April 24, 1962 W. B. DRIVER 3,031,236

AUTOMATIC BRAKE CONTROL FOR A ROTARY DRILLING RIG

Filed March 28, 1958 3 Sheets-Sheet 1

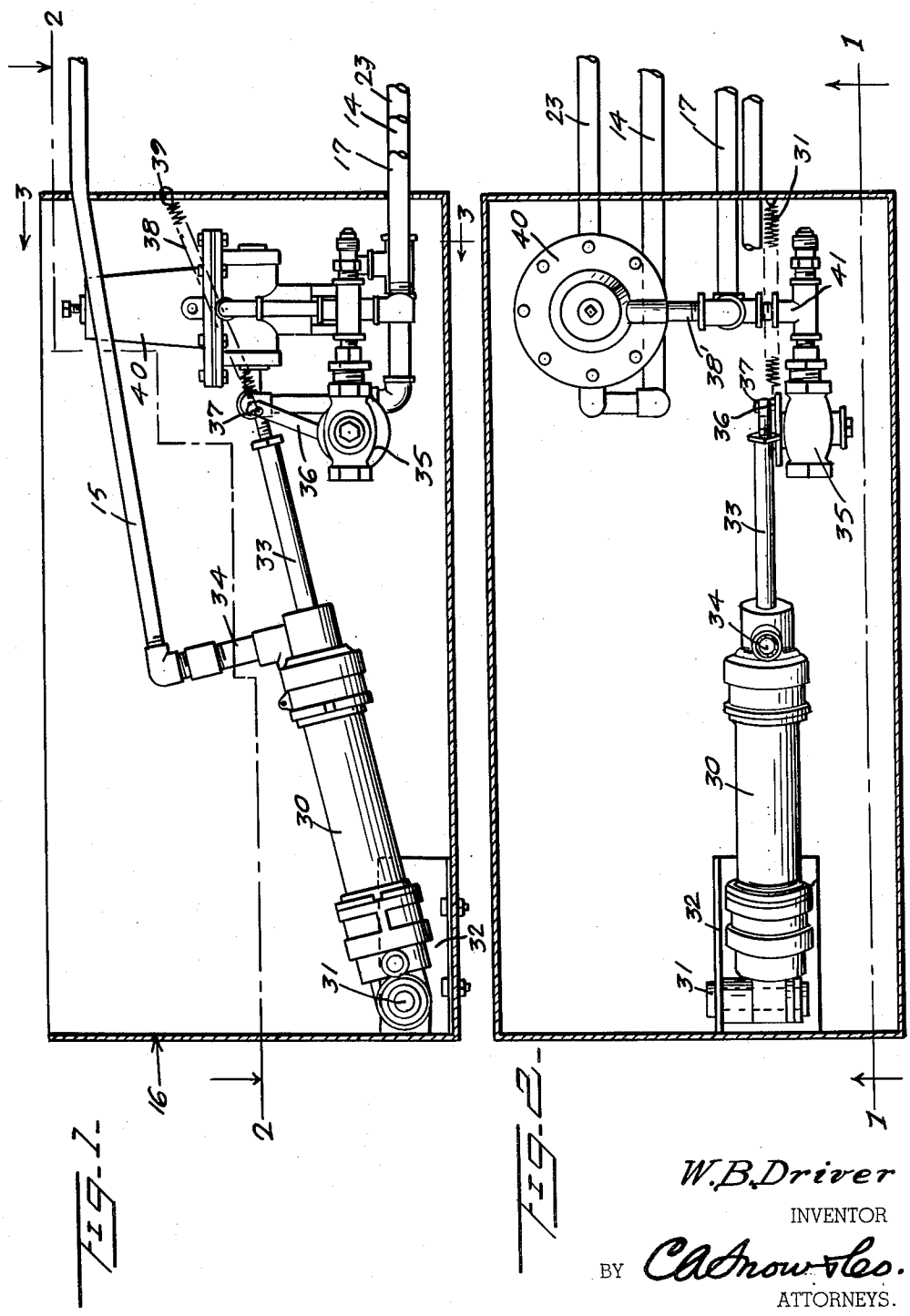


FIG. 1.

