May 6, 1952 J. I. SLOAN 2,595,715

METHOD OF AND APPARATUS FOR EXPEDITING THE DRILLING OF WELLS

Filed Jan. 28, 1947 2 SHEETS—SHEET 1

Fig. 1.

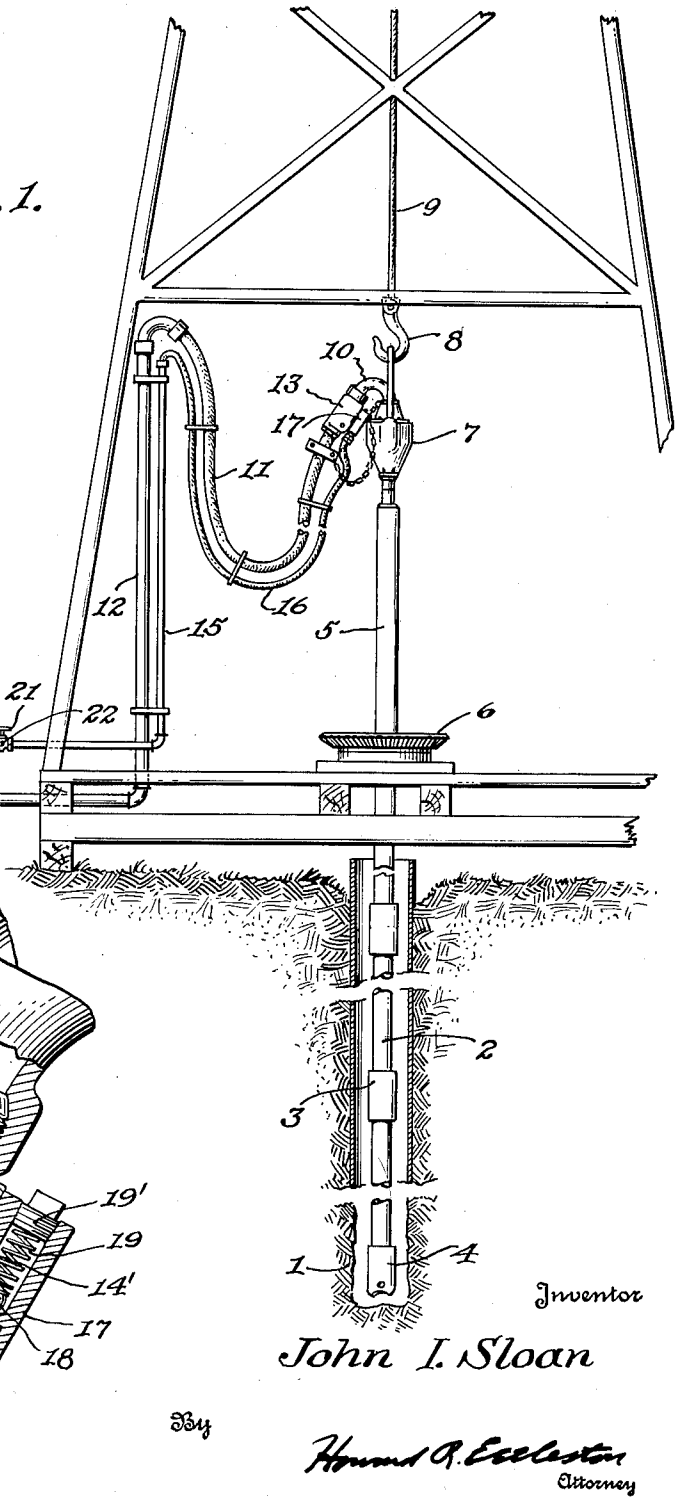


Fig. 3.

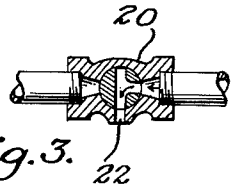
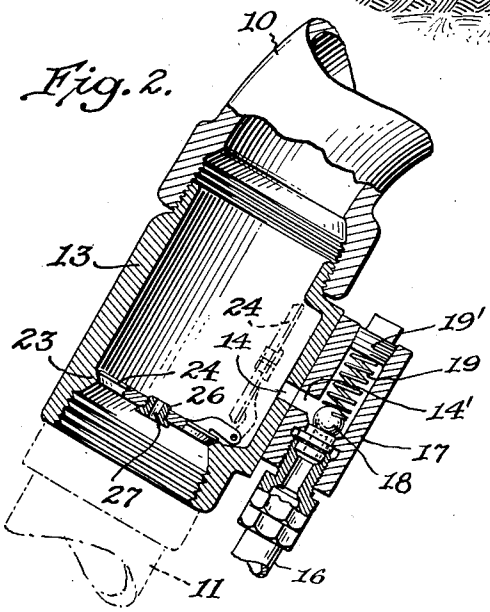


Fig. 2.



