April 6, 1937. B. YOUNG 2,075,878

WELLHEAD CONTROL

Filed Sept. 7, 1933

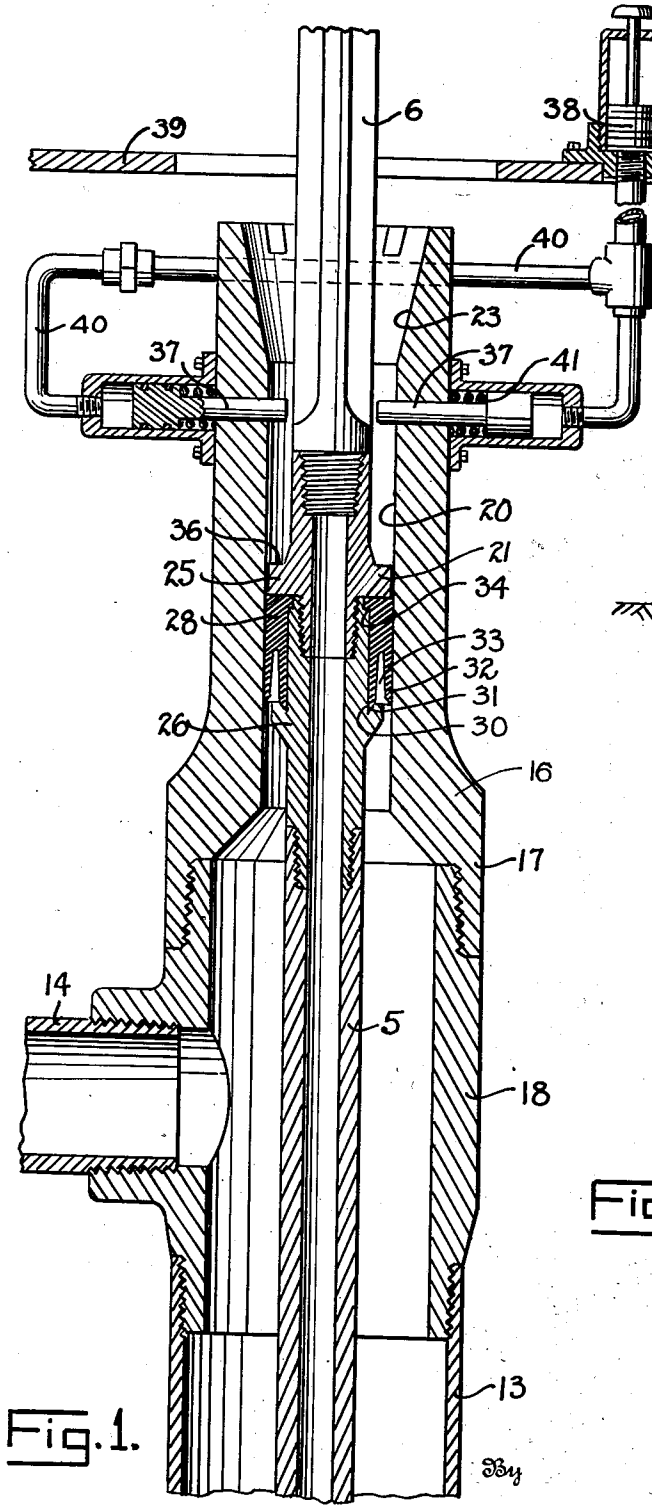



Fig. 1.

