Jan. 5, 1932. C. M. HATCHER 1,839,310

PACKER AND SETTING TOOL

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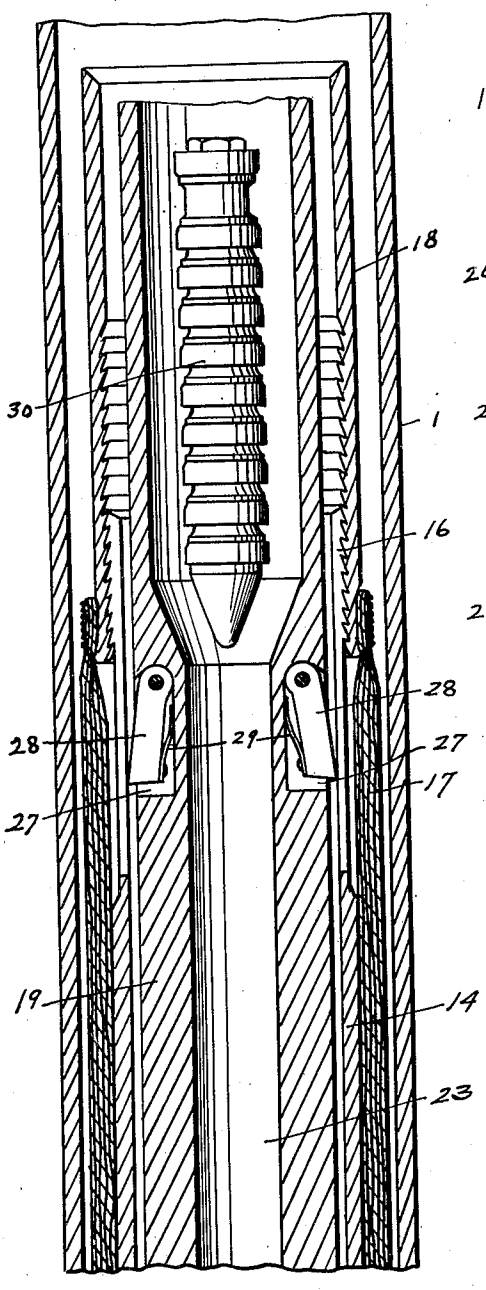


Fig. 1

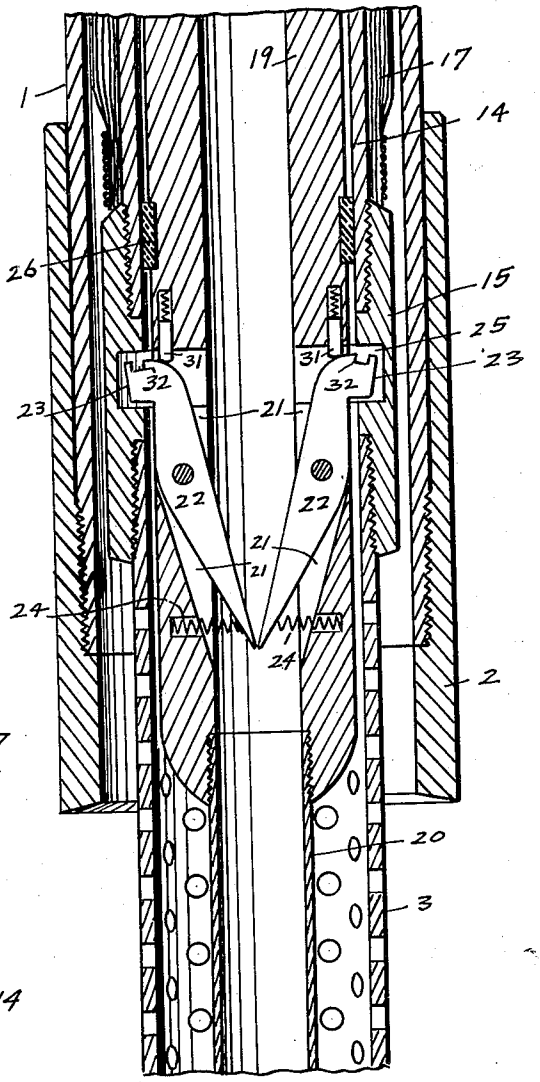


Fig. 2.

