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TUBE CATCHER SUB

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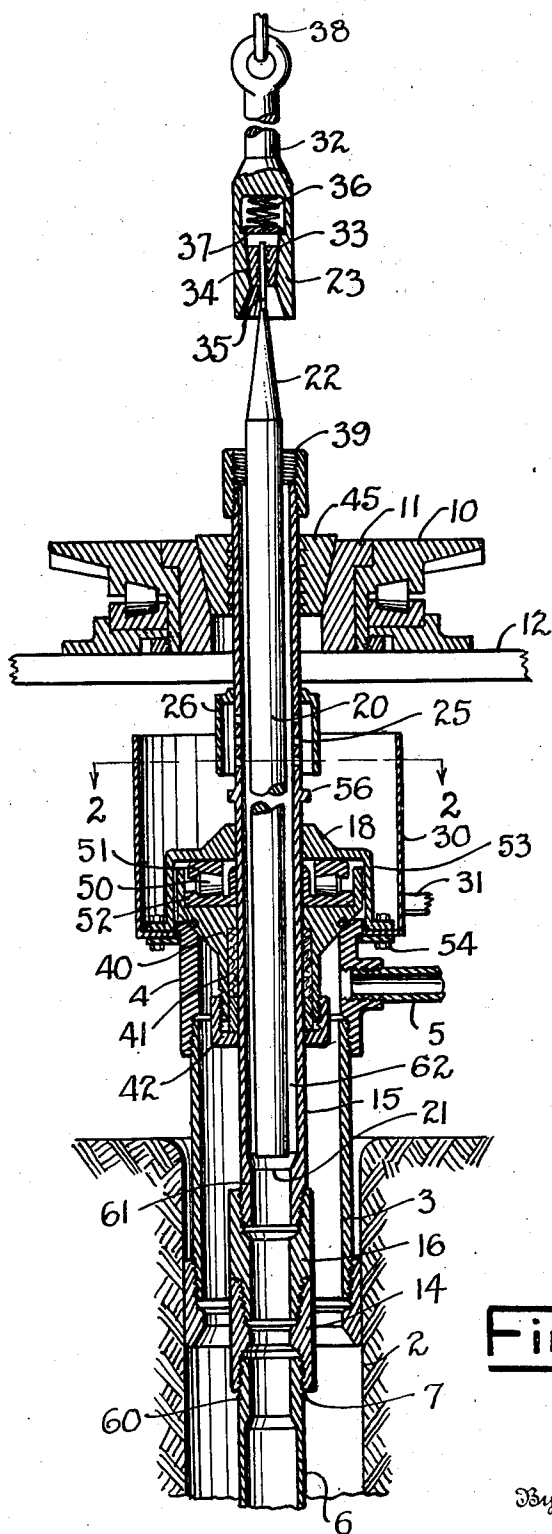


Fig. 1.

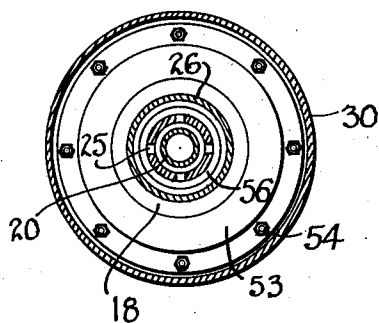


Fig. 2.

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TUBE CATCHER SUB

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1 Claim. (Cl. 255—72)

The invention relates to a means and apparatus for use with the rotary well drilling equipment, particularly where some tool or apparatus is being retrieved from the well bore by the force of hydraulic fluid.

In the drilling of wells by the rotary method it is often desirable to lower the tool or piece of equipment into the well bore either by gravity or by circulation of fluid and to thereafter retrieve this piece of equipment or apparatus also by the force of hydraulic fluid and under these circumstances it is not uncommon for the tool or piece of equipment to move along the well bore at a considerable rate of speed so that when it arrives at the surface it is desirable to release the fluid pressure beneath the tool as quickly as possible in order to stop the tool and to prevent its being forced upwardly from the well bore into the derrick.

It is also desirable to prevent the discharge of the fluid or liquid which serves to raise the tool in the well bore so that it will not be wasted or be discharged about the derrick floor.

The invention particularly relates to the retrieving of a core barrel such as described in my copending application for patent, Serial No. 378,613, (1925 series) filed July 16, 1929, or my retrieving sand tester described in my copending application, Serial No. 57,329, filed January 3, 1936, now Patent No. 2,094,022, granted September 28, 1937.

