May 23, 1933. W. E. KING 1,910,698

CASING HEAD CONTROL

Filed May 17, 1928 2 Sheets-Sheet 1

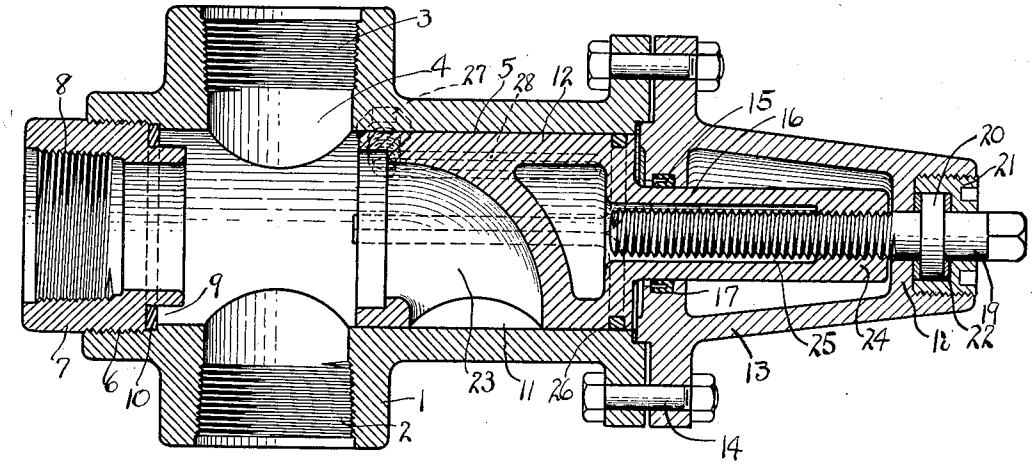



Fig. 1

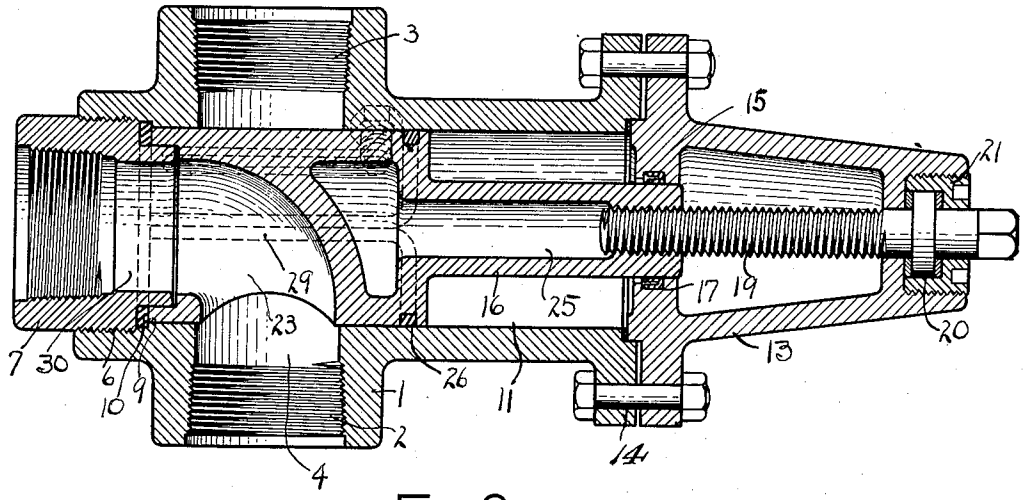



Fig. 2

Walter E. King INVENTOR.

BY Jesse R. Stone

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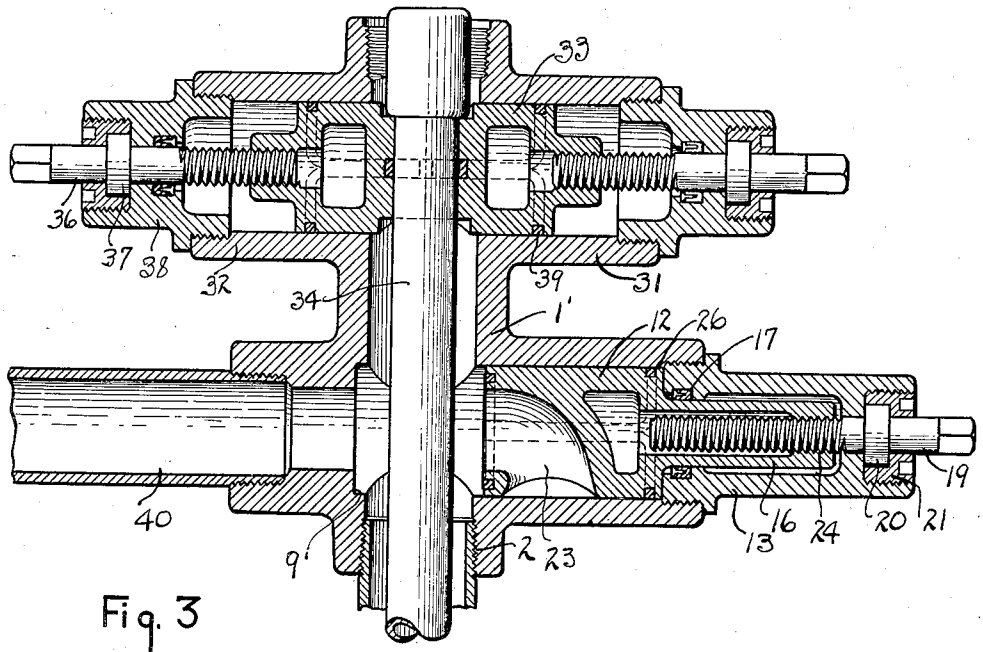



