Oct. 7, 1958 W. C. STRATMAN 2,854,871

DEPTH CONTROL STOP FOR AIR FEED DRILLS

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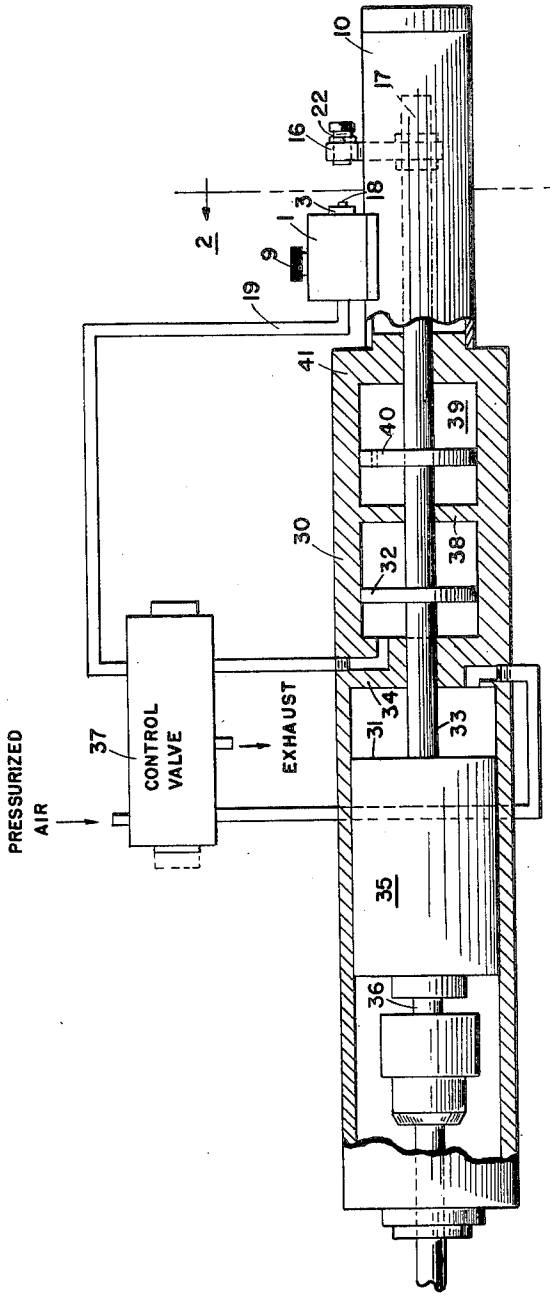


FIG. 1

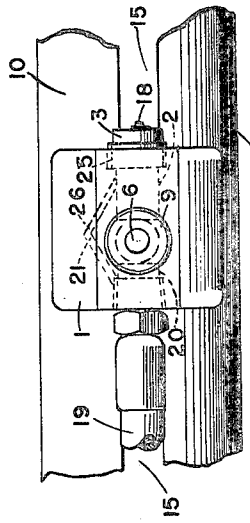


FIG. 4

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DEPTH CONTROL STOP FOR AIR FEED DRILLS

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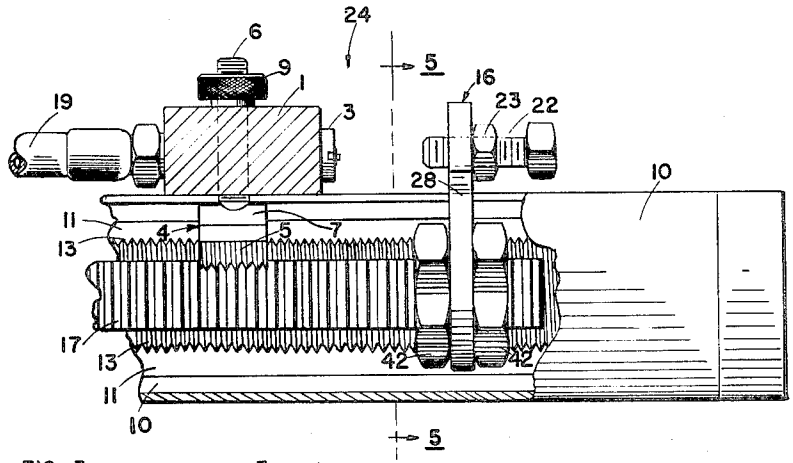


