Dec. 18, 1951 H. W. MARTIN 2,578,818

PUMP ROD CATCHING DEVICE

Filed July 2, 1949

Fig. 1

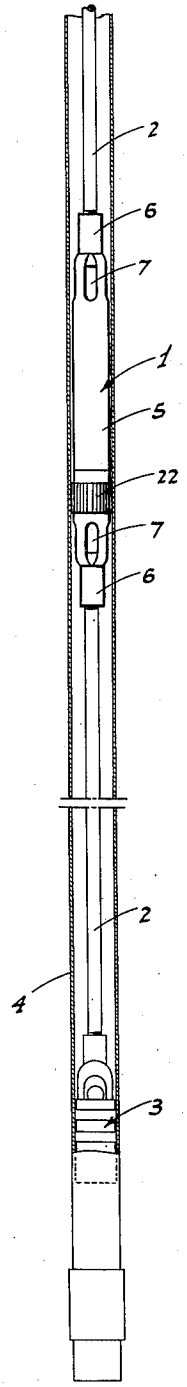


Fig. 2

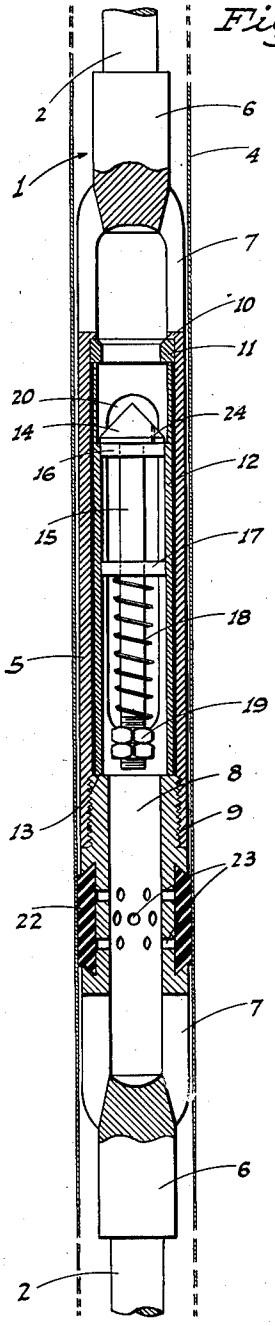
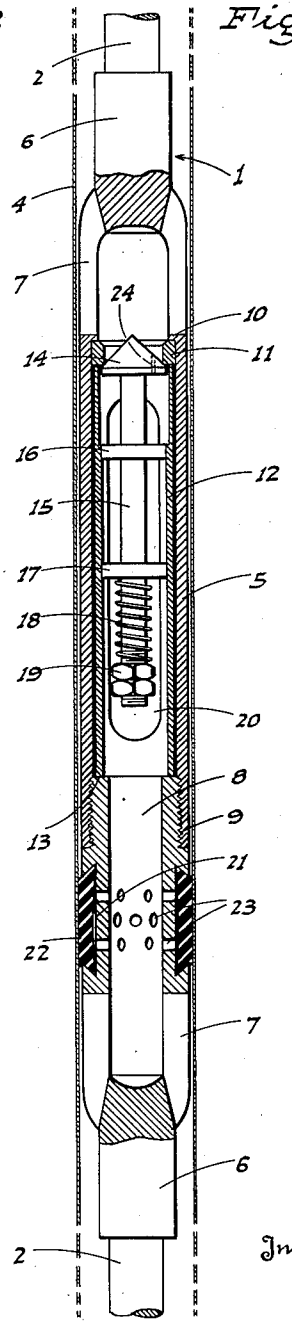


Fig. 3



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PUMP ROD CATCHING DEVICE

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7 Claims. (Cl. 255—28)

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This invention relates generally to well pumping apparatus, especially for oil wells.

In particular the invention is directed to, and it is an object to provide, a safety device adapted to be interposed in the string of pump rod and operative to catch such string and prevent its falling in the well if said string parts above the device.

