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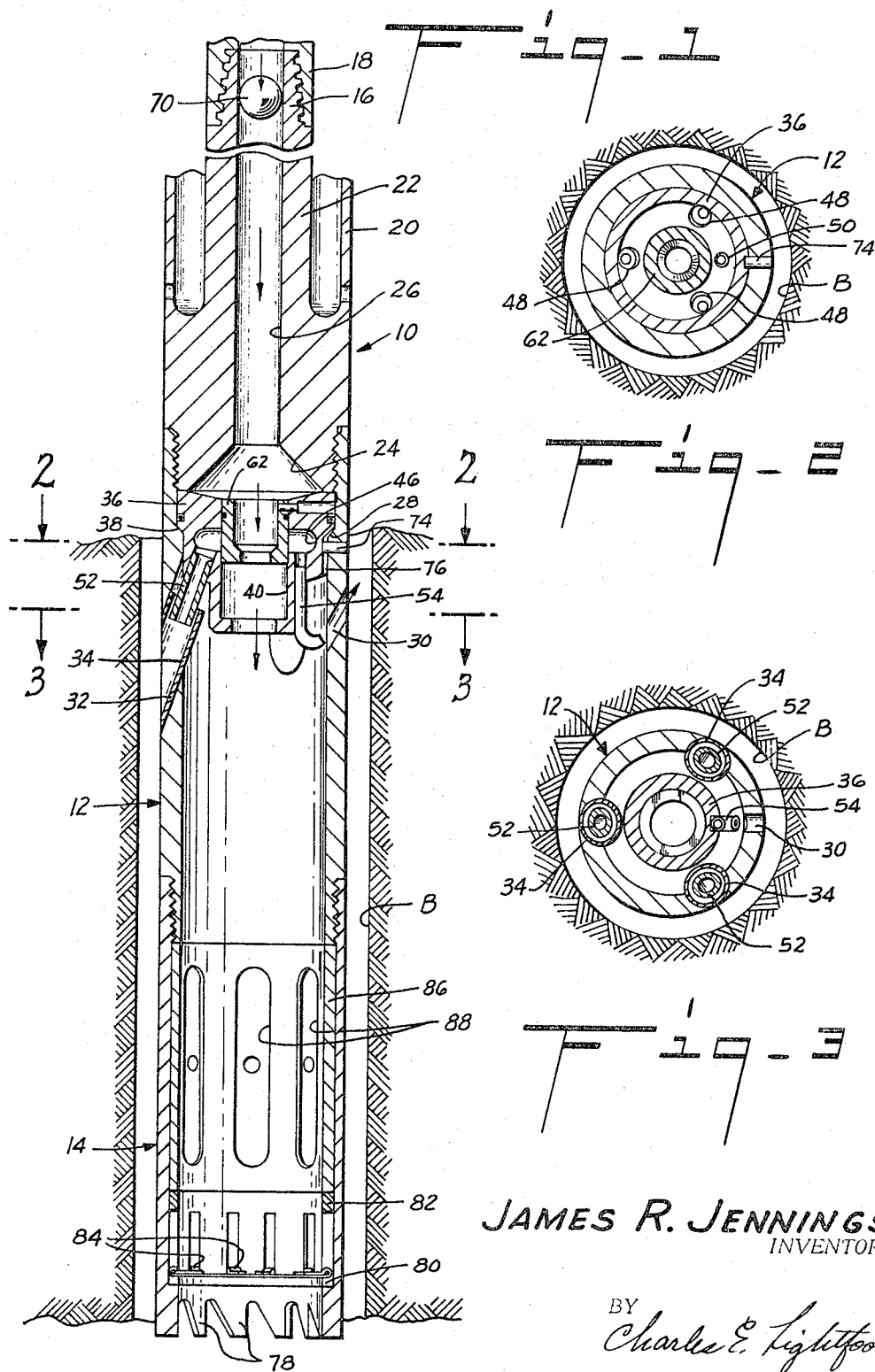
J. R. JENNINGS

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REVERSE CIRCULATING JUNK BASKET