FIG. 3

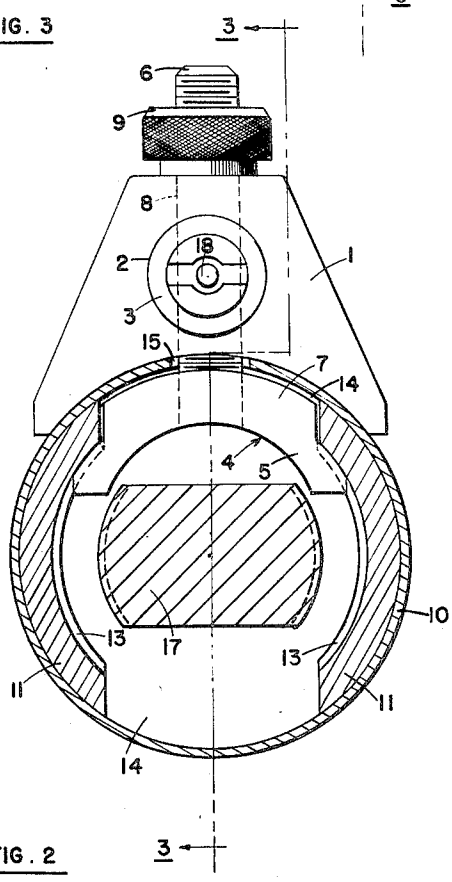


FIG. 2

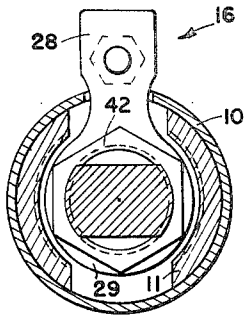


FIG. 5

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DEPTH CONTROL STOP FOR AIR FEED DRILLS

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Application November 8, 1955, Serial No. 545,690

6 Claims. (Cl. 77—34.5)

This invention relates to a control device for a machine tool and in particular relates to an improved depth control stop for use on a rotary airfeed drill.

Many of the airfeed drills in use at the present time in the aircraft industry depend on a cumbersome, exposed, and extremely vulnerable device for controlling the amount of travel of the drill spindle and the depth of the hole being drilled. Existing means for depth control for such drills generally consist of a poppet type bleed valve mounted transversely relative to the drill longitudinal axis, by a clamp on a longitudinally extending cantilevered rod. An adjustable trip lever fixedly mounted on a reciprocating drill traverse rod moves with the traverse rod, as the drill bit advances into the work, and contacts and opens the bleed valve whereby pressurized air is bled from the balanced type drill control valve, the bleed valve and control valve being intercommunicating, and the drill is shut off. This arrangement is shown in Johnson Patent No. 2,607,197. By adjustably moving the bleed valve along the cantilevered rod or by moving the adjustable trip lever on the traverse rod the depth of the hole being drilled can be controlled. Maintenance of this depth control device has been found to constitute a major problem throughout the industry and the number of air drills normally inoperative due to failures of the present type of depth control device represents a considerable percentage of the total drills in stock.

The cantilevered rod of the control device of the prior art is subject to being bent out of alignment due to rough handling and its exposed location on the drill. This causes the bleed valve to be shifted out of central alignment so that the trip fails to contact and operate the valve and the drill continues to advance causing further bending and breakage of the depth control elements, as well as often resulting in a ruined work piece due to the hole being drilled too deep. Another source of difficulty with the present type of control device results from sticking of the balanced type control valve on the airfeed drill. Such sticking is caused by accidental blows and jars on the control valve housing which deform the housing and cause the valve to "hang up." When this occurs the bleed valve is ineffective to halt the drill operation and the trip is brought to bear against the bleed valve member with increasing force, as the drill continues to advance, causing bending and eventual breaking of the depth control elements.