Inventor

John I. Sloan

By

Howard A. Eccleston

Attorney

May 6, 1952 J. I. SLOAN 2,595,715

METHOD OF AND APPARATUS FOR EXPEDITING THE DRILLING OF WELLS

Filed Jan. 28, 1947 2 SHEETS--SHEET 2

Fig. 4.

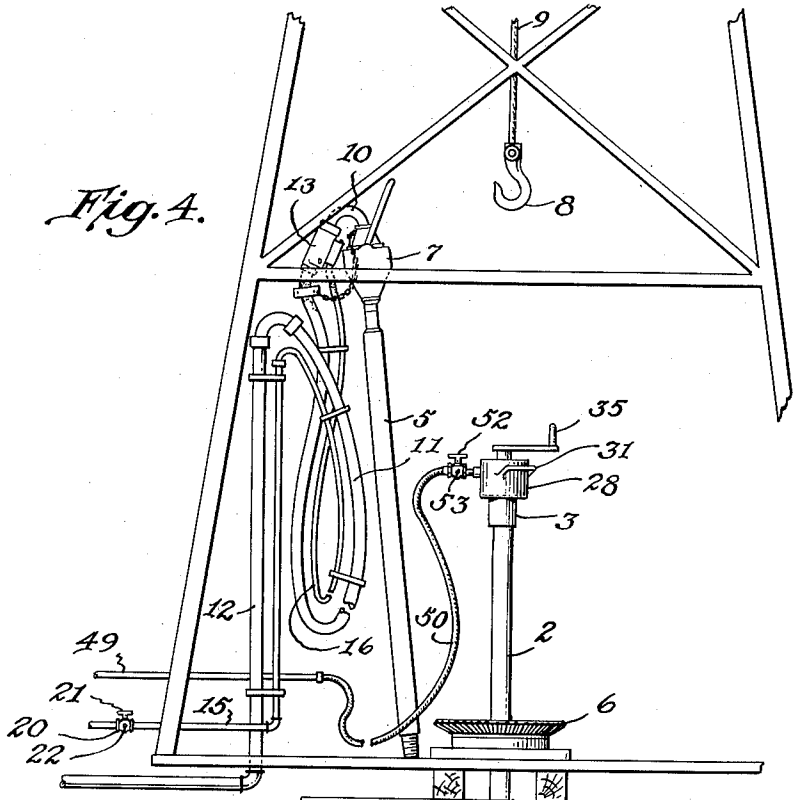


Fig. 5.

