

May 23, 1939.

J. E. BRANTLY

2,159,249

OIL WELL TOOL

Filed Nov. 9, 1937

Fig. 1.

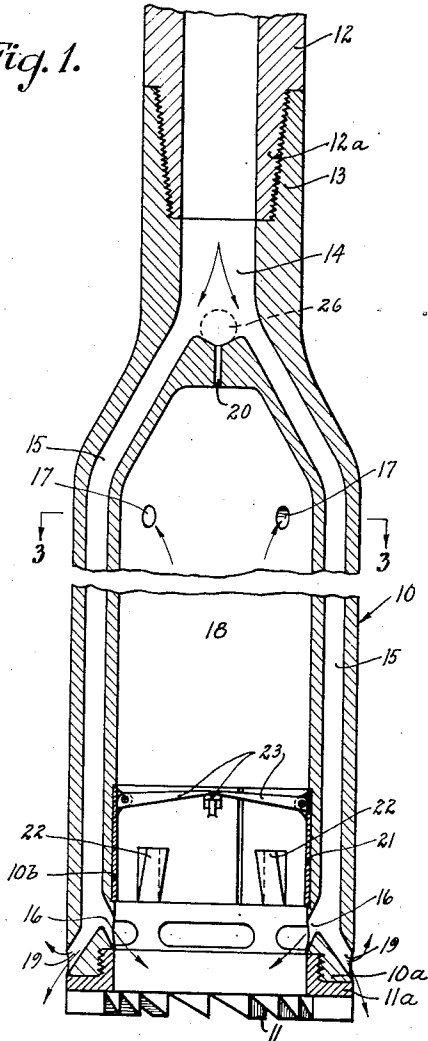


Fig. 2.

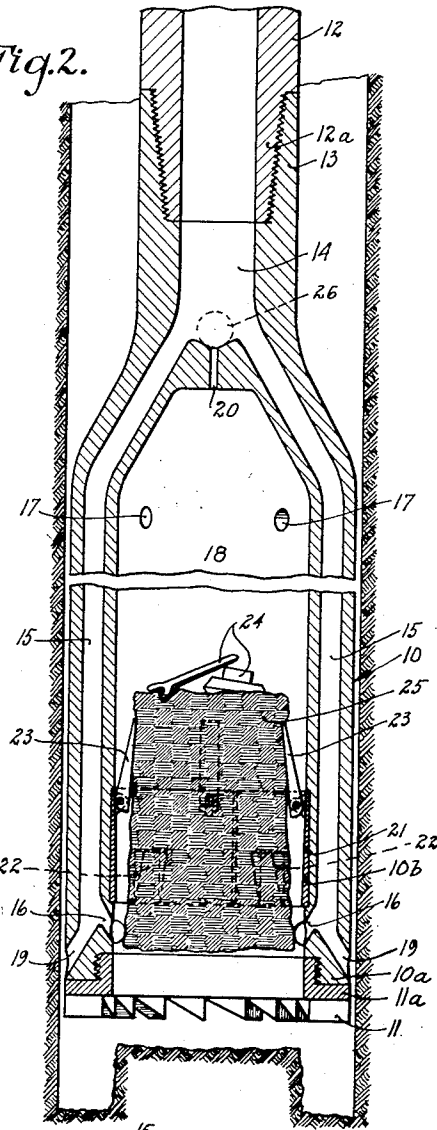


Fig. 3.

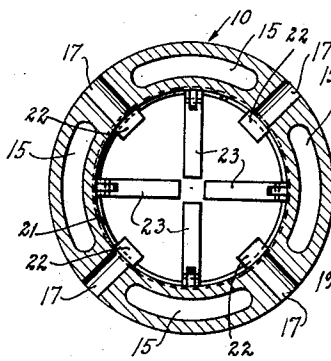
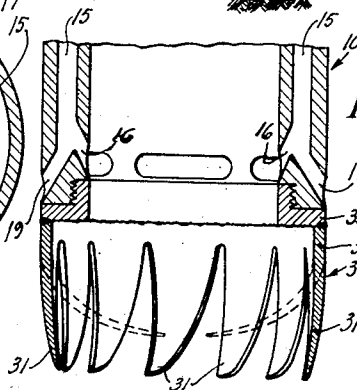


Fig. 4.



Inventor.
John E. Brantly.

Attorney.

UNITED STATES PATENT OFFICE

2,159,249

OIL WELL TOOL

John E. Brantly, Pasadena, Calif.

