Sept. 24, 1940. C. O. TULLBERG ET AL 2,215,599

TUBING BLEEDER

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Fig. 1.

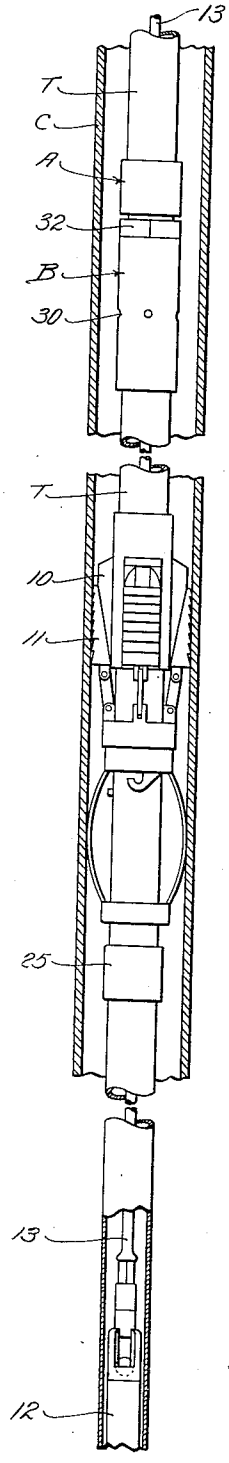


Fig. 2.

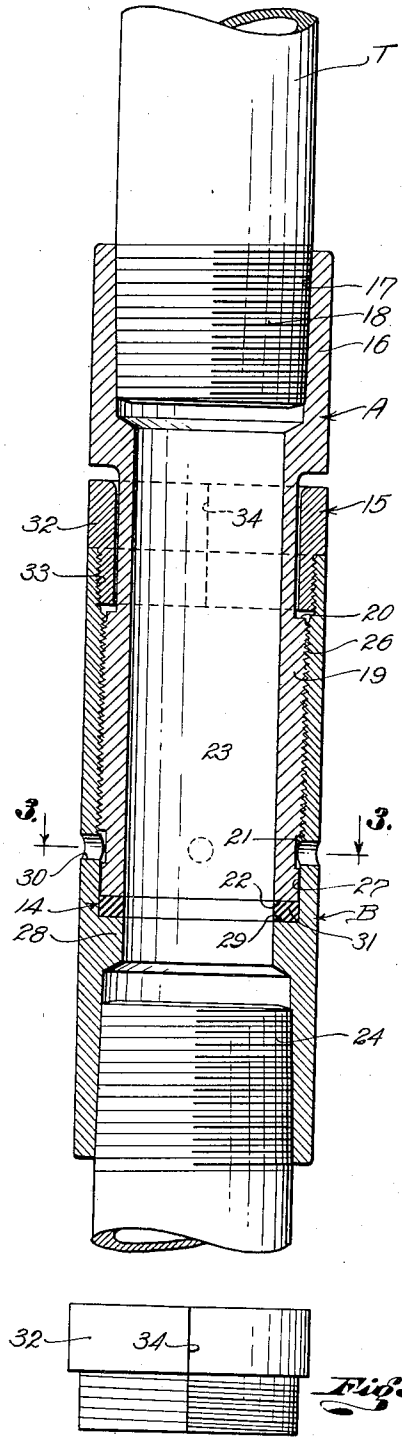


Fig. 3.

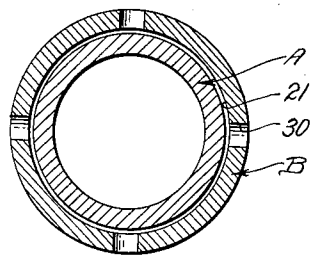


Fig. 4.

