This invention relates to devices for preventing the flow of oil from wells, when for any reason it is necessary to withdraw the well tubing which is frequently necessary a number of times annually.

To make certain repairs in the tubing, or to withdraw the tubing in which case the flow of oil from below must be stopped. Devices have been heretofore devised for this purpose, but so far as known they have not operated with that certainty which is necessary in order to insure the complete cut off of oil from the well, either when the tubing is withdrawn, or there is a leakage through the tubing. With a view to providing a device which will be thoroughly reliable in action to prevent the blowout of oil from the pressure below, my invention includes as a valuable feature a device which, when the pumping pressure is relieved, will reliably act under the oil pressure from below to instantly stop the flow from the well regardless of the amount of pressure therein.

The device includes novel features of construction which are so designed as to accomplish the purposes above specified, as well as a simplified arrangement of parts, the device being capable of production in quantities at a relatively low cost by reason of the simplicity of its several elements.

In the accompanying drawing, illustrating a device which embodies the invention:—

Fig. 1 is a view in elevation of the flow preventer in a well tubing.

Fig. 2 is a vertical sectional view, and

Fig. 3 is a transverse section on the line 3—3 of Fig. 2.

The device comprises a mandrel 1 which extends throughout the length of the flow preventer, and is herein shown as provided at its opposite ends with swab rubbers or packing rings 3, 4, 5 and 6. The swab rubbers 3, 4 at the upper end of the mandrel are spaced apart by a spool 7, and the inner rubber 4 has bearing against a washer 8, fastened to the mandrel 1, while the outer rubber 3 is held between said spool and a nut 9 in threaded engagement with a thread formed at the upper extremity of the mandrel and held against accidental displacement by a lock nut 10.

The two swab rubbers 5, 6 at the lower end of the mandrel are similarly confined between a washer 11, setting against a shoulder formed by a tapering enlargement 12 of the mandrel 1, a nut 13, and lock nut 14, in threaded engagement with a screw thread at the lower terminal of the mandrel serving as securing means for the swab rubbers 5, 6, the latter being spaced apart by a spool 15.

A packer sleeve 16 is provided with a longitudinal bore which fits over the enlarged tapering portion 12 of the mandrel and extends upwardly a substantial distance thereon, provided at its upper terminal with a metal ferrule or sleeve portion 17. A freely movable conical sleeve 18 is provided with a bore to receive that portion of the mandrel above the packer sleeve 16, the upper end of the metallic sleeve 16 terminating a suitable distance below the washer 8, whereby considerable amount of play of the sleeve 18 is permitted in a vertical direction along the mandrel between the washer 8 and the upper end portion of the packer sleeve 16.

Surrounding the sleeve 18 is a plurality of slips 20 which are herein shown as integrally formed with a collar 21, the slips being separated from each other by slight spaces, as shown, and leaf springs 22 extend rigidly from the collar 21 and have their outer end portions bearing against the slips to normally hold the latter contracted and out of gripping engagement with the interior of the well tubing, which is indicated by the numeral 25. The slips 28 are, as usual, formed with annular teeth 26 in order that said slips may, when properly spread, grippingly engage the interior of the tubing so as to prevent the flow preventer from being blown outwardly by the pressure from within the well, after the pressure of the pumping fluid from above has been relieved, or stopped.

For the purpose of properly spreading the slips, their interior walls are tapered from a large bore to a smaller diameter of bore in an upward direction, as will be clear from Fig. 2 of the drawing, such tapering interior surface of the slips effecting through engagement with the tapered surface of the sleeve 18 when the latter moves upwardly relatively to the slips, due to the pressure from below, a spreading movement of the slips outwardly, whereby they engage the well tubing to thereby arrest outward movement of the flow preventer as an entirety. At all other times than when the pressure from the well below prevails over the pressure from above, due to the pumping of the fluid downwardly, the slips will be out of wedging engagement with the surface of the sleeve 18, and the springs 22 will effect a contraction of the slips, thereby leaving the flow preventer freedom of movement in a downward direction. This occurs while the pump is operating to force the fluid against the flow preventer.
cause it to move downwardly in the well to that point where it is desired to shut off the well flow from the tubing.

The packer sleeve 16 which is shown in Fig. 1 as having its upper end portion slightly separated from the lower end of the tapered sleeve 18, is so arranged that when the downward flow of the pumped fluid ceases, and the pressure from below being then effective will act upon the two swab rubbers 5, 6 which normally fit fairly tightly within the tubing, and through the pressure upon these swab rubbers two operations are performed. The upward pressure from the well acting upon the two swab rubbers 5, 6 will first move the mandrel upwardly, whereupon engagement between the conical surface 12 and the packer sleeve 16 will lift the latter, causing it to engage and move upwardly the sleeve 18. This operation will spread the slips, causing them to effectually grip the interior of the tubing, and immediately thereafter the pressure from the well will be sufficient to effect relative movement of the mandrel and the packer sleeve 16, spreading the latter and causing it to engage the interior of the tubing, and stop any upward flow of oil therebeyond.

It will be observed that during the operation of the pressure from the well, the swab rubbers 5, 6 act as pistons, and effectually permit the pressure to not only spread the slips against the tubing to arrest movement of the flow preventer, but additionally, will spread the packer sleeve 16, thereby effecting an absolutely liquid tight joint, preventing any flow beyond the flow preventer.

