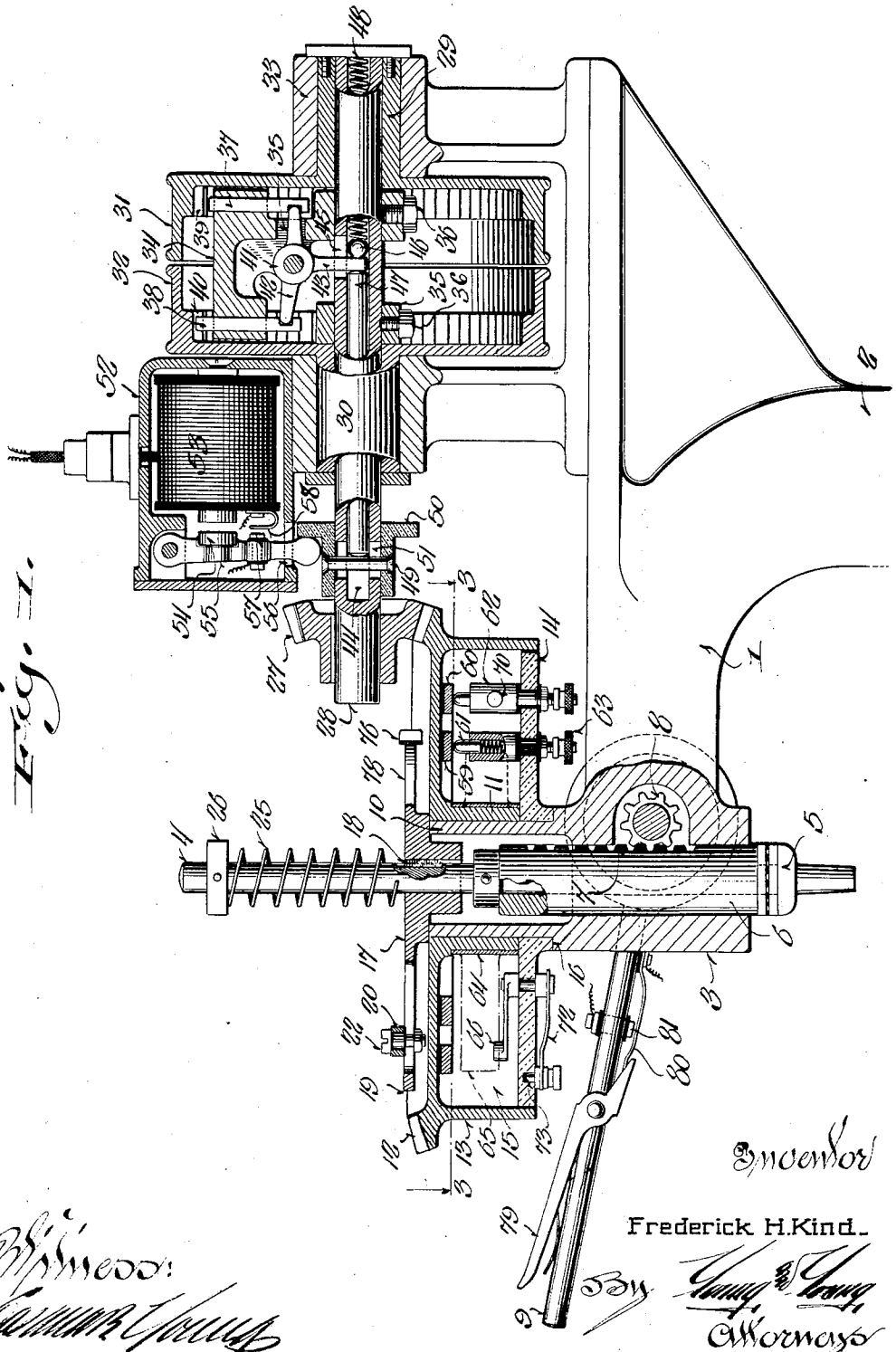


Fig. 1.

Witnesses:

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3 SHEETS—SHEET 2.

Fig. 2.