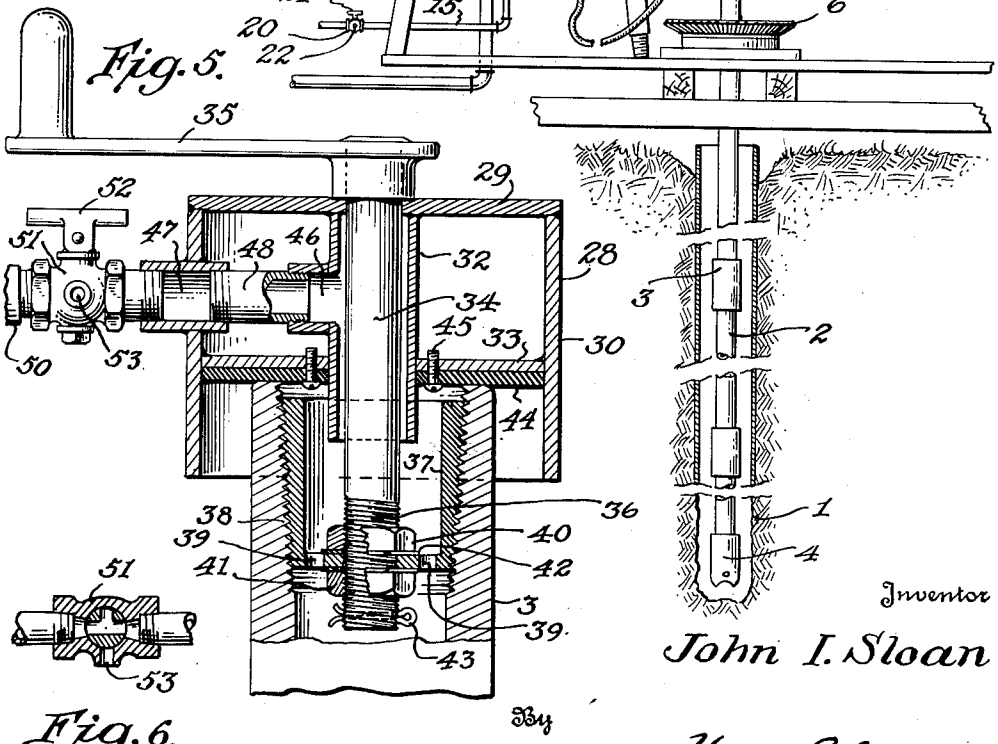


Fig. 6.

Inventor

John I. Sloan

By

Howard R. Eccleston

Attorney

Patented May 6, 1952 2,595,715

UNITED STATES PATENT OFFICE

2,595,715

METHOD OF AND APPARATUS FOR EXPEDITING THE DRILLING OF WELLS

John I. Sloan, Tulsa, Okla., assignor of one-fifth to John H. Poe, Tulsa, Okla.; Pearl Sloan, executrix of said John I. Sloan, deceased, assignor of four-fifths to Pearl Sloan

Application January 28, 1947, Serial No. 724,832

8 Claims. (Cl. 255—1.8)

1

In the drilling of oil wells, particularly by rotary rigs, a continuous stream of mud flows down through the string of drill pipe, out through holes in the drill bit, and thence upwardly and out through the mouth of the well. Thus the string of drill pipe is always full of drilling mud.

This use of drilling mud is essential in the drilling of wells, but its use very materially increases the time required in handling the string of drill pipe. For example, every time a new length of pipe must be added because of the deepening of the well, and the kelly is hoisted for that purpose, it is necessary to delay operations until sufficient mud has drained through the drill bit, thus freeing the kelly of mud. Also, it becomes necessary from time to time to pull the entire string of drill pipe from the hole, to replace the bit or for other purposes. This is a long tedious job and one of the reasons the operation is so lengthy is because of the time required for the drilling mud to drain from the pipe sections before they can be disconnected.

One of the objects of the present invention is to provide a novel method and apparatus by which the time formerly required for boring a well is greatly reduced.

Another object of the invention is to provide such a method and apparatus which requires little skill in its operation.

A further object of the invention is to provide such a method and apparatus in which only very slight changes are made in the apparatus now commonly employed in the boring of wells.

Still another object of the invention is to provide such a method and apparatus in which the novel added devices are very simple in construction and inexpensive in manufacture.

Various other objects and advantages of the invention will be apparent to those skilled in the art from the following detailed description when taken in connection with the accompanying drawings, in which:

Figure 1 is an elevational view of the apparatus combined with the swivel gooseneck and other apparatus employed in boring wells.

Figure 2 is a longitudinal sectional view of a particular mechanism associated with the gooseneck.

Figure 3 is a horizontal sectional view of a three-way valve in an air line leading to the gooseneck.

Figure 4 is an elevational view of another apparatus mounted on the upper end of the string of drill pipe; the swivel gooseneck, kelly and associated parts having been removed and shown at one side.

2

Figure 5 is a vertical sectional view of the apparatus mounted on the top of the string of drill pipe; and

Figure 6 is a horizontal sectional view of a three-way valve in an air line to the apparatus shown in Figure 5.

Referring to the drawings in more detail, and particularly to Figure 1, numeral 1 indicates an oil well in process of being drilled, and within which is the usual string of drill pipe 2 formed of sections connected by pipe coupling 3 and having at its lower end a bit 4 having the usual holes through which the drilling mud is forced.

