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FLUID CIRCULATING AND RETRIEVING APPARATUS FOR OIL WELLS

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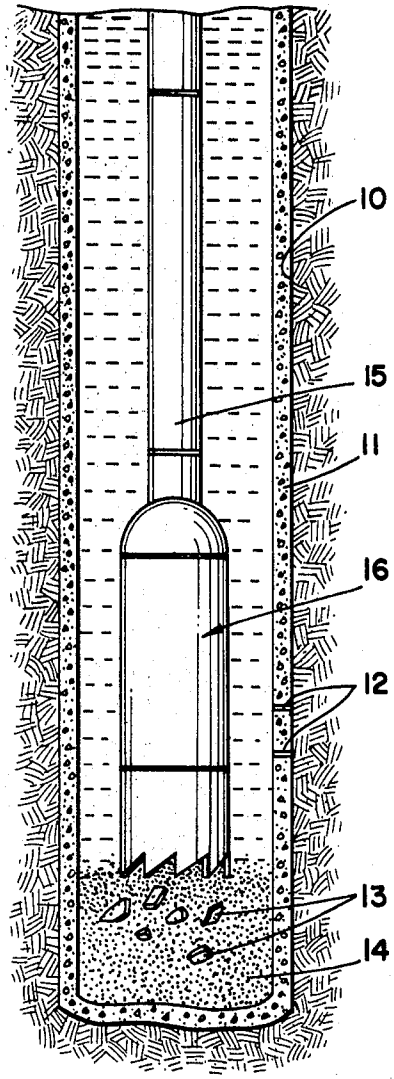


FIG. 1

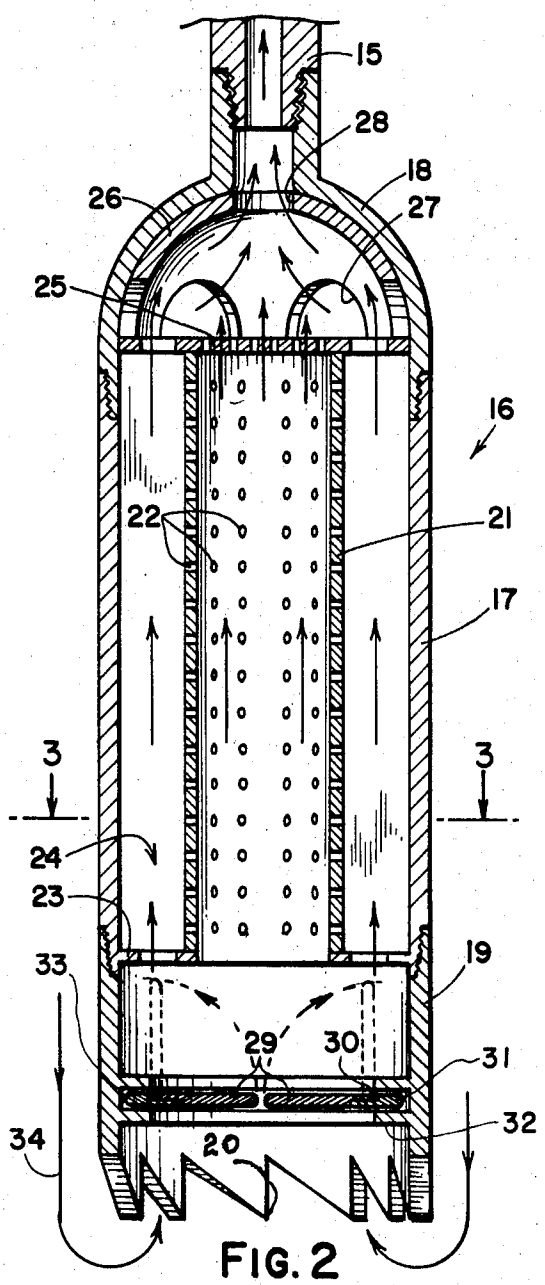


FIG. 2

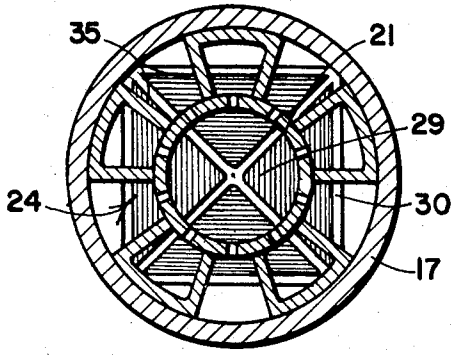


FIG. 3

INVENTOR:
DONALD P. HAMMON
BY
Pastoriza & Kelly
ATTORNEYS.