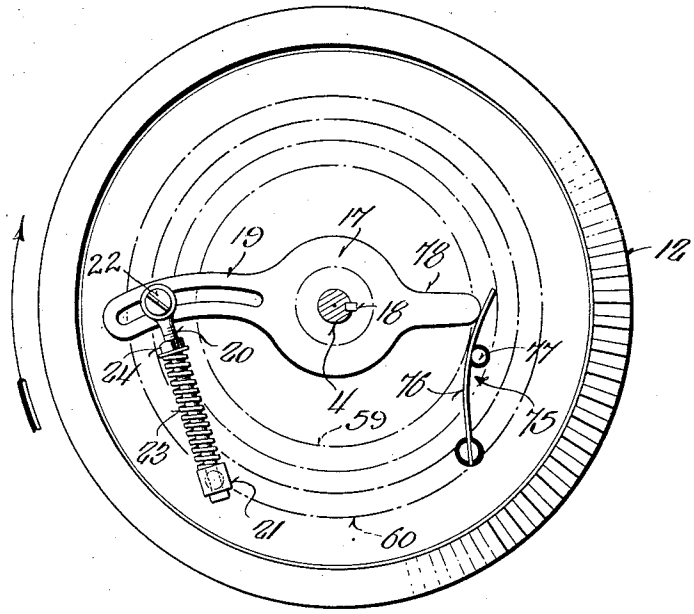
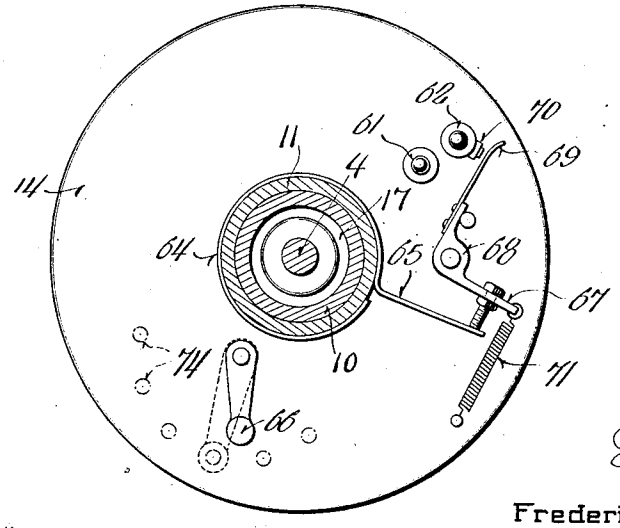


Fig. 3.



Witness:

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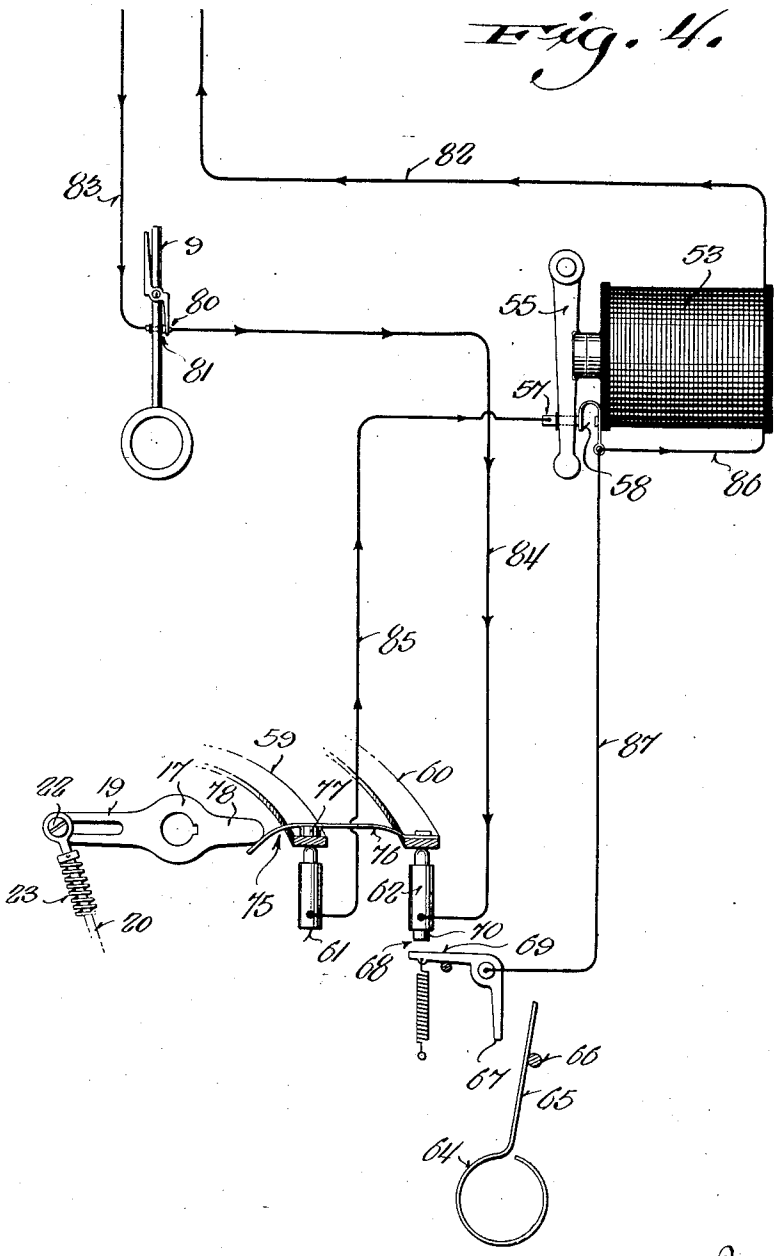
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3 SHEETS—SHEET 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC THREAD-TAPPING MACHINE.