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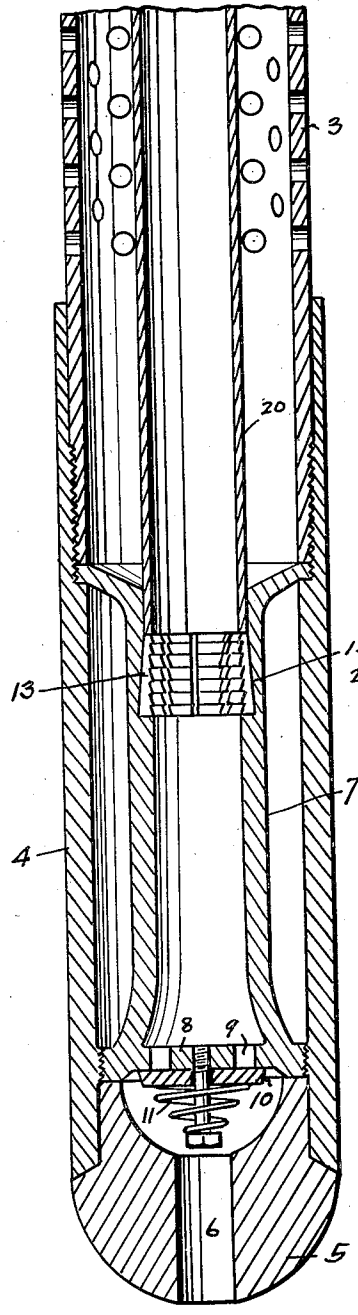


Fig. 3.

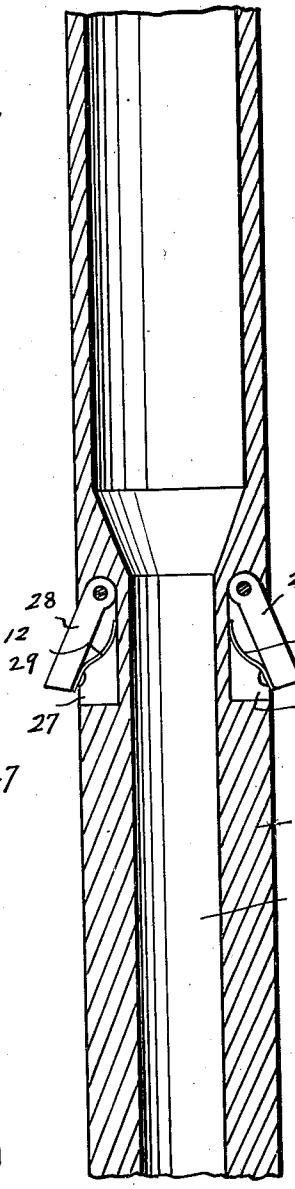


Fig. 4.