FIG. 2.

W. B. Driver
INVENTOR

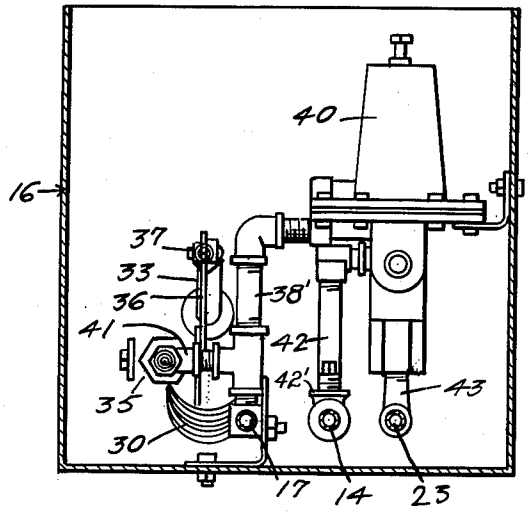
BY C. A. Snow & Co.
ATTORNEYS.

April 24, 1962 W. B. DRIVER 3,031,236

AUTOMATIC BRAKE CONTROL FOR A ROTARY DRILLING RIG

Filed March 28, 1958 3 Sheets-Sheet 2

Fig. 3.



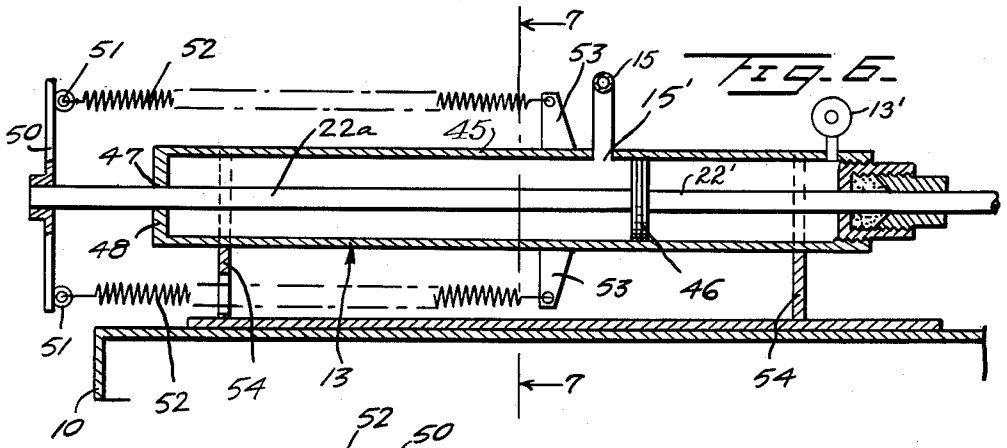


Fig. 6.

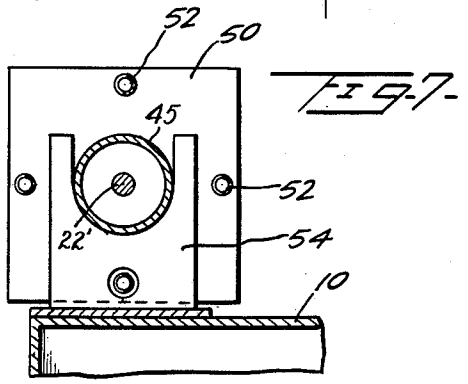


Fig. 7.

W. B. Driver
INVENTOR

BY Cl Arrowsmith.
ATTORNEYS.