Filed Jan. 17, 1966

2 Sheets-Sheet 1



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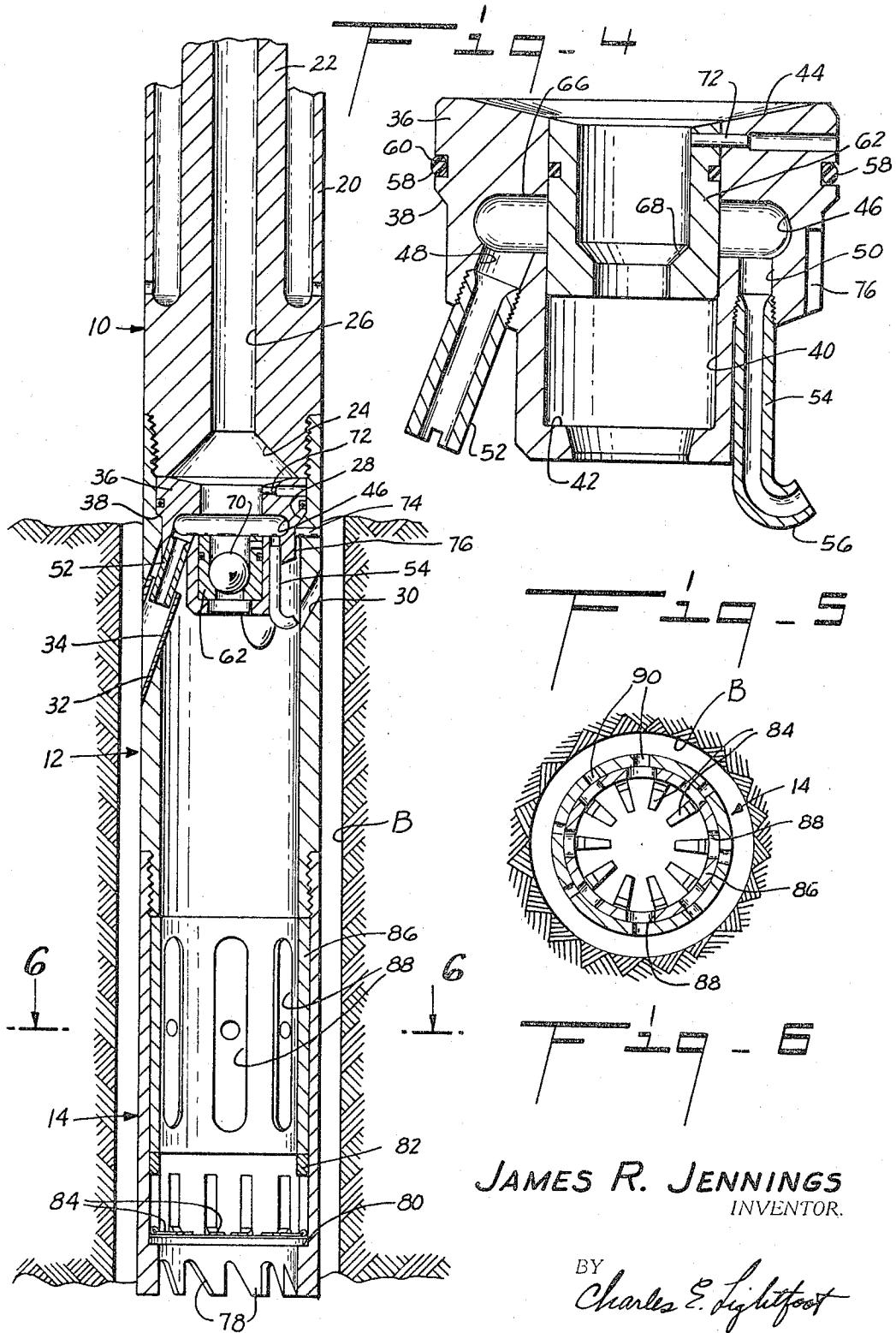
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ABSTRACT OF THE DISCLOSURE

A reverse circulating junk basket for use in well bores in which a circulating fluid is used which flows downwardly through a string of well pipe and upwardly in the well bore about the pipe to whose lower end a junk basket is attached. Means is provided for reversing the circulation of the fluid through the junk basket to cause cuttings to be swept upwardly into the basket while maintaining the downward flow in the string and upwardly in the bore about the string.

This invention relates to the retrieving of loose objects from well bores, and more particularly to a retrieving device for such use which is operable to cause a reverse circulation of fluid in the well at a location to facilitate the retrieval of loose objects.

