Dec. 5, 1961 E. G. SPYRIDAKIS ET AL 3,011,479

IMPACT TOOL

Filed March 22, 1960 3 Sheets-Sheet 1

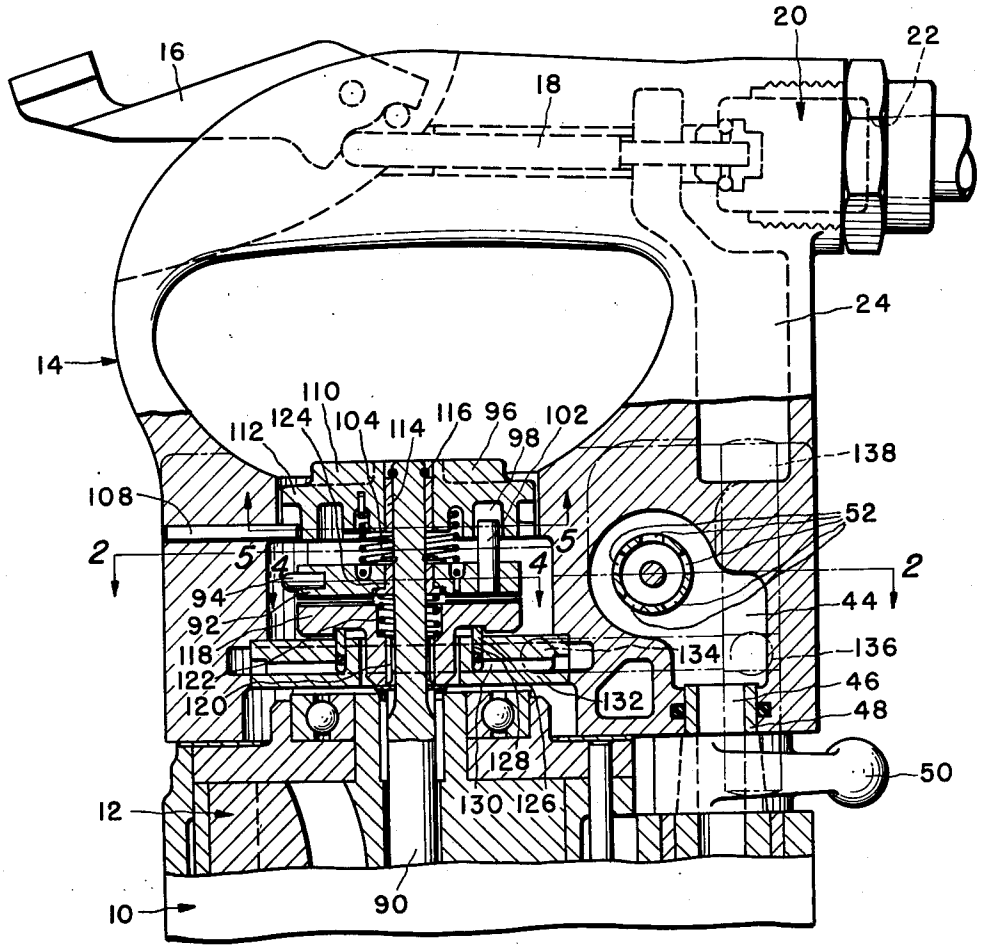


FIG. 1

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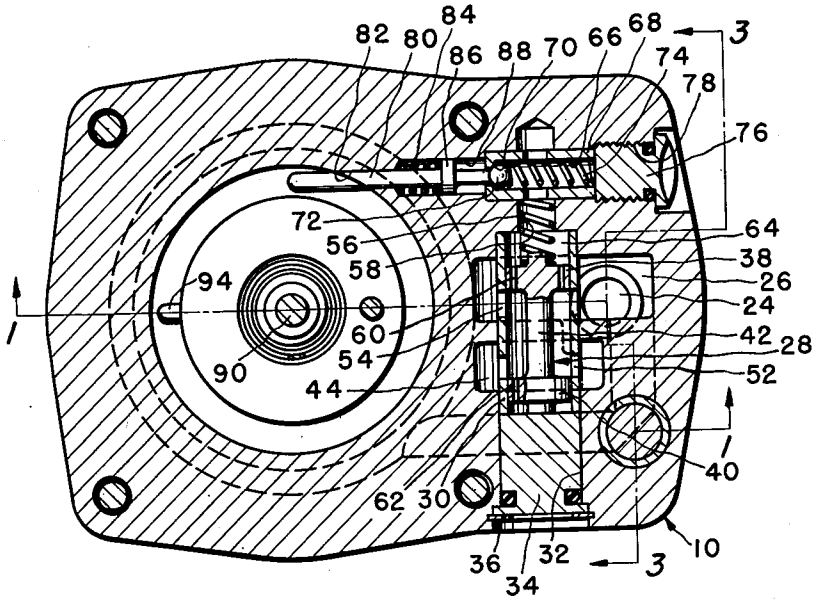