It is to be noted that when the flow preventer is in the position shown in Fig. 2 where the enlarged or conical portions on the mandrel 1 and sleeve 18 have effected a distention of the slips 20 to engage the inner wall of the tubing and secure the flow preventer in position, and to spread the packer sleeve 16, due to the action of the tapering enlargement 12, a space exists between the upper end of the sleeve 18 and the washer 8. Accordingly, when it is desired to return the parts of the device to their original position, as shown in Fig. 1, where the flow of fluid is lost in the well tubing, such position of the parts may be accomplished by an application of the hydraulic pressure from the pump, such pressure acting upon the swab rubbers 3, 4 to cause a downward movement of the mandrel, washer 8 then impacting against the upper end of the slips 20, thus spreading the slips from gripping engagement with the tubing, and the tapering or conical portion 12 of the mandrel passing then below and out of spreading relation with the packer sleeve 16, whereby the latter again becomes loose in the tubing as in the original position of the parts, shown in Fig. 1.

It will thus be seen that the device is entirely controllable by the pressures, either from above to force the flow preventer down into the well locating it at the desired position to stop the flow of oil, or to loosen the device and detach it from engagement with the inner surface of the tubing, and likewise the pressure from the well is effective in causing a gripping engagement between the flow preventer and the tubing when the slips are spread, followed promptly by an enlargement of the conical portion 12 of the mandrel, and that these two functions are performed in rapid succession.

In this connection it will be noted that the first movement upward of the mandrel will cause engagement between the ferrule 17 and the sleeve 18, which latter is moved upwardly to spread the slips as soon as the packer sleeve is lifted by the mandrel, due to the preliminary engagement between these parts when the tapered portion 12 of the mandrel enters the packer sleeve, and that then the latter is instrumental in causing the sleeve 18 to spread the slips, the arresting of the movement of the sleeve, due to the gripping engagement of the slips with the tubing, resulting in the movement of the inner sleeve being stopped by contact of its upper end with the enlarged base portion of the sleeve 18. Movement thereafter of the mandrel will spread the packer sleeve against the tubing and complete the operation of the device as a means for stopping positively the outward flow from the well.

What I claim is:—

1. In a device of the class described, the combination of a mandrel having a tapered portion, a plurality of slips surrounding said mandrel, a wedge member slidable on the mandrel and engaging a wedging surface interiorly of said slips, pistons at the opposite ends of said mandrel, and a packer sleeve on said mandrel having a bore to engage the tapered portion thereof, whereby upward pressure on the mandrel will cause the slips to engage a well casing, and movement of the mandrel thereafter under pressure against the lower end of the sleeve effect a retracting of said packer sleeve to arrest the oil flow.

2. In a device of the class described, the combination of a mandrel provided with pistons at its opposite ends and having intermediate thereof a tapered portion, a sleeve slidable on said mandrel provided with an outer tapering surface, spring pressed slips having teeth to engage the interior of a well tubing, said slips having an interior tapered surface for engagement by the tapered surface of said sleeve, and a packer sleeve on said mandrel below said tapered sleeve and having a bore for engagement with the tapered surface of the mandrel.

3. In a flow preventer, a mandrel provided with an enlarged conical portion, swab rubbers below said conical portion, a packer sleeve provided with a bore to receive said mandrel and fit said conical portion wherein is loose in the well tubing, such position of the parts may be accomplished by an application of the hydraulic pressure from the pump, such pressure acting upon the swab rubbers 3, 4 to cause a downward movement of the mandrel, washer 8 then impacting against the upper end of the slips 20, which latter again becomes loose in the tubing as in the original position of the parts, shown in Fig. 1.

4. In a flow preventer, the combination of a mandrel having swab rubbers at its opposite end portions and a conical enlargement above the lower of said swab rubber, a packer sleeve having a bore fitting upon said mandrel at the conical enlargement, a metal sleeve provided with a bore to fit said mandrel above the packer sleeve having a portion of its exterior surface tapering upwardly, a collar surrounding said sleeve and having depending therefrom a plurality of slips whose interior surface are fitted to engage the conical portion of said sleeve, and springs
secured to said collar and normally tending to hold the slips contracted and out of engagement with the well tubing.

5. In a flow preventer, the combination of a mandrel provided near its lower end portion with a conical enlargement having a shoulder facing downwardly, a plurality of swab rubbers mounted on said mandrel and firmly secured below said shoulder, an elongated packer sleeve of yieldable material having an interior bore and fitted upon said mandrel above the conical portion thereof, said portion being adapted to be moved within the bore of said packing sleeve to spread the sleeve and effect a tight fit thereof with a well casing, a metallic ferrule surrounding the upper end of said sleeve, a slidable metallic sleeve on said mandrel above said ferrule having a portion of its exterior surface tapered upwardly, a collar surrounding the upper portion of said sleeve and provided with a plurality of downwardly extending, freely movable slips having exterior gripping surfaces and shaped interiorly to fit over the tapering portion of said sleeve, leaf springs secured at their upper ends to said collar and bearing at their lower ends against said slips to normally hold them withdrawn, and swab rubbers rigidly mounted upon said mandrel at a point thereon above and spaced from the upper terminal of said sleeve.

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