The string of drill pipe is attached to the lower end of the usual kelly 5 which is caused to rotate with the table 6 in the well known manner. The kelly is attached to the usual swivel 7 carried by a hook 8 of a cable 9 commonly employed for the raising and lowering equipment used in connection with the well.

The swivel gooseneck is indicated by the numeral 10, and in accordance with the usual practice the gooseneck is connected by a flexible hose 11 with a mud pipe line 12. As is well known, drilling mud is forced under pressure by a pump (not shown) in a continuous stream through the gooseneck down through the kelly and the string of drill pipe, out through holes in the drilling bit, up through the well and back to the original source.

Thus the kelly 5 and the string of drill pipe are filled with drilling mud during the drilling operation. As the well deepens additional pipe sections are added from time to time. In order to add an additional section it is necessary to disconnect the kelly from the string of drill pipe, and of course before this can be done the mud must be drained from the kelly. The kelly and string of drill pipe are first hoisted the length of the kelly by the cable 9 and the drill pipe is secured and held fast at the level of the derrick floor.

The parts must now remain in this position for considerable time until the mud has drained from the kelly. After this rather long delay the kelly and associated parts are removed, another length of drill pipe is added and then the string is lowered into the hole until the upper end of the new length is at the level of the derrick floor. Then the kelly is re-attached and drilling resumed and continued until the well is drilled another full length of the kelly, and then the operation of adding a new length of pipe section is repeated. Thus every time a pipe section is added there is the delay while the mud drains from the kelly, and this very considerable loss

of time is eliminated or practically eliminated by the present invention.

With reference to Figures 1 and 2, it will be noted that a body member 13 is attached at its upper end to the gooseneck 10 and its lower end is attached to the mud hose 11 which leads to and forms part of the pipe line 12.

The body member 13 is provided at one side with an opening 14 which communicates with a check valve 17 preferably carried by the body member, and having an opening 14' aligned with the opening 14. This valve includes the usual ball 18 and spring 19, and a plug 19' closes one end of the valve. An air line 15 from any preferred source of compressed air, and including a flexible hose 16, connects with the opposite end of the check valve. This check valve prevents drilling mud from entering the air line when pressure is not being supplied to unseat the ball.

Mounted in the air line, preferably at a distance from the body member and convenient to an operator on the derrick floor, is a valve 20. The purposes of this valve are to shut off the supply of compressed air or steam and at the same time release the compressed air or steam in the air line between this valve and the check valve 17. So the valve is preferably of the three-way type, and may include an operating handle 21 and a port 22 through which the fluid pressure between it and the check valve can escape when the valve is in the position shown in Figure 3.

The body member 13 is provided with a valve seat 23 having a ground surface, and pivotally mounted in the body member, and adapted to cooperate with the valve seat, is a flap valve or clapper 24. This valve is shown as provided with a nipple 26 having a passage 27 therethrough. Preferably this nipple is removably mounted in the flap valve, as by being screwed therein, so that nipples having passages of different sizes may be substituted. It will be apparent that when the flap valve 24 is seated it will shut off communication between the mud line 11 and the gooseneck 10, and the nipple 26 will permit air or steam pressure delivered through the opening 14 to bleed off.

When in the drilling of a well it becomes necessary to add a new section to the string of drill pipe, the kelly is hoisted in the usual manner and the line of drill pipe secured. In accordance with the old practice it was necessary to delay everything until the mud drained from the kelly through the openings in the drill bit. But in accordance with the method and apparatus disclosed herein, this loss of time may be eliminated or practically eliminated. When it becomes necessary to add a new section to the string of drill pipe, because of the deepening of the well, the drilling is stopped by stopping the rotation of the table 6. The present invention is now brought into play, and by the time the swivel and associated parts have been hoisted the length of the kelly the mud will have been forced from the kelly, so that it is ready to be removed by the time it has been hoisted, thus avoiding any loss of time. To accomplish this very desirable result it is only necessary, when a new section is to be added, for the operator to open the conveniently located valve 20, to admit air pressure or steam. This fluid pressure may be varied as desired, but will usually be between fifty and one hundred and fifty pounds. Wherever this pressure is referred to herein or in the claims as air pressure or compressed air, it will be understood to also include steam or other desired fluid pressure.

The air pressure admitted by the operation of the valve 20 will unseat the ball 18 of the check valve 17 and the pressure will enter the body member 13. This pressure will force the flap valve or clapper 24 down to seated position to close the mud line, and the pressure will force the drilling mud through the gooseneck and down and out of the kelly 5.