In the drilling and operation of oil and gas wells it is customary to employ a tubular string of pipe in the well bore through which fluid is circulated downwardly and about which the fluid returns upwardly in the annulus surrounding the string. During the drilling of such wells, as well as in carrying out various operations in the operation and maintenance of the same, objects such as parts of broken tools, pieces of metal, bit cones, and the like, are often lost in the well and must be removed before operations can be resumed.

For the purpose of recovering lost objects of this kind, commonly referred to as "junk," special tools are employed, known as "junk baskets," which are customarily provided with an enlarged lower end bore forming a chamber to receive and return the junk, when the tool is lowered into the bore on the lower end of the tubular string.

Means is usually provided in retrieving mechanism of this kind for maintaining the circulation of fluid in the well to wash the junk free from mud or the like which may accumulate in the bore and which may also serve to cause the junk to enter the basket and to retain the same therein.

The present invention has for a primary object the provision of junk retrieving mechanism of the kind mentioned, which is constructed to allow normal circulation of fluid downwardly through the string and upwardly in the annulus surrounding the same, but which may be placed in condition to make use of the circulating fluid to facilitate the movement of the junk into the basket.

Another object of the invention is to provide a junk basket of the type referred to, through which circulation of fluid may take place in the usual manner downwardly through the string and upwardly in the annulus surrounding the same, and having means by which a reversal of the flow of fluid may be caused at a location to greatly facilitate the movement of junk into the basket while at the same time continuing the circulation of fluid through the well.

A further object of the invention is the provision of a junk basket of the kind mentioned through which fluid circulation may take place downwardly through the string and upwardly in the annulus surrounding the same, and having passageways for the circulation of fluid from the string downwardly in the annulus and upwardly in the basket to facilitate the movement of junk into the

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basket, and including means for closing such passageways to allow downward circulation of fluid through the basket and means for operating such closing means to close the basket against downward flow of fluid therethrough and to open said passageways to cause such upward flow in the basket.

SUMMARY OF THE INVENTION

Briefly described the invention comprises a tubular junk basket adapted to be connected to the lower end of a well string for rotation with the string and through which fluid may be circulated downwardly through the string and upwardly in the well bore about the string. Fluid discharging means is provided through which the circulating fluid may be discharged from the interior of the junk basket into the surrounding bore at locations spaced above the lower end of the basket to cause a reverse flow of the circulating fluid from the bore into the lower end of the basket while continuing the downward circulation of fluid through the string and upward circulation in the bore about the string. Means is also provided whereby such fluid discharging means is closed and which may be operated when desired to open the same.

Another object of the invention is to provide a reverse circulating junk basket which is of simple design and rugged construction and in which the parts are easily replaceable.

The above and other obvious advantages of the invention may be best understood from the following detailed description of a preferred embodiment of the same when considered with the annexed drawings wherein—

FIGURE 1 is a vertical, central, cross-sectional view of the retrieving tool of the invention positioned for use in a well bore with the parts shown in the positions which they occupy when the tool is in condition for the normal circulation of fluid therethrough;

FIGURE 2 is a cross-sectional view, taken along the line 2—2 of FIGURE 1, looking in the direction indicated by the arrows;

FIGURE 3 is a cross-sectional view, taken along the line 3—3 of FIGURE 1, looking in the direction indicated by the arrows;

FIGURE 4 is a view, similar to that of FIGURE 1, showing the parts of the mechanism of the tool in the positions which they occupy when the tool is in condition for the reverse circulation of fluid therethrough;

FIGURE 5 is a fragmentary, vertical, central, cross-sectional view, on an enlarged scale, showing details of structure of the reverse circulation mechanism of the tool in its closed condition; and

FIGURE 6 is a cross-sectional view, taken along the line 6—6 of FIGURE 4, looking in the direction indicated by the arrows.

Referring now to the drawings in greater detail the junk basket of the invention as illustrated herein attached to the lower end of a tubular string of pipe positioned in the bore B of a well, such as an oil well, for use in the removal of lost objects therein, such as pieces of metal, broken tools or parts or bit cones which may have become broken or detached during the carrying out of drilling or other operations in the well.

