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APPARATUS FOR REMOTE CONTROL OF DRIFTER ROTATION

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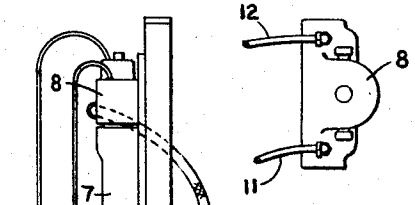


FIG. 2

FIG. 1

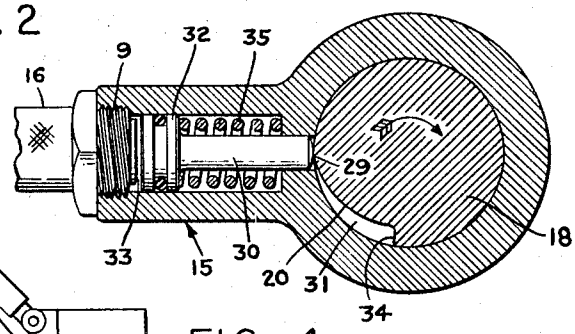


FIG. 4

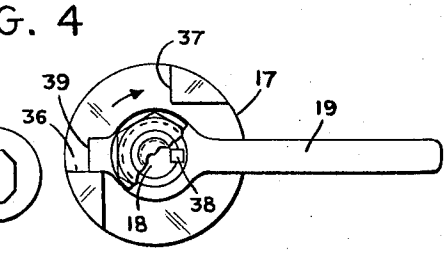


FIG. 6

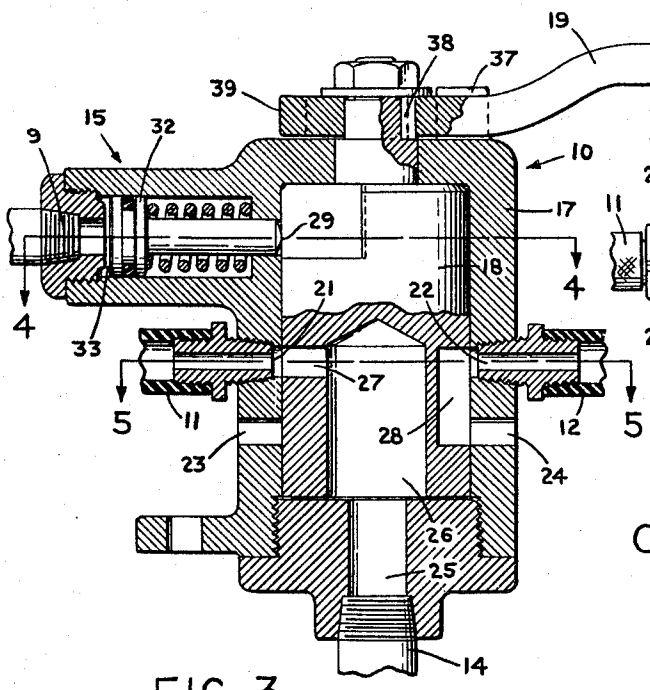


FIG. 3

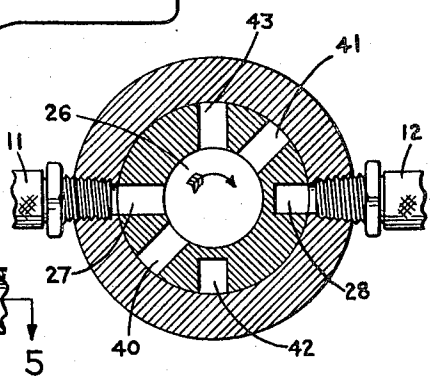


FIG. 5

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APPARATUS FOR REMOTE CONTROL OF DRIFTER ROTATION

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This device relates generally to an automatic controller for use with percussion tool apparatus, such as pneumatic type rock drills and their associated compressor equipment, and more particularly, to a remote safety control device for controlling the direction of rotation of the drill steel in drilling equipment and automatically preventing the operator of said equipment from reversing the rotation of the drill steel in the drifter, when the drifter is being operated at full power.