It is one of the objects of the invention to provide a device for releasing the fluid pressure beneath a tool being raised in a well bore by hydraulic pressure.

Another object of the invention is to arrest the flight of a tube within a drill pipe at a fixed position such that the upper end of the tube will project above the upper end of the drill pipe.

Another object of the invention is to automatically seize the tool as it appears at the mouth of the well bore due to force of hydraulic fluid so that the force of fluid may be released and the tool retained at the surface.

Another object of the invention is to vent out of the well bore the slush which is used during the circulation in moving a tube in a well bore.

Another object of the invention is to provide a means of confining the slush discharged from a well bore to an area beneath the derrick floor.

Another object of the invention is to provide a sub for the drill pipe which will vent the flushing fluid therefrom.

Another object of the invention is to provide a well head connection so that drilling fluid may

be vented from the drill pipe while the drill pipe is being rotated in event a piece of equipment is being moved into the drill pipe by hydraulic pressure.

Another object of the invention is to seal the well head so that pressure fluid may be introduced into the casing around the outside of a drill pipe and will circulate down the casing and up the drill pipe in order to effect movement of a piece of equipment in the drill pipe in an upward direction.

Another object of the invention is to provide a piece of well head equipment whereby the drill stem may be rotated while a tube is being retrieved in upward flight through the drill pipe.

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

Fig. 1 is a central vertical section through the upper end of a well head which has been equipped with the invention in illustrating the assembly and arrangement of the parts.

Fig. 2 is a section taken on the line 2—2 of Fig. 1 and looking downwardly.

In Fig. 1 the well bore is indicated generally at 2 and as is usual it is provided with a surface casing such as 3 which extends into the earth formation a sufficient distance so that it may be suitably anchored in order to support the casing head and other equipment in event of pressure in the well bore. It is the usual practice to cement this pipe 3 into position and it may be of any desired length, depending upon the contemplated pressures to be encountered.

In the present instance this casing 3 has been equipped with a casing or drilling head 4 which has the usual pipe connection 5 thereon so that the drilling fluid may discharge from the casing into the slush pit during the normal drilling operation.

The equipment shown is merely diagrammatic to illustrate one form of the casing head. The drill pipe by which the drill bit is rotated and the drilling operation is performed is indicated at 6 and is made up of sections of pipe coupled end to end. During the normal drilling operation the Kelly joint or grief stem is connected to the upper end of the drill pipe at 7 and extends upwardly through the rotary table 10. A drive bushing 11 and a usual driving connection are carried by the rotary so as to impart rotation to the drill stem. The rotary table is mounted on the derrick floor 12.

It is well understood that the string of drill

pipe 6 is supported by a swivel in the derrick in a manner so that it may be rotated during the drilling operation. A rotary hose is usually extended from the mud pump so as to draw mud from the slush pit and force it through the swivel and down through the Kelly joint and the drill pipe 6 in the usual form of circulating slush or drilling fluid in the well. This mud passes through the lower end of the drill bit and up the well bore 2 through the casing 3 and out the discharge or return outlet 5. All of the equipment so far described is that usually employed in the normal drilling operation.

The present invention directs itself to a means and a method of inserting and retrieving tubes or tools from the well bore while the drill stem 6 is in position in the well bore, and with this in mind the Kelly joint has been disconnected at the point 7 from the tool joint 14 and the tube catcher sub 15 has been attached thereto by means of the tool joint pin member 16 which has been screwed into the tool joint box member 14.

This sub is of special construction so that it may be extended upwardly through the rotary table and will pass through the sealing head 18, which is positioned on the casing head 4.

The particular feature of the sub 15 is to vent the drilling fluid or slush from the upper end of the drill pipe when the circulation is reversed in order to retrieve the tool or tube which is indicated generally at 20. This tube is the piece of equipment which has been lowered into the well bore and is being retrieved. It may be a core barrel, sand tester or any other piece of equipment.

It seems obvious that when the circulation of fluid is reversed by passing it from the pumps into the pipe 5 and downwardly through the casing 3 and the well bore 2 that there will be a pressure exerted on the lower end of the drill pipe 6 so as to cause a circulation upwardly through this pipe. This circulation will be exerted on the lower end 21 of the tube 20 so as to cause the tube to move upwardly through the drill pipe.