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Donald P. Hammon, 2939 Adelita Drive, Hacienda Heights, Calif. 91745

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ABSTRACT OF THE DISCLOSURE

A retrieving apparatus for picking up debris from the bottom of oil wells comprises a hollow cylindrical body communicating at its upper end with the lower end of a drill pipe string and terminating at its lower end in an entrance opening. In the preferred embodiment there is supported in the body a cylindrical basket of smaller dimensions than the body to define an annulus between the exterior of the basket and the internal walls of the body itself. This annulus communicates between the lower end of the drill pipe string and the lower entrance opening of the body. A one-way catcher assembly is loosely mounted at the lower end of the basket. Oil well fluid is circulated down the oil well between the exterior walls of the drill pipe string and apparatus and the interior walls of the well and thence up through the entrance opening, catcher assembly, basket and annulus to the interior of the drill pipe string. This reverse circulation forces debris and the like up through the catcher assembly and into the basket where it is held by the catcher assembly. When the basket is filled, circulation can be maintained through the annulus to thereby wash out remaining small debris and sand at the bottom of the wall. In other embodiments, the basket can be eliminated.

This invention relates to oil well tools and ore particularly to an improved fluid circulating and retrieving apparatus for recovering debris and washing out sand and the like in wells.

BACKGROUND OF THE INVENTION

During oil well pumping operations wherein a pumping motor is lowered into a completed well casing and fluid pumped through perforations in the casing, various items of junk and debris as well as mud and sand often accumulate at the bottom of the well. One serious source of such debris constitutes sall bands or brackets used to periodically tie electrical cable to pipe string leading from the upper end of the oil well to the pump at the end of the pipe string within the well. As the pipe string is withdrawn the cable is separated at the surface and these small bands or clamps often fall back into the well.

To recover such junk from the well, it is common practice to lower retriever baskets on the end of a pipe string and then circulate fluid down the pipe string and up the well annulus. By providing suitable passages, the fluid can be diverted through the basket to thereby "suck up" debris at the bottom of the well and trap the same in the basket.

After the basket has been filled, circulation is very poor because of the presence of the debris and thus it is necessary to pull the pipe string and empty the basket. The string must then be lowered into the well and circulation continued to clean out other smaller articles such as sand, mud and the like. This operation is known as "washing out" the well.

In addition to the problem of clogging of the circulation as a consequence of the basket becoming filled with debris, damage to the apparatus itself can result by the debris being picked up. More particularly, the retrieval baskets include a catcher assembly at the lower end through which debris passes and is thus trapped in the basket. In retrieving the debris, the entire apparatus is often rotated by the pipe string to dig into the junk and sand at the bottom of the well. The catcher assembly itself is thus rotated and should there be a large object protruding partway through the assembly, which object itself is stuck and thus stationary, the rotation of the apparatus can damage the assembly requiring replacement as well as preventing operation of the tool.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

With the foregoing in mind, it is a primary object of the present invention to provide an improved retrieving apparatus wherein problems encountered with presently available structures relating to clogged circulation and damaged catcher assemblies are overcome.

More particularly, the invention contemplates the provision of a hollow cylindrical body, which, in the preferred embodiment, incorporates an interior basket of smaller dimensions than the body itself. The upper end of the body communicates with the lower end of the pipe string and the lower end of the body terminates in an entrance opening incorporating a catcher assembly means loosely mounted in the opening. The diameter of the basket is less than the interior diameter of the hollow body to define an annulus between the exterior of the basket and the inner walls of the hollow body. This annulus communicates with the pipe string at its upper end and the entrance opening at its lower end and provides for free circulation of fluid.