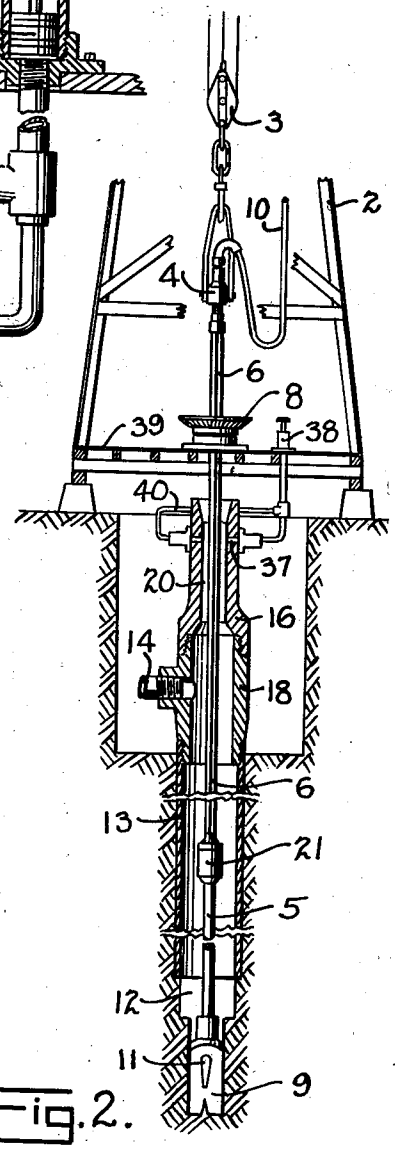



Fig. 2.

Inventor

BOB. YOUNG.

Jesse R. Stone.

& Lester B. Clark

Attorneys.

Patented Apr. 6, 1937 2,075,878

# UNITED STATES PATENT OFFICE

2,075,878

## WELLHEAD CONTROL

Bob Young, Henderson, Tex., assignor to Granville A. Humason, Houston, Tex.

Application September 7, 1933, Serial No. 688,440

6 Claims. (Cl. 255—1)

The invention relates to an improvement in well head or drilling control assemblies to be used in preventing blowout of the wells during the drilling operation.

In the drilling of wells it is usual to provide a surface casing and well head thereon in order to support the various apparatus which are to be used during the drilling and flowing of the well. The drill bit and drill stem are passed downwardly through this casing and casing head, and caused to rotate in performing the drilling operation. In event the drill penetrates a gas pocket or high pressure formation it is not unusual for the pressure encountered to overbalance the column of drilling fluid which is in the well, and to blow out not only the drilling fluid but in most instances the drill bit. Various devices have been conceived with a view of closing the well head as quickly as possible when a heavy pressure is encountered. These devices include blowout preventers, tubing retractors, and similar constructions. All of these, however, require the manipulation of separate and independent devices in order to close the well head against the escape of fluid. The present invention has therefore been devised in order to incorporate a closure member in the drill stem so that the well head may be closed by merely raising the drill stem to the proper elevation.

It is one of the objects of the invention to provide a well head closure which constitutes an enlarged portion on the drill stem in combination with a restricted arrangement in the casing head so that when these parts are at the same elevation the well head will be closed.

Another object of the invention is to provide a closure member for well heads which is incorporated in the drill stem.

Another object of the invention is to provide a casing head having a restricted area which is adapted to cooperate with a closure member on the drill stem.

A still further object of the invention is to provide a device for instantly closing the well head in event an excessive pressure is encountered.

It is also an object of the invention to provide a method for closing the well bore by merely raising the drill stem to the proper elevation so that it will be caused to completely close off the well head.

Other and further objects of the invention will be readily understood when the following description is considered in connection with the accompanying drawing wherein:

Fig. 1 is a vertical sectional view of a well head equipped with the invention, and showing the drill stem in position to close the well head.

Fig. 2 is a diagrammatic view showing the general arrangement and assembly of the drilling apparatus with the present invention incorporated therein, and illustrating the parts in drilling position.

Fig. 2 shows the general arrangement of the drilling apparatus which embodies the derrick 2, the hoisting apparatus and traveling block 3, and the rotary swivel 4. The swivel serves to support the drill stem 5 and the drill bit as well as the grief stem or kelly joint 6.

It will be understood that during the drilling operation the rotary 8 is caused to turn, and the kelly joint 6 being of a non-circular configuration, is gripped by the rotary 8 and caused to turn. This turning, of course, is transmitted to the drill stem 5 and the drill bit 9 to perform the drilling operation. In order that the bit may penetrate the formation, the hoisting apparatus 3 is gradually lowered as the drilling proceeds, so that the kelly joint 6 slides through the rotary 8.