FIG. 2

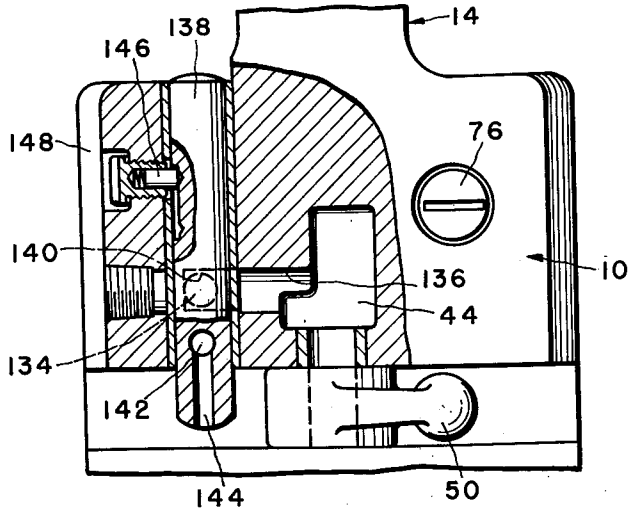


FIG. 3

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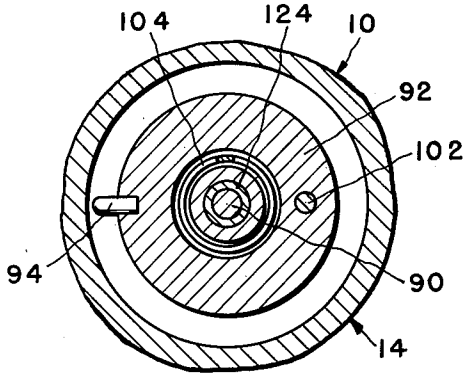


FIG. 4

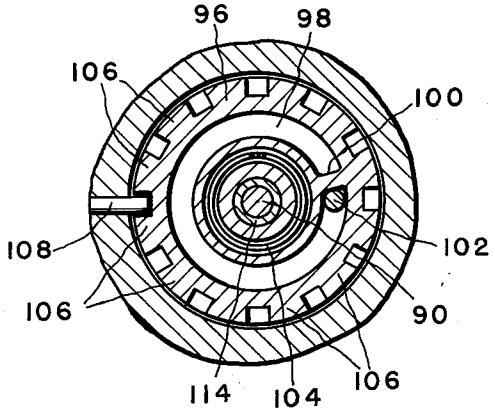


FIG. 5

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3,011,479

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IMPACT TOOL

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14 Claims. (Cl. 121—33)

This invention relates to an automatic shut-off for power wrenches and such tools particularly of the pneumatic type provided with an air motor and a rotative spindle. The invention is particularly useful in connection with hand-held tools portable and used on production jobs.

The improved construction of this invention is related to that disclosed in the John B. Vilmerding application for Impact Tool, Serial No. 27,374, filed May 6, 1960.

It is an object of this invention to provide a tool such as a wrench which can be employed in the normal manner either for forward or reverse operation and when desired can be set to automatically shut-down on a given degree of rotation of a spindle which may be preferably associated with the work engaging part of the wrench. It will be understood that while the invention may be very useful in connection with power wrenches, screw drivers and the like, other applications will be obvious and such are contemplated.

Other objects of the invention will be in part obvious and in part pointed out hereinafter.

In the drawing

FIGURE 1 is a longitudinal section through part of a preferred embodiment of the invention, a portable hand-held wrench;

FIG. 2 is a cross section through the shut-off mechanism at the line 2—2 looking in the direction of the arrows;

FIG. 3 is a longitudinal section of that portion of the tool containing the shut-off mechanism, taken along the line 3—3 of FIG. 2;

FIG. 4 is a cross section through an actuating portion of the shut-off taken at the line 4—4 of FIG. 1, looking in the direction of the arrows; and

FIG. 5 is a cross section taken along the line 5—5 of FIG. 1.