April 24, 1962 W. B. DRIVER 3,031,236

AUTOMATIC BRAKE CONTROL FOR A ROTARY DRILLING RIG

Filed March 28, 1958 3 Sheets-Sheet 3

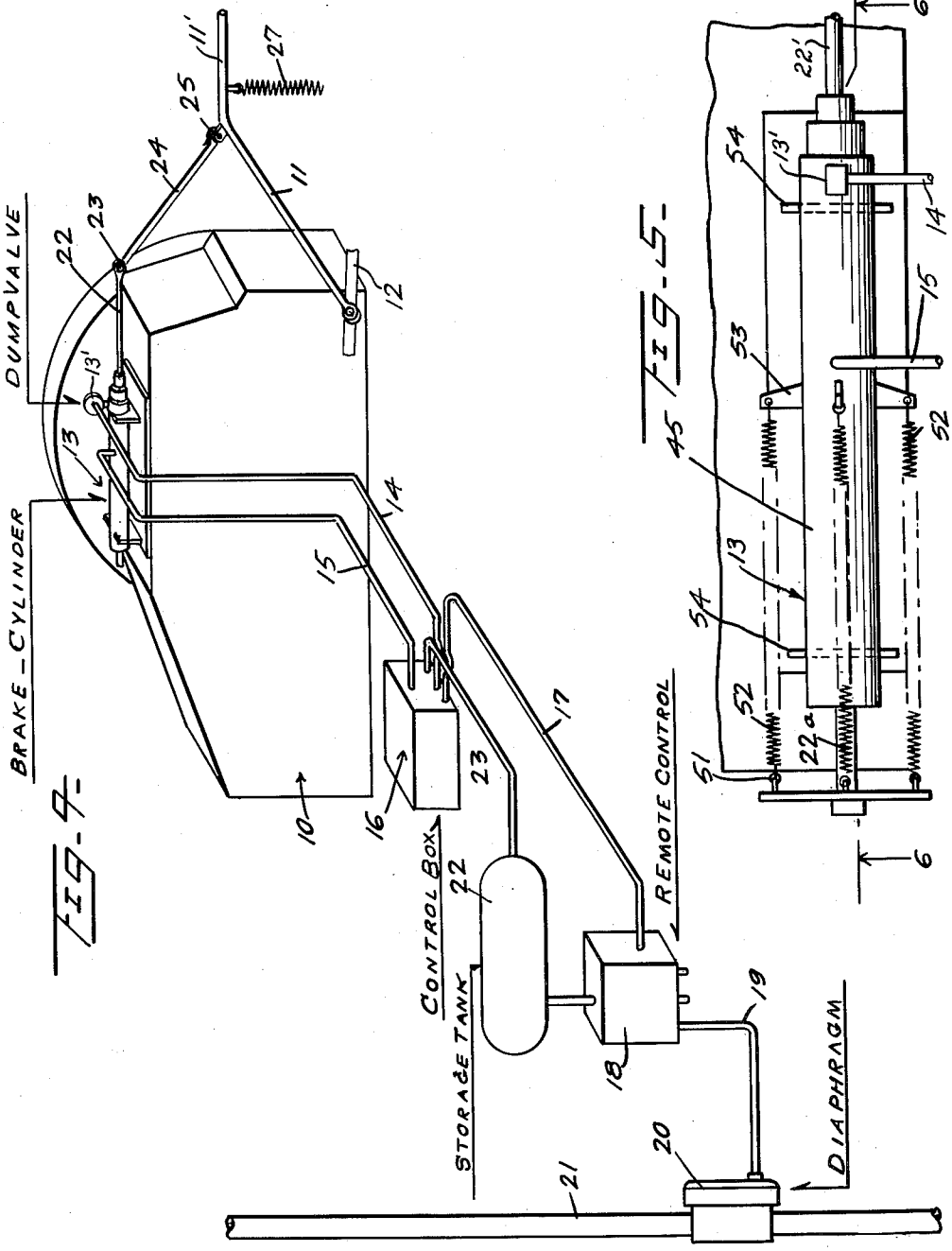


FIG. 4.

FIG. 5.

W. B. Driver
INVENTOR

BY C. A. Snow & Co.
ATTORNEYS.

United States Patent Office

3,031,236

Patented Apr. 24, 1962

3,031,236

AUTOMATIC BRAKE CONTROL FOR A ROTARY DRILLING RIG

William B. Driver, Rte. 1, Wynnewood, Okla.