In the present invention the cantilevered rod and bleed valve member mounted thereon are replaced by a heavy rigid valve body seated on the outer surface of the cylindrical drill extension barrel and secured to the barrel by means of a nut mounted on a bolt or retainer having teeth or serrations on the undersurface of the arcuate bolt head. The arcuate bolt head is mounted within the drill rear extension barrel, with the bolt shank extending radially outwardly through a slot in the barrel, and it engages serrations or teeth on the inner surface of a slotted sleeve mounted within the barrel. The

present invention thus provides a rugged, durable valve block having provision for firmly attaching and positioning the valve and valve block relative to the drill extension barrel. The valve block is mounted symmetrically on the drill extension barrel about a plane passing through the drill axis, the valve axis and the valve actuator axis. In this manner the difficulties and troubles encountered with the eccentric cantilevered mounting of the prior art are obviated.

Accordingly it is an object of this invention to provide an improved airfeed drill depth control stop adaptable to existing equipment without further modification.

It is also an object of the invention to provide a positive action airfeed drill stop that will require a minimum of maintenance.

It is a further object of the invention to provide an airfeed drill stop that will not create a safety hazard through breakage of the stop device.

It is a still further object of the invention to provide a positive action airfeed drill stop of rugged construction that will stop the forward travel of the drill spindle even though the poppet type bleed valve may have been rendered inoperative.

Still a further object of the invention is to provide an airfeed drill stop that will eliminate work spoilage due to overrunning of the drill in its forward travel.

These and other objects and advantages of the present invention will become apparent to those skilled in the art after reading the present specification and the accompanying drawings forming a part hereof, in which:

Fig. 1 is a longitudinal schematic showing, partly in elevation and partly in section, of a rotary type airfeed drill incorporating the depth control stop device of the present invention.

Fig. 2 is a transverse cross-sectional view taken in the plane of line 2—2 in Fig. 1 and showing the valve block and its method of attachment to rearward extension housing of the drill.

Fig. 3 is a longitudinal view, partly in elevation and partly in section and on an enlarged scale, taken substantially in the plane of line 3—3 in Fig. 2, of the drill extension housing with the improved travel control stop device mounted thereon.

Fig. 4 is a fragmentary top plan view, on a larger scale, of the drill extension housing and the valve block positioned thereon.

Fig. 5 is a transverse cross-sectional view taken in the plane of line 5—5 in Fig. 3 and showing the valve trip device.

The device of this invention is for application to a pneumatic rotary airfeed drill of the type disclosed in Taylor Patent 2,674,098 as modified by an air control valve of the balanced type which may be unbalanced by means of one or more bleed type poppet valves, as disclosed in Johnson Patent No. 2,607,197.

Referring specifically to the drawings, wherein like reference characters have been used throughout the several views to designate like parts, and referring at first to Fig. 1, the conventional type airfeed drill comprises a cylinder 30 having pistons 31 and 32 spaced apart on a rod 33 and disposed on opposite sides of a stationary abutment 34. A rotary air motor 35 guided for reciprocation in the forward end of cylinder 30 is connected to piston rod 33 and drives tool spindle 36. Rearwardly of piston 32, the cylinder is provided with a transverse partition 38 forming the forward wall of an oil dashpot chamber 39 having a piston 40 therein. The rear wall of chamber 39 is formed by partition 41, both partitions 38 and 41 being centrally apertured for the passage of piston rod 33. Reciprocable extension rod or member 17 is rigidly secured to the rear end of piston rod 33 and forms an axial continuation of the piston rod. Rod 17

is formed with two oppositely diposed flat sides for passage through a slot in an abutment at the rear end of cylinder 30 whereby rotation of rod 17 is prevented. Slotted sleeve 11 is concentrically positioned about rod 17 and both the sleeve and rod are covered by a tubular tail piece or cover 10 having a longitudinal slot 15 therein. Slotted sleeve 11 has a threaded internal surface 13.

To control the supply and exhaust of air to and from the front and rear piston chambers and also to the motor, a normally balanced two position valve 37 is used in conjunction with a spring loaded poppet type bleed valve 3 for shifting valve 37 in a direction to unbalance the valve and cause operation of the drill to cease.

Travel control or stop device 24 of this invention comprises a valve block or saddle member 1 having an arcuate lower surface with the same degree of curvature as the outer surface of cylindrical cover 10, on which the saddle member seats. The rearward end of block 1 has a longitudinally extending valve bore 2 and threaded counterbore 25 to receive the conventional type of air bleed valve 3 used in the existing depth control stop on this type of drill. A bore 20 is formed in the forward end of saddle 1 and is threaded to receive the connecting end of flexible conduit 19. Bores 2 and 20 communicate through angularly offset conduits 21 and 26. Positioned between the longitudinally extending bores 2 and 20 is a transverse bore 8 extending through saddle member 1 from top to bottom.

