March 16, 1937. A. KIEFER 2,073,967

BOLT TURNING MACHINE AND THE LIKE

Original Filed Dec. 12, 1932 6 Sheets-Sheet 1

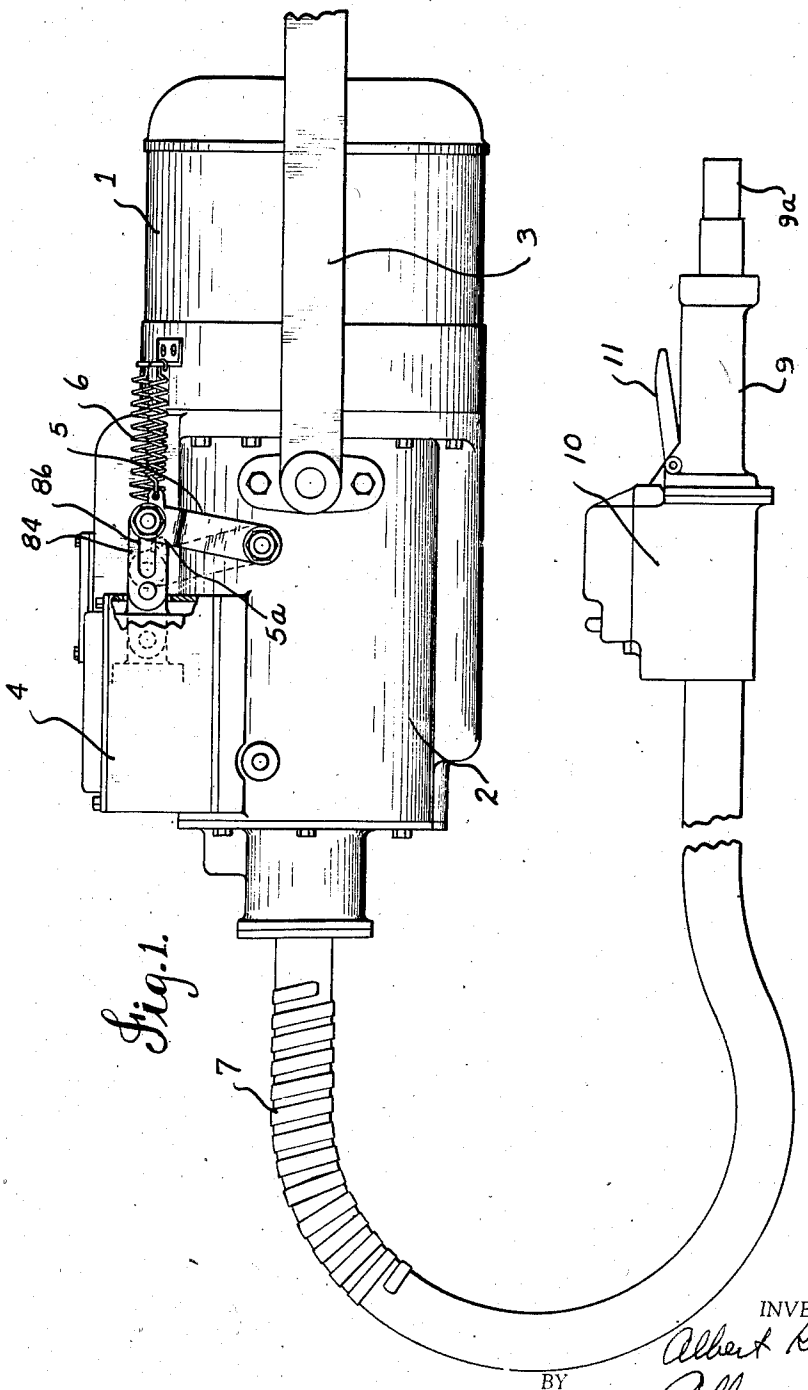


Fig. 1.

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BOLT TURNING MACHINE AND THE LIKE