As this tube arrives at the surface it may be traveling at a considerable rate of speed, depending upon the pressure of the pump and the volume of circulation. It is desirable, of course, to merely have the head 22 of this tube project above the rotary table 10 so that it may be seized by a suitable catcher or overshot 23. At this time it is desirable to release the pressure fluid from beneath the end of the tube 20 and with this in mind a plurality of openings 25 have been provided in the periphery of the pipe which makes up the sub 15. These openings are sufficient in number and size so as to vent the volume of fluid which will be moving up through the drill pipe. A suitable skirt 26 is also carried by the pipe 15 and overhangs these openings 25 so that there will not be any unnecessary spraying or splashing of the mud as it discharges.

A basin 30 has been shown as attached to the casing head 4 and having an outlet 31 so that the mud can drain down and out this outlet 31 back into the slush pit so that it will not be wasted.

When the fluid pressure is released through these openings 25 of course there will be no force exerted on the tube 20 and it will come to rest in a more or less floating position on the fluid which is moving upwardly through the drill stem. It is preferable, however, to seize the tube automatically with the catcher 23 and for this reason a plurality of jaws 33 have been positioned

in the taper 34 of the catcher so that they will grasp the stem 35 on the upper end of tube 20. A spring 36 may normally press the plate 37 downwardly so that shock of the stem 35 moving into the catcher 23 will be absorbed and at the same time the jaws 33 will be held against excessive upward movement. This catcher 23 may be supported by any suitable rope or cable 38 which can be raised or lowered in order to move the tube 20 into or out of the well bore.

Incorporated within the catcher 23 there may be a weight portion 32 known as a sinker bar whose weight will serve to absorb the inertia of the moving tube. If desired, the catcher 23 may be positioned upon the upper end 39 of the sub 15 before the tube arrives to the upper end of the well bore so that the tube will move into the catcher and will be automatically retained thereby.

In many instances it is desirable to rotate the drill pipe 6 while the retrieving operation is being carried out and it is also necessary to form a seal with the casing head 4 when pressure is applied to reverse the circulation in order to retrieve the piece of equipment. To accomplish this the sealing and rotating head 18 has been provided and it is in the form of a body 40 which carries a stuffing box or packing gland 41 which is held in position by a cap 42. In this manner a seal is formed with the periphery of sub 15 so that there will be no leakage of fluid thereby. When the drill stem is rotated in this manner its weight will be supported by a set of slips 45 carried by the rotary table, but in some instances the pressure of the circulating fluid due to reversing of circulation may be such that the pressure will tend to lift the drill pipe and in this event it is necessary to have a hold-down so that any desired pressure can be applied. If the drill stem is to be rotated a rotating hold-down is therefore necessary and to this end the bearing 50 has been positioned between the upper race 51 and the lower race 52 so that the body 40 may rotate relative to the bonnet 53 which is held on the casing head 4 by a series of bolts 54. The bonnet 53 forms a seal with the casing head so that when there is an upward pressure on the drill stem the sub 15 may move upwardly a maximum distance such that the tool joint 16 will engage against the cap 42 and then any further thrust would be taken by the body 40 and the bearing 50. On the other hand, if the drill stem moves downwardly a flange 56 thereon will engage the upper end of the bonnet 53 and limits the downward movement of the drill stem relative to the well head.

Naturally the restrictions such as 60 in the drill pipe and the tool joint restrict the circulation of fluids or the slippage thereof past the tube 20 during its movement and as soon as the lower end 21 of the tube moves above the last restriction 61 then there is a release of the fluid upwardly through the area 62 and outwardly through the openings 25. It is more or less difficult to cut off the operation of slush pumps at the exact instant when the head 22 of the tube appears at the surface, but of course the pumps may be slowed down so as to reduce the rate of travel of the tube as it nears the surface so that the rate of circulation will be such that the tube 20 will merely float on the upwardly moving liquid as it discharges from the openings 25. In this manner the tube is prevented from flowing by gravity back into the fluid if the pumps are shut

off completely or if the overshot 23 should fail to seize the tube.

Broadly, the invention contemplates a means and a method by which a tube may be recovered at the surface without inconvenience and waste of the circulating fluid.

What is claimed is:

In an apparatus for retrieving core tubes from wells by circulation of liquid upwardly through the drill pipe when the casing is closed and liquid pressure applied, a sub connected to the up-

per end of the drill pipe, discharge ports in the sub below the top thereof, the top of said sub being open, said ports being normally spaced below the rotary table of the apparatus, and a core tube movable by the upward flow of liquid in the drill pipe and of a length that it will project above the top of the open ended sub as the elevating liquid discharges from said ports whereby the core tube may be recovered without discharging elevating liquid from the top of said sub.

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