Application November 9, 1937, Serial No. 173,604

14 Claims. (Cl. 255-72)

This invention has to do with oil well tools for recovering from the bottom of the well such objects as loose pieces of metal, broken tool parts and the like, and has for its major object to provide a tool of this character that is capable by reason of various improvements that I have made, of insuring more complete and ready recovery of these objects than has been possible with conventional tools heretofore used.

Tools of the present type may be generally described as comprising a hollow body, open at its lower end so that it may be rotated down or lowered to the bottom of the well or bore and about metallic objects that may rest on the formation at the bottom of the well, to bring these objects into the hollow interior of the body. Suitable means have been employed for retaining the objects within the body and provision has been made for maintaining a flow of circulating fluid through the interior of the body so that excess sand or cuttings may be washed away to enable the body to accommodate or contain the objects to be recovered. In all prior instances of which I am aware, the practice has been to direct all or the main stream of circulating fluid downwardly and more or less centrally through the hollow interior of the body, so that the action of the fluid stream is to wash the sand or cuttings and foreign material outwardly and away from the bottom open end of the body. The difficulty encountered, however, has been that not only are the sand and cuttings washed outwardly and away from the interior of the tool, but the objects to be recovered as well. The result has been that in a single run, generally there is no recovery, or the recovery is incomplete, making it necessary to run the tool into and out of the well several times before all the objects are recovered, if at all.

The principal feature of the present tool is the provision of means for maintaining a flow of circulating fluid inwardly within the lower portion of the body so that the effect of the circulation is to move the objects to be recovered, into, rather than outwardly from the interior of the body. In the preferred form of the invention the circulating fluid is directed inwardly from the sides of the body toward its center, and is then caused to flow upwardly and outwardly through the wall of the body. Means also may be provided for directing a stream of the fluid downwardly within the body for the purpose of progressively washing away any excess core that would interfere with the ultimate movement into and accumulation of the objects within the body.

These as well as additional features and objects of the invention can best be explained by reference to the accompanying drawing, which shows the invention in one of its typical and illustrative forms. In the drawing:

Fig. 1 is a longitudinal section of the tool showing the core catchers in released position;

Fig. 2 is a view similar to Fig. 1 showing a core retained within the body of the tool;

Fig. 3 is a section on line 3-3 of Fig. 1; and

Fig. 4 is a fragmentary view showing a variational form of the invention.

The hollow body of the tool, generally indicated at 10, is somewhat elongated in shape and has a bottom open end 10a provided with suitable cutting means, such as teeth 11 formed on a shoe 11a threaded into or otherwise secured to the body. Upon rotation of the tool, teeth 11 cut downwardly around the core to bring the core, together with the objects to be recovered, within the body. The upper end of the body may be provided with any suitable means for attachment to the drill pipe 12. Typically, the body is shown to have an integral threaded box 13 which receives the pin end 12a of the drill pipe. As indicated in the foregoing, the tool is provided with fluid passages so arranged as to direct circulating fluid from the drill pipe 12 downwardly toward the lower end of the body, and thence both inwardly toward the axial center of the hollow interior and outwardly around the outside of the body. It is to be understood that the various fluid passages may be formed in any suitable manner, although for practical considerations I find it convenient and advantageous to construct the body as a single casting or fabricated double shell with the fluid passages formed in the wall thereof.

The upper fluid course 14 within the body communicates with a plurality of downwardly extending fluid passages 15 that are circularly arranged within the wall of the body and preferably given sufficient width to provide, in effect, a substantially annular passage. Near the lower end of the body, the fluid is discharged from passages 15 through downwardly and inwardly inclined outlets 16 which may correspond in width substantially with the width of passages 15, as indicated in Fig. 2. Fluid discharged from outlets 16 is directed from all sides of the body wall inwardly toward the center of the hollow interior in paths of flow substantially as indicated by the arrows. The inward fluid discharge from outlets 16 tends to move or hold all loose material toward the center of the body, and to displace the lighter material upwardly into the body chamber. In or-

der that the projected fluid streams may take the desired course of flow upwardly within the interior of the body, suitable discharge openings 17 are provided at points above the outlet 16, and preferably toward the upper end of the chamber 18. As illustrated in Fig. 3, openings 17 may conveniently be extended through the wall of the body between passages 15.