Original Filed Dec. 12, 1932 6 Sheets-Sheet 2

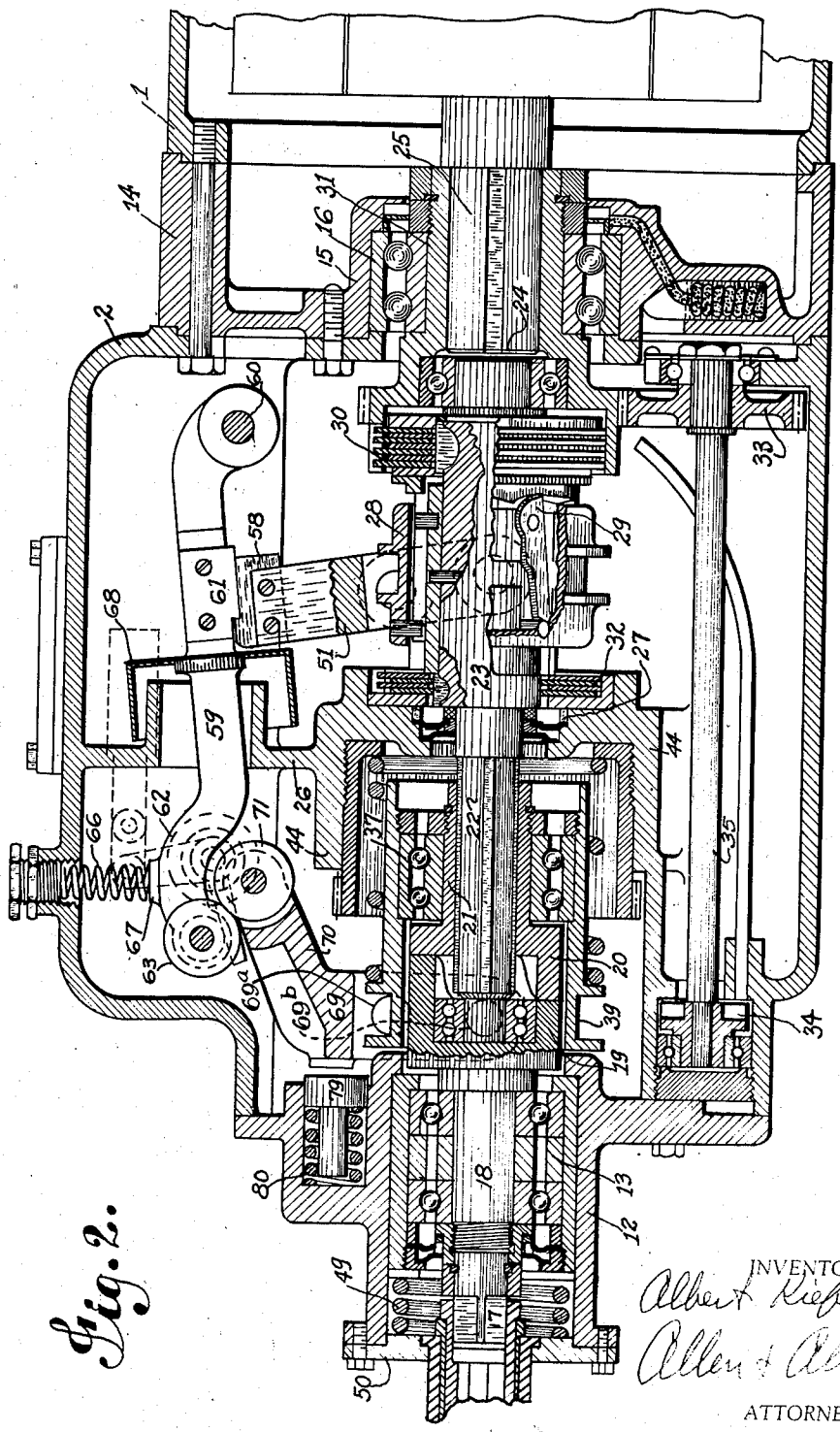


Fig. 2.

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BOLT TURNING MACHINE AND THE LIKE