Stop 24 further includes arcuate retaining member or bolt 4 having a toothed or threaded outer portion 5 and stud 6 attached to center portion 7. Outer portion 5 is curved to fit within slotted sleeve 11 and the threads on the outer surface thereof are adapted to engage internal threads 13 on sleeve 11. Center portion 7 comprises a shorter piece of arcuate shape and is dimensioned to fit slidably within slot 14 of sleeve 11. Center portion 7 is brazed or otherwise rigidly concentrically attached to the outer surface of outer portion 5 with the threaded outer ends of the latter projecting beyond the edges of center portion 7. Stud 6 is rigidly attached to and projects radially outwardly from center portion 7.

The remainder of stop device 24 comprises a trip 16 for attachment on extension rod 17. Trip 16 is of a sturdy, rugged construction and comprises a lower enlarged end 29 having a threaded bore for engaging threaded extension rod 17 and an arm portion 28. Arm 28 has a threaded bore near its upper end to receive threaded member 22 for operatively contacting valve stem 18 of bleed valve 3. Member 22 can be moved in or out to provide for adjustment during initial installation and for subsequent wear. Lock nut 23 secures member 22 in a fixed position when the latter is satisfactorily adjusted.

Stop device 24 is installed on the drill by removing cover 10 surrounding slotted sleeve 11. Retainer member 4 is inserted within sleeve 11 so that the toothed or threaded portion 5 engages the internal threads 13 on sleeve 11 and center portion 7 fits within slot 14 with stud 6 projecting outwardly therefrom. Trip 16 is installed on extension rod 17, with the head end of member 22 facing rearwardly, and is positioned by means of the existing lock nuts 42 on the traverse rod. Cover 10 is then replaced on the drill with stud 6 of retainer 4 and arm 28 of trip 16 projecting through slot 15 in cover 10. Saddle member 1 is positioned over retainer 4 and on cover 10, with stud 6 projecting through bore 8. Nut 9 engages stud 6 to draw saddle member 1 down tightly on cover 10 while the toothed or threaded surface of retainer outer portion 5 is simultaneously brought into mating engagement with a portion of the threads 13 on slotted sleeve 11, whereby saddle member 1 is rigidly secured in adjusted position on cover 10. By loosening nut 9 the saddle and retainer assembly may be moved longitudinally along the rear portion 12 of the drill to any desired location to suit the depth of hole to be drilled. A flexible conduit 19 connects bore 20 with the drill air control valve 37. Existing bleed valve 3 is threaded into bore 2 and member 22 is adjusted longitudinally for the depth of hole desired to be drilled or to compensate for wear resulting from prolonged usage.

In operation, trip 16, secured to extension rod 17 of the drill, is advanced as the drill bit penetrates the work until the desired depth is reached. At this point trip 16 contacts stem 18 of bleed valve 3. This opens valve 3 to release the air pressure in conduit 19 and allows the spring loaded drill control valve 37 to which conduit 19 connects to return to the off position, thus stopping the drill travel.

In the embodiment of the invention herein disclosed the bleed valve mounting consists of a relatively massive structure having a positive means for engaging the drill and is mounted with its longitudinal axis in the line of thrust of the trip device. This stop thus is not susceptible of being sprung out of alignment as is the case with the present cantilevered type of bleed valve mounting. Furthermore in the event that the drill control poppet type air valve becomes stuck or inoperative while in the run position and the operation of the bleed valve will not shut off the drill, stop device 24 and trip 16 are of a sufficiently sturdy construction and have a sufficiently firm and positive engagement with their coacting drill components that the drill bit will not be advanced after trip 16 abuts stop 24.

Thus it will be seen that this invention provides a sturdy, safe and positive depth control stop that is not subject to misalignment or malfunctioning as was the prior stop device.

While a particular embodiment of this invention has been illustrated and described herein, it will be apparent that various changes and modifications may be made in the construction and the arrangement of the various parts without departing from the spirit and scope of this invention in its broader aspects or as defined in the following claims.