1,403,170. Specification of Letters Patent. Patented Jan. 10, 1922.

Application filed March 22, 1920. Serial No. 367,965.

To all whom it may concern:

Be it known that I, FREDERICK H. KIND, a citizen of the United States, and resident of Manitowoc, in the county of Manitowoc and State of Wisconsin, have invented certain new and useful Improvements in Automatic Thread-Tapping Machines; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to new and useful improvements in drilling and tapping machinery, and has particular reference to the latter type of machines.

The primary object of the present invention resides in the provision of a machine of this character with automatic means for reversing the direction of normal operation of a tool or tap when a predetermined strain is placed thereon, thus rendering it impossible to feed a tool to the work at too great a speed and eliminating the customary manual precaution for preventing the same from being forced into hard spots present in the metal, which results in breakage to the tool.

It is a secondary object of the invention to provide automatic alternate rotation of a drill or tap so that the same may be fed indeterminate distances into the work as well as given a limited number of revolutions or a portion of a revolution in a non-working direction.

It is a further object of this invention to carry out the operations thereof by means of electricity.

With these general objects in view the invention resides in the novel features of construction, combination and arrangement of parts which will be hereinafter more particularly described and claimed and shown in the accompanying drawings wherein:

Figure 1 represents a transverse sectional view through a drilling and tapping machine constructed in accordance with my invention.

Figure 2 is a plan view of the main drive gear showing the chuck carrying spindle in transverse section.

Figure 3 is a horizontal section taken on the plane of the line 3—3 of Figure 1, and

Figure 4 is a semi-diagrammatic view to particularly illustrate the system of wiring used in controlling the several mechanical parts of the invention.

As is usual in machines of this character the spindle operating mechanism is mounted upon a bracket 1 spaced above a suitable work-table (not shown) by a standard or column 2. The portion of the bracket which would be normally disposed above said work-table is shaped to form a spindle housing 3 in which a spindle 4 is rotatable and vertically reciprocable; the lower end of this spindle carries the usual drill or tap chuck 5. The lower half of the spindle 4 is surrounded by the non-rotatable feed-sleeve 6, the same having a plurality of teeth 7 which cooperate with the similar elements of a feed pinion 8. The shaft of the pinion 8 has a crank fixed thereto which provides a feed arm 9 whereby said pinion may rotate to raise or lower the spindle 4.

The upper portion of the spindle housing 3 provides a bearing 10 for the hub 11 of a main drive gear 12. This drive gear has an annular depending flange forming an apron 13 which cooperates with a stationary carrying plate 14 to provide a casing 15. From Figure 1 it will be noticed that the plate 14 is seated on the shoulder 16 at the base of the bearing 10, it being secured thereto in any preferred or desired manner.