In percussion tools, such as pneumatic type rock drills, there is provided in the drifter a reversing mechanism. This reversing mechanism is utilized in uncoupling drill steel sections. These drill steel sections are the rotating components of the drilling equipment, and are commonly connected by threaded connections which form couplings between such parts as the rifle bar and rifle nut, the piston hammer and chuck nut, the chuck drive ring and striking bar, etcetera. A sudden reversal of rotation may loosen any of these threaded connections, and could result in loss of steel sections or serious damage to the interior of the drilling equipment. It is desirable, therefore, to utilize only light hammer action and slow reverse rotation for changing drill steel sections.

In the prior art a common three-way valve located at the operator's station was usually employed to provide fluid pressure to actuate the reversing mechanism in the drifter. A valve of this type has not proven to be entirely satisfactory, as it permits the operator to change the direction of rotation from normal drilling position, i.e. forward rotation, to reverse rotation, at full drifter power.

The present invention prevents the operator from reversing the rotation of the drifter at full drifter power. It operates automatically by way of a cam-actuated valve interlock. This interlock is energized by the fluid in the power supply line to the percussion tool. It is so disposed that the power supply line to the tool must be closed off, before the reversing mechanism can be shifted from either a forward or a neutral position into a reverse position. The control mechanism is such that only the power supply line is shut down and not the power supply itself. Thus, pressure fluid is still available to operate the reversing mechanism. When the power supply line is closed, the device automatically disengages itself from the valve cam and allows the operator to shift the reversing mechanism into reverse. The operator may then select the proper reverse rotation speed for safety uncoupling drill steel sections.

Accordingly, it is the object of this invention to provide a means to prevent the operator from reversing the direction of rotation of the drill steel in pneumatic type drilling equipment at full drifter power, by providing a remote drifter rotation control valve with interlocking safety means.

It is another object of this invention to provide a remote safety control device for use in conjunction with percussion tool apparatus to prevent the operator of such apparatus from reversing the rotation of the rotating tool parts while the tool is being supplied with full power, which device is automatic in both its interlocking and disengaging functions.

These and other objects and advantages of the invention will become evident from the following description with reference to the accompanying drawings of which:

FIGURE 1 is a general assembly drawing of percussion tool apparatus;

FIGURE 2 is a top view of the drifter backhead;

FIGURE 3 is a detail drawing in partial section of the remote rotation control valve;

FIGURE 4 is a section view taken along the line 4—4 of FIGURE 3;

FIGURE 5 is a section view taken along the line 5—5 of FIGURE 3; and

FIGURE 6 is a top view of the remote rotation control valve.

Referring to the drawings, FIGURE 1 shows a pneumatic hammer type rock drill **1** connected by means of a power supply line **2** to a compressor. The basic elements of the drill are shown, such as, the drill bit **4**, the drill steel **5**, the drill steel coupling **6**, and the drifter **7**. The drifter backhead **8** contains a built-in reversing mechanism. This reversing mechanism is connected to the remote rotation control valve **10** by means of supply lines **11** and **12**. The main power supply line **2** contains a power regulating valve **13**. The remote drifter rotation control valve **10** is connected to the main power supply line **2** upstream of the power control valve **13** by means of feeder line **14**. Integral with the remote drifter control valve is interlock **15**, which itself is connected to the main power supply line **2** downstream of the power control valve **13** by means of feeder line **16**.

The various connections just described are shown in more detail in FIGURE 3, in which the remote drift rotation control valve is shown in partial cross section. The valve consists of a valve body **17**, a valve plug **18**, a means for rotating the plug, e.g. handle **19**, and an interlock means **15**.