The junk basket mechanism is conveniently made up of three tubular sections threadably connected together, the uppermost section 10 being an external basket section or sub, while the intermediate section 12 comprises a reverse circulation sub, and the lowermost section 14 is a bottom shoe equipped to receive and retain an object which is to be removed from the well. The uppermost or external basket section 10 has an externally threaded upper end pin portion 16 for attachment to the internally threaded,

lower end, box portion 18 of an operating string of pipe by which the junk basket is supported and manipulated in the well. The external basket section 10 has an external, annular, upwardly opening collar portion 20 surrounding and spaced radially from a shank portion 22 to form an external basket positioned to catch and retain small objects which may fall out of the well fluid as the same flows upwardly in the annulus surrounding the tool. At its lower end the section 10 has an internal, downwardly flaring, lower end recess 24, which opens upwardly into the central bore 26 of the section.

The intermediate section or reverse circulation, sub 12 has an upper end counterbore whose lower end terminates in an internal shoulder 28 forming an inside tapered seat. The intermediate section 12 also has one or more angularly upwardly directed outlets, such as that shown at 30, and one or more angularly downwardly directed outlets, such as those shown at 32, each of which may be provided with a tubular liner 34 whose outer end is substantially flush with the external surface of the intermediate section and whose inner end portion may extend inwardly beyond the inner surface of the section.

Within the upper end of the section 12 a valve housing and nozzle supporting member 36 is disposed, which is formed with an external annular shoulder 38 positioned to seat on the internal seat 28 of the intermediate section. The member 36 has an internal cylindrical bore 40, whose lower end terminates in an internal annular shoulder 42, and whose upper end opens into the lower end of an upwardly flaring, upper end cavity 44. An internal, annular cavity 46 or nozzle chamber is formed in the member 36, surrounding and opening radially inwardly into the bore 40 and from which outlet passageways 48 and 50 open downwardly into the interior of the section 12. The passageways 48 are each provided with a discharge pipe or nozzle 52, threadably secured therein and whose outer end portion extends into one of the outlet openings 32 within the liner 34 thereof, and the passageways 50 are each provided with a discharge pipe or nozzle 54 threadably secured therein and whose outer end portion is curved, as seen at 56, to direct fluid discharged from the outer end thereof into one of the outlets 30. Suitable seal forming means, such as the O-ring 58 is provided, in means for receiving the same, such as the external groove 60 in the member 36, to form a fluid tight seal between the member 36 and the section 12. The member 36 opens at its lower end into the interior of the section 12 beneath the seat 28.

Within the bore 40 of the member 36 a tubular valve element 62 is slidably disposed for movement from an upper position, as shown in FIGURE 1, closing the cavity or nozzle chamber 46 from communication with the interior of the member 36, to a lower position on the shoulder 42, as shown in FIGURE 4, in which the nozzle chamber is open to allow the flow of fluid from the bore 26 through chamber 46 and nozzles 52 and 54. Suitable seal forming means, such as the O-ring 66 is provided positioned to form a fluid tight seal between the element 62 and the member 36, as best seen in FIGURE 5. The member 36 is also formed with an internal, tapered seat 68 upon which a ball valve 70 is adapted to be seated, to close the element when the ball valve is dropped down through the operating string during the operation of the equipment.

The element 62 is secured in its upper position by suitable means such as a frangible pin 72, adapted to be sheared by the downward pressure of fluid in the operating string exerted on the element 62 when the ball 70 is seated on the seat 68.

Suitable means, such as the pin or key 74 is carried by the section 12, which extends inwardly into an external, longitudinal groove 76 in the member 36 to hold the member against rotation in the section.

The lowermost section 14 may be provided at its lower end with downwardly directed lower end teeth 78, and

above the teeth the section has an internal annular, upwardly facing shoulder 80, upon which an annular catcher collar 82 is seated, to which radially inwardly projecting catching fingers 84 are hingedly connected at their outer ends for vertical swinging movement. The fingers 84 are thus hingedly supported to swing upwardly to allow junk to enter the lower end of the basket, but are held against swinging movement downwardly past a substantially horizontal position in which the fingers act to retain the junk in the basket.

An internal sleeve 86 is disposed in the section 14 for free rotation therein between the upper end of the collar 82 and the lower end of the section 12, which sleeve has peripherally spaced longitudinal slots 88, and the section 14 is provided with peripherally spaced openings 90 which are positioned so that at least one such opening will be in communication with one of the slots 88 in all positions of rotation of the sleeve 86 in the section.