As previously stated, the principal feature of the tool is its capacity for directing fluid circulation so that objects to be recovered from the bottom of the hole are washed inwardly toward the center of the well bore below the open end of the body, as contrasted with the usual method of circulation whereby debris is washed outwardly and upwardly away from the bottom of the body. With provision for ample fluid circulation upwardly within the body, as by providing a series of unrestricted ports 17, the desired debris gathering course of the fluid is maintained by reason of the position and direction of ports 19. As illustrated, these ports are inclined and positioned above the lower end of the body, so that the fluid discharged therefrom, flows downwardly and outwardly at high velocity against the well bore wall (see the lower arrows directly outside the teeth 11) and thus encompasses the full cross-sectional area of the well. Then, upon striking the bore wall, the fluid is deflected inwardly toward the axial center of the bore and is caused to gather any loose objects on the bottom of the well, inwardly within the area directly below the body. With these loose objects thus centered in the well, the body may then be lowered about them. It is of course understood that the combined areas of ports 17 are sufficient to permit a rate of fluid circulation upwardly through the body, sufficient to maintain inward circulation of the fluid discharged from ports 19, at a rate that will gather in the objects to be recovered. A fluid passage 20 may be formed within the upper portion of the body to direct a stream of circulating fluid downwardly and more or less centrally within the hollow interior 18 of the body. The tool may also include any suitable means for retaining metallic objects that have been circulated or otherwise brought into the interior 18 of the body. Typically, I may utilize for this purpose any of the common forms of core catchers, which in addition to retaining the metallic pieces to be recovered, will also hold a core if one is to be taken. As illustrative, the core catchers may consist of a split resilient ring 21 expanded into and seated within the body recess 18b, the ring carrying inwardly projecting teeth 22 arranged at circularly spaced intervals, and pivotally mounted fingers 23 which, as illustrated in Fig. 2, are upwardly displaceable to pass the core but which remain in retaining engagement with the core to hold it within the tool.

In operation, the tool may be lowered to within a few feet of the bottom of the hole and the circulation then started, the fluid flowing down through passage 15 to be discharged through outlets 16 and 19. By lowering the tool with continued circulation, metallic objects 24 lying in the bottom of the hole are prevented from escaping the lower open end of the body by reason of the directions of circulation or discharge of fluid through outlets 16 and 19, as explained above. The tool finally is set on bottom and rotated in the cutting direction until a short core 25 has been cut, the core passing upwardly into the body with the metal pieces 24 on top of the

core. When sufficient length of core has been taken, rotation is stopped and the tool is raised off bottom so that the core catchers 22 and 23 break off a part of the core and support it while still holding the objects 24, as shown in Fig. 2.

In order to avoid completely filling the interior 18 of the body with sand, clay or core during the descent of the tool and before it reaches a depth at which the objects to be recovered will have become fully moved into the interior of the body, circulating fluid may be discharged downwardly through passage 20 against the top of the material accumulating within the tool, so as to continuously disintegrate and flush out through the openings 17 at least a part of any clay or formation. In this manner I am able to insure upward displacement of the objects 24 within the tool to a point at which either they alone, or together with the core 25, will be retained by the core catchers. As shown in the drawing, passage 20 may be positioned so that it can be closed by an object, such as a ball indicated by the dotted lines 26 dropped through the drill string and fluid course 14. Initially, fluid circulation may be maintained through passage 20 to thoroughly flush out and clean the interior of the tool. Then in the event it is unnecessary to maintain circulation through passage 20 during the recovery operations, ball 26 may be dropped to close the passage so that subsequently, all the fluid will be diverted through the passage 15.

In Fig. 4 of the drawing I show a variational form of the invention similar to the described embodiment with respect to the body construction and fluid passage arrangement, but differing in the substitution for the core catcher assemblies 21, 22 and 23, of a bottom shoe carrying elongated toothed fingers that may be caused to bend or fold toward the axial center of the body to retain the core or objects to be recovered. In the form of Fig. 4, the shoe 30 comprises a series of tooth-shaped fingers 31 that may be cut in a piece of tubing 32 whose diameter corresponds to the maximum diameter of the tool. Tube 32 may be welded or otherwise attached to the upper portion 33 of the shoe threaded into the body. The fingers 31 may be given a slight inward curvature or inclination, as illustrated, and their length may correspond substantially to one-half the diameter of the tool, or less, so that as the tool is rotated in a clockwise direction with the fingers bottomed in the hole, sufficient weight may be applied to cause them to fold inwardly to the dotted line position in which they effectively close the lower end of the body to the extent that the core and any loose pieces to be recovered will be retained in the body.