Original Filed Dec. 12, 1932 6 Sheets-Sheet 3

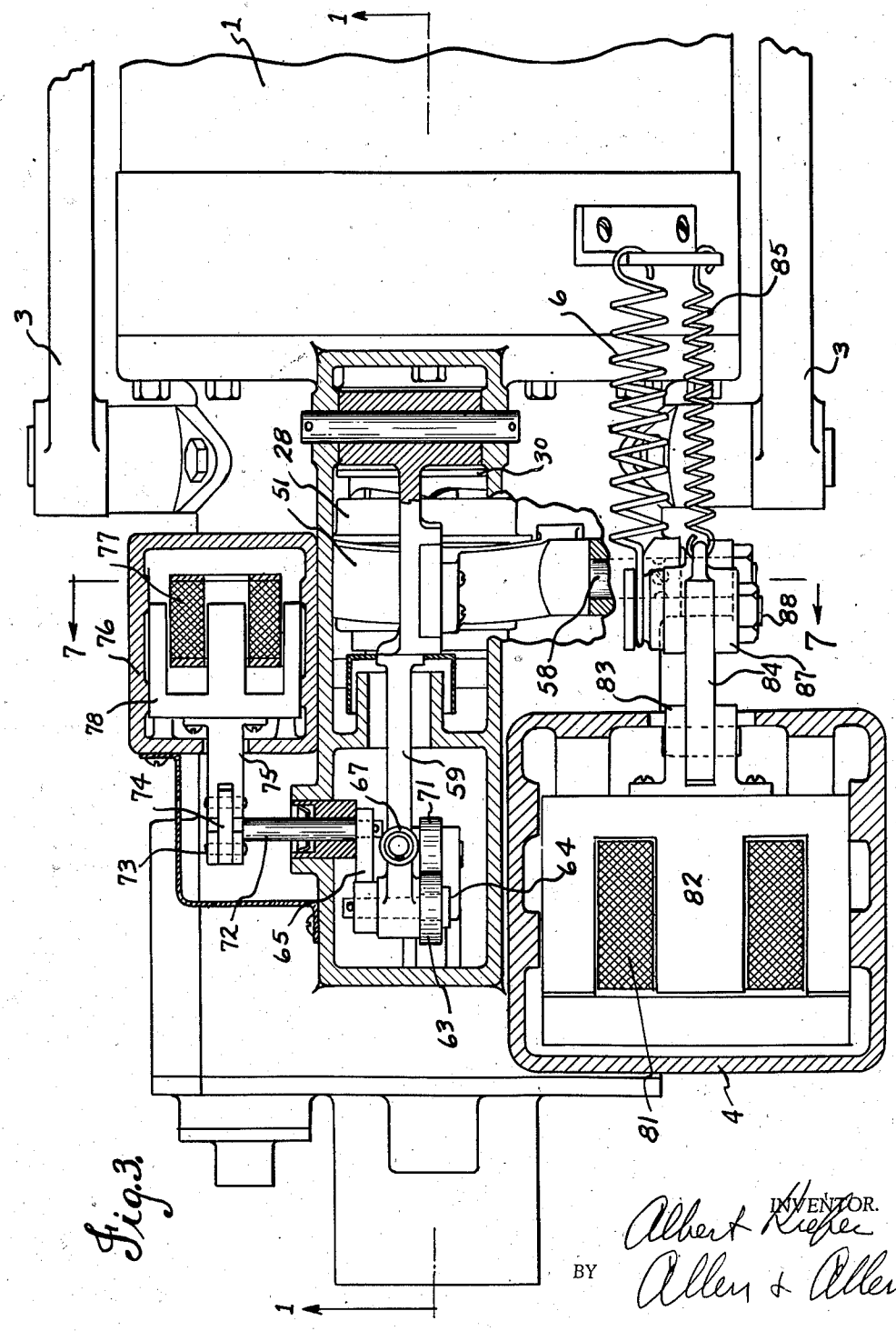


Fig. 3.

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BOLT TURNING MACHINE AND THE LIKE

Original Filed Dec. 12, 1932 6 Sheets-Sheet 4

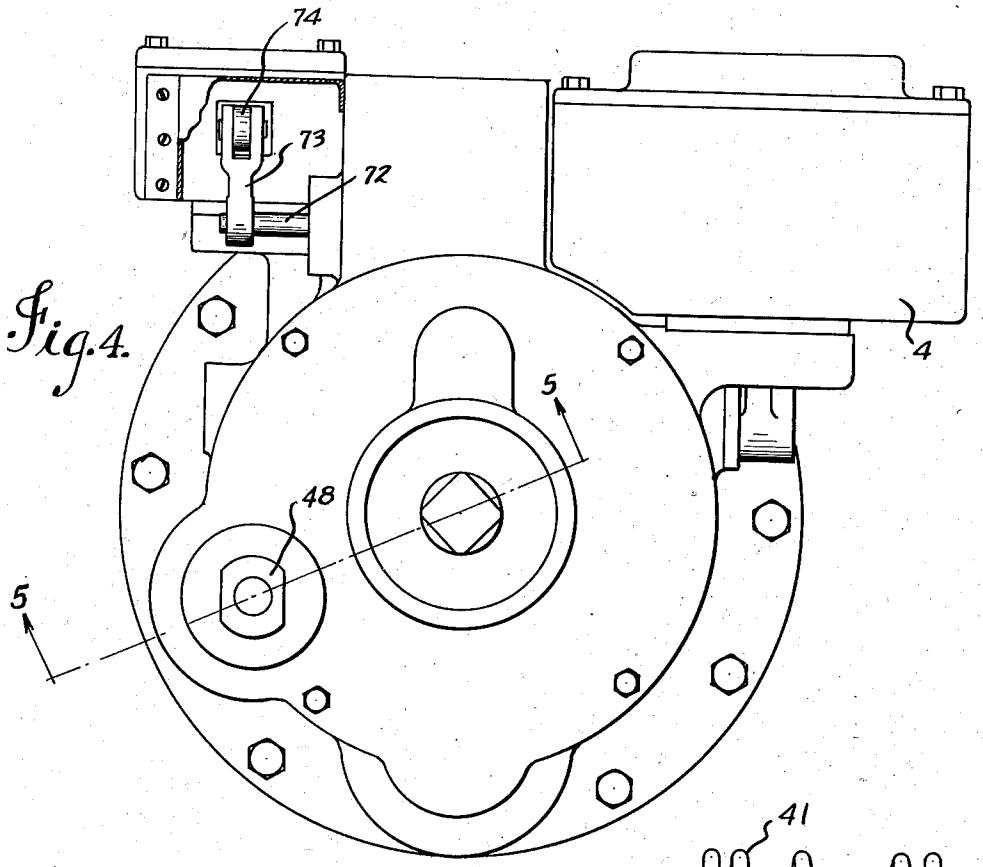


Fig. 4.

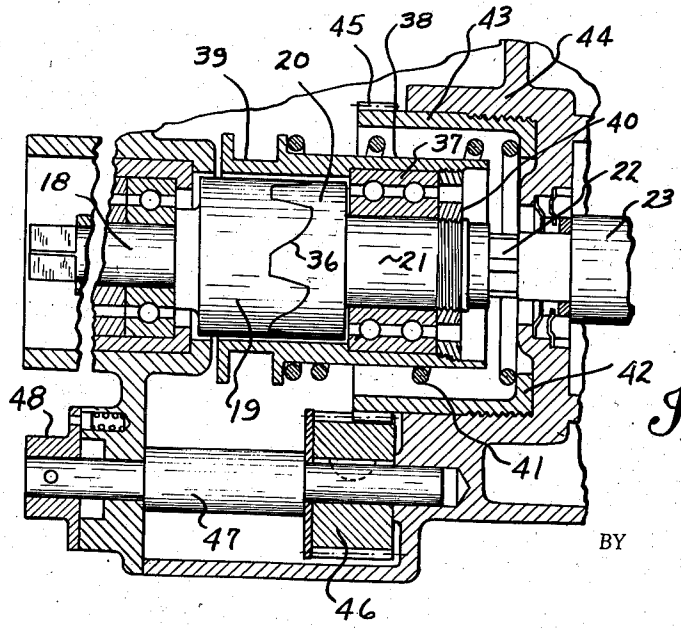


Fig. 5.