A connector plate 17 surrounding the spindle 4 seats against the upper end of the bearing 10 and the similar face of the gear 12, and is keyed as at 18 to said spindle. Connection between this plate 17 and the gear 12 is provided through a slotted arm 19 projecting from the former and a spring rod 20, the latter being pivoted at one end as at 21 to this gear 12, and adjustably joined with the said arm 19 as shown at 22. The rod 20 is designed to slide through the connection 21, and is urged against such movement by means of an expansile coil spring 23 surrounding the same and having one end engaged with said connection 21 and the other end with an adjustable nut 24. An expansile coil spring 25 surrounds the spindle 4 above the conductor plate 17 and has one end bearing thereagainst, the other or upper end being in engagement with a stop collar 26. This spring 25 obviously causes the spindle 4 to move upwardly within its housing 3 upon the release of the feed arm 9.

The gear 12 is preferably of a bevel or mitre type and its teeth are designed to be

continuously meshed with the teeth of a drive pinion 27 which is keyed upon one end portion of a main drive shaft 28. This shaft 28 is journalled in the hubs 29 and 30 of the forward and reverse pulleys 31 and 32 respectively which in turn are revolubly mounted in bearings 33 carried by said bracket 1. The pulleys 31 and 32 receive belts or other suitable driving connections so that the spindle 4 may be driven in a selected forward or reverse direction through the shaft 28 and the gears 12 and 27, together with the connector plate 17.

Housed within the pulleys 31 and 32 is a clutch mechanism for selectively locking either of the same to the shaft 28. This clutch mechanism includes a clutch head 34 which has a pair of arms 35 fixed to the shaft 28 as at 36, said head being adapted to carry a pair of clutch pins 37 and 38, the former being for cooperation with clutch teeth 39 on the forward pulley 31, whereas the pin 38 co-acts with teeth 40 on the reverse pulley 32 when brought into engagement therewith.

The head 34 also carries a shifter 41 for selectively moving the clutch pins 37 and 38 into engagement with the teeth 39 and 40 respectively, said shifter including arms 42 for co-action with said clutch pins, and an arm 43 for rocking the same. This actuating arm 43 projects into a bore 44 in the shaft 28 through a slot 45 therein and is engaged on one side by a bearing ball 46 and on its opposite side by a clutch rod 47, both of which elements are slidable in said bore. The ball 46 is urged against the arm 43 by an expansile spring 48 located within said bore, said spring also exerts its tension to hold the clutch rod 47 in engagement with the transverse pin 49 of a sliding collar 50, the same being movable longitudinally on the shaft 28. Such movement is, however, limited by the ends of slots 51 in the shaft 28 through which said pin 49 extends.

One of the bearings 33 has an electromagnet casing 52 mounted thereon in which is disposed a usual electromagnet 53, the armature 54 of which is carried by a pivoted arm 55. This arm is hung within the casing 52 and its lower end projects through a slot 56 therein and engages with the sliding collar 50. In addition to the armature 54, the arm 55 also carries a contact 57 for engagement with the contact 58 on the magnet 53. It will be seen that by energizing the electromagnet 53, the collar 50 will be slid toward the pulleys 31 and 32 to move the clutch rod 47 in the same direction with the result that the clutch pin 37 is engaged with one of the clutch teeth 39 while the other clutch pin is rendered inactive. On the other hand when the magnet is de-energized, the spring 48 moves the shifter 41, the clutch rod 47 and the collar 50 in the opposite direction to thus throw the clutch pin 38 into engagement with one of its teeth 40 and disconnect the clutch pin 37 from its teeth 39, as shown in Fig. 1.

The means for making and breaking the circuit of the electromagnet is contained largely within the casing 15 and is directly controlled through the connector plate 17. Therefore referring more particularly to the portion of the figures illustrating these parts, it will be seen that the under side of the gear 12 is provided with conductor rings 59 and 60, a brush 61 being provided for engagement with the former, and a similar brush 62 with the latter, both of which brushes are supported upon the carrying plate 14 and have binding posts 63 projecting from the casing 15. The hub 11 of the gear 12 is provided with a split or slip collar 64 having a radially extended trip arm 65; engagement between the hub 11 and the collar 64 is such that when the arm 65 is engaged with an adjustable stop 66 by the rotation of the gear 12 in one direction, the same will slip, but when the gear 12 is rotated in the reverse direction, and the trip arm 65 brought into contact with one arm 67 of an auxiliary circuit switch 68, said collar will bind upon the hub 11 and be moved therewith with the result that the switch 68 is closed.