It will be understood that the drawing is to be regarded merely as typical and illustrative of the invention in one of its preferred forms, and that various changes and modifications may be made without departure from the scope of the invention as expressed in the appended claims.

I claim:

1. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe outwardly through an opening extending through the outside surface of the body above its lower end, and means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid up-

wardly within the body, at a rate such that said outwardly directed fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

2. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe outwardly through an opening extending through the outside surface of the body above its lower end, and means forming a passage extending through the side wall of the body and of sufficient size to permit circulation of fluid upwardly within and laterally through the wall of the body into the well, at a rate such that said outwardly directed fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

3. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe outwardly through a port extending through the outside surface of the body above its lower end, and means forming in the body a passage of sufficient size to permit circulation of said fluid upwardly within the hollow interior of the body and through the wall thereof at a point above said port, at a rate such that said outwardly directed fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

4. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe outwardly from the lower peripheral portion of the body through an inclined port extending through the outside surface of the body and located at a point above the lower end of the body, and means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said outwardly directed fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

5. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for conducting a flow of fluid from said pipe through a plurality of circularly arranged, downwardly and outwardly inclined ports extending through the outside surface of the body and positioned above the lower end of the body, said fluid being discharged outwardly from the lower peripheral portion of the body, and means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said outwardly discharged fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

6. A tool for recovering objects from wells,

comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming circularly arranged passages extending longitudinally within the wall of the body for directing a flow of fluid from said pipe downwardly and outwardly from the body through circularly arranged ports extending through the outside surface of the body above its lower end, said body having openings extending through its wall at points in offset relation to said ports and of sufficient size to permit circulation of fluid upwardly through the body, at a rate such that said outwardly directed fluid is caused to flow from around the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

7. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming circularly arranged passages extending longitudinally within the wall of the body for directing a flow of fluid from said pipe downwardly and outwardly from the outer periphery of the body through circularly arranged ports extending through the outside surface of the body and above the lower end thereof, said body having circularly arranged passages extending through its side wall above said ports and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said outwardly directed fluid is caused to flow from around the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

8. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe outwardly through an opening extending through the outside surface of the body above its lower end, means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said outwardly directed fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well, and means for directing a stream of fluid downwardly within the central portion of the body.

9. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe outwardly from the body through circularly arranged ports extending through the outside surface of the body above its lower end, means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said outwardly directed fluid is caused to flow from around the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well, and means for directing a stream of fluid downwardly within the central portion of the body.

10. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe

outwardly through an opening extending through the outside surface of the body above its lower end, means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said outwardly directed fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well, and means for retaining objects within the body that have accumulated therein.

11. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe outwardly through an opening extending through the outside surface of the body above its lower end, means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said outwardly directed fluid is caused to flow from the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well, means for directing a stream of fluid downwardly within the central portion of the body, and means for retaining objects within the body that have accumulated therein.

12. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe through circularly spaced passages in the body wall and outwardly through the outside peripheral surface of the body through circularly arranged, downwardly and outwardly inclined ports located above the lower end of the body, said body having ports in its wall between said passages and above the first mentioned ports of sufficient size to permit upward fluid circulation through the body, at a rate such that said outwardly directed fluid is caused to flow from

around the outside of the body below and toward the axial center of its lower open end, to gather toward said center objects to be recovered from the well.

13. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, an annular toothed cutter on the lower end of the body, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe downwardly from the lower peripheral portion of the body through circularly arranged ports extending through the outside surface of the body above the cutter teeth, and means forming a passage extending through the body from its interior and of sufficient size to permit circulation of fluid upwardly within the body, at a rate such that said downwardly directed fluid is caused to flow from around the outside of said cutter, below the cutter and toward the axial center of the body to gather toward said center objects to be recovered from the well.

14. A tool for recovering objects from wells, comprising a hollow body open at its lower end and adapted to be lowered on a pipe, an annular cutter on the lower end of the body, said cutter comprising an annular series of teeth adapted to be bent inwardly by downward pressure on the teeth to retain objects that accumulate within the body, means forming a passage extending longitudinally of the body for directing a flow of fluid from said pipe downwardly from the lower peripheral portion of the body through circularly arranged ports extending through the outside surface of the body above the cutter teeth, and means forming a passage extending through the body from its interior and of sufficient size to permit circulation of said fluid upwardly within the body, at a rate such that said downwardly directed fluid is caused to flow from around the outside of said cutter, below the cutter and toward the axial center of the body to gather toward said center objects to be recovered from the well.

JOHN E. BRANTLY.