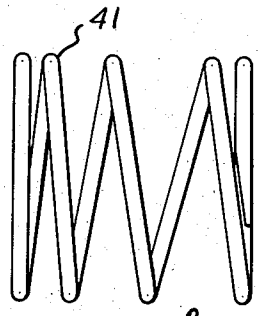


Fig. 6.

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BOLT TURNING MACHINE AND THE LIKE

Original Filed Dec. 12, 1932 6 Sheets-Sheet 5

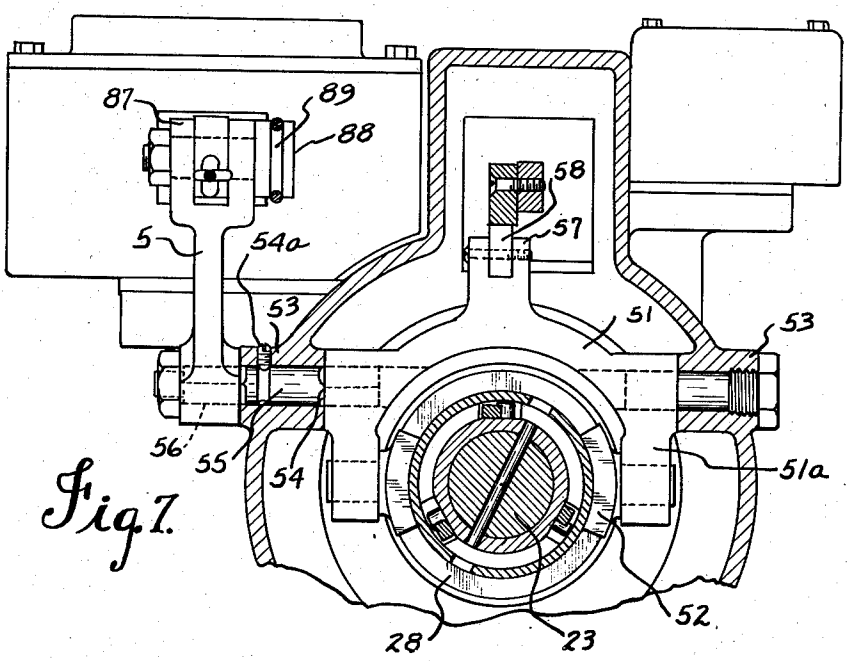


Fig. 7.

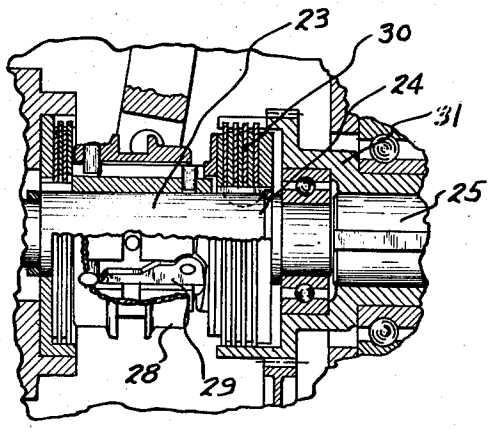


Fig. 8.

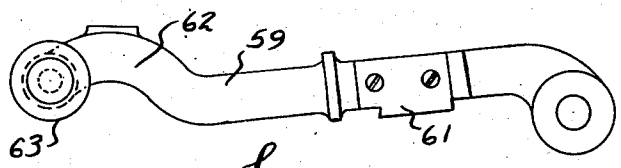


Fig. 9.

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BOLT TURNING MACHINE AND THE LIKE

Original Filed Dec. 12, 1932 6 Sheets-Sheet 6

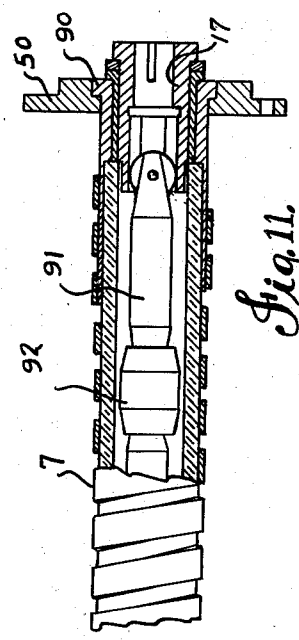


Fig. 11.

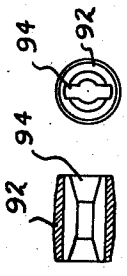


Fig. 13.

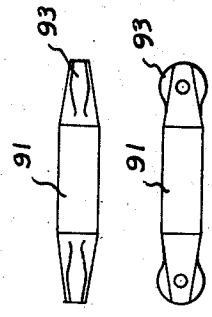


Fig. 12.

