Nov. 11, 1947. R. G. TAYLOR, JR., ET AL 2,430,623

CONTROL HEAD PACKER

Filed March 19, 1942 2 Sheets-Sheet 1

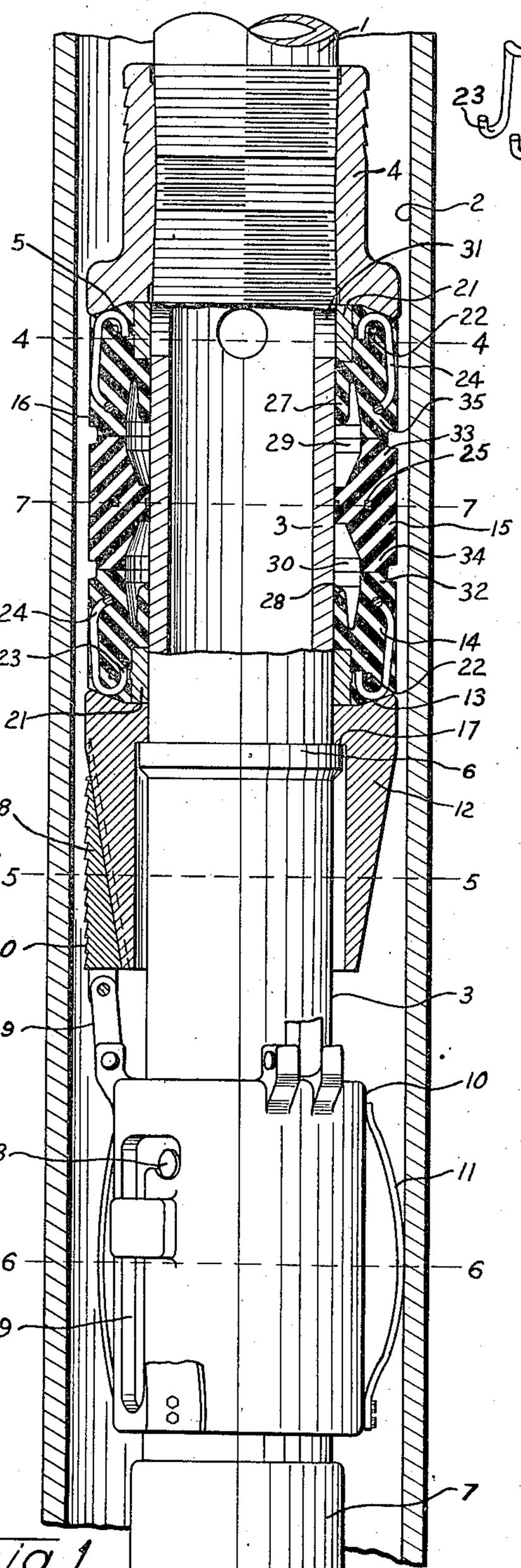

Fig. 1

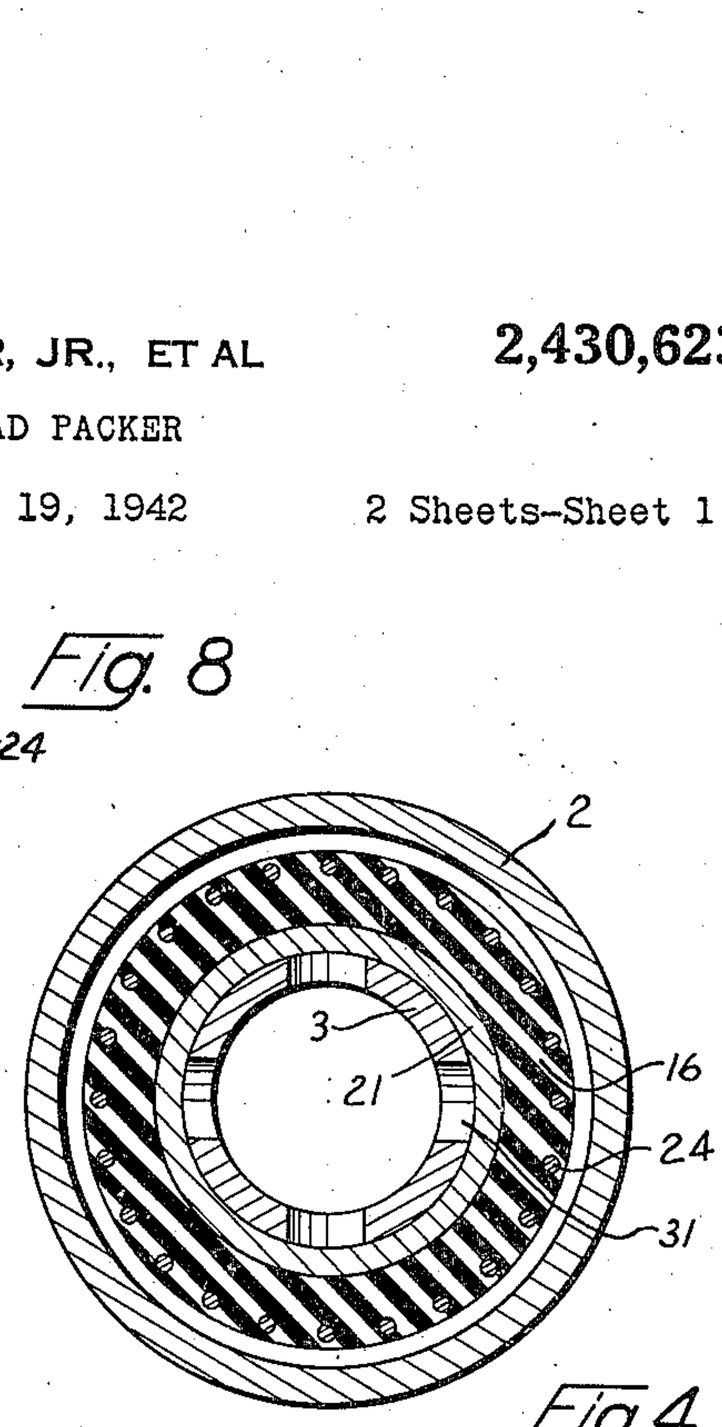

Fig. 8

Fig. 4

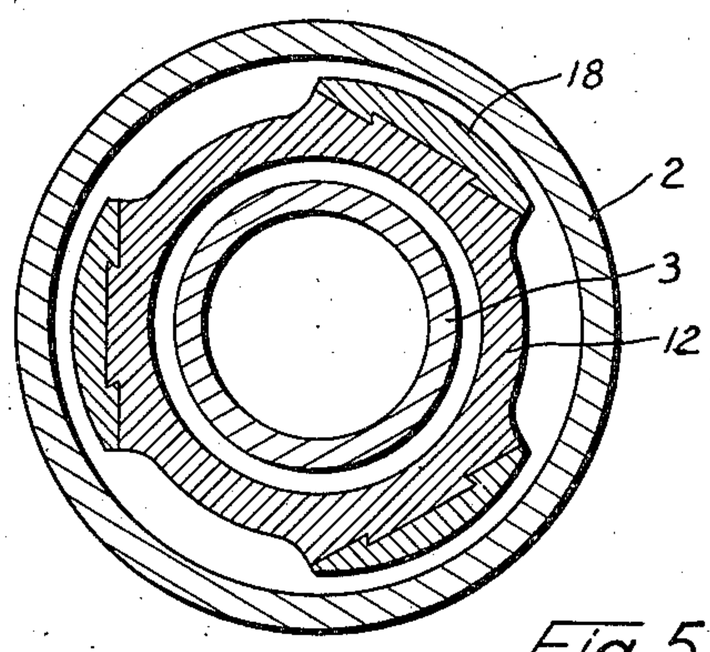

Fig. 5

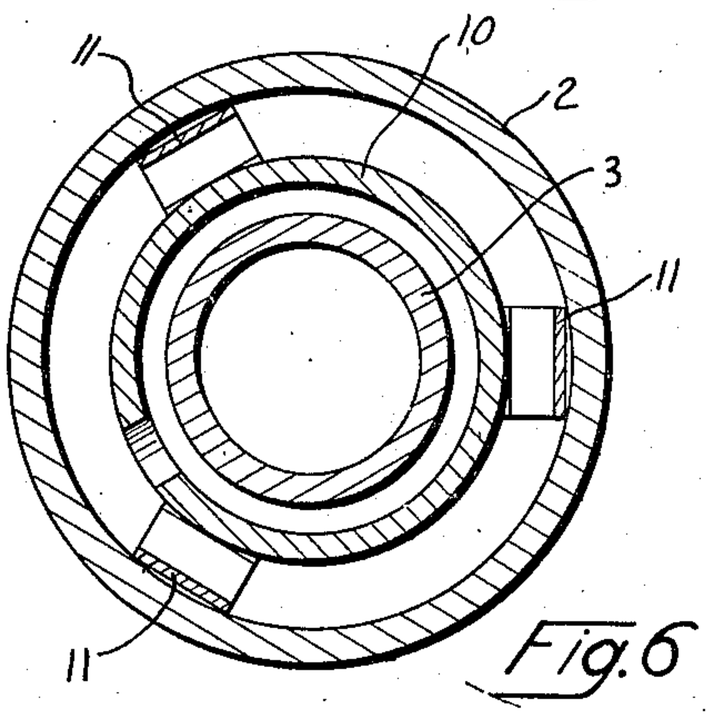

Fig. 6

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CONTROL HEAD PACKER

Filed March 19, 1942 2 Sheets-Sheet 2