Filed Mar. 28, 1958, Ser. No. 724,659
1 Claim. (Cl. 303—71)

This invention relates to an automatic brake control for a rotary drilling rig, and more particularly to an automatic brake control for such a rig as employed in drilling for oil.

The primary object of this invention is the provision of an automatic brake control adapted to be applied to the drawworks of a drilling rig whereby the weight or pressure on the drill bit may be maintained substantially constant without the necessity of manual control.

An additional object of the invention is the provision of such a brake control which may be actuated entirely by pneumatic power.

Still another object of the invention is the provision of a brake control of this character which may be operated from a remote control point.

A further object of the invention is the provision of a control box adapted to be employed in association with such a brake control assembly whereby a brake cylinder is intermittently operated relatively rapidly to release the pressure on the drilling line intermittently to a slight extent, until the desired pressure on the drill bit is obtained, whereupon such operation ceases until the device is again automatically actuated by a drop in the pressure on the drill bit.

Still another object of the invention is the provision of a device of this character which is sturdy and durable in construction, reliable and efficient in operation, and relatively simple and inexpensive to manufacture, assemble and utilize.

Still other objects reside in the combinations of elements, arrangements of parts, and features of construction, all as will be more fully pointed out hereinafter and shown in the accompanying drawing wherein there is disclosed a preferred embodiment of this inventive concept.

In the drawing:

FIGURE 1 is a vertical sectional view taken through the control box, substantially on the line 1—1 of FIG. 2 as viewed in the direction indicated by the arrows.

FIG. 2 is a sectional view taken substantially along the line 2—2 of FIG. 1 as viewed in the direction indicated by the arrows.

FIG. 3 is a sectional view taken substantially along the line 3—3 of FIG. 1 as viewed in the direction indicated by the arrows.

FIG. 4 is a schematic view showing the layout of the control box in association with the drawworks, the remote control, the drilling line, and other associated elements of the invention.

FIG. 5 is a fragmentary enlarged top plan view of the brake cylinder as disclosed in FIG. 4.

FIG. 6 is a sectional view taken substantially along the line 6—6 of FIG. 5 as viewed in the direction indicated by the arrows, and,

FIG. 7 is a sectional view taken substantially along the line 7—7 of FIG. 6 as viewed in the direction indicated by the arrows.

Similar reference characters refer to similar parts throughout the several views of the drawings.

As conducive to a clearer understanding of this invention, it may here be pointed out that in the employment of a drilling rig the driller is responsible for the pressure on the drill bit. The drilling rig operates by rotation of the bit and the pressure on top of it. The rotation is always constant but the type of formation in

which the bit is drilling determines the pressure that should be put upon it. This pressure is applied to the bit from the drill pipe above it. The drilling pipe is attached to a swivel which is hung by a block and tackle to the drill derrick, and the drilling line is customarily a cable which runs from its spool, commonly termed the drawworks, to the block and tackle and is anchored to the derrick floor. In operation as the bit drills down, the weight is shifted back to the derrick. This is indicated on a conventional weight indicator attached to the deadline, while the driller, standing at the drawworks brake customarily watches the weight indicator. When it shows a weight increase on the derrick, the drawworks brake is released to let out the desired quantity of drilling line until the weight drops to the desired level.

This has hitherto been done manually. A primary object of this invention is therefore, the provision of an automatic device whereby the drawworks brake may be released automatically upon an increase of weight on the derrick, until the weight on the derrick drops to the desired level, thus indicating that the pressure on the bit is as it should be.

Having reference now to the drawings in detail, and particularly to FIG. 4, there is generally indicated at 10 a drawworks, containing the conventional reel and cable, and provided with a brake lever 11 mounted on a brake shaft 12. The top of the drawworks carries a brake cylinder generally indicated at 13 to be more fully described hereinafter, which is connected by suitable hydraulic lines 14 and 15 to a control box generally indicated at 16, also to be more fully described hereinafter.