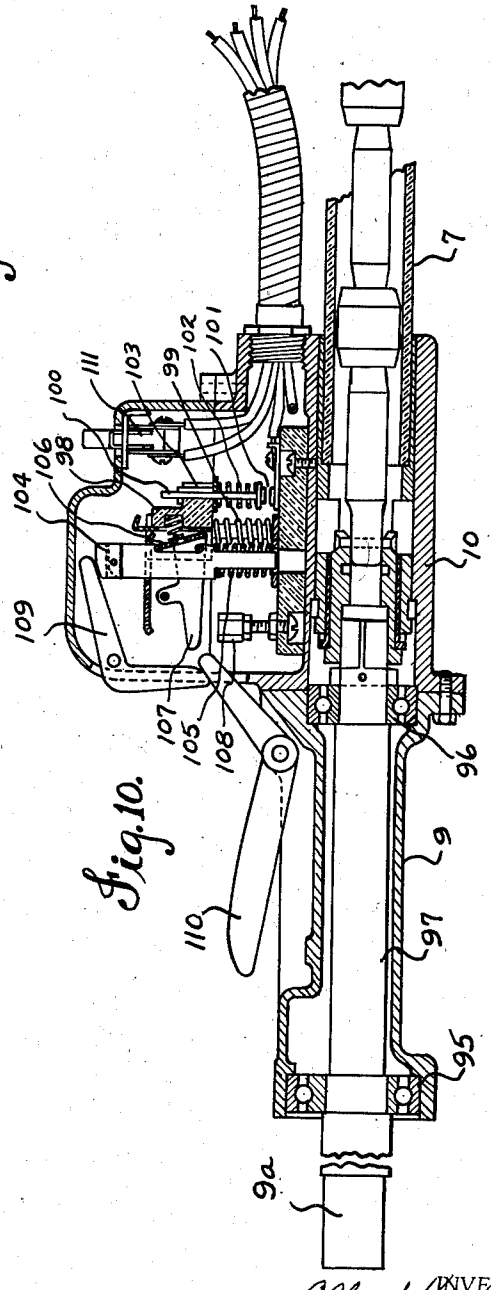


Fig. 10.

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Patented Mar. 16, 1937

2,073,967

UNITED STATES PATENT OFFICE

2,073,967

BOLT TURNING MACHINE AND THE LIKE

Albert Kiefer, Cincinnati, Ohio, assignor to The Hisey-Wolf Machine Company, Cincinnati, Ohio, a partnership composed of Walter J. Friedlander and John W. Friedlander

Application December 12, 1932, Serial No. 646,880
Renewed April 1, 1935

5 Claims. (Cl. 192—150)

My invention relates to the provision of a machine primarily for the purpose of turning down bolts and nuts which has as its object the application of a measured torque, and which will throw itself out of operation without any shock or jar to the operator of the machine.

In machines used at present for the turning down of bolts, as, for example, in automobile factories, the torque is applied to the bolt head with an amount of power depending upon the pressure applied by the operator with the machine. Thus, the uniformity with which the bolts are driven home is dependent upon a variable human element. In the next place, when the bolts are driven home by the mechanisms in use at present, there is a violent jerk which results in the mechanism jumping away from the bolt in opposition to the force applied to it by the operator. As a result, practiced operators cannot operate these machines continuously, and a crew of men must be employed, taking turn and turn about.

According to my invention, as noted above, the torque applied to the bolt is of uniform quantity controlled by the machine itself and the throw out of the machine operates without shock to the operator.

The throw out mechanism employed by me consists of a cam member axially movable and opposed by a measured force, such as a regulatable compression spiral spring. This cam member, which in the preferred form is a clutch-like member having spiral cut teeth, does not itself release its driving function, but by its movement throws out another clutch interposed between it and the driving motor.

It is one of my objects to provide a remote control for the machine located adjacent the bolt-engaging chuck, this being in the form of a momentary contact switch which makes and breaks a circuit to a master solenoid that throws in and latches the clutch. The driving motor remains in operation at all times. It is my object in connection with the remote control, to provide a switch for a second solenoid which will trip the latch when desired.

I have provided in connection with the various mechanisms, for a simple and powerful construction readily manufactured and assembled and highly fool-proof in operation.

My mechanism is to be distinguished from safety couplings or release clutches where the releasable member rides out of operative relation, since such a mechanism would be impractical in a bolt turning machine which requires a powerful and adequate clutch which itself is operated by a member which forms part of the driving train, but which of itself is never removed from driving relation.

I have illustrated in the drawings a typical embodiment of my invention, and I now refer to the appended claims in which I have set forth the essentials in mechanisms such as the one illustrated which are required to accomplish my objects. In other words, I will describe my preferred mechanisms in detail, and refer to the claims for those generalizations which will indicate to the man skilled in the art the essential elements of said illustrated embodiment.

In the drawings:—

Figure 1 is a side elevation of my machine.

Figure 2 is a central longitudinal section of the machine, from which the chuck and flexible shaft have been omitted.

Figure 3 is a plan view, partly in horizontal section, of the machine.

Figure 4 is a front end elevation of the machine.

Figure 5 is a detail section on the line 5—5 of Figure 4.

Figure 6 is a view of the torque control spring.

Figure 7 is a section on the line 7—7 of Figure 3.

Figure 8 is a section of the parts shown in Figure 7, but at right angles thereto.

Figure 9 is a detail of the clutch latch lever.

Figure 10 is a detail section of the remote control switch.

Figure 11 is a detail of the flexible drive shaft.