Referring to the drawings there is shown merely the rear portion of a hand-held tool which may be a wrench or screw driver having a casing 10 and a conventional vane type air motor 12. Attached to the casing 10 is a handle 14 and backhead portion of the casing 10 which houses suitable throttle valve and shutdown mechanism for the motor 12 to be hereinafter described in detail. On the grip portion of the handle 14 of the casing 10 is mounted a suitable trigger 16 controlling through a plunger 18 a conventional throttle 20 controlling the flow of air from an inlet 22 adapted to be connected to a suitable source of compressed air (not shown) to a supply port 24 for operating motor 12. Supply port 24 leads to a cavity 26 in casing 10 in which is mounted a control valve 28 for admitting compressed air to motor 12 and for shutting it off. Valve 28 is adapted to reciprocate in a chamber within a cylindrical bushing 30 extending across cavity 26 and fitting closely in a transverse bore 32 in casing 10. A plug 34 holds bushing 30 in place, plug 34 in turn being held in place by a spring wire retainer 36.

Valve 28 is of the spool type and is thus provided with a pair of heads 38 and 40 connected by a stem 42. Surrounding the portion of valve 28 adjacent head 40 is a cavity 44 leading by way of a central passage 46 in a reversing valve 48 to motor 12. Reversing valve 48 is provided with a suitable handle 50.

Bushing 30 is provided with suitable ports 52 which head 40 of valve 38 is adapted to open and close depending upon its position in bushing 30. Additional ports 54 adjacent head 38 of valve 28 admit air from supply cavity 26 into the interior of the bushing. Normally valve 28 is in its open position being biased by spring 56 in bore 58 axially positioned with respect to the bushing 30 and bearing against the head 38.

Normally, so far as air pressure is concerned the valve 28 is balanced since leak ports 60 and 62 in heads 38 and 40, respectively, admit air under pressure to the space beyond those heads. This balance is adapted to be upset by exhausting the space shown at 64 beyond head 38. To this end the bore 58 communicates with a bore 66 transverse thereto and provided with a bushing 68 having at one end a restricted passage at a seat 70 controlled by a ball valve 72. Valve 72 is held on its seat by a spring 74 held in place by a plug 76 in a counterbore 78 coaxial with bore 66. Valve 72 is adapted to be unseated by a plunger 80 extending through the seat 70 and guided in a bore 82 also coaxial with bore 66. Plunger 80 is held in contact with ball valve 72 by a spring 84 bearing against a flange 86 on plunger 80 and guided in a bore 88 intermediate in size between that shown at 82 and bore 66 and coaxial with both of them.

By this invention the operation of the control valve for shutting down the motor or permitting it to operate is to be governed by the degree of rotation of a spindle 90 in this instance mounted coaxially with the rotor of air motor 12. Spindle 90 will be rotatively connected to any suitable member whose operation is the critical factor. Accordingly, on spindle 90 is mounted a rotating member 92 bearing a pin which acts as a trip to engage the end of plunger 80. In this instance the point of tripping or in other words the degree of rotation of spindle 90 at the time of tripping will depend upon the point at which the pin 94 starts its rotation. This is controlled by an adjustable stop member 96 rotatably mounted on the end of spindle 90 and having a groove 98 in a stop 100 for engagement with a pin 102 extending into groove 98 from member 92.

When motor 12 is not in operation the member 92 is free to rotate around spindle 90 but has a suitable torsion spring 104 between it and the stop abutment member 96 to cause pin 102 to contact stop 100. The positioning of stop 100 can vary. Such positioning is set by means of rotation of the abutment member 96 and fastening it in proper desired position.

For this purpose abutment member 96 is provided with upright portions 106 extending like spokes from the body of abutment member 96 and adapted to engage a pin 108 fixed in the wall of the casing 10. For such rotative adjustment member 96 is merely depressed to disengage the spokes 106 from the pin 108 and rotated to the desired position. This would be indicated by the gripping portion 110 provided on the face of the member 96. Spring 104 will return the member 96 axially to pin engaging position. Member 96 cannot be depressed unreasonably being provided with a flange 112 arranged to contact pin 108.

To hold the abutment member 96 on the end of spindle 90 a pressed-in bushing 114 is provided preferably pressed into abutment member 96. Its end forms an abutment for the spring retainer 116 on the end of spindle 90. As has been described above, member 92 is normally disengaged from spindle 90 that is to say while the motor 12 is at rest or when disengagement is produced by means to be described later herein.