The air pressure which builds up in the kelly may bleed off through the nipple 26 into the mud line, and there is no pressure in this line, for of course the mud pump is shut down when drilling is stopped, and there is a release valve (not shown) in the mud line adjacent to the derrick floor which is opened to release the mud. This valve, when in one position, allows mud to be forced through the entire system by the pump, and when in the other position it shuts off communication with the pump and opens the line to the flap valve to atmosphere, so that the mud below the flap valve flows out by gravity onto the ground or through a pipe leading toward the mud pit.

While the air pressure is on to force the mud from the kelly, the kelly is hoisted, and in accordance with the present method and apparatus the preferred operation is such that by the time the kelly has been hoisted its full length, the mud has been forced out of the kelly and sufficient time has elapsed to allow the air pressure to bleed off through the nipple 26. Hence there is no loss of time whatever. It will be understood that at the proper moment the valve 20 is turned to the position shown in Figure 3, which not only stops the admission of air pressure, but also releases the pressure in the line between it and the check valve, thereby permitting the check valve to seat.

As mentioned hereinbefore the nipple 26 is preferably removable so that nipples having passages of different sizes may be substituted. This particular feature of using nipples of different sizes is not an essential part of the invention, but it is desirable in that nipples of particular sizes may be selected in accordance with the time each particular rig takes in lifting the kelly out of the hole, so that by the time it is up the air pressure will have bled off, after displacing the mud.

It will be apparent from the foregoing description that the delay heretofore encountered in clearing the kelly of mud is eliminated or practically eliminated. The body member 13 and its valves 17 and 24 are of course permanently associated with the swivel 7, and these parts are at times high in the air, but the operation is controlled by the valve 20 which is conveniently located.

When the kelly has been disconnected a new pipe section is added and lowered into the hole until the upper end is at the derrick floor level and then the kelly is reattached, all in the well known manner. When drilling is to be resumed drilling mud is again forced through the line 11 and, of course, this throws the flap valve 24 to inoperative position, as shown by dotted lines in Figure 3. And this drilling mud cannot enter the air line for the check valve seated when the three-way valve 20 was turned to release the air pressure between it and the check valve.

The method and means by which the kelly is cleared of drilling mud each time it is hoisted for the addition of a new drill pipe section, thereby very considerably shortening the drilling operation, will be entirely clear from the foregoing

description. But from time to time during the drilling of a well it is necessary to pull the entire string of drill pipe from the hole for the purpose of substituting a new bit, or for other reasons. Of course each pipe section had to be drained of drilling mud before it could be removed, and this caused long delays. Such delays are also eliminated to a large extent by means of the present invention.

The kelly is first cleared of mud by the method hereinbefore described, and the kelly and the associated apparatus also previously described, are then placed to one side, as shown in Figure 4. The hook 8 is now free and it is employed for pulling the drill string, section by section, from the hole; being connected to suitable equipment for that purpose. Instead of delaying operations until the mud drains from each length through the bit, the apparatus shown in Figures 4 and 5 is mounted on the upper end of the uppermost length, and such apparatus and the method of freeing the lengths of mud will now be described, reference being had particularly to Figure 5.

Numeral 28 indicates a casing having a top 29 and a depending flange 30 which may be provided with handles 31. Centrally of the top is an opening from which depends a tubular member 32, such member extending through and preferably beyond an opening in a plate 33 carried by the casing. The invention is in no manner limited to this particular construction, which may be changed in any way desired, and these parts may be welded or formed integral.

A shaft 34 extends through the tubular member 32, in spaced relation thereto, and projects above and below the casing. Secured to the upper end of the shaft and resting on the top 29 of the casing, is an operating handle 35, and the lower portion of the shaft is threaded over a considerable distance, as indicated by numeral 36.

Numeral 37 refers to a securing member which may be slightly tapered and is exteriorly threaded as indicated by numeral 38. This securing member is hollow, open at the top, and at the lower end has a plate or base provided with any desired number of openings 39 and a central threaded opening by which the securing member is threaded on the lower end of the shaft 34.