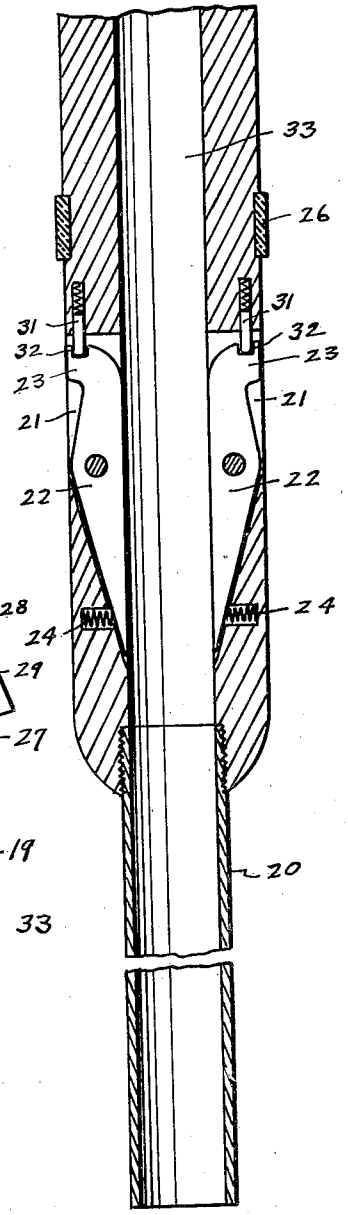


Fig. 5

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PACKER AND SETTING TOOL

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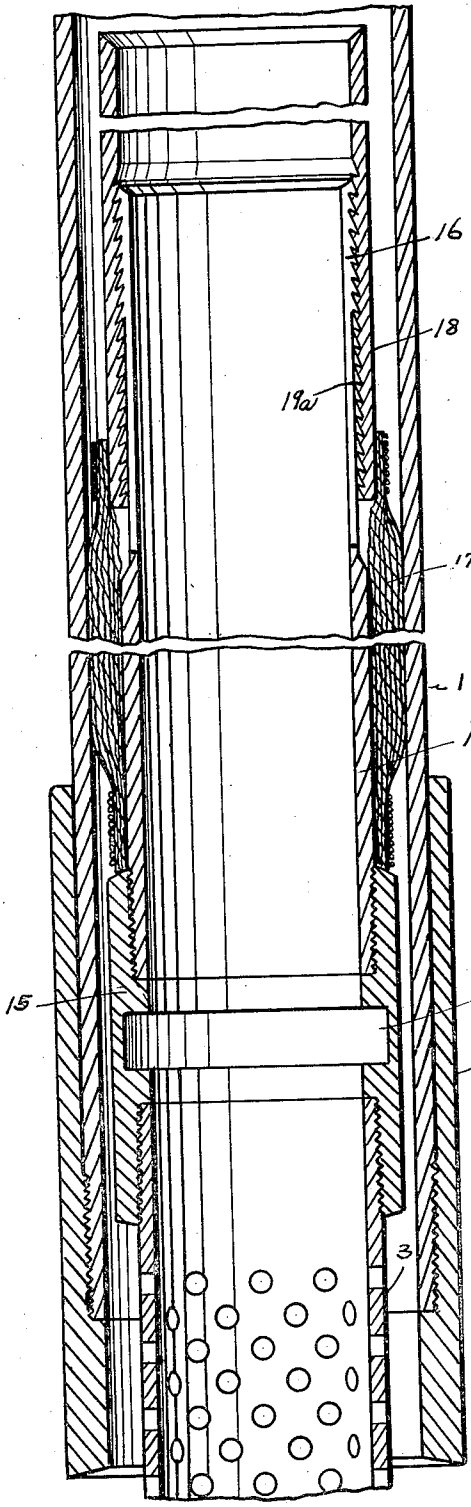


Fig. 6.