I claim:

1. In a machine tool comprising a tool spindle, a fluid pressure operated spindle reciprocating means, an axially extending elongated cylindrical housing at the rear end of said tool, a first valve means controlling the admission and exhaustion of air under pressure to and from said reciprocating means, a second valve means for bleeding operating air pressure from the first valve means whereby the reciprocating means is rendered inoperative; and means attached to said reciprocating means for operatively contacting and actuating said second valve means upon a predetermined amount of spindle travel; bolting means secured within said cylindrical housing and extending outwardly therefrom, said second valve means having a valve body with a curvilinear surface complementary to the surface of said cylindrical housing and being mounted and attached thereon by said bolting means.

2. In combination, a rotary air actuated drill comprising a longitudinally reciprocating axial member and a threaded sleeve rigidly mounted at one end of said drill enclosing said axial member, drill depth control means comprising a valve adapted to bleed the operating air pressure from said drill and thereby render the drill inoperative, said drill depth control means having a threaded portion threadedly engaging said threaded sleeve and securing said depth control means to the one end of said drill, and means rigidly attached to said reciprocating member and positioned thereon to actuate said depth control means and render said drill inoperative upon a predetermined amount of movement of said reciprocating member.

3. In a rotary drill comprising a tool spindle, a fluid pressure operated spindle reciprocating means, a rearward axial extension rod on said reciprocating means, a threaded axial sleeve surrounding the rearward portion

of said axial extension rod, a drill control valve of the balanced valve type controlling the admission and exhaust of air under pressure to and from said reciprocating means; valve means communicating with said drill control valve for bleeding operating air pressure from the same whereby said control valve may be moved to an off position and the drill rendered inoperative, means attached to the rearward portion of said extension rod for operatively contacting and actuating said bleed valve means upon a predetermined amount of drill travel; said valve means including a valve block mounted directly on the surface of said drill and a threaded portion engaging said threaded sleeve; and means on said threaded portion for joining said valve block and said threaded portion into an assembly and securely attaching said assembly at the surface of the rear end of said drill.

4. In a rotary drill comprising a tool spindle, a fluid pressure operated spindle reciprocating means, a rearwardly extending axial rod on said reciprocating means, an internally threaded sleeve surrounding said rod, a slotted rearwardly extending housing surrounding said rod and said threaded sleeve, and a drill control valve of the balanced valve type controlling the admission and exhaust of air under pressure to and from said reciprocating means; a spindle travel control means comprising a valve block adapted for mounting on the outer surfaces of said housing and having a bleed valve positioned therein communicating with said drill control valve for bleeding operating air from the drill control valve whereby the drill may be rendered inoperative, a bolting member adapted to fit within the housing and engage said internally threaded sleeve whereby the member is restrained against movement, said valve block being positioned on the surface of said housing and being attached to said bolting member whereby said block is rigidly positioned on said drill, and means attached to said spindle reciprocating means for actuating said bleed valve upon predetermined movement of the reciprocating means to render said drill inoperative.

5. A rotary drill as described in claim 4 wherein said valve block has a bore therethrough adapted to receive a stud and an arcuate lower surface adapted to seat on said rearwardly extending housing, and wherein said bolting member has an arcuate transverse cross-section with a toothed upper surface thereon adapted to fit within and engage said internally threaded sleeve, an integral stud projecting radially outwardly from said member through the slotted housing and through said bore in the valve block, and a nut locking said valve block and said bolting member rigidly together on the drill.

6. In combination, a pneumatic rotary air feed drill comprising a drill control valve, a rearwardly extending longitudinally reciprocable axial member, and an elongated cylindrical housing extension of reduced diameter at the rear end of said drill enclosing said member; drill depth control means rigidly but adjustably clamped onto the curvilinear surface of said cylindrical housing with the housing cylinder wall being securely gripped between portions of said depth control means; and means for actuating said depth control means attached to said reciprocating member and positioned thereon to operatively contact said depth control means upon a predetermined longitudinal movement of said reciprocating member whereby the flow of pressurized air to said drill is interrupted and the drill thereby rendered inoperative, said depth control means comprising a bleed valve connected to said drill control valve adapted to bleed the pressure therefrom.

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