Another object of the invention is to provide a pump rod catching device which includes an expansible member which normally runs in free sliding relation to the tubing in which the string of pump rod is suspended for reciprocation; there being mechanism in the device arranged to act in a manner to cause expansion of the member into holding or friction drag engagement with the tubing if said string parts above the device.

A further object of the invention is to provide a pump rod catching device, as in the preceding paragraph, wherein said mechanism is responsive to increased fluid pressure, below the device, resultant from parting of the string of pump rod above the device and initial fall thereof in said tubing.

An additional object of the invention is to provide a pump rod catching device, as above, in which said increased pressure responsive mechanism includes a valve which closes against continuance of normal fluid flow through the device; the resultant greatly increased pressure below the valve then acting to expand said member, the latter being an expansible collar of resilient material.

A separate object of the invention is to provide a safety device, of the type described, adapted to serve additionally as a guide for the string of pump rod, and as a means to maintain the tubing full of the fluid, such as oil, being pumped from a well; this latter being especially useful in a well which at times tends to "head" or flow.

It is also an object of the invention to provide a pump rod catching device which is designed for ease and economy of manufacture.

A still further object of the invention is to provide a practical and reliable pump rod catching device, and one which will be exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is an elevation, foreshortened, showing the device as interposed in a string of pump rod; the tubing being part in section.

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Fig. 2 is an enlarged sectional elevation of the device with the parts in normal positions; i. e. the valve open and the resilient collar not expanded.

Fig. 3 is a similar view, but shows the parts in position for rod catching; the valve being closed and the collar expanded into friction drag engagement with the tubing.

Referring now more particularly to the characters of reference on the drawings, the safety device, which is indicated generally at 1, is of elongated tubular construction, and is adapted to be interposed in the string of pump rod 2 which, as usual, connects at its lower end with a pump unit 3 in the tubing 4; such string of pump rod 2 being power reciprocated in such tubing 4 to work the pump unit 3, whereby to cause a column of pumped fluid, such as oil, to flow upwardly in said tubing.

The device 1 comprises an elongated, tubular, heavy-duty body 5 formed, at opposite ends, with tapped fittings 6, into which the adjacent pump rod 2 is threaded; the device being interposed in this manner in the string of said pump rod.

Inwardly of the fittings 6 at each end of the body 5 the latter is formed with a plurality of relatively short, circumferentially spaced slots 7 to provide communication with the bore 8 of said body from exteriorly of the device adjacent each end thereof.

The tubular body 5 is two-part, with the parts threaded together, as at 9; this two-part arrangement being for ease of assembly of the hereinafter described valve mechanism which is mounted in said body 5.

At its upper end the body 5 is formed with an annular, radially inwardly projecting shoulder 10 of limited extent, and an annular valve seat 11 is disposed in the body 5 in abutment with said shoulder 10 from the inner side.

A sleeve liner 12 extends in the tubular body 5 between the annular valve seat 11 and an abutment 13 adjacent the threading 9 and formed by the inner end of one of the threaded-together parts of the body 5. In this manner the sleeve liner 12 and valve seat 11 are removably but normally fixedly secured in the tubular body 5.

A taper plug valve 14 is normally disposed in upwardly facing but open or spaced relation below the valve seat 11; such valve 14 being carried on the upper end of a valve stem 15 which extends in slidable and guided relation through vertically spaced webs 16 and 17 in the sleeve liner below the valve 14.

Such valve 14 normally rests, in stop engagement, on the web 16; being urged downwardly to such position by a helical compression spring 18 which surrounds the valve stem 15 between the web 17 and an adjustment nut assembly 19 threaded on the lower end portion of said valve stem 15.

The nut assembly 19 is adjusted to load the compression spring 18 sufficiently to maintain the valve 14 in its lowered open position under normal working conditions.