For locking the securing member on the shaft, and for adjusting it longitudinally thereof, nuts 40 and 41 are threaded on the shaft, respectively above and below the base of the securing member, and lock washers 42 are preferably provided between the base and the nuts. The shaft 34 may also be provided with a cotter pin 43 adjacent its lower end.

A gasket 44, of rubber or other desirable material, is attached to the plate 33, as by screws 45.

The tubular member 32 is provided with a lateral opening 46, and the depending flange 30 is provided with an aligned lateral opening 47; the two openings being connected by a short pipe section 48.

A compressed air or steam line 49, which preferably includes a flexible section 50, leads from any desired source to the opening 47. This line is provided with a three-way valve 51, and preferably it is mounted, as shown, directly on the casing at the opening 47. The valve is provided with an operating handle 52 and a port 53 adapted to open to atmosphere.

When from time to time it becomes necessary, in the drilling of wells, to pull the string of drill pipe as, for example, to replace the drill bit,

the kelly is cleared of drilling mud, preferably by the method and apparatus hereinbefore described, and the kelly and associated parts are then put aside. Now the lengths of pipe forming the drill string must be cleared of mud before the lengths can be removed, and as has previously been mentioned, one of the purposes of the present invention is to avoid to a very large extent the long delays formerly incurred while waiting for the drilling mud to drain from the drill string through holes in the bit.

To mount the device in place the securing member 37 is mounted over the interiorly threaded coupling 3 at the upper end of the top length of drill pipe, and by rotation of the handle 35 the securing member is screwed into the coupling. The rotation of the handle is continued until the securing member enters the coupling far enough to bring the gasket 44 into tight sealing relation with the upper end of the coupling 3. At this point it may be mentioned that the invention is in no manner limited to the particular means shown and described for mounting the device and bringing the gasket into sealing position. Obviously the device need not be attached to a coupling, for it could be attached directly to the pipe, or to some other device attached to the pipe, and it is unimportant in so far as the scope of the present invention is concerned, whether the securing member is interiorly or exteriorly threaded. The important thing is to bring the gasket into good sealing relation with the upper end of the drill string, rather than the particular means by which this is done. And in this connection it is very desirable to be able to vary the distance between the securing member carried by the shaft 34 and the gasket carried by the plate 33. Such adjustment is easily made in the structure disclosed herein. As previously mentioned the securing member is threaded on the shaft and is held in locked position by the nuts 40 and 41. When it is desirable or necessary to vary the distance between the gasket and the securing member, it is only necessary to back off the lower nut 41, and then by rotating the handle 35 and at the same time holding the securing member against rotation, the securing member will move up or down on the shaft, depending upon the direction of rotation of the handle. The same result is obtained by holding the handle 35 against rotation and rotating the securing member. After the adjustment has been made to insure good sealing relation between the gasket and the drill pipe string, the lower nut 41 is screwed up to lock the securing member in its adjusted position. The cotter pin 43 is to prevent parts from becoming accidentally detached from the shaft.

To attach the device to the upper end of the drill string requires only a moment or two. Then the valve 51 is opened to admit air or other fluid pressure, which passes through the instrument and the holes 39 to enter the drill pipe and thereby force the mud down through the drill pipe and out through the bit at the bottom of the hole. By leaving the instrument on the drill pipe only a few minutes the mud can be forced down three or four lengths of drill pipe.

As soon as the mud has been forced down as far as desired, the valve 51 is turned from the position shown in Figure 6 to shut off the air pressure and at the same time open the drill pipe and the instrument to the atmosphere, to release the pressure. The instrument is then

quickly removed by rotating the handle 35 in the opposite direction to detach the securing member from the coupling, and the drill pipe sections are now ready to be removed in the usual way. The number of sections which can be removed in a single operation, depends upon the particular derrick and equipment, but it may vary from two to as many as four sections.

As soon as those sections free of mud have been removed, the instrument is again mounted on the drill pipe as before, and the mud forced farther down to free additional pipe sections, and of course the operation is repeated as many times as may be necessary to clear the entire line.

It is believed the novel method and apparatus will be clearly understood from the foregoing description, and it will be apparent that there is a very great saving of time in both the removal of the kelly and the string of drill pipe, and that this very important saving of time is accomplished by the use of simple and inexpensive instruments requiring little skill in their operation and no material change in ordinary drilling equipment.