The switch 68 includes a bell crank, one of its arms being the arm 67 and the other carrying a spring contact 69 for engagement with a stationary contact 70 formed on the brush 62. A contractile spring 71 connected with the arm 67 and the plate 14 normally rotates the switch 68 to an open position, that is to say moves the spring contact 69 away from the stationary contact 70.

The hereinbefore mentioned adjustable stop 66 is carried by a crank arm, the shaft of which projects through the plate 14 and has an external adjusting arm 72. This arm 72 is of spring material and carries a detent 73 at its free end which is adapted to spring into any one of an arcuately arranged series of sockets 74. Thus by shifting the adjustable stop 66, it may be moved to greater or less distances from the arm 67 of the switch 68.

Exteriorly of the casing 15 is located a main circuit switch 75, the same including a spring contact 76 having one end secured to the gear 12 and electrically connected with the conductor ring 60. The other portion of this switch 75 includes a stationary contact 77 also electrically connected with the conductor ring 59 and arranged to be engaged by the spring contact 76 by means of a switch finger 78 extending from the connector plate 17.

A third or main switch also forms a part

of the electromagnet circuits and is manually controlled by the operator of the machine, the other two switches above referred to being automatically opened and closed. In other words this main switch is disposed on the feed arm 9 and comprises a main switch lever 79, a movable or spring contact 80 and a stationary contact 81. When the operator forces downwardly on the free end of the feed lever 9 he automatically rocks the switch lever 79 and moves the contact 80 into engagement with the contact 81, thus making a circuit.

Referring now to Figure 4, the means for connecting the parts of the several switches with the electromagnet will be described. One line wire 82 connects directly with the electromagnet 53, whereas the other line wire 83 runs to the stationary contact 81 on the main switch, the current after entering the movable contact 80 flowing through a conducting wire 84 to the brush 62. After flowing through the main circuit switch, provided the same is closed, the current runs from the brush 61 through a conducting wire 85 to the contact 57 of the swinging arm 55, through the spring contact 58 of the electromagnet, thence through the coils of the same by way of a conducting wire 86. This circuit may be termed the main circuit and as long as it is complete the electromagnet will be energized and the spindle 4 rotated in an operative direction.

That circuit which for the sake of convenience in description may be referred to as the auxiliary circuit includes a line wire 83, the main switch, the conducting wire 84, the brush 62, the auxiliary switch 68, and the conducting wire 87. This latter conducting wire is connected with the spring contact 58 and the current after passing therethrough and into the electromagnet 53 flows out to the line through the line wire 82.

The operation of my invention may be briefly described as follows: Assuming that a tap has been secured in the chuck 5 and the main circuit switch manually closed by the pressure of the operator's hand on the switch lever 79, the main switch above referred to will be closed and the electromagnet 53 energized which will cause the forward pulley 31 to be locked to the drive shaft 28 as hereinbefore particularly set forth, and the rotation of this pulley will be imparted to said shaft and through the gears 12 and 27 and the connector plate 17 to the spindle 4. As long as the workman continues to feed the tap to the work in a proper manner and at the required rate of speed, or as long as the tap is cutting through metal which offers only an average resistance, the electromagnet will remain energized and the spindle will revolve in an operative direction. However, as soon as the tap meets with more than the usual predetermined resistance, the rotation of the spindle will tend to lag with respect to that of the gear 12, this being readily possible through the instrumentality of the connector plate and the spring connection between it and said gear 12, thus moving the switch finger 78 away from the spring contact 76 and breaking the main circuit switch 75. Since the switch 75 is open, the main circuit will be broken and the electromagnet immediately de-energized with the result that the reverse pulley is thrown into operation and the shaft 28 rotated in a direction the reverse of that at which it was just previously revolved. Consequently the spindle 4 will be revolved in a reverse or non-operative direction, and this rotation will continue until the normally open auxiliary switch 68 is closed. As hereinbefore mentioned the auxiliary switch 68 is closed by engagement by the trip arm 65 with the switch arm 67. As soon as the auxiliary switch is closed, the electromagnet will be again energized and the armature 54 attracted thereto; the normal direction of rotation of the several parts of the machine is thus again obtained.