The valve body contains a forward port **21** which is connected to the reversing mechanism in the drifter backhead by means of line **11**, FIGURES 1 and 2, and reverse port **22** which is connected to the opposite side of the reversing mechanism by means of line **12**, FIGURES 1 and 2. Below each of these ports there are vent ports in the valve body; which vent ports are designed to be in fluid communication with their respective forward and reverse ports depending on the position of the valve plug **18**.

The valve plug is shown in the forward position in FIGURE 3. In this position there is an open channel through which pressure fluid could pass from the feeder line **14** into the valve inlet **25**, and thence into the valve plug chamber **26** from which it would pass through the connecting port **27** in the valve plug, the forward port **21** in the valve body, and line **11**, thereby actuating the reversing mechanism so that it would be in its forward position. In this position the opposite side of the reversing mechanism is vented through line **12**, and passages **22**, **28** and **24**.

INTERLOCK MEANS

Referring to FIGURE 4, the interlock **15**, which is connected at **9** to the main supply line, is shown in contact with the valve plug **18** at point **29**. As can be seen, the pin **30** does not protrude into the valve body cavity **31** which is occupied by the valve plug **18**, which, as in FIGURE 3, is in its forward position. The pin **30** is an integral part of the piston **32**, which is slidably mounted in the cylinder **33** of the interlock mechanism **15**.

FIGURE 5 is a section taken on the line **5—5** in FIGURE 3. It shows the various passages in the valve plug **18**. The passages designated **27** and **28** are those depicted

in FIGURE 3 and are the forward rotation passages. The passages designated **40** and **41** are the neutral position passages, and the passages designated **42** and **43** are the reverse position passage.

OPERATION

As the valve plug is rotated in a clockwise direction, the various passages will line up with the forward and reverse ports and their respective vents in the valve body. The various positions of the valve plug **18** with respect to the valve body **17** control the reversing mechanism in the drifter backhead **8**, by supplying control fluid to actuate the reversing mechanism as follows:

(a) In the forward position, as shown in FIGURES 3 and 5, the pressure fluid from the line **14** passes through the valve plug chamber **26** and out the forward port **21**, to the reversing mechanism in the drifter backhead **8**. When thus acted upon, the reversing mechanism **8** will cause clockwise rotation (i.e. forward rotation) of the drill steel **5**, FIGURE 1.

(b) In the neutral position, valve plug passages **40** and **41** will be aligned respectively with ports **21** and **22** in the valve body **17**. Pressure fluid in the plug chamber **26** will flow out of both ports simultaneously and equalize the pressure on either side of the reversing mechanism **8**, thereby causing it to return to its neutral position wherein the drill steel will not rotate.

(c) In the reverse position, passages **42** and **43** will be aligned respectively with ports **21** and **22**, and pressure fluid in chamber **26** will flow out of port **22**, through line **12**, and act upon reversing mechanism **8**, thereby causing it to move into its reverse position wherein the drill steel will be caused to rotate in a counter-clockwise direction.

Referring once again to FIGURE 4, note that the piston and cylinder are continuously acted upon by pressure fluid in the feeder line **16** which emanates from the main power supply line **2**, thereby maintaining the pin **30** in constant contact with the valve plug **18**. As can be seen, the valve plug at the point of contact **29** with the interlock means, has a cam surface **20**. The pin **30**, being acted upon by constant fluid pressure through the piston, acts as a cam follower when the plug is rotated. Thus, as the plug is rotated in a clockwise direction from the forward position as shown in FIGURES 3, 4, and 5, to the neutral position, as previously described in connection with FIGURE 5, the pin follows the cammed surface of the valve plug and is drawn into the valve body cavity **31**. With the pin thus engaged in the valve plug, it is impossible to continue to rotate the plug in a clockwise direction due to the stop **34**.

The spring **35** exerts a force which is much less than the line pressure exerted by the fluid in the main supply line on the opposite side of the piston. However, when the power control valve **13**, FIGURE 1, is closed, the pressure fluid in the supply line is no longer communicating with the feeder line **16**, and can no longer exert a force against the piston **32**, and, therefore, the spring **35** will automatically eject the pin from the valve body cavity **31**. This will enable the operator to continue to rotate the valve plug in the clockwise direction from the neutral position to the reverse position. The operator may now select the proper reverse rotation speed for uncoupling drill steel sections by adjusting the power control valve **13**.