In order that the cuttings may be washed away from the drill bit and the walls of the well bore maintained, a drilling fluid is circulated through the hose 10 and swivel 4 and discharged from the opening 11 in the drill bit. This drilling fluid flows upwardly through the well bore 12 and the casing 13 and is discharged from the outlet 14 into the slush pit where it is again picked up and circulated through the well. All of the apparatus so far described is standard construction, and well known in the drilling operation.

The upper end of the casing usually has mounted thereon some type of casing head which has an opening therein of sufficient diameter to permit the passage of the drill bit 9. One of the parts of the present invention constitutes an improved form of casing head which is illustrated generally at 16. This casing head is best seen in enlarged section in Fig. 1 and embodies a base 17 which is attached to the pipe 18 which is in turn attached to the casing 13. The discharge or outlet 14 is shown as being carried by the pipe 18. Obviously this pipe 14 will have suitable valves thereon so that the escape of fluid from the outlet may be cut off if desired.

The casing head 16 is of special construction in that it has an internal bore 20 which is shown as cylindrical and of sufficient length to adequately accommodate the closure member 21, which is shown as being a connection or coupling between the drill stem 5 and the kelly joint 6. The upper end of the casing head 16

has the usual form of tapered bowl 23 in order to receive the slips to support the drill stem if desired, or to support the additional tubing hangers or other constructions during the operation of the well.

The closure member 21 forms an essential part of the invention in combination with the casing head 16, because the closure member is of such a diameter as to quite closely fit within the cylindrical bore 20 of the casing head. The closure member comprises a head 25 connected to a packing mandrel 26, which is in turn connected to the drill stem. An expansible packing gland or seal 28 is shown as carried by the mandrel 26 and clamped in position by the head 25. This packing may be of any desired type, but an improved form of lip packing has been illustrated wherein the inner lip 30 is so formed as to be inserted in the recess 31 in the packing mandrel and the outer or sealing lip 32 is of such diameter that a recess 33 is formed to receive the fluid and cause expansion of the lip 32. It should be noted that the lower end of the lip 32 extends outwardly beyond the shoulder of the packing mandrel so that the fluid may enter the recess 33. The upper end of the packing is shown as having an inwardly turned shoulder 34 which is clamped against the upper end of the mandrel 26 by the head 25. From the foregoing construction it will be apparent that when the closing member is moved to the elevation of the bore 20 in the casing head, that the casing head will be closed against the flow of fluid around the outside of the drill stem.

The head 25 is provided with a shoulder 36 which is arranged to abut against the stop pins 37 which are carried by the casing head. Two of these stop pins have been shown as being projected into the bore 20 so that any pressure accumulating in the well cannot cause the drill pipe and closure member to be ejected from the well.

These stop pins 37 are shown as being operated by means of a pressure plunger 38 which is mounted on the derrick floor 39. The conduits or pipes 40 connect the plunger 38 with the stop pins 37, and these conduits are filled with hydraulic liquid. Pressure on the plunger 38 exerts a balanced pressure on the two stop pins 37 and causes them to move inwardly against the resistance of the springs 41. Any desired type of mechanical arrangement can be provided to accomplish the movement of these stop pins.

The operation of the device is as follows: The drill bit and desired number of sections of drill pipe are lowered into the well bore until the drill bit approaches the bottom of the bore where the drilling operation is to occur. The closure member 21 is then connected to the upper section of drill pipe and the kelly joint 6 connected to the closure member. The bit is then lowered on to the formation and the drilling operation proceeds. It is preferable that the closure member 21 be located slightly below the bore 20 at the beginning of the drilling operation so that there will be no wear due to rotation on the packing 28. It is to be understood that the kelly joint 6 is of considerable length as seen in Fig. 2, and permits the drilling of a considerable distance.

When the kelly joint has been lowered to its full length, the apparatus is then raised and the kelly joint and closure member as a unit are disconnected from the upper end of the drill stem. The next section of drill stem is interposed in the string and the closure member and the kelly joint again connected and the drilling is resumed. Fig. 2 shows the closure member 21 at an elevation considerably below the bore 20 in the casing head 16.