To couple member 92 to the spindle 90 a sliding clutch member 118 is provided suitably splined as shown at 120 to engage spindle 90 so as to be rotatable therewith. A spring 122 normally holds member 92 and clutch member

118 out of engagement with each other. Upon engagement their contiguous surfaces are either roughened to grip each other or toothed or otherwise as may be desired. Spring 122 is adapted to press against a flanged bushing 124 in member 92 which acts as a bearing member on spindle 90.

Clutch member 118 is actuated by a suitable cylindrical collar 126 reciprocable in a similarly shaped slot 128 to which air under pressure is adapted to be supplied by way of a passage 130 in a supporting bushing 132 and connected by a port 134 to a passage 136 communicating with cavity 44.

Interposed between port 134 and passage 136 is provided a plunger type valve 138 having a port 140 to effect such communication. Valve 138 is however adapted to be reciprocated to a position to cut off such communication and to bleed air from passages 130 and 136 to atmosphere by way of a port 142 adapted to register with port 134. Another passage 144, longitudinal of the valve 138, leads from port 142 to atmosphere.

Thus valve 138 has two positions and it is held in either of these positions by a detent 146. Valve 138 is mounted in an extension 148 of casing 10 so that the ends of valve 138 can be engaged by the thumb or finger of the operator. As will be seen in FIG. 3, one end of valve 138 projects from casing portion 148 adjacent reversing valve handle 50. This is the position of valve 138 for normal forward operation of motor 12, and when valve 138 is in this position reversing valve handle 50 cannot be operated to reverse motor 12. In the other position of valve 138 in which clutch 118 is operative, reversing valve handle may be rotated (see FIG. 3) and valve 138 is locked in that position.

To operate the device in the manner intended, and assuming that it is desired that the automatic shut-off be utilized, the operator, having determined what degree of rotation of spindle 90 is desired, depresses abutment member 96 and by observing the position of the engaging portion 110 rotates that member to bring the stop 100 to its suitable position with respect to pin 108. Under the influence of torsion spring 104, pin 102 will be rotated with member 92 to follow stop 100. This follows automatically. Then as the operator opens throttle 20 admitting air through passage 24 and cavity 26 into the interior of the valve chamber within bushing 30 by way of ports 54, air passes through ports 52 into cavity 44 and passage 46 to the pneumatic motor 12.

Simultaneously air passes through passage 136 and ports 140 and 134, to the under face of clutch collar 126 pushing the clutch member 118 into engagement with rotating member 92 and as the spindle 90 rotates carrying with it member 92, pin 94 extending from member 92 rotates to engage the end of plunger 80. Depression of plunger 80 unseats valve 72 permitting air from the space 64 to escape. Since bleed ports 60 are relatively small, air cannot be supplied to the chamber 64 to keep the pressure up. Therefore, the air at the opposite face of the head 40 of valve 28 compresses spring 56 pushing valve 28 to its closed position where head 40 blanks ports 52. This cuts off the supply of motive fluid to motor 12 and the apparatus stops.

Having stopped, the parts stay in their stopped position until the operator releases the throttle whereupon by the usual leakage in such apparatus the air pressure is reduced to atmosphere. Under these conditions, spring 56 pushes valve 28 back to its open position in which the apparatus is ready to repeat the cycle of events described above.

Should the operator desire to operate this tool without benefit of the stop mechanism, he need merely reverse the position of valve 138, whereupon the shut-off does not work. He is then in a position to operate his tool forward or reverse without benefit of the shut-off. However, in reverse position of throttle 50 he cannot use the shut-off nor is it adapted to operate thus. In fact such operation is prevented.

Thus by the above construction are accomplished the objects hereinbefore referred to with obvious advantages.

We claim:

1. An automatic shut-off for power wrenches and the like having a pneumatic motor and a rotative spindle including a valve to control the flow of motive air to the motor, a throttle valve, biasing means controlled by the throttle valve to hold said control valve in open position, and means controlled by a given degree of rotation of said spindle to actuate said biasing means to control said control valve including a clutch to rotatably couple the last said means to said spindle.

2. An automatic shut-off for power wrenches and the like having a pneumatic motor and a rotative spindle including a reciprocatory valve to control the flow of motive air to the motor, a valve chamber for the valve, a throttle for admitting motive air to said chamber, said valve being provided with surfaces exposed to motive air from said throttle and normally balanced thereby, and means controlled by a given degree of rotation of said spindle to relieve the air pressure from one of said surfaces to operate the control valve in its closed position, said means including a clutch to rotatably couple said means to said spindle.