A fluid pressure diaphragm control 20 of a conventional type, such as that shown in the patent to Simmonds et al., No. 2,867,411, is attached to the dead line of the cable 21 and responsive to variations in tension thereon. A conduit 19 connects the diaphragm control 20 to a remote control unit 18 of any desired conventional type. Within the remote control unit 18 is a valve (not shown) which is operated in response to pressure transmitted through the fluid in diaphragm control 20 and conduit 19.

A supply of fluid under pressure is contained in storage tank 22 and a pipe "P" places the fluid therein in communication with one side of the valve (not shown) in remote control 18. A conduit 17 is secured to the other side of the valve and upon actuation thereof, in response to pressure transmitted by control diaphragm 20, carries fluid under pressure from tank 22 to a valve 40 in control box 16.

The diaphragm control 20, remote control unit 18, and valve therein, and the storage tank 22, form no part of the present invention. A description of these parts is given to indicate the manner in which the invention is caused to operate.

The present invention comprises a cylinder 13 that contains a piston rod 22', which is pivotally connected as by a pivot 23 to a brake cable 24, which is in turn pivoted as at 25 to a lug extending from the brake lever 11.

A spring 27 extends from the extremity of the brake control lever 11' to the floor of the derrick, or other fixed object, and normally holds the brake in braking position. In the conventional operation of the device the brake lever is released manually, and the apparatus of the instant invention is adapted to release the brake lever 11, and correspondingly the brakes within the drawworks 10 automatically in an intermittent fashion, as will be more fully described hereinafter.

Having now particular reference to control box 16, as disclosed in FIGS. 1, 2 and 3, the control box contains a pneumatic cylinder 30, which is pivotally mounted as on a pivot 31, on a bracket 32 suitably secured to the

floor of the control box. The cylinder 30 is provided with a piston rod 33, and has positioned interiorly thereof a suitable conventional diaphragm (not shown). Pneumatic pressure is applied to the diaphragm by means of a fitting 34, which communicates directly with the line 15, which constitutes the return line from the brake cylinder 13. The control box also contains a quick opening valve 35, provided with an actuating lever 36, which is connected pivotally as by means of a pivot 37 to the end of the piston rod 33. A spring 38 suitably connected as at 39 to a wall of the control box 16 serves normally to bias the actuating lever 36 to valve-closing position. The valve 35 serves to control the pressure in line 17, which extends from the remote control box, and from which a line 38' extends to a relay valve 40 of conventional design. The relay valve 40 communicates with the line 23, which extends from the storage tank 22, and also with the line 14, which is the pressure line to the brake cylinder 13.

As best shown in FIGS. 2 and 3 the valve 35 is connected to the line 17 by means of a T fitting 41, and serves, when open, to release pressure in the line 17, to preclude its acting on the valve 40, in a manner and for a purpose to be more fully described hereinafter.

Similarly, as best shown in FIG. 3, the line 14 is communicated with the valve 40 by means of a fitting 42' and pipe 42, while an upward extension 43 communicates the line 23 with the valve 40.

The brake cylinder 13 is comprised of a casing 45, within which is positioned a piston 46, connected to the piston rod 22', which is connected as previously described to the brake operating lever 11. The line 14 communicates with the cylinder at a point adjacent its forward end, while the return line 15 is positioned intermediately of the cylinder. The arrangement is such that as fluid under pressure enters the forward end of the cylinder 13, the piston 46 is pushed rearwardly, thus releasing the brake controlled by the brake lever 11, until such time as the piston passes the outlet 15'. At this time the pressure in the cylinder is released, and the piston 46 is permitted again to move forwardly, whereupon the spring 27 moves the brake control lever 11' to brake actuating position. The piston rod 22' extends on the opposite side of piston 46, as indicated at 22^a through an opening 47 in the rear wall 48 of the casing 45, and is connected to a plate 50, of generally rectangular configuration which carries a plurality of eyes 51, to each of which is connected a tension spring 52. The opposite ends of the springs 52 are connected to lugs 53 suitably secured to the cylinder 45, the arrangement being such that the springs 52 serve normally to bias the piston rod and its associated piston 46 towards the forward end of the casing 45, or to brake operative position.