In accord with an important feature of this invention, the circulation of the fluid during the retrieving operation is in a reverse direction; that is, the fluid is pumped down the well between the exterior of the pipe string and apparatus and interior walls of the well and thence into the entrance opening, through the catcher assembly, basket and annulus, to the interior of the pipe string. The fluid is thus brought up through the pipe string to the surface to complete the circulation cycle. It should be noted that with this arrangement full circulation and thus hydraulic force through the apparatus results.

With the foregoing arrangement, and with the catcher assembly loosely mounted such that it can remain stationary while the remaining portion of the apparatus rotates, various serious problems encountered with prior art devices are avoided. Thus, should the basket become completely filled with debris which would normally block circulation in known types of structures, circulation is still maintained through the annulus between the basket and interior wall of the body. Accordingly, it is possible to not only collect the debris but also to wash out the well of sand and mud during a single trip into the bore hole.

In addition, because of the loose mounting for the catcher assembly, the assembly itself may remain stationary while the apparatus is rotating so that should a large piece of debris jam in the assembly, it will not be broken.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by referring to a preferred embodiment thereof as illustrated in the accompanying drawings, in which:

FIG. 1 is a side elevation partly in cross section of an oil well showing a pipe string to which the retrieving apparatus of this invention has been attached for cleaning out debris and other material in the well;

FIG. 2 is a greatly enlarged cross section of the retrieving apparatus of FIG. 1; and,

FIG. 3 is a cross section taken in the direction of the arrows 3—3 of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, there is shown an oil well **10** lined with casing **11** perforated at **12** for the recovery of oil by suitable pumping apparatus.

As mentioned, such pumping apparatus must be periodically removed and various pieces of junk, debris, and the like tending to accumulate at the bottom of the well such as indicated at **13** removed. In addition, it is often necessary to wash out the well of sand and mud such as indicated at **14**.

Towards the foregoing ends, a retrieval apparatus is lowered on the end of the pipe string indicated at **15**. The present invention contemplates an improved retrieval apparatus designated generally by the numeral **16** in FIG. 1 shown secured to the end of the pipe string **15**.

This improved retrieval apparatus is shown in detail with reference to FIG. 2. Basically, the apparatus comprises a hollow cylindrical body **17** having an upper dome shaped section **18** threadedly secured thereto and serving to connect the upper end of the body to the lower end of the pipe string **15** as shown. The lower end of the body in turn connects to a lower section **19** defining a lower entrance opening to the body **17**. The extreme lower end of the lower section **19** may be provided with teeth **20** to facilitate penetration of the apparatus into debris, sand, mud, and the like upon rotation of the apparatus by the pipe string **15**.

Supported within the hollow body **17** is a cylindrical basket **21** which may have perforated side walls as indicated at **22**. A first internal annular flange **23** is provided on the lower end of the hollow body **17** and may serve to support the lower end of the basket **21** in a coaxial position within the body.

As will be evident from the drawing, the diameter of the basket **21** is smaller than the internal diameter of the hollow body **17** to thereby define an annulus **24** between the exterior walls of the basket and the interior wall of the body.

The upper end of the basket **21** is closed off as by a screen **25**. This screen is held in its shown position by a concentric dome shaped member **26** having a plurality of arch shaped openings **27** and central top opening **28** to provide communication between the upper end of the annulus and the pipe string **15**. The lower end of the annulus is in communication with the lower section **19** and its associated entrance opening by suitable holes in the flange **23**.

The apparatus is completed by provision of a catcher assembly **29** including flaps pivoted such as at **30** for one-way movement to the dotted line positions depicted so that debris can pass upwardly through the catcher but is trapped from falling back from the basket through the catcher. As shown, the periphery of the catcher is indicated at **31** and is arranged to be sandwiched within a second annular flange **32** defining a channel **33** formed on the interior of the lower section **19**. The sandwiching loosely mounts the catcher structure so that it is free to rotate relative to the body member **17** and lower section **19** but is restrained against appreciable vertical movement.