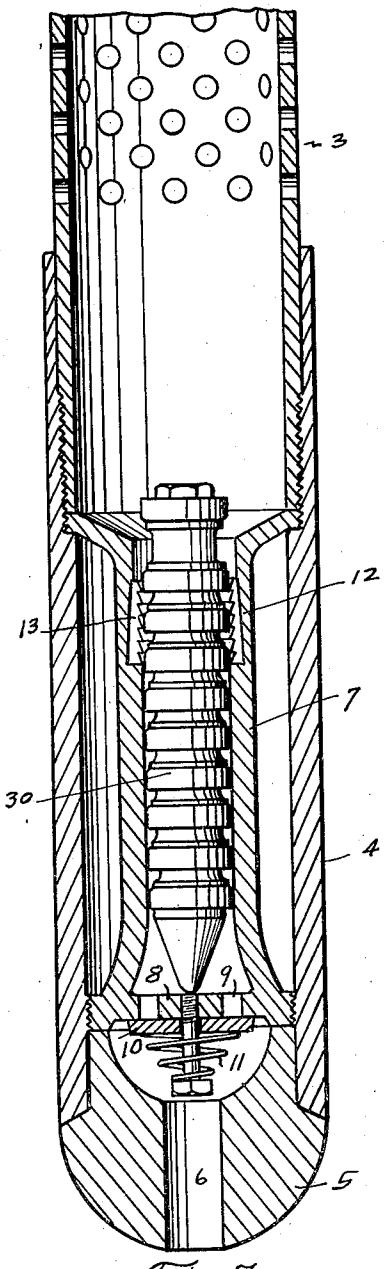


Fig. 7.

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# UNITED STATES PATENT OFFICE

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## PACKER AND SETTING TOOL

Application filed November 19, 1929. Serial No. 408,183.

This invention relates to new and useful improvements in a packer and setting tool.

One object of the invention is to provide apparatus of the character described whereby a fluid tight joint between an outer casing or pipe and an inner pipe or well screen may be formed.

A further feature of the invention resides in the provision of means whereby a packer, or seal may be formed between the lower end of a casing in a well bore and the upper end of a screen set beneath said casing, said means embodying also a wash pipe through which the screen may be washed after the packer is set and before the setting tool is withdrawn; and the invention further comprehends means for closing the lower end of the screen against the inlet of fluid after the packer has been set and before the setting tool has been withdrawn.

A still further feature of the invention resides in the provision of a setting tool which may be released and withdrawn from a well after a packer has been set.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings wherein:—

Figure 1 shows a vertical sectional view of the upper end of the apparatus showing the set shoe plug in released position therein.

Figure 2 shows a vertical sectional view of an intermediate section of the apparatus.

Figure 3 shows a vertical sectional view of the lower end of the screen showing the set shoe and wash pipe associated therewith.

Figures 4 and 5 show vertical sectional views of the upper and lower ends respectively of the setting tool.

Figure 6 shows a vertical sectional view of the packer as set in the casing, and

Figure 7 shows a vertical sectional view of the set shoe with the set shoe plug seated therein.

Referring now more particularly to the drawings, wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates an outer casing in a well bore and having the casing shoe 2 attached to the lower end thereof. The numeral 3 designates a screen or other inner pipe to be set in the well bore within and usually beneath the casing. Attached to the lower end of the screen there is the tubular set shoe 4 whose lower end has a plug 5, preferably of wood, attached thereto with the vertical inlet passageway 6 therethrough. Anchored within the set shoe 4 there is a tubular housing 7 whose lower end has the transverse spider 8 with the discharge openings 9 therein controlled by the downwardly opening back pressure valve 10 which is seated on the coil spring 11. Within the upper end of the housing 7 there is an upwardly converging seat 12 in which is located the upwardly tapering wedge shaped slips 13 whose inner faces are toothed.

There is a tubular packer support 14 attached to the upper end of the screen or inner pipe by means of the coupling 15. The upper end of this packer support is longitudinally slitted forming the expansible ratchets 16 having ratchet teeth on their outer sides. Around the packer support 14 there is an expansible packer sleeve 17 whose lower end is anchored to said support and the upper end of this sleeve surrounds and is anchored to the lower end of the tubular setting nipple 18. This nipple has the inside ratchet teeth 19*a* arranged to coact with the teeth of the ratchets 16.

There is a setting tool embodying the tubular body 19 into the lower end of which the upper end of the wash pipe 20 is connected. This body is adapted to be connected to the lower end of the setting string of pipe which extends to the ground surface.