Figure 12 is a plan and elevation of one of the long links.

Figure 13 is a plan and elevation of one of the short links of the flexible shaft driving elements.

Referring first to the elevation of the entire machine, 1 is an electric motor; 2, the main casing of the machine to which is pivoted a yoke 3 to be suitably suspended, thereby giving mobility to the apparatus; 4 is a housing for the main clutch operating solenoid; 5, the external lever of the main clutch yoke; 6, the main spring which pulls the said lever into a normal position with the main clutch open; 7 is the casing for the flexible operating shaft; 9 is the chuck housing; 9a, the chuck; and 10 the casing for the remote control switch.

In operating the device, the operator holds the chuck housing in his hand and presses the switch operating lever 11. This energizes the magnet in the housing 4 which pulls over the lever 5, thereby engaging the main driving clutch. The

motor is always in operation when the machine is running, and the engagement of the clutch causes the chuck to revolve. The chuck is then applied to a nut and held there until the nut is turned down as tightly as the machine is set to accomplish, whereupon the releasing mechanism located within the machine trips the latch which has been holding the parts controlled by the lever 5, and permits the spring 6 to pull the lever 5 over, thus opening the clutch.

As I will describe, a depression of the member 11 will release the machine for one operation only, and the clutch is opened without any jar to the operator when the required torque has been applied by means of the chuck. Furthermore, the release of the main operating clutch is positive and accompanied by no preceding diminution in the power applied to the flexible shaft and chuck.

Referring particularly to Figures 2 and 3, the main housing portion 2 has a boss 12 in which is a roller bearing 13, and has attached at the opposite end a ring member 14 having a boss 15 in which is another roller bearing 16. The flexible shaft has at its inner end a member 17 which is secured to the end of a stub shaft 18 supported in the bearing 13.

As indicated more clearly in Figure 5, a toothed cup 19 is secured on the inner end of the stub shaft. The toothed cup 19 meshes with another toothed cup 20, which cup has a sleeve portion 21 splined to the end 22 of the main shaft 23 of the device. The shaft 23 terminates at 24 within the clutch, and is coaxial with the shaft 25 of the driving motor.

There is a transverse partition generally indicated at 26 which forms part of the main casing 2, and where the shaft passes through this partition it is provided with discs 27 to prevent oil leakage. The master clutch which I have illustrated is the one shown in United States Patent No. 1,753,085, to which reference is made for its operation. Any other suitable friction clutch can be substituted for the particular one that I have selected.

Referring to Figures 2 and 8, the master clutch includes a grooved collar 28, a cam finger 29, friction disc assembly 30 held in a housing 31. The housing 31 is supported in the roller bearing 16, and is splined to the motor shaft 25. Instead of a double clutch, as shown in the patent to which I have referred, I provide at the forward end of the clutch a relatively few friction discs 32 to act as a brake when the clutch collar is thrown to open position. I also utilize the housing 31 to drive a gear 33 which operates an oil pump 34 by means of a shaft 35. This oil is confined to that portion of the housing which surrounds the master clutch.

Referring back to the toothed cups 19 and 20, it should be noted that these cups have spiral engaging faces 36 in the driving direction, which is illustrated as being clockwise in Figure 5. The cup 20, when the rotation of the cup 19 is prevented, rides away from mesh position in a spiral manner so as to move to the right on the splined end 22 of the main shaft in the illustrated embodiment of the machine. Mounted on the sleeve 21 of the toothed cup 20 is a bearing 37 which mounts the sleeve portion 38 of a grooved collar 39. The bearing and the parts 38 and 39 move with the cup 20 along the splined shaft, a nut 40 being used to hold together the sleeve or hub 21, the bearing 37, and the sleeve portion 38 of the collar 39. Located around the sleeve portion 38 and bearing against the collar portion 39 is a spiral spring 41, which spring is arranged with a lead so that these spiral convolutions are increasingly far apart. Such a spring opposes a force tending to collapse it with a fairly constantly increasing force, which is quite necessary in the present device. The spring 41 also bears against the inner end 42 of a housing 43, and the housing is threaded into a circular flange 44 of the partition 26. This housing has gear teeth 45 which mesh with a gear 46. The gear 46 is mounted on a shaft 47 which projects through the front face of the casing, where it is provided with a head 48 for the application of a wrench.

The purpose of this last mentioned construction is to enable the operator to adjust the tension of the spring 41 since, as the housing 45 is threaded to the right for example in the illustrated embodiment, this will tend to collapse the spring 41 and thus increase its force applied against movement of the collar 39 and the parts which move with it, including the toothed cup 20.

Referring now to the operation of the machine when the chuck is being driven to turn down a nut or bolt, the cup 20 will start in full mesh with the cup 19, and will drive the cup 19, and through it the flexible shaft which extends to the chuck. When the bolt is turned down, the cup 20 continues to apply a torque to the cup 19, and at the same time to move along the shaft portion 22 axially, thus pressing the spring 41. The greater the compression that must be overcome in the spring 41, the more force the cup 20 will apply to the cup 19 before the former has any retrograde movement. When the cup 20 has moved back, however, the predetermined distance, the collar 39 will accomplish a release of the master clutch as will be described.

The movement of the cup 20 will not be sufficient to disengage the said cup from the cup 19, and as the cup 20 moves to the right it does not cease to apply its full driving force to the cup 19.