If, when the tap is a second time rotated in an operative direction, it meets with unusual resistance, the main circuit switch will be a second time opened as hereinbefore set forth. This alternate rotation of the tap in opposite directions will continue in this manner until the resistance is gradually overcome. Although the spindle may rotate as many revolutions in an operative direction as necessary, it can only rotate a predetermined distance in a non-operative direction, this distance being controlled by adjusting the stop 66. In other words when the spindle is rotated in an operative direction the trip arm 65 lies in engagement with the stop 66 and is moved away from same when the spindle is rotated in a non-operative direction. Therefore the distance which the trip arm 65 travels from the stop 66 to the arm 67 of the switch 68 regulates the amount of non-operative operation of the spindle.

The ease with which the finger 78 of the connector plate is moved away from the spring contact 76 is also regulatable. This being accomplished through the slotted arm 19 and the connection 22 of the spring rod 20. In other words the degree of movement between the carrying plate and the main drive gear is adjustable so as to make the action of the various parts of the invention more or less responsive to the resistance to rotation of the spindle. The spring 23 which surrounds the rod 20 in addition to forming a connection between the connector plate and the gear 12 provides a cushioning means to absorb the shock which is incident to the striking of the work by the tap or other tool.

Various changes may be made in the form

or proportions of the several parts of the invention and in the general association of these parts without departing from the principles of the invention or sacrificing any of the advantages.

I claim:

1. In a mechanism of the character described, a tool carrying spindle, means for rotating the spindle in one direction, means for automatically discontinuing rotation of the spindle in said direction for a predetermined length of time when resistance to rotation of said spindle reaches a predetermined degree, and means for varying the length of time of non-rotation of the spindle in said direction.

2. In a mechanism of the character described, a tool carrying spindle, and means for automatically alternately rotating the spindle in opposite directions, the amount of rotation in one direction being indeterminate, and the amount of rotation in the reverse direction being predetermined.

3. In a mechanism of the character described, a tool carrying spindle, and means for automatically alternately rotating the spindle in opposite directions, the amount of rotation in one direction being indeterminate, and the amount of ~~rotation~~ in the reverse direction being predetermined, and means for varying the predetermined amount of rotation in said reverse direction.

4. In a mechanism of the character described, a tool carrying spindle, means for rotating the spindle in one direction, means for discontinuing rotation of the spindle in said direction, means for rotating the spindle a predetermined distance in a reverse direction, and means for automatically rotating the spindle in the initial direction when same has rotated said predetermined distance in the reverse direction.

5. In a mechanism of the character described, a tool carrying spindle, means for rotating the spindle in one direction, electromagnetic means for discontinuing rotation of the spindle in said direction, means for rotating the spindle a predetermined distance in a reverse direction, and means for automatically rotating the spindle in the initial direction when the same has rotated said predetermined distance in the reverse direction.

6. In a mechanism of the character described, a tool carrying spindle, means for rotating the spindle in one direction, electromagnetic means for discontinuing rotation of the spindle in said direction, means for rotating the spindle a predetermined distance in a reverse direction, and electromagnetic means for starting rotation of the spindle in the initial direction when the same has rotated said predetermined distance in the reverse direction.

7. In a mechanism of the character described, a tool carrying spindle, means for rotating the spindle in a forward direction, means for rotating the spindle in a reverse direction, an electromagnet for actuating the said means, a switch, an electric circuit including said switch and electromagnet, said circuit being normally complete whereby the spindle will be rotated in a forward direction, and means operable by the spindle to open the switch and break the circuit when rotation of the spindle is resisted.

8. In a mechanism of the character described, a tool carrying spindle, means for rotating the spindle in a forward direction, means for rotating the spindle in a reverse direction, an electromagnet for actuating the said means, a switch, an electric circuit including said switch and electromagnet, said circuit being normally complete whereby the spindle will be rotated in a forward direction, means operable by the spindle to open the switch and break the circuit when rotation of the spindle is resisted, and means for automatically remaking the circuit after a predetermined space of time.

In testimony that I claim the foregoing I have hereunto set my hand at Manitowoc, in the county of Manitowoc and State of Wisconsin.

FREDERICK H. KIND.