Near its lower end the body 19 has the oppositely disposed slots 21, 21, cut therethrough whose lower ends converge downwardly and inwardly and pivotally mounted in these slots are the respective locking dogs 22, 22 whose upper ends 23, 23 are outwardly turned and whose lower ends are seated against the respective springs 24, 24. These last mentioned springs act normally to hold the lower ends of the dogs inwardly with their outwardly turned upper ends projecting into the inside annular groove 25 in the coupling 15. Above said dogs 22 there is an annular packing ring 26 around said body 19 of a size to fit closely within said packer support 14. Above said packer ring 26 the body 19 has the vertical bearing slots 27, 27 in which work the setting dogs 28, 28 whose upper ends are pivoted in said slots. These dogs carry the yieldable seats 29, 29 which tend to hold their lower ends projected outwardly.

In operation the apparatus is assembled as shown in Figures 1, 2 and 3 with the outwardly turned ends 23 in the groove 25 of the coupling 15 and with the dogs 28 held retracted by the packer support 14, and with the lower end of the wash pipe 20 entering the upper end of the housing 7. As thus assembled, the apparatus is let down into the casing until the set shoe rests on the lower end of the bore. Water may be then forced down through the setting string and it will pass on down through the tubular body 19 and through the wash pipe and thence out through passageway 6 and up around the screen so as to wash the outside of said screen. The back pressure valve 10 however will ordinarily prevent the inflow of any fluid from the bore into the lower end of the screen. When the screen has been washed a plug 30 may be dropped from the ground surface through the setting string and this plug will pass down through the tubular body 19 and will force the lower ends of the dogs 22 outwardly into the slots 21 and will withdraw the outwardly turned ends 23 from the groove 25 and thereupon the yieldably seated locking dogs 31, 31 will engage in the notches 32, 32 of said outwardly turned ends and hold the latter in said withdrawn position and the plug 30 will pass on down through the wash pipe 20 into the housing 7 and will be engaged and locked therein by the slips 13. It is to be observed that the lower portion of the tubular body 19 is reduced inwardly forming in effect a cylinder 33 in which the said plug 30 fits closely so that the water pressure above will force it down to its final position. This plug has a plurality of downwardly facing cup rings which will prevent the upward passage of fluid through the set shoe 4 into the screen. This plug 30 is provided as a supplemental means for excluding all fluid in case the valve 10 should become disabled or for any reason should leak.

The setting apparatus may now be elevated until the dogs 28 clear the upper end of the setting nipple 18 whereupon said dogs will be forced outwardly into the position shown in Figure 4 and the setting string may then be permitted to move downwardly and the dogs 28 will then engage on said upper end of said setting nipple and will force the same downwardly expanding the packer sleeve 17 out against the casing as shown in Figure 6. The ratchet teeth 19*a* will be engaged by the ratchets 16 and the packer sleeve 17 thereby held expanded. The setting tool may then be withdrawn from the well.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration while the broad principle of the invention will be defined by the appended claims.

What I claim is:—

1. Apparatus of the character described including a tubular packer support, an expansible packing element thereon, a setting nipple above said packing element, a setting tool formed to work through said nipple and support, releasable dogs on said tool and engageable with said support for locking said tool against longitudinal movement in said support, said tool including setting dogs, movable therewith, when said tool is released, into engagement with said nipple, and through which said nipple may be moved downwardly, and the packing element expanded, upon downward movement of said tool.

2. Apparatus of the character described including a packer support, an expansible packing element thereon, a setting nipple associated with, and adapted to expand said element, a tubular setting tool formed to work through said nipple and support, said tool including releasable dogs and means carried by the support interengageable with the dogs and adapted to lock the tool against lengthwise movement in said support, and also including yieldably mounted means engageable with said nipple and through which said nipple may be moved downwardly, and the packing element expanded, upon downward movement of said tool.

3. Apparatus of the character described including a packer support, an expansible packing element thereon, a setting nipple associated with, and adapted to expand said element, a tubular setting tool formed to work through said nipple and support a packing ring between said tool and packer support, said tool including releasable means located beneath said ring and adapted to lock the tool against lengthwise movement in said support, and also including yieldably mounted means engageable with said nipple and

through which said nipple may be moved downwardly, and the packing element expanded, upon downward movement of said tool, and a wash pipe attached to and depending from said tool and extended beneath said support.