By this means, the torque applied to a bolt or nut by the machine can be controlled with a large degree of accuracy, and can be adjusted by adjusting the preliminary compression of the spring, as has been described.

To hold the bearing 13 in place at the front end of the casing, I preferably employ a heavy spring 49 held in place by a cap 50, so as to apply a cushioned backing to the cup member 19.

The clutch latch and release

Referring to Figures 2, 3, and 7, I have indicated a clutch yoke 51 having arms 51*a* and shoes 52 which engage in the clutch collar 28. This clutch yoke 51 is supported in bosses 53, 53, in the sides of the main casing on suitable trunnions, one of them being of special nature. This special trunnion has a squared end 54 engaging a socket in the yoke, a rounded portion 55 mounted in the boss 53 and held against sliding by a set screw 54*a*, and a squared portion 56 on which is mounted the lever 5, to which reference has already been made, said lever serving to operate the yoke.

The central portion of the yoke within the casing is provided with a slotted lug 57 in which is mounted a latch plate 58, the arrangement being such that when the yoke is rocked with its upper end forwardly to apply the clutch, the latch bar will hold the yoke in this position until released. The latch bar is shown by itself in Figure 9, and consists of a long bar 59 pivoted at

60 in the rear part of the main casing, and having a notched portion 61 serving as a latch to engage the member 58. The forward end of the latch bar is bent at 62 and terminates in a roller 63. By reference to Figure 3 it will be noted that this roller is mounted on a stud 64 which extends through the end of the bar 59 and mounts a lever 65. By means of this lever, as will be described, the latch bar can be operated independently of the torque release that has already been described.

The latch bar is held down by means of a spring 66 engaging a pad 67 on the portion 62 of the latch bar. The latch bar also passes through the central partition 26, and I have shown a shield 68 mounted on the latch bar to prevent oil from being dashed into the forward part of the casing.

The latch bar is lifted to release the clutch yoke of the master clutch by means of a clutch yoke 69 having trunnions 69*a* in the casing, and having legs with shoes 69*b* in the grooved collar portion 39. The yoke 69 has a rearwardly slanting central arm 70 which mounts a roller 71 at its upper end. This roller lies under the roller 63 on the latch bar, the arrangement being such that when the collar 39 is moved rearwardly or to the right in the illustrated showing, the yoke 69 is rocked so as to thrust the roller 71 upwardly, thereby raising the end of the latch bar. As has been described, this releases the yoke of the master clutch, permitting the clutch to open.

Referring now to the auxiliary means for raising the latch bar, the lever 65 which, as has been noted, is mounted on the end of the latch bar, is secured fast to a stub shaft 72 which extends out through the top of the main casing, where it is engaged by a link 73. The link 73 is secured by means of another link 74 to the solenoid stem 75. The solenoid is housed in a casing 76 independent of the main casing, but secured thereon, and consists of a coil 77 and an E-shaped solenoid armature 78 arranged to slide in the casing and connected to the stem 75.

With this construction, an energizing of the coil 77 will withdraw the armature 78 inwardly, pull the link 73 to the right, rock the lever 65 to the left, and lift the latch bar.

In connection with the yoke 69, in order to avoid any shock or jar when this yoke is rocked to lift the latch bar, I provide an abutment 79 backed up by a spring 80 located in a suitable socket in the main casing.

The main solenoid

Referring more particularly to Figures 3 and 7, it will be noted that in the solenoid case 4 there is mounted a coil 81 and a sliding E-shaped armature 82, the stem 83 of which is forked. Pivotally secured in the stem 83 is a link 84 which is acted on by a spring 85 which tends to hold the armature in its retracted position. The link 84 is slotted, as shown at 86 in Figure 1, and the external operating lever 5 for the master clutch yoke is bifurcated as at 87 so as to accommodate a stud 88 that passes through the slot in the link. The stud also provides a mounting groove 89 for the main spring 6, the arrangement being such that the spring 6 tends to hold the lever 5 in position to hold the main clutch open.

Starting with the machine in condition for operation with the motor 1 rotating and the master clutch in its spring-held position, the operator closes the circuit to the main solenoid coil 81 for an instant. This draws the link 84 toward the solenoid case 4 and pulls over the main clutch lever to the position shown in dotted lines in Figure 1 at 5*a*. This operates the clutch yoke so as to engage the clutch and drive the chuck. When the yoke is pulled over the latch plate 58 rides behind the latch plate 61 on the latch bar 59 which holds the clutch in its operative position until the latch bar is raised by the mechanism which has already been described.

The flexible shaft, chuck and switch

The casing of the flexible shaft which has been indicated at 7, is flanged at 90 so as to be engaged and held in place by the cover plate 50. The flexible shaft itself is formed of any standard design, the one I have selected consisting of long links 91 and short links 92, the long links having rounded heads 93 which enter rounded pockets 94 in the short links. The terminal member 17 of the flexible shaft is directly connected to the stub shaft 18, as has been described.

As has been noted, a chuck housing 9 and switch case 10 are secured on the flexible shaft casing 7 adjacent the end of the shaft. The housing 9 provides for roller bearings 95 and 96 for the chuck spindle 97 terminating in the hollow chuck indicated at 9*a*. The switch member in the casing 10 may be of any standard make which will provide a momentary contact and no more upon each depression of the actuating member.