In the cross section of FIG. 3, it will be noted that the annulus **24** is provided with partitions or angle walls **35** to lend structural strength to the apparatus and properly support the basket in coaxial relationship with the interior wall of the body **17**. The catcher structure is shown as comprising four flaps such as indicated at **29** all pivoted for upward swinging movement. The cross-sectional area of the annulus **24**, exaggerated in the drawings, is preferably substantially equal to the interior cross-sectional area of the pipe string **15**.

OPERATION

In operation, the apparatus is secured to the end of a pipe string as by coupling the upper section **18** to the lower end of the pipe string **15** as illustrated in FIGS. 1 and 2. The apparatus is then lowered into the oil well until the lower section **19** is positioned close to the junk to be retrieved whether it be at the bottom or trapped at an intermediate level. The pipe string may be rotated and simultaneously, reverse fluid circulation is effected by pumping fluid down the well between the exterior walls of the pipe string **15** and apparatus **16** and interior wall of the well itself. All of the fluid is thus forced up into the entrance opening of the lower section **19** of the apparatus, through the catcher assembly, the interior of the basket and the annulus **24**, the dome shaped structure **26** and thence into the interior of the pipe string **15**. This latter circulation is through the apparatus as indicated by the arrows.

The above described circulation of well fluid will force junk and debris and the like through the catcher assembly into the basket wherein the debris is retained. When the basket becomes filled, circulation is still maintained through the annulus **24** so that it is possible to clean out sand, mud, and the like; that is, wash out the well without having to raise the pipe string and empty the basket. As a result, the retrieval and washing operation can be carried out during a single trip into the bore hole with a considerable savings in time, expense, and labor.

Should any large piece of junk or debris get caught in the catcher assembly **29** while the apparatus is rotating, the catcher will not be broken since the same is floating in the channel **33** so that the catcher itself can remain stationary while the apparatus continues to rotate. With continued circulation, such caught objects or pieces of junk will eventually work loose and be retrieved in the basket at which time the catcher is free to rotate with the apparatus.

Because of the fact that there is full fluid circulation through the apparatus; that is, all fluid muct pass into the apparatus and up the pipe string, it is possible to eliminate the basket and simply utilize the body itself to retrieve relatively larger objects such as broken drill cones.

From the foregoing description, it will be evident that the present invention has provided a greatly improved retrieval apparatus wherein full and positive circulation can be continuously realized even though collected junk may completely fill or even clog the holes in the basket and wherein the risks of damaging the apparatus, particularly the catcher assembly, are minimized.

What is claimed is:

1. A fluid circulating and retrieving apparatus for oil wells comprising, in combination:

(a) a hollow cylindrical body;

(b) an upper section connecting the upper end of said body to the lower end of an oil well drill pipe string;

(c) a lower section connected to said body to define a lower entrance opening to the interior of said body;

(d) an open ended basket centrally supported within said body of smaller size than said body to define an annulus between the exterior of said basket and the exterior wall of said body, said annulus being in fluid communication with the said upper and lower sections;

(e) an upper screen overlying the upper end of said basket;

(f) a catcher assembly adjacent to said lower entrance opening; and

(g) mounting means coupling said catcher assembly to said body to permit fluid to pass upwardly therethrough and permit rotation in a horizontal plane while restraining said catcher assembly against vertical movement, whereby said apparatus may be lowered into an oil well and fluid circulated down said well between the exterior walls of said pipe

string and apparatus and the interior side walls of said well, and thence into said lower entrance opening to thereby urge debris and the like into said basket, circulation being maintained through said annulus during and after the time said basket is filled.

2. An apparatus according to claim 1, in which the cross-sectional area of said annulus is substantially equal to the interior cross-sectional area of said pipe string.

3. An apparatus according to claim 1, in which said mounting means includes an internal annular flange defining a channel on the lower inside wall of said body, said channel loosely sandwiching the periphery of said catcher assembly so that said catcher assembly is "floating" and can thus stay rotationally stationary within said apparatus when said apparatus is rotated in said well by

said pipe string, the lowermost end of said lower section including teeth to facilitate penetration of said apparatus into any debris and sand in said well when rotating.

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JAMES A. LEPPINK, Primary Examiner

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