The casing 45 is adapted to be supported on the drawworks housing 10 by means of suitable U-shaped brackets 54, as best shown in FIG. 7.

From the foregoing the use and operation of the device should now be readily understandable. When the weight on the dead end of the drilling cable 21 exceeds a predetermined or preset value, the diaphragm control 20 is actuated transmitting pressure through the fluid contained therein and in the line 19 to the remote control box 18, the fluid pressure responsive valve (not shown) in control box 18 is actuated placing the fluid under pressure in storage tank 22 in communication with line 17 through which it flows to control box 6. Fluid passes through the line 38' into the relay valve 40, opening the relay valve. From the relay valve fluid passes through the line 14, into the brake cylinder 13, where it acts upon the piston 46 to force the same rearwardly. This action through the piston rod 22' and the brake cable 24 acts upon the brake operating lever 11 to release the brakes in the drawworks 10. As the piston 46 is forced rearwardly, the line 15 is opened, from which fluid flows back into the control box 16, and actuates the piston of the cylinder 30 to actuate piston rod 33 to move lever 36 to open valve 35. This immediately relieves the fluid pressure in the line 17, whereupon the valve 40 is closed. Upon closure of the valve 40 excess fluid flows through the line 23 back to the storage tank 22. Simultaneously as the pressure in the cylinder 13 is relieved, the springs 52 force the piston 46 and the piston rods 22^a and 22' forwardly in the cylinder 13, which in turn relieves the pressure on the brake cable 24, whereupon through the action of the spring 27 the brake control lever 11' is moved to braking position. The dump valve 13' as shown in FIG. 4 on cylinder 13 alleviates any excess fluid pressure remaining in the cylinder 13.

As the pressure is relieved, and the brake is applied, if the weight on the drilling cable 21 is still in excess of the preset or predetermined value, the diaphragm 20 is reactuated, whereupon the cycle is repeated, fluid flowing from the storage tank 22 through the line 23 to the relay valve 40 to reactuate the piston 46 and its associated mechanism.

From the foregoing it will be seen that there is herein provided an automatic drawworks brake control, which accomplishes all of the objects of this invention and others, including many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept, and as many modifications may be made in the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative and not in a limiting sense.

What is claimed is:

An automatic brake control for the brake operating means on a drawworks of a rotary drilling rig having a control means responsive to the cable tension thereof, a source of fluid under pressure, and means to transmit the fluid from the source to said automatic brake control in response to said cable tension responsive control means, said automatic brake control comprising a relay valve means operable in response to the pressure of the fluid transmitted from the source and through which the fluid passes, a brake cylinder, a reciprocable piston in said cylinder operatively connected to a piston rod extending through said cylinder and the opposite ends thereof, one end of said piston operatively connected to the brake operating means, the other end of said piston rod connected to spring bias means whereby the brake operating means is normally biased in an operative position, fluid inlet means in said cylinder and in communication with said relay valve to admit fluid from the source into the cylinder to move said piston and rod against said spring bias means to release the brake, fluid outlet means intermediate the ends of said cylinder and operative in response to reciprocation of said piston to cause an outflow of fluid from the cylinder when said piston travels beyond said outlet means, a fluid pressure cylinder having an inlet in communication with the outlet in said brake cylinder to receive fluid therefrom, a piston and piston rod reciprocable in said fluid pressure cylinder, a pressure relief valve means in communication with said relay valve and operatively connected to said last mentioned piston rod and operable thereby to relieve pressure in said relay valve, and fluid return means communicating said relay valve to the source of fluid.

References Cited in the file of this patent

UNITED STATES PATENTS

2,117,078	Brauer	May 10, 1938
2,327,505	Conrad et al.	Aug. 24, 1943
2,657,011	Slonneger	Oct. 27, 1953
2,664,107	Spengler	Dec. 29, 1953
2,672,222	Stevens	Mar. 16, 1954
2,796,957	Gilbert	June 25, 1957
2,867,411	Simmonds et al.	Jan. 6, 1959
2,931,628	Simmonds et al.	Apr. 5, 1960