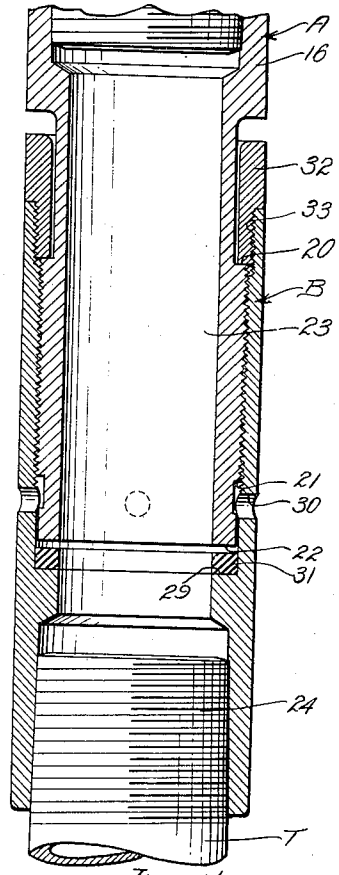


Fig. 5.

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TUBING BLEEDER

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7 Claims. (Cl. 137—34)

This invention relates to a device for use in wells and relates more particularly to a tubing bleeder for use in connection with well tubing. A general object of this invention is to provide a practical, dependable and very effective tubing bleeder.

Deep well pumps such as oil well pumps are usually anchored in or suspended from strings of well tubing. The string of tubing carrying a pump serves to conduct the pumped liquid to the top of the well and normally carries a full column of liquid. In a deep well this liquid column is very heavy and imposes severe strains on the pump and tubing. When it is desired or necessary to remove the pump or to raise the pump to overcome a "sanded in" condition, or the like, the entire column of fluid in the tubing must be lifted. This stretches and strains the pump rod and in some cases results in breaking of the rod. Under some conditions, for example when the pump cannot be raised or removed, it is necessary to pull the string of tubing from the well with the liquid column contained therein. This is known as a wet job and creates an undesirable and very hazardous condition at the top of the well, as the oil, water, etc. spills from the tubing sections or stands as they are uncoupled, making it difficult and hazardous for the operators to work.

Another object of this invention is to provide a practical, easily operated device for unloading or bleeding the well tubing when it is desired to relieve the tubing, pump, etc. of the weight of the liquid column in the tubing.

Another object of this invention is to provide a tubing bleeder that may be easily and quickly opened and closed without disturbing the pump, the tubing catcher, or the other parts, and without the use of a go-devil, cable, or special operating string. The improved tubing bleeder of the present invention is operable by simple turning of the tubing, which operation may be performed at the top of the well without releasing the tubing catcher and without introducing a line or other object into the tubing.

Another object of this invention is to provide a tubing bleeder of the character mentioned that is constructed and proportioned so that it does not interfere with the assembling and running of the tubing string and does not interfere with the setting and operating of the pump, the bailers, or other devices that may be operated in the tubing.

Another object of this invention is to provide a tubing bleeder that does not weaken the tubing string and does not increase the wall thickness of the tubing assembly over that of the usual joints or connections in the tubing string.

Another object of this invention is to provide a tubing bleeder of the character referred to that cannot possibly part or become disconnected to allow separation of the tubing parts, even though operated unskillfully or incorrectly.

Another object of this invention is to provide a tubing bleeder of the character referred to that releases or discharges the fluid from the tubing in a controlled manner so that it does not disturb the sand or formation in the well.

A further object of this invention is to provide a tubing bleeder of the character mentioned that is simple and inexpensive to manufacture, embodying a minimum number of simple parts.

The various objects and features of our invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawing, in which:

Fig. 1 is a side elevation of a portion of a string of well tubing in position in a well casing, showing the bleeder of the invention and the tubing catcher and illustrating a portion of the well pump. Fig. 2 is an enlarged longitudinal detailed sectional view of the tubing bleeder of the invention in the normal closed position, showing tubing parts in elevation threaded in the opposite ends of the bleeder. Fig. 3 is a horizontal detailed sectional view taken as indicated by line 3—3 on Fig. 2. Fig. 4 is a fragmentary longitudinal detailed sectional view of the bleeder showing the parts in the open position, and Fig. 5 is a side elevation of the split locking sleeve.

In the drawing we have shown the bleeder of the present invention connected in a string of oil tubing T. The tubing T extends through the well casing C with considerable clearance and is supported by a tubing rest or tubing catcher 10. The tubing catcher 10 embodies slips 11 gripping the interior of the casing C and the catcher is preferably of a type that is controlled or set by longitudinal movement of the tubing T followed by turning of the tubing. The invention is not primarily concerned with the details of the catcher 10. A pump 12 is removably secured in the tubing T below the catcher 10 by an anchor, or the like (not shown), and is operated by a pump rod 13 extending through the tubing T. In accordance with the usual practice the pump 12 is operated by reciprocating of the

rod 13 and is removable from the tubing T by pulling the rod 13 from the well. The pump 12 of course may be of any type and construction and when in operation serves to raise fluid from the well through the tubing T. The tubing T extends to the ground surface and normally contains a full column of liquid.