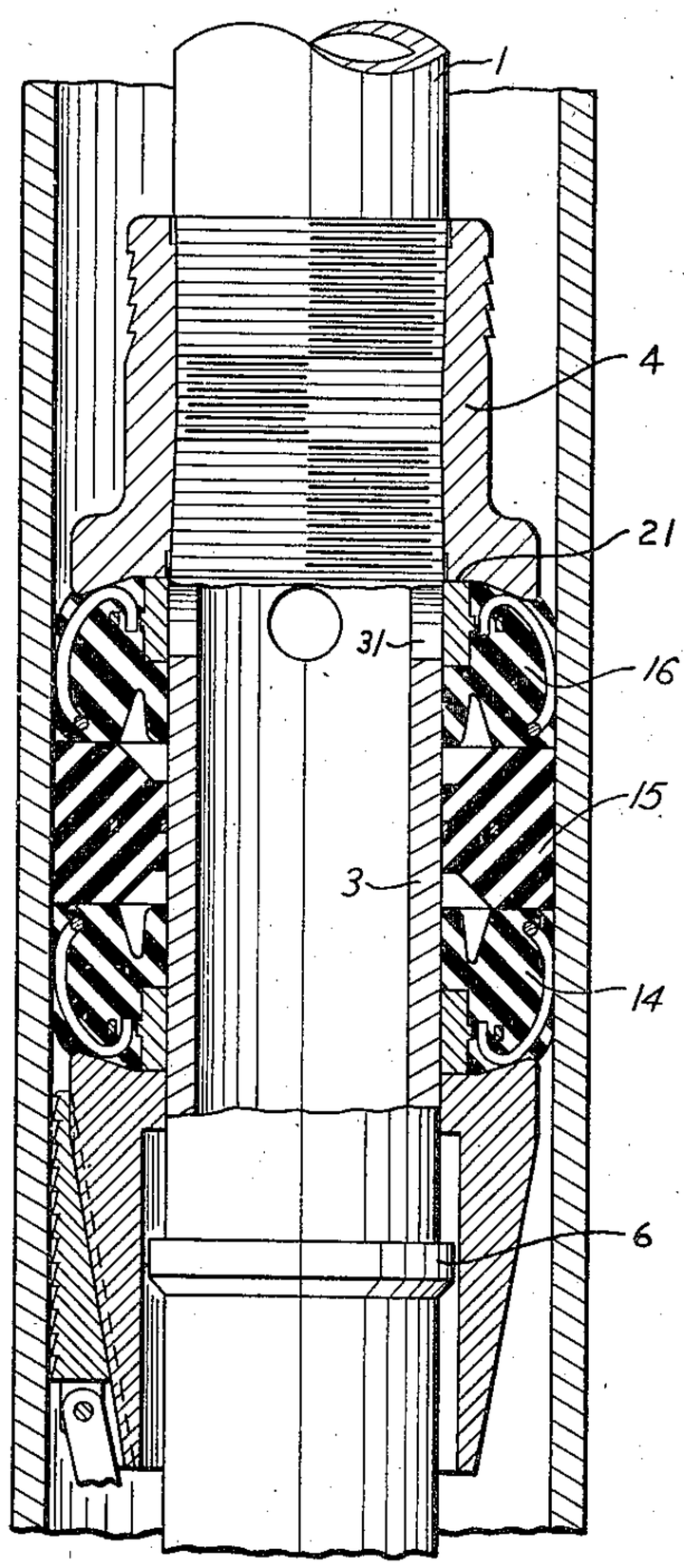

Fig. 2

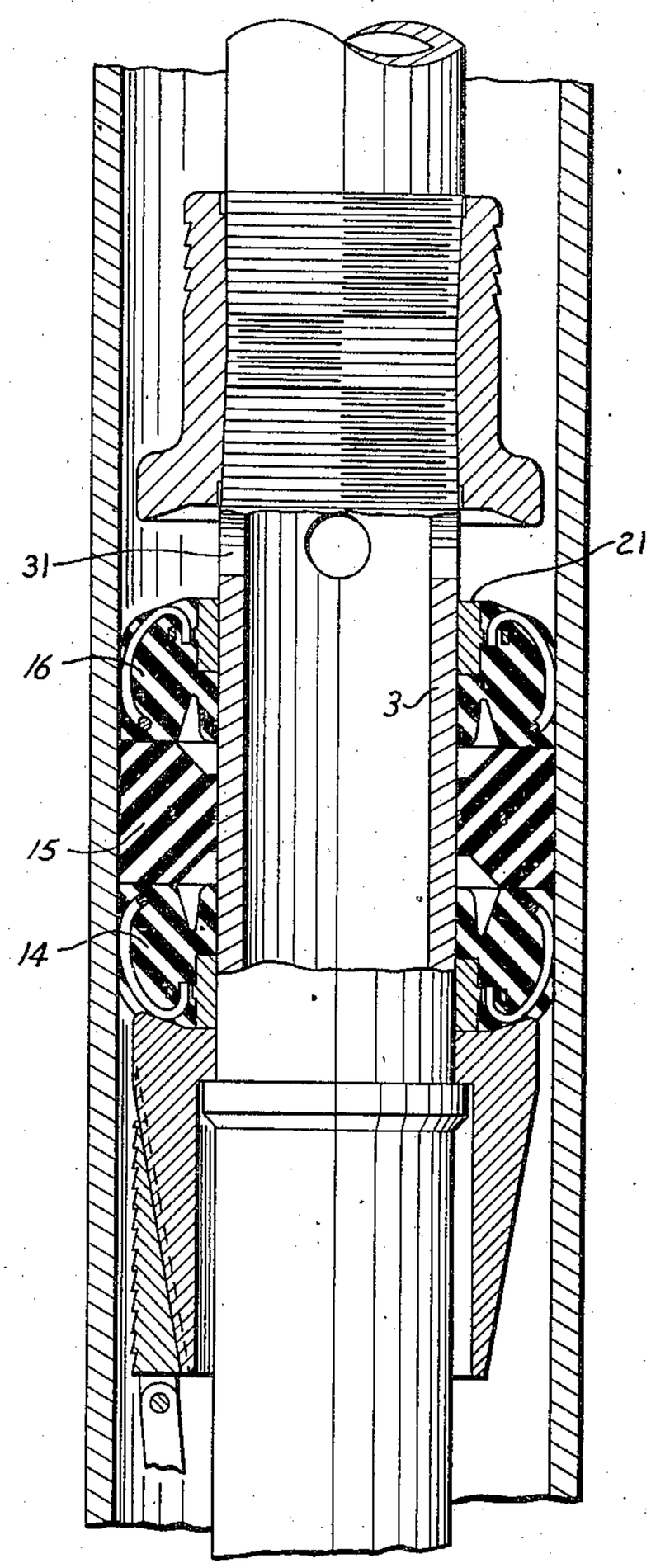

Fig. 3

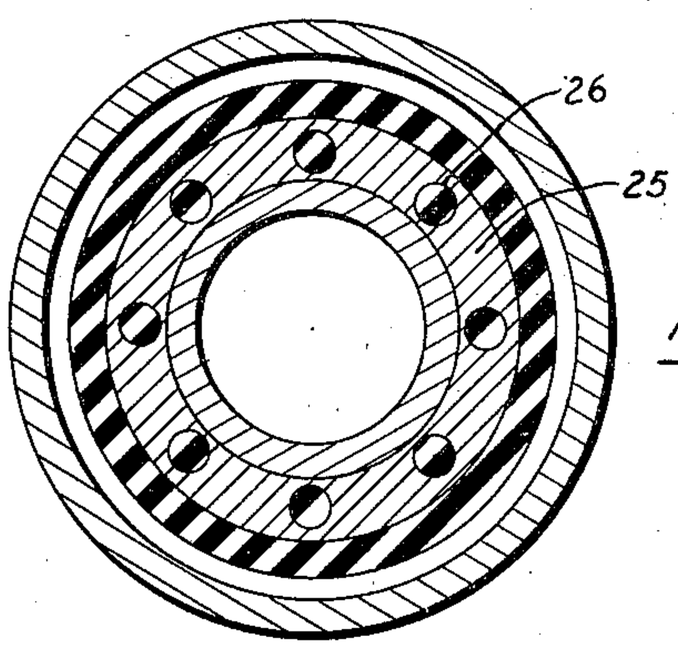

Fig. 7

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CONTROL HEAD PACKER

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8 Claims. (Cl. 166—12)

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This invention relates to a control head packer having a port connecting the interior of the tubing with the exterior thereof, and a packing ring designed to open or close the said port. Another object of the invention is to provide means to prevent the packing ring from flowing into the said port. Still another object of the invention is to provide an improved packer having means to prevent the packing ring from cold flowing.

In packers having no control valve or other means of by-passing the well fluid, the well fluid accumulates above the packer, and it was frequently difficult to recover the packer without ruining it. This, of course, was particularly true when solid rubber packing was used. The greater the weight of the well fluid above the packer, the more tightly the said fluid will tend to keep the packing set. Also, rubber tends to be permanently deformed with the passage of time