Fig. 3

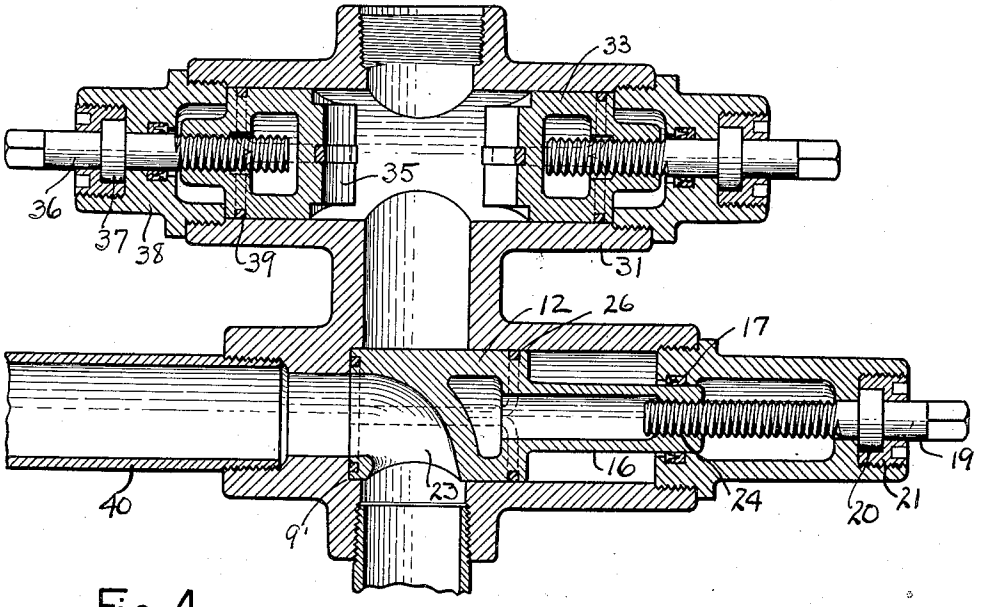



Fig. 4

Walter E. King INVENTOR.

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Patented May 23, 1933 1,910,698

# UNITED STATES PATENT OFFICE

WALTER E. KING, OF HOUSTON, TEXAS, ASSIGNOR TO JAMES S. ABERCROMBIE, OF HOUSTON, TEXAS

## CASING HEAD CONTROL

Application filed May 17, 1928. Serial No. 278,538.

My invention relates to attachments for casing heads in deep well operations to control the flow of fluids from the casing.

In well drilling, particularly for oil or gas, the well frequently has to be drilled in and operated under gas pressure in the well and this pressure is sometimes excessive. In rotary drilling there is danger that the well may blow in when the drill stem is still in the hole and blowout preventers of different types must be employed to stop such a blowout and its consequent danger to the equipment and to prevent the loss of oil or gas which may occur when the well happens to get out of control.

The well is usually equipped with a blowout preventer to close about the drill stem; and also a drilling valve below the preventer to close the casing where the drill stem is removed. But in order to allow the flow of fluid from the well under control, some provision must be made to allow a valve controlled outlet below the gate valve which is usually placed on the casing. But where so much equipment is provided it takes up too much space and is not easily handled.

It is an object of my invention to provide a valve to be employed in the casing, which will act both as a closure for the casing where the drill stem is removed, and as a means to divert the fluid laterally into branch pipes under control.

It is also an object to provide a combination of a blowout preventer and a control valve so that the casing may be closed and the flow of fluid controlled, both when the drill stem is in the well, and when it has been removed.