Referring to FIGURE 6, the handle **19** is shown keyed to the valve plug **18** by means of key **38**. Handle extension **39** is in engagement with stop **36** of valve body **17** with the valve in the forward position as previously described. When the handle is rotated a full 90° in the clockwise direction, the valve plug is moved from a forward to a reverse position, at which point the handle extension **39** engages the stop **37** of the valve body, thereby preventing further clockwise rotation. It is in this position that the operator selects the proper reverse rotation speed.

Forward rotation may be resumed when the operator rotates the handle in a counter-clockwise direction until it engages the stop **36**.

It will be understood that various changes in the details, materials, and arrangements of parts which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

What is claimed is:

1. In a rock drilling apparatus, the combination of:
(a) a percussion type drilling tool comprising, a rotating shaft, and a rotational control mechanism for regulating the direction of rotation of said shaft;
(b) a source of fluid under pressure;
(c) a pressure fluid supply line connecting said source of pressure fluid to said percussion tool;
(d) a regulating valve in said pressure fluid supply line for regulating the amount of pressure fluid delivered to said percussion tool;
(e) remote valve means connected at its upstream side to the pressure fluid supply line upstream of said regulating valve and at its downstream side to the rotational control mechanism, to control the flow of fluid to said mechanism to operate said mechanism; and
(f) interlock means connected to the pressure fluid supply line downstream of the regulating valve and disposed to coact with said remote valve means to prevent said remote valve means from supplying fluid to the rotational control mechanism for operating said mechanism so as to prevent said mechanism from reversing the direction of rotation of the shaft while fluid is continuously flowing through the regulating valve.

2. An apparatus as in claim **1** wherein:
(a) said remote valve means comprises,
  (1) a multi-way valve having a valve body, and
  (2) a valve plug rotatably mounted within said valve body to control the flow of fluid to operate the rotational control mechanism;
(b) said interlock means comprises,
  (1) a body having a chamber therein,
  (2) said chamber having an inlet at one end connected to the pressure fluid supply line downstream of said regulating valve and a port at the opposite end disposed within said valve body,
  (3) a piston slidably mounted in said chamber intermediate said inlet and said port and disposed to be acted upon by the pressure fluid in said supply line to move said piston within said chamber toward said port,
  (4) said piston having a pin connected to it, said pin being slidably mounted in said port; and
(c) said pin being disposed to engage said valve plug to prevent said valve plug from rotating within said valve body thereby preventing said plug from operating the rotational control mechanism in the drilling tool, whereby said mechanism is prevented from reversing the direction of rotation of the shaft while fluid is continuously flowing through the regulating valve.

3. An apparatus as in claim **2** wherein a spring is mounted in the chamber of the interlock means between the port and the piston and is disposed to move the piston from the port toward the inlet of the chamber when said regulating valve is closed and the fluid in the pressure fluid supply line is no longer acting against the piston, thereby automatically disengaging the pin from the valve plug, whereby the plug may be rotated to operate the rotational control mechanism and cause said mechanism to reverse the direction of rotation of the shaft upon opening of the regulating valve.

4. An apparatus as in claim **3** wherein:
(a) said valve plug has a cammed surface, and said pin is disposed to act as a follower on said cammed sur-

face, said cammed surface having a stop thereon for engaging said pin when pressure fluid is continuously flowing through the regulating valve and the valve plug is being rotated in a clockwise direction;

(b) a handle connected to said valve plug to rotate said plug; and

(c) stops on said valve body to engage said handle to prevent further rotation when said plug is rotated in a clockwise direction from a forward to a reverse position or when said plug is rotated in a counterclockwise direction from a reverse to a forward position.

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