3. An automatic shut-off as set forth in claim 2 in which said means includes an exhaust valve and a member rotatable by the spindle to actuate said exhaust valve.

4. An automatic shut-off as set forth in claim 2 in which said means includes an exhaust valve, a member movable by the spindle to actuate said exhaust valve, and means to adjust the degree of motion of said member to actuate said valve.

5. An automatic shut-off as set forth in claim 2 in which means is provided to adjust the means controlled by a given degree of rotation of said spindle as to the degree of such rotation to effect such relief.

6. An automatic shut-off as set forth in claim 2 in which is provided means controlled by the throttle to restore said control valve to its normal open position.

7. An automatic shut-off for power wrenches and the like having a pneumatic motor and a rotative spindle including a valve to control the flow of motive air to the motor, a valve chamber for the valve, a throttle for admitting motive air to said chamber, said valve having pressure surfaces exposed to motive air and normally balanced to hold said valve in its open position, means controlled by rotation of said spindle to relieve air pressure from one of said surfaces to operate the control valve to its closed position, a clutch to couple said means to said spindle, a controller for the clutch, a reversing valve for the motor, said controller and reversing valve being mutually cooperative to prevent operation of said reversing valve without operation of said controller.

8. An automatic shut-off for power wrenches and the like having a pneumatic motor and a rotative spindle including a valve to control the flow of motive air to the motor, a valve chamber for the valve, a throttle for admitting motive air to said chamber, said valve having pressure surfaces exposed to motive air and normally balanced to hold said valve in its open position, and means controlled by rotation of said spindle to relieve air pressure from one of said surfaces to operate the control valve to its closed position comprising a member rotatable on the shaft having an engaging portion, an exhaust valve associated with said valve chamber at one of said pressure surfaces and operable by said engaging portion, means to adjust the initial position of said engaging portion with respect to said exhaust valve, and a clutch controlled by said controlling valve to couple the said member to rotate with the shaft.

9. An automatic shut-off for power wrenches and the like having a pneumatic motor and a rotative spindle including a valve to control the flow of motive air to

the motor, a valve chamber for the valve, a throttle for admitting motive air to said chamber, said valve having pressure surfaces exposed to motive air and normally balanced to hold said valve in its open position, and means controlled by rotation of said spindle to relieve said air pressure from one of said surfaces to operate the control valve to its closed position comprising a member rotatable on the shaft having an engaging portion, an exhaust valve associated with said valve chamber at one of said pressure surfaces and operable by said engaging portion, means to adjust the initial position of said engaging portion with respect to said exhaust valve including an abutment adjustable as to position with respect to said exhaust valve, a biasing spring tending to rotate said member to engage said abutment, and a clutch controlled by said controlling valve to couple the said member to rotate with the shaft.

10. An automatic shut-off for power wrenches and the like having a pneumatic motor and a rotative spindle, including a valve to control the flow of motive air to the motor, a valve chamber for the valve, a throttle for admitting motive air to said chamber, said valve having pressure surfaces exposed to motive air and normally balanced to hold said valve in its open position, means controlled by rotation of said spindle to relieve air pressure from one of said surfaces to operate the control valve to its closed position, a pneumatic clutch to couple said means to said spindle, a controller valve for the clutch, a reversing valve for the motor, said controller valve and reversing valve being mutually cooperative to prevent operation of said reversing valve without operation of said controller, said reversing valve having a shoulder and movable to hold said throttle valve in its closed position.

11. An automatic shut-off device for wrenches and the like having a pneumatic motor and rotating spindle comprising a valve to control the flow of air to the motor, a throttle valve, biasing means controlled by said throttle valve to hold said control valve in open position, means controlled by a given degree of rotation of said spindle to actuate said biasing means to close said control valve including an exhaust valve and a member carried by the spindle to actuate said exhaust valve, and a clutch to disengage said means from rotational control by said spindle.

12. An automatic shut-off device as set forth in claim 11 in which the member carried by the spindle is adjustable as to its degree of motion to actuate said valve.

13. An automatic shut-off device as set forth in claim 11 in which the member carried by the spindle is adjustable as to its initial position before rotation of said spindle.

14. An automatic shut-off device as set forth in claim 11 in which is provided means controlled by the throttle to restore said control valve to its normal open position.

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