The improved tubing bleeder of the present invention may be said to comprise, generally, two threaded together telescopically related tubular sections A and B, one of which is ported for the discharge of fluid, means 14 normally sealing between the sections A and B to prevent the loss of fluid from the tubing T and means 15 limiting relative threading or travel of the sections A and B to prevent their disconnection.

The tubular sections A and B are intended to be connected or interposed in the string of tubing T. It is preferred to connect the sections A and B in the tubing T at a point spaced above the tubing catcher 10. The section A is the inner section being received in the outer section B, and is preferably, though not necessarily, the upper section of the tool. The section A is provided at its upper end with an enlargement or upset portion 16 having an upwardly facing threaded socket 17 for the reception of the threaded end portion 18 of a tubing section. The section A is provided with an externally upset part or enlarged part 19 spaced below the upset portion 16. The upper end of the enlarged part 19 forms an upwardly facing annular shoulder 20 spaced from the upset portion 16. An external annular groove 21 is provided in the section A adjacent the lower end of the enlarged part 19. The groove 21 forms an element of the port means for bleeding the fluid from the tubing as will be later described. The lower end of the section A is ground or finished to form a flat annular downwardly facing surface 22. The longitudinal opening 23 of the section A is preferably of uniform diameter from the socket 17 to the lower end of the section and in accordance with the invention the opening 23 is at least as large in diameter as the opening in the tubing T.

The lower section B has a threaded socket 24 in its lower end for receiving a threaded end part of a tubing section. The section B may be of uniform external diameter and is preferably of the same external diameter as the upset portion 16 of the section A. In the preferred construction the external diameter of the section B and upset portion 16 is no greater than that of the couplings or connections 25 in the string of tubing T. The major upper portion of the lower section B is formed to receive the part 19 and the lower end portion of the section A. The interior of the section B has a long thread for mating with a thread on the enlarged part 19 of the section A. The threads 26 on the interior of the section B and on the part 19 are free running, for example, they may be straight or substantially straight threads. The threads 26 are such that the section A may be turned or threaded relative to the section B without loosening or endangering the numerous threaded connections of the string of tubing T. In the preferred construction the threads 26 are righthand threads. The internal surface 27 of the section B below the threads 26 is plain and is preferably cylindrical. An annular inwardly projecting flange 28 is formed in the section B between the socket 24 and the surface 27. The internal diameter of the flange 28 preferably equals that of the opening 23. The upper end of the flange 28 constitutes an upwardly facing annular shoulder 29.

The section B is provided with one or more lateral ports 30 at or below the lower end of the thread 26 of the section B. It is preferred to provide a plurality of circumferentially spaced ports 30. The groove 21 in the section A and the ports 30 in the section B are related so that they are in register when the sections are in their normal threaded together relation. The surface 27 has clearance with the peripheral surface of the section A to permit a restricted or controlled flow of fluid to the groove 21 and the ports 30 under certain operating conditions to be later described. The clearance between the surface 27 and the periphery of the section A may determine the rate of discharge of fluid from the tubing T and may be varied to suit different operating conditions.

The means 14 is provided to seal between the sections A and B under normal operating conditions of the pump 12, etc. to prevent the leakage of fluid from the tubing T to the casing C. The sealing means 14 comprises a sealing ring 31 on the shoulder 29. The sealing ring 31 may be formed of copper, bronze, or other suitable sealing material. The sealing ring 31 flatly bears on the shoulder 29 and has a flat upper end engageable by the end surface 22 of the section A. With the sections A and B made up or threaded together in their normal relation the surface 22 clamps against the ring 31 and the ring provides an effective pressure and fluid-tight seal between the sections A and B to prevent the passage of fluid outwardly through the groove 21 and the ports 30.