In event excessive pressure is encountered and the driller is of the opinion that a blowout is imminent, or it is desired to close the top of the well, he merely operates the hoisting apparatus 3 to raise the kelly joint and the drill bit upwardly in the well bore until the closure member 21 arrives at the elevation of the restricted bore 20. The stop pins 37 can be moved inwardly and then if the well pressure is sufficient it will raise the fluid in the well and cause expansion of the lip 32 to form a complete seal in the casing head. The valve on the outlet 14 may then be closed and this will serve to completely cut off the escape of fluid from the well, except through the drill stem. The escape through the drill stem may be properly controlled by a back pressure valve or the pressure overcome by the operation of the circulating pumps.

In some formations the drill bit encounters a gas pocket and before drilling can proceed the gas pressure must be reduced. The usual practice is to suspend the drill pipe and rotate it while the circulating pumps are operated. The flushing fluid passing out through the drill bit and up the well bore carries some gas with it so that the pressure in the formation is reduced. The present equipment is ideal for these operations because the well head can be closed around the kelly.

The particular advantage of the present invention resides in the fact that casing heads can be closed almost instantly by merely raising the closure member 21 to the elevation of the restricted bore 20. This can be accomplished very quickly because the driller is at all times operating the hoisting apparatus 3 during the drilling operation, because he is gradually permitting the drill stem, drill bit swivel, and hoisting apparatus to be lowered in the well.

On many occasions it is necessary to raise and lower the drill stem and this is the principal duty of the driller to have constant control of the hoisting apparatus at all times. He can, therefore, very quickly raise the closure member to the proper elevation and, by merely moving the plunger 38, will have the closure member stopped at the desired elevation to close the casing head.

It is contemplated that any size pipe may be connected to either end of the sealing assembly so that the well head may be closed as described regardless of the size of pipe in the well. This is of advantage over the closure heads now used which generally require a change in the size of the rams with every change in size of the pipe being used.

The invention contemplates broadly a method of closing the well head by merely raising the drill stem during the drilling operation, and does not require the actuation of blowout preventers or other equipment. The sealing operation is accomplished in proportion to the pressure tending to cause a blowout of the well and the apparatus used does not interfere in any way with the standard operation of drilling wells.

What is claimed is:

1. A casing head for wells including a body, a bore therein in combination with a drill stem and a closure member thereon, said member including a mandrel, a head, a packing on said mandrel and supported against upward movement by said head, and means carried by said casing and operable

from the derrick floor to limit the upward movement of the closure member in said casing head.

2. The combination of a casing head, a flexible closure member on the drill stem adapted to cooperate with the casing head to close the well, a head to restrain said member against flowing under pressure, and a means to limit the upward movement of said head in the casing head, said means including radially movable hydraulically operated stop pins in the casing head.

3. The combination with a casing head having a restricted opening therethrough of a drill stem in said opening, said stem being made up of pipe sections and a kelly joint, a connection for the lower end of the kelly to the pipe comprising a mandrel, a lip packing thereon, a flange confining the inner lip, a head above said mandrel, a shoulder thereon to support said packing against upward movement, and means movable into said opening to obstruct the upward movement of said head whereby an automatic seal is obtained by raising said packing into said opening.

4. A drilling control head comprising a casing, a casing head thereon, a working barrel carried by said head, a sealing assembly forming a part of the drill stem and disposed in said working barrel and adapted to form a seal with said barrel during the drilling operation, and means also on said casing head to hold said sealing assembly against removal due to pressure in the well.

5. A drilling head the upper end of which comprises a working barrel, an outlet from said head below said barrel so that the circulation returns may flow therefrom, a sealing assembly carried by the drill stem and adapted to seal in said working barrel during the drilling operation, and means to lock said assembly against upward movement out of said barrel.

6. A drilling head the upper end of which comprises a working barrel, an outlet from said head below said barrel so that the circulation returns may flow therefrom, a sealing assembly carried by the drill stem and adapted to seal in said working barrel during the drilling operation, and means on the top of said working barrel to latch said sealing assembly against upward movement.

BOB YOUNG.