In the drawings, Fig. 1 is a central vertical section through a valve structure for use when the drill stem is removed showing the valve open.

Fig. 2 is a similar section showing the valve in closed position.

Fig. 3 is a view illustrating the valve used in combination with a blowout preventer of ordinary construction adapted to close the casing about the drill stem when the drill stem is in the hole.

Fig. 4 illustrates the same construction with the drill stem removed and the valve closed to shut off the opening through the casing head.

In drilling operations where gas is encountered in both oil wells and gas wells, provision has to be made to prevent the gas from blowing out of the well. The operator must hold the gas pressure at the bottom of the well through pumping of the heavy mud down above the gas, for it is known that if the gas once gets started blowing from the well it increases in intensity rapidly and will ofttimes blow the drill stem from the hole and wreck the whole well. The type of structure shown herewith is intended to assist the operator in maintaining control of the well and prevent the gas from blowing out.

In Figs. 1 and 2 I have shown a type of drilling valve which is particularly effective because of its structure in preventing gas from blowing out of the well when the drill stem is removed. I provide a tubular body 1 which may be connected upon the upper end of the casing in the same manner as a casing head. It is threaded at 2 and 3, at the upper and lower ends thereof, for attachment to the casing or to an extension thereof. The passage 4 through the body permits the insertion of a drill stem in drilling and also is a fluid outlet when the fluid is circulating therein, or when the well is producing.

Transversely of this body is a cylinder 5. Said cylinder is open at one side and has a threaded seat 6 to receive a tubular nut or fitting 7. Said nut is threaded on its inner surface at 8 for connection in a flow line for the fluid coming from the well. On its inner face the outer side is recessed at 9 and a seat is formed at the inner end of said recess to receive a ring or washer 10 of compressible material, such as rubber or similar composition. When the nut 7 is screwed within the seat 6, as shown in the drawings, the gasket or washer 10 is thus seated at the end of the annular space 9 about the inner end of the nut and forms a seat for the valve which will be presently described.

On the opposite side of the body 1 the cyl-

inder is extended to form a chamber 11 in which the cylindrical valve 12 may slide. At the outer end of the chamber 11, the walls of the cylinder are extended radially to form a connection with a bonnet 13 secured upon the outer end of the cylinder by means of bolts 14 extending through the flange upon the cylinder and through a similar flange upon the bonnet 13, as will be seen from the drawings.

The bonnet 13 is tapered outwardly and has an inner wall 15 through which the stem 16 upon the valve may fit. A stuffing box is formed about the said valve stem to receive packing 17, which because of its U-shape is adapted to be automatically expanded by pressure escaping past the piston. The outer end of the bonnet is formed with a wall or partition 18 to receive the rotatable shaft 19, by means of which the valve is operated. The partition wall 18 serves as a stop on one side for a radial flange 20 upon the shaft 19, and a nut 21 screwed into the outer end of the bonnet on the outer side of the flange 20 holds the flange against longitudinal movement. There are anti-frictional washers 22 placed on each side of the flange 20.

The piston 12 is of cylindrical outline but has an L-shaped passage 23 therein, one end of said passage issuing directly out of the forward end of the valve. The other end of the passage has an opening radially outward from the axis of the piston, and it will be obvious that when this valve is in closed position, as shown in Fig. 2, the opening at the side of the piston will be connected with the passage 4 through the body of the device. The forward end of the piston is therefore of annular shape and is formed to fit within the seat 9 on the nut at the opposite end of the cylinder. The outer end of the valve is formed with a stem 16 thereon, which is formed toward its outer end with the threaded nut 24 within which the valve shaft 19 is screwed. Beyond the threaded portion 24 the valve stem is of larger diameter at 25 so that the threaded end of the shaft 19 is out of contact therewith.

The valve piston 12 is formed with packing thereon which is set in a groove longitudinally of the piston on opposite sides thereof, said strips of packing being set in a groove extending from the forward end toward the rear and then fitting within a circumferential groove 26 extending around the outer end of the piston and making a tight contact with the cylinder walls. The piston is held non-rotatable within the cylinder by means of a key or pin, shown in dotted lines at 27, the end of which is extended into a slot indicated at 28 in the drawing, and it is to be understood that the piston is slidable in the cylinder with the end of the pin 27 sliding in the slot 28 holding the piston against rotation.