The sleeve liner 12 is longitudinally slotted, as at 20, preferably with two or more of such slots in circumferentially spaced relation; each of said slots 20 being of a length extending from a point above the web 16 and the normally open position of the valve 14 downwardly to a point some distance below the web 17.

It will therefore be recognized that with normal reciprocating speed of the string of pump rod 2, and the interposed device 1, the upwardly flowing fluid in the tubing 4 will pass into the tubular body 5 through the lowermost slot 7, flowing upwardly in said body 5, bypassing the valve assembly by flowing through the slots 20, and will then return into the tubing 4 through the uppermost slots 7. Thus, under normal working conditions the device 1 does not in any way affect pumping operations or obstruct fluid flow upwardly in the tubing 4. In fact the device 1, being interposed in the string of pump rod 2, tends to guide the same and prevent undue wear on the tubing 4.

Below the threading 9 the tubular body 5 is formed with a circumferential groove 21 having dovetail edge portions, as shown, and a resilient collar 22, of rubber or the like, engages in such groove 21 in close matching relation; such collar having its outer face normally in free running relation to the tubing 4, whereby not to impose any drag on the string of pump rod 2.

A plurality of radial passages 23 extend in the body 5 in communication between the bore 8 and the bottom of the circumferential groove 21.

Normally, the parts of the device are in the positions indicated in Fig. 2; the valve 14 being open and the resilient collar 22 freely slidable relative to the tubing 4.

If the string of pump rod 2 parts above the device 1, said string—below the point of parting, and including the device 1—immediately begins to fall, increasing the velocity and pressure of the fluid flowing through said device from below. This increase in pressure of the fluid closes the valve 14 in engagement with the valve seat 11, and against the action of the compression spring 18.

Immediately upon the valve 14 so closing, a relatively great fluid pressure builds up in the tubular body 5, which pressure is imposed on the resilient collar 22 from the inside through the radial passages 23, resulting in such resilient collar expanding or bulging outwardly, as in Fig. 3. This expansion of the resilient collar 22 causes it to grip the tubing 4 in forceful holding or friction drag relation, immediately decelerating, if not stopping, falling of the string of pump rod 2 in the tubing 4. The result is that the string of pump rod does not fall at a damaging speed, preventing damage to the pump rod, as well as to the pump unit 3.

If desired, the valve 14 may have a bleed hole 24 therethrough parallel to the valve axis but radially inward relative to the valve seat 11; the purpose of such bleed hole being to gradually relieve the pressure below the device so that the parted string of pump rod may slowly lower, whereby to clear it from the upper unparted portion of the string and which may continue to reciprocate. In this way said upper, unparted portion cannot strike and cause damage to the parted string of pump rod.

In those instances where the string of pump rod 2 is relatively short, a single device 1 may suffice when interposed at a predetermined point in the string of pump rod 2 intermediate the ends of such string. However, when the string of pump rod is relatively long, a plurality of such devices are used in spaced-apart relation in the string.

In addition to its use as a safety device, and as a guide for the string of pump rod, the device is useful to maintain the tubing 4 full of pumped fluid at all times. Especially in oil wells which tend to "head" or flow at times during the pumping operation, the valve 14 prevents up-surging in the tubing 4 by closing against increased velocity resultant from such up-surging. The valve will remain closed until sufficient density is present in the tubing 4, and thus assures that such tubing never becomes empty of fluid.

For catching a string of pump rod which parts, the device is a positive and extremely valuable accessory to such string, and prevents much damage thereto which would otherwise occur.

The device is practical and reliable, and its inclusion in a string of pump rod requires no special fittings, adapters, or the like.

From the foregoing description it will be readily seen that there has been produced such a device as substantially fulfills the objects of the invention, as set forth herein.

While this specification sets forth herein the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent is desired:

1. A safety device for a string of pump rod suspended in a well tubing, comprising a body coupled between adjacent rods of the string, a member on the body normally free running relative to the tubing, said member being formed to expand under conditions of increased fluid pressure in the body whereby to then impose a friction drag on the tubing, and means associated with the body acting in response to a sudden drop thereof to produce such increased fluid pressure therein.