4. Apparatus of the character described including a tubular packer support, a packer about said support including an expansible packing element, a setting tool adapted to work through said support and including releasable engaging dogs whose lower ends converge downwardly and whose upper ends are turned outwardly and adapted to lock said tool in position against longitudinal movement relative to said support, said tool also including yieldably mounted setting dogs arranged to be maintained in inactive position within the packer, when said tool is so locked, said dogs being movable into active position into engagement with the packer, when said tool is moved to another position, and through which said packer may be expanded, upon downward movement of said tool.

5. Apparatus of the character described including a tubular packer support, a packer about said support including an expansible packing element, a setting tool adapted to work through said support and including releasable engaging dogs whose lower ends converge downwardly and whose upper ends are turned outwardly and adapted to lock said tool in position against longitudinal movement relative to said support, said tool also including yieldably mounted setting dogs arranged to be maintained in inactive position within the packer, when said tool is so locked, said dogs being movable into active position into engagement with the packer, when said tool is moved to another position, and through which said packer may be expanded, upon downward movement of said tool, and means for maintaining said packer in expanded position.

6. Apparatus of the character described for forming a seal between an outer pipe and an inner pipe beneath the outer pipe and including a tubular packer support above and connected to the inner pipe, a packing device about said support including an expansible packing element, a tubular setting tool formed to work through said support, said tool and support having interengaging means adapted to lock said tool against longitudinal movement in said support, and one of which is arranged to be released from the other, a body movable through said tool and effective to so release said releasable means to permit said tool to be moved in said support said body being shaped to close the lower end of the inner pipe, said tool also including packer engaging means effective to engage the packing device upon the release and upward movement of the tool, and through which said packer may be expanded upon the subsequent downward movement of said tool, and means for automatically locking said releasable interengaging means in said released position.

7. Apparatus of the character described having a passageway for fluid therethrough and including a packer support, having an inside seat, an expansible packing element thereon, a setting nipple associated with and adapted to expand said element, a tubular setting tool formed to work through said nipple and support, said setting tool including a releasable dog one end of which is engaged in said seat and is effective to lock the tool against movement in the support and whose other end extends into the passageway through said tool, said tool also including yieldably mounted means engageable with said nipple and through which said nipple may be moved downwardly and the packing expanded upon downward movement of the tool.

8. Apparatus of the character described having a passageway therethrough and including a packer support, having an inside seat, an expansible packing element thereon, a setting nipple associated with and adapted to expand said element, a tubular setting tool formed to work through said nipple and support, said setting tool including a releasable dog one end of which is engaged in said seat and is effective to lock the tool against movement in the support and whose other end extends into the passageway through said tool, said tool also including yieldably mounted means engageable with said nipple and through which said nipple may be moved downwardly and the packing expanded upon downward movement of the tool, and packing around said tool forming a fluid tight joint between the tool and packer support.

9. Apparatus of the character described having a passageway therethrough and including a packer support, an expansible packing element on said support, means associated with and adapted to expand said element, a tubular setting tool formed to work through said expanding means and support, means adapted to interlock said tool and support against relative longitudinal movement, said interlocking means being exposed in said passageway, means carried by the tool and engageable with said expanding means and through which said expanding means may be moved downwardly and the packing expanded upon downward movement of the tool.

10. Apparatus of the character described having a passageway therethrough and including a packer support, an expansible packing element on said support, means associated with and adapted to expand said element, a tubular setting tool formed to work through said expanding means and support, means adapted to interlock said tool and support against relative longitudinal move-

ment, said interlocking means being exposed in said passageway, means carried by the tool and engageable with said expanding means and through which said expanding means may be moved downwardly and the packing expanded upon downward movement of the tool, and packing forming a fluid tight joint between said tool and packer support.

In testimony whereof I have signed my named to this specification.

CHARLES M. HATCHER.