In operating this valve, the valve will be normally open while drilling is in operation. When gas is encountered and the driller wishes to allow the well to flow, the drill stem will be withdrawn from the well while the circulation is being continued to keep the gas within the well. As soon as the drill is withdrawn, however, the valve will be closed and this will be accomplished in the present instance by the rotation of the shaft 19 to screw the piston forward on the said shaft, bringing the end of the piston into the seat 9 firmly against the compressible washer 10, and thus making a tight closure. When the piston is in closed position, as shown in Fig. 2, the packing 29 across the side of the piston will prevent the passage of fluid upwardly along the piston in an obvious manner. The packing within the groove 26 will also prevent the escape of gas or fluid past the end of the piston into the chamber 11. There will, therefore, be a tight closure against the passage of fluid except through the outlet passage 23 to the opening 30 through the nut 7. The flow of fluid through this outlet may be controlled by valves in the flow line in the usual manner.

It is obvious that in some cases the gas pressure will become too high so as to cause a blowout while the drill stem is still in the well, and it is necessary therefore to have in connection with the safety valve which I have just described a means of closing the passage through the casing about the drill stem, and in Figs. 3 and 4 I have shown the body 1′ of the valve extended upwardly and formed with a pair of opposite cylinders 31 and 32 thereon, as will be seen in Figs. 3 and 4. These cylinders are fitted with opposite rams or pistons 33 which are slidable in cylinders 31 and 32 to engage against the opposite sides of the drill stem shown at 34. The forward ends of the pistons 33 are rounded to engage the drill stem, as is shown at 35 in Fig. 4. The pistons are operated in a manner similar to that described in connection with the valve piston. There is a rotatable stem or shaft 36 held against longitudinal movement by a flange 37 fitting within the box in the outer end of the bonnet 38, as was described in connection with the valve. The piston has packing 39 extending across the forward face of the rams and backwardly along the sides of the same and circumferentially around the body of the ram, as will be seen in the drawings. These rams may be operated to close about the drill stem from opposite sides and prevent the blowing of fluid from the well. The lateral outlet from the valve below may be connected with a flow line, as shown at 40 and when the drill stem is thus in the well, the rams will be closed to prevent the blowing of fluid from the casing and the valve being open, the lateral outlet through the flow line 40 will be provided for

the fluid. This lower valve is adapted to seat at 9'.

The advantages of my invention lie in the fact that when the valve alone is used, the passage through the casing can be entirely closed off so as to divert the fluid into a line under control. When the drill stem is in the well at the time a blowout is threatened, the rams can be closed above the valve to prevent the passage of fluid and the outlet from the valve below will be available to control the fluid flowing out through the line 40. I have thus provided a simple and effective combination which will serve to control the well under any emergency which may arise.

Having thus described my invention, what I claim as new is:

1. In a device of the character described, a valve body having a fluid passage therethrough, a cylindrical chamber extending transversely across said passage, having an opening at one end, a seat surrounding said opening, a cylindrical valve in said chamber having an L-shaped passage issuing at the forward end thereof, strips of packing material extending longitudinally of said valve and around the rear end thereof, and means to move said valve to and from said seat.

2. In a device of the character described, a valve body having a fluid passage therethrough, a cylindrical chamber extending transversely across said passage, having an opening at one end, a seat surrounding said opening, a cylindrical valve in said chamber having an L-shaped passage issuing at the forward end thereof, strips of packing material extending longitudinally of said valve and around the rear end thereof, a threaded stem engaging said valve, means to prevent longitudinal movement of said stem, and means to prevent rotation of said valve.

3. In a device of the character described, a valve casing including a tubular body having an open fluid passage longitudinally thereof, a cylindrical chamber extending transversely across said passage and forming a cross-shaped fitting therewith, a tubular nut screwed into one end of said chamber at one side of said passage, a compressible washer on said nut, a cylindrical piston in said chamber and means to move said piston into contact with said nut to close said passage and seat the forward end of said piston upon said washer.

4. In a device of the character described, a valve casing including a tubular body having an open fluid passage longitudinally thereof, a cylindrical chamber extending transversely across said passage and forming a cross-shaped fitting therewith, an annular tubular seat at one side of said chamber, a packing washer on said seat, a cylindrical piston in said chamber opposite said seat, an annular flange at the forward end of said piston, and means to move said piston to seat said flange upon said packing washer to close said passage.

5. In a device of the character described, a valve casing including a tubular body having an open fluid passage longitudinally thereof, a cylindrical chamber extending transversely across said passage and forming a cross-shaped fitting therewith, said chamber being open at one end, a seat surrounding said opening, a cylindrical valve in said chamber having its forward end constructed to fit said seat to seal around the open end of said chamber, means to move said valve, and an L-shaped passage in said piston adapted, when said piston is seated, to connect one end of said passage with the open end of said chamber.

In testimony whereof I hereunto affix my signature this 11th day of May, A. D. 1928.

WALTER E. KING.