2. A safety device for a string of pump rod suspended in a well tubing, comprising a tubular body coupled between adjacent rods of the string, the body having vertically spaced openings therein for fluid flow through said body, an upwardly closing valve in the body between said openings, means normally holding the valve open, said valve presenting an area to the upward fluid flow sufficient to cause the valve to close by predetermined increase in fluid pressure from below, a member on the body normally free running relative to the tubing but movable radially out to impose a forceful friction drag thereon, and means to so move said member in response to increased pressure in the body upon closing of the valve.

3. A safety device for a string of pump rod suspended in a well tubing, comprising a tubular body coupled between adjacent rods of the string, the body having vertically spaced openings therein for fluid flow through said body, an upwardly closing valve in the body between said openings, means normally holding the valve open, said valve presenting an area to the upward fluid flow sufficient to cause the valve to close by predetermined increase in fluid pressure from below, the body having a circumferential groove therein between said openings and below the valve, and an expansible collar seated in the groove in normally free running relation to the tubing; the bottom of the groove being in communication with the bore of the tubular body, whereby the collar will expand and impose a forceful friction drag on the tubing in response to increased pressure in the body upon closing of the valve.

4. A safety device for a string of pump rod suspended in a well tubing, comprising a tubular body coupled between adjacent rods of the string, the body having vertically spaced openings therein for fluid flow through said body, a vertically movable valve in the body between said openings, a valve seat in the body between said openings, spring means normally holding the valve open, said valve presenting an area to the upward fluid flow sufficient to cause the valve to close upon predetermined increase in fluid pressure from below, fluid bypass means in the body about the valve but below the seat, the body having a circumferential groove therein between said openings and below the valve, and an expansible collar seated in the groove in normally free running relation to the tubing; the bottom of the groove being in communication with the bore of the tubular body, and the collar being adapted to expand and impose a forceful friction drag on the tubing in response to increased pressure in the body upon closing of the valve.

5. A safety device for a string of pump rod suspended in a well tubing, comprising a tubular body coupled between adjacent rods of the string, the body having vertically spaced openings adjacent the ends thereof for fluid flow through said body, an annular valve seat in the body below the upper openings, a vertically movable pressure responsive valve mounted in the body for upward closing against the valve seat from below, spring means normally holding the valve open and said valve presenting an area to the upward fluid flow sufficient to cause the valve to close

in response to excess pressure from below, the body having passage means therein to bypass fluid about the valve only when the latter is open, the body having a circumferential groove therein between said openings and below the valve, and an expansible collar seated in the groove in normally free running relation to the tubing; the bottom of the groove being in communication with the bore of the tubular body, and the collar being adapted to expand and impose a forceful friction drag on the tubing in response to increased pressure in the body upon closing of the valve.

6. A safety device for a string of pump rod suspended in a well tubing, comprising a tubular body coupled between adjacent rods of the string, the body having vertically spaced openings adjacent the ends thereof for fluid flow through said body, an annular valve seat in the body below the upper openings, a vertically movable pressure responsive valve in the body for upward closing against the valve seat from below, a stem depending from the valve, a fixed guide member through which the stem slidably projects, an adjustable nut on the stem below the guide member, a compression spring about the stem between the guide member and nut, the valve being normally open and closing against the action of the spring in response to excess pressure from below, the body having passage means therein to bypass fluid about the valve only when the latter is open, the body having a circumferential groove therein between said openings and below the valve, and an expansible collar seated in the groove in normally free running relation to the tubing; the bottom of the groove being in communication with the bore of the tubular body, and the collar being adapted to expand and impose a forceful friction drag on the tubing in response to increased pressure in the body upon closing of the valve.

7. A device, as in claim 6, in which said fluid bypass passage means is formed by longitudinal, internal slotting in the body from a point below to a point above the valve but below the seat.

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