The intermediate and lower sections 12 and 14 form a tubular barrel having an internally enlarged, elongated basket chamber for the reception of objects to be recovered from the well, and from which fluid may be discharged downwardly into the annulus surrounding the basket at one location and upwardly into the annulus at another location to cause a reverse circulation of fluid upwardly into the basket to draw in junk from the bore through the lower end of the basket.

In making use of the junk basket of the invention, constructed as described above, the upper end pin 18 is attached to the lower end box 18 of the operating string and the junk basket is lowered into the well bore with the string, in the usual manner, without the ball 70, so that circulation of fluid may take place downwardly through the string and upwardly about the same, while the same is being rotated to cause the teeth 78 to cut away accumulated material in the bore to allow the basket to be lowered over lost objects therein. During such operation of the apparatus, it will be apparent that the valve element 62 will be in its uppermost position, as seen in FIGURE 1, so that the chamber 46 will be out of communication with the interior of the string, thus preventing outflow of fluid through nozzles 52 and 54. Thus, fluid will be circulated downwardly through the basket to wash away accumulated mud, chips, and other particles which will flow upwardly exteriorly of the basket with the fluid. As the fluid flows upwardly heavy particles entrained therein will tend to fall out and will be caught and retained in the external basket formed by the collar 20 to be removed from the well with the string.

In the event that it should be desired to cause a reverse circulation of fluid in the basket to aid in moving junk from the bore into the lower end of the basket, the ball 70 is dropped into the string to close the internal seat 68 of the element 62, as seen in FIGURE 4, whereupon the pressure of the circulating fluid may be increased to exert a downward force on the element 62 to shear the pin 72 and move the element to its down position, shown in FIGURE 4, to cut off the downflow of fluid through the basket and cause an outflow of fluid under pressure through nozzles 52 and 54. The outflow of fluid through nozzles 52, which are directed downwardly through outlets 32, causes a downflow of fluid exteriorly of the basket, while the outflow of fluid through nozzle 54, which is directed upwardly causes an upflow of fluid in the basket, so that junk in the bottom of the bore will be drawn into the lower end of the basket to be retained therein by the fingers 84.

The size of the nozzles or discharge pipes 52 may be varied as desired, and these may be readily interchanged without disconnecting or disassembling the tool to regulate the velocity of the outward jetting of the fluid there-through whereby reverse circulation may be controlled.

The number and size of the shear pins 72 may be varied to predetermine the amount of downward pressure which

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must be exerted by the circulating fluid on the valve element 62 to move the same to its lowered position.

It will also be apparent that by the use of the invention reverse circulation of fluid through the basket may be accomplished without reversing the downward flow of fluid in the string and the upward flow of fluid about the same.

The invention thus provides a reverse circulating junk basket, which is of economical manufacture and in which the parts are easily replaceable.

The invention is disclosed herein in connection with a certain specific embodiment of the same which is intended by way of example only, it being understood that various changes can be made in the construction and arrangement of the parts, within the spirit of the invention and the scope of the appended claims.

Having thus clearly shown and described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. A junk basket comprising an elongated tubular barrel, means for connecting the barrel at its upper end in communication with the lower end of a pipe for lowering with the pipe in a well bore and to permit the downward flow of fluid from the pipe through the barrel, said barrel having an opening through which fluid may be discharged downwardly into the bore externally of the barrel at a location above the lower end of the barrel and an opening through which fluid may be discharged upwardly into the bore externally of the barrel at a location above the lower end of the barrel, passageway forming means in communication with the interior of said pipe and positioned to discharge fluid therefrom through said openings and means movably disposed in the barrel for longitudinal

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tudinal movement therein to one position to close said passages and to another position to open the same.

2. The junk basket as set forth in claim 1 wherein said means for shutting off the flow of fluid from said pipe through said barrel and for causing an outflow of fluid from said pipe through said openings includes a tubular element positioned to discharge fluid from said pipe through each of said openings and movable means in the barrel positioned in closing relation to said elements and movable to a position to open the same.

3. The junk basket as set forth in claim 1 wherein said means for shutting off the flow of fluid from said pipe through said barrel and for causing an outflow of fluid from said pipe through said openings includes a tubular body in the barrel having a central bore through which fluid may flow from said pipe into the barrel and passages in communication with said bore through which fluid from said pipe may flow into said openings, and a movable member in said bore positioned in closing relation to said passages and movable to a position to open the same.

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