In the form shown, there is a dielectric block 98 which slides against spring tension on a pair of posts 99. The block carries at its rear end a finger 100 with a contact bar 101 at its lower end. A spring 102, bearing against the under side of the block 98, presses on the contact member, holding it down. A member 103 on the finger 100 limits the downward movement of the contact member so that when the block 98 is in its upward position, no contact is established. The block 98 is depressed to make a contact by means of a plunger 104 which is normally held in upward position by a spring 105. The plunger engages a lip 106 on a pivoted latch 107 which is formed of two parallel plates which straddle the plunger 104. When the plunger is depressed, it will move the block 98 downwardly and establish contact; but a full depression of the plunger will cause the end of the latch 107 to strike an abutment 108, thus rocking the latch, and move the lip 106 rearwardly away from engagement with the plunger 104. This permits the entire block and switch contact to be moved upwardly independent of whether the plunger is held down or not.

As a convenient method of operating the plunger, I provide a bell crank lever 109 in the casing 10, and another bell crank lever 110 which engages one end of the lever 109, so that by depression of the lever 110, which the operator can readily accomplish with the hand that is holding the chuck housing, the lever 109 is rocked so as to depress the plunger. As already noted, this will cause a momentary contact which is at once broken, so that the operator, by holding down on the member 110, cannot effect the operation of the device. The short period of contact of the switch is sufficient, however, to energize the main solenoid, and thus throw in the master clutch.

In addition to the main switch I provide another switch, in the form of a snap button switch 111, in the casing, which closes the circuit to the latch bar raising solenoid 77, so that the operator can, if anything goes wrong, stop the operation of the machine.

It is not believed to be necessary to state again the operation of the various parts of the device, since this has been done as the description has progressed. It will be apparent that various modifications can be made in the structure described without departing from the novel elements and combinations of elements which the structure illustrates.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a device of the character described, the combination of a casing having an apertured partition across the same, a friction clutch, a motor, and a shaft extending from the clutch at one side of the partition, said shaft extending through the aperture of the partition, a torque release forming part of the transmission from said shaft to the member to be driven at the other side of the partition, and means mounted in the aperture around the shaft, preventing passage of oil from the clutch side of the casing to the torque release side thereof.

2. In a device of the character described, the combination of a casing having a partition across the same, a friction clutch, a motor, and a shaft extending from the clutch at one side of the partition, said shaft extending through the partition, a torque release forming part of the transmission from said shaft to the member to be driven at the other side of the casing, and means for preventing passage of oil from the clutch side of the casing to the torque release side thereof, said clutch having an operating yoke, a latch bar for said yoke to hold it in "on" position, said latch bar extending through the partition, and means for preventing oil from splashing through the partition alongside of said latch bar.

3. In a device of the character described, the combination of a casing having a partition across the same, a friction clutch, a motor, and a shaft extending from the clutch at one side of the partition, said shaft extending through the partition, a torque release forming part of the transmission from said shaft to the member to be driven at the other side of the casing, and means for preventing passage of oil from the clutch side of the casing to the torque release side thereof, an electromagnetic member for operating the clutch, said member located outside of the casing, a yoke for the clutch located within the casing, one of the trunnions of the yoke being extended through the casing for interlinkage with the said electromagnetic member.

4. In a machine of the character described, comprising a casing, a motor mounted at one end of the casing, a chuck rotatably connected to the opposite end of the casing, and a master clutch in said casing, connected to the motor, means tending to bring said clutch into inoperative condition, a shaft connected to the motor by the master clutch, mutually engaging members relatively rotatable coaxially with the master clutch and connected to the shaft and the chuck, respectively, having their engaging surfaces adapted to slip one on the other under increased load on the chuck, and means contained in said casing including a latch restraining the master clutch in operative condition to transmit the motion from the motor to said shaft, and an operative connection from the latch to one of said members, operative to release the latch after a desired degree of slippage of the members, and thereby allow the master clutch to be brought into its inoperative condition, the two members having their mutually slipping surfaces inclined at an angle to the line of movement imparted to the one member due to the slippage, which angle decreases as the slippage progresses, and in which said one member is resisted by a spring constructed to maintain a substantially uniform resistance to the movement of the member as the slippage progresses.

5. In a machine of the character described, comprising a casing, a motor mounted at one end of the casing, a chuck rotatably connected to the opposite end of the casing, and a master clutch in said casing, connected to the motor, means tending to bring said clutch into inoperative condition, a shaft connected to the motor by the master clutch, mutually engaging members relatively rotatable coaxially with the master clutch and connected to the shaft and the chuck, respectively, having their engaging surfaces adapted to slip one on the other under increased load on the chuck, and means contained in said casing including a latch restraining the master clutch in operative condition to transmit the motion from the motor to said shaft, and an operative connection from the latch to one of said members, operative to release the latch after a desired degree of slippage of the members, and thereby allow the master clutch to be brought into its inoperative condition, the casing having a partition between the clutch and the mutually sliding members, and in which the latch connection includes a swinging element extending through said partition, said partition having an extension surrounding said element in the part of the casing enclosing the clutch, and said element having an extension surrounding the partition extension, the extensions being spaced from each other and the partition extension being spaced from said element to allow the swinging of the element, and by their relation being adapted to hinder passage of oil from the clutch containing part of the casing to that part containing the mutually sliding members.

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