The means 15 serves to limit the travel of the section A relative to the section B to positively prevent disconnection of the sections when the tubing T is in the well. The means 15 comprises a ring or sleeve 32 at the upper end of the section B. The upper end of the section B has a socket 33 and the lower portion of the sleeve 32 is threaded into the socket 33 to have shouldered engagement with the upper end of the section B. The threads of the sleeve 32 and the socket 33 are preferably lefthand threads. The sleeve 32 surrounds the section A between the upset portion 16 and the shoulder 20. The lower end of the sleeve 32 opposes the shoulder 20 and is engageable by the shoulder 20 to limit the upward threading of the section A relative to the section B. When the sections A and B are in their normal closed positions the shoulder 20 is spaced some distance below the lower end of the sleeve 32.

The sleeve 32 is longitudinally split at 34 to facilitate its assembly on the sections A and B. The sleeve 32 is split to form two sections or halves. In assembling the device the sealing ring 31 is arranged on the shoulder 29 and the sections A and B are partially screwed together. The sleeve 32 is then assembled on the section A in a position where it may be screwed in the socket 33. Following the screwing of the sleeve 32 in the socket 33 the sections A and B may be fully screwed together to bring the surface 22 against the sealing ring 31. The sleeve 32 is proportioned so that its interior has clearance with the section A and so that its external diameter is no greater than the external diameter of the section B and the portion 16.

In the use or operation of the tubing bleeder the parts are assembled as described above and the connected sections A and B are assembled in the tubing T as the tubing string is made up.

When the tubing T is run into the well it is run to the selected depth and is manipulated to set or operate the catcher 10. The pump 12 may be run in and anchored in the usual manner and may be operated to pump the well fluid up through the string of tubing T. If at any time it becomes necessary or desirable to bleed or discharge the column of liquid from the tubing T to facilitate the removal of the pump 12, to remove the weight of the liquid column from the pump and the tubing T, or to relieve a sanded in condition at the pump 12, the tubing T is rotated to screw the section A upwardly relative to the section B. The lower portion of the tubing T below the tubing bleeder is held against rotation by the tubing catcher 10, a tubing rest, or the like, so that the section B is held against rotation. The section A is rotated relative to the section B by turning the string of tubing T to screw the section A upwardly and thus raise the surface 22 from the sealing ring 31. The shoulder 20 may engage the lower end of the sleeve 32 to limit the upward movement of the section A. The sleeve 32 constitutes a positive stop to prevent complete unscrewing or disconnection of the section A from the section B.

When the surface 22 is raised from the sealing ring 31 by the upward movement of the section A the fluid in the string of tubing T drains out through the clearance space between the surface 27 and the section A to discharge through the groove 21 and the ports 30. The limited clearance at the surface 27 assures a controlled or restricted discharge of the fluid. The groove 21 further assists in controlling the discharge of the fluid and assures an even distribution of the fluid to the several ports 30. In practice the fluid discharges from the ports 30 in such a manner that it does not agitate the fluid in the casing C or disturb the sand or formation in the well. The section A may be allowed to remain in its up or raised position until the entire column of fluid above the ports 30 has drained from the string of tubing T. With the column of fluid drained from the tubing T the pump 12 may be easily raised by means of the rod 13 and if desired or necessary the tubing T may be pulled. If it is desired to reclose the tubing bleeder the tubing T is rotated to screw the section A downwardly in the section B until the surface 22 again tightly seals with the ring 31. This reconditions the tubing string structure for further use. It will be observed that the tubing bleeder of the invention does not in any way restrict the tubing T so that bailers, swabs, etc. may be operated in the tubing. The tubing bleeder is strong and dependable and embodies a minimum number of parts.

Having described only a typical preferred form and application of our invention, we do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to ourselves any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having described our invention, we claim:

1. A device for use with a well tubing comprising a pair of telescopically related tubular sections, one an outer for connection with a part of the tubing, the other an inner section for connection with a part of the tubing, the outer section having a port for the discharge of fluid, an internal shoulder on the outer section, threads connecting the sections and operable upon turning of the tubing to move the inner section between a closed position where its inner end cooperates with the shoulder and an open position where its said inner end is spaced from the shoulder, telescopically related surfaces on the sections, one of said surfaces extending to said end of the inner section, and said surfaces having clearance space between them leading to said port to allow only a controlled discharge of fluid when the inner section is in said open position, and sealing means for sealing between said shoulder and said end of the inner section when the inner section is in said closed position.