Having fully described the invention, what I claim is:

1. The method of expediting the drilling of wells in which drilling mud is forced through the kelly and string of drill pipe during the drilling operation, which consists in stopping the drilling operation and admitting compressed air or other gaseous fluid at superatmospheric pressure to force the drilling mud downwardly and out through the drilling bit, and relieving the built up pressure prior to removal of the kelly or section of the string of drill pipe.

2. The method of expediting the drilling of wells in which drilling mud is forced through the kelly and string of drill pipe during the drilling operation, which consists in stopping the drilling operation and admitting gaseous fluid at superatmospheric pressure to the upper end of the kelly to rapidly clear the kelly of drilling mud, and relieving the built up pressure prior to removal of the kelly.

3. The method of expediting the drilling of wells in which drilling mud is forced through the kelly and string of drill pipe during the drilling operation, which consists in stopping the drilling operation and admitting gaseous fluid at superatmospheric pressure to the upper end of the kelly prior to hoisting it preparatory to removal, allowing the fluid pressure to continue to act to force the drilling mud from the kelly while the kelly is being hoisted, and relieving the built up pressure prior to removal of the kelly.

4. The method of expediting the drilling of wells in which drilling mud is forced through the kelly and string of drill pipe, which consists of stopping the drilling operation and applying gaseous fluid at superatmospheric pressure to the interior of the kelly to force the mud downwardly and out of the kelly, relieving the built up pressure prior to removal of the kelly, removing the kelly, and applying gaseous fluid at superatmospheric pressure to the interior of the string of drill pipe to force downwardly the mud therein, relieving the built up pressure in the string of drill pipe, and removing sections of the drill pipe cleared of mud.

5. Well drilling apparatus including a kelly and a string of drill pipe through which drilling mud is forced when drilling, a mud line communicating with the interior of the kelly, a valve for

closing the mud line, said valve constructed and positioned to be closed by the admission of fluid pressure to the kelly, means for delivering gaseous fluid at superatmospheric pressure to the interior of the kelly to close said valve and force the mud from the kelly, and means in said valve for relieving the fluid pressure built up in the kelly.

6. Well drilling apparatus including a swivel gooseneck, a kelly and a string of drill pipe through which drilling mud is forced when drilling, a body member associated with the swivel gooseneck, a mud line and an air line leading to said body member, a valve in the body member for closing and opening the mud line, a check valve associated with the body member and controlling the admission of fluid pressure to force mud from the kelly, and means associated with the flap valve for relieving fluid pressure.

7. Well drilling apparatus including a string of drill pipe through which drilling mud is forced when drilling, an instrument adapted to be attached to the upper end of the drill pipe, said instrument including a gasket to close the upper end of the drill pipe, a vertical shaft extending through the instrument, a threaded member carried by the lower end of the shaft and adapted to engage threads on the string of drill pipe, a handle on the upper end of said shaft to rotate the threaded member to bring the said gasket into sealing relation with the upper end of the string of drill pipe, and said closing gasket having a passage therethrough for admitting fluid pressure through the instrument to force the drilling mud downwardly in the string of drill pipe.

8. Well drilling apparatus including a string of drill pipe through which drilling mud is forced when drilling, an instrument adapted to be attached to the upper end of the drill pipe, said instrument including a casing, a horizontal plate carried by the casing, a gasket attached to the under side of said plate, a tubular member extending downwardly through said plate and gasket, a shaft extending through said tubular member in spaced relation thereto, a threaded member carried by the lower end of said shaft and adapted to engage threads on the string of drill pipe, said threaded member having a passage therethrough, a handle on the upper end of said shaft to rotate the threaded member to attach the instrument and draw the said gasket into sealing relation with the upper end of the drill pipe, and a fluid pressure line to admit fluid pressure to the tubular member and thence downwardly through the tubular member and through the said attaching member to the interior of the string of drill pipe to force the drilling mud downwardly therein.

JOHN I. SLOAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
307,606	Westinghouse, Jr.	Nov. 4, 1884
1,077,697	Gates	Nov. 4, 1913
1,217,467	Lincoln	Feb. 27, 1917
1,801,788	Zublin	Apr. 21, 1931
1,928,947	Newman	Oct. 3, 1933
2,128,352	Creighton	Aug. 30, 1938
2,130,401	Spalding	Sept. 20, 1938
2,158,356	Dyer	May 16, 1939