2. A device for use with a well tubing comprising an upper tubular section for connection with a part of the tubing, a lower tubular section for connection with a part of the tubing, one section having a port for the discharge of fluid from the tubing, threads connecting the sections and operable upon turning of the tubing to move the upper section between a closed position where the port is closed and an open position where fluid may discharge from the port, an axially facing shoulder on one section, a sleeve secured to the other section engageable with the shoulder upon said turning of the tubing to prevent disconnection of said threads and allow only limited flow to said port, and sealing means for sealing between the sections when the upper section is in said closed position.

3. A device for use with a well tubing comprising an inner tubular section for connection with a part of the tubing, an outer tubular section for connection with a part of the tubing, the sections extending one into the other, the outer section having lateral ports for the discharge of fluid, the inner section having an external groove registering with said ports to connect the same, the sections being related and proportioned to have an annular clearance space between them leading from the inner end surface of the inner section to the groove to conduct fluid from the tubing to said groove and said ports, an internal shoulder on the outer section, means for sealing between said end surface of the inner section and the shoulder to normally prevent the leakage of fluid through said clearance space, and mating threads on the sections operable to move the upper section relative to the lower section to allow the flow of fluid through the clearance space, groove and ports.

4. A device for use with a well tubing comprising an upper tubular section for connection with a part of the tubing, a lower tubular section for connection with a part of the tubing, one section having a port for the discharge of fluid from the tubing, threads connecting the sections and operable upon turning of the tubing to move the upper section between a closed position where the port is closed and an open position where fluid may discharge from the port, an axially facing shoulder on one section, a split sleeve screwed with the other section and engageable with said shoulder to limit screwing apart of the sections and to prevent disconnection of the threads, and sealing means for sealing between the sections when the upper section is in said closed position.

5. A device to be interposed in a string of well tubing comprising two tubular sections, one an outer section, the other an inner section extending into the outer section, the outer section having lateral ports, the inner section having an external groove registering with the ports, an internal axially facing shoulder on the outer section opposing an end of the inner section, there being a clearance space between the in-

terior of the outer section and the exterior of the inner section leading from said end to the groove, a sealing ring on said shoulder, free running threads connecting the sections operable upon turning of the tubing to move the sections between a position where said end cooperates with the sealing ring to prevent the passage of fluid through the clearance space and a position where the said end is clear of the sealing ring to allow the flow of fluid through the clearance space, there being a second external groove in the inner section, and a sectional sleeve secured to the outer section and received in said second groove with clearance to limit relative threading of the sections.

6. A device to be interposed in a string of well tubing comprising two tubular sections, one an outer section, the other an inner section extending into the outer section, the outer section having lateral ports, the inner section having an external groove registering with the ports, an internal axially facing shoulder on the outer section opposing an end of the inner section, there being a clearance space between the interior of the outer section and the exterior of the inner section leading from said end to the groove, a sealing ring on said shoulder, free running threads connecting the sections operable upon turning of the tubing to move the sections between a position where said end cooperates with the sealing ring to prevent the passage of fluid through the clearance space and a position where the said end is clear of the sealing ring to allow the flow of fluid through the clearance space, an external shoulder on the inner section, and a split sleeve sprung onto the inner section and screwed into the outer section and engageable by the last named shoulder to limit the screwing apart of the sections.

7. A device to be interposed in a string of well tubing comprising two tubular sections, one an outer section, the other an inner section extending into the outer section, the outer section having lateral ports, the inner section having an external groove registering with the ports, an internal axially facing shoulder on the outer section opposing an end of the inner section, there being a clearance space between the interior of the outer section and the exterior of the inner section leading from said end to the groove, a sealing ring on said shoulder, and free running threads connecting the sections operable upon turning of the tubing to move the sections between a position where said end cooperates with the sealing ring to prevent the passage of fluid through the clearance space and a position where the said end is clear of the sealing ring to allow the flow of fluid through the clearance space, the internal diameters of the sections being at least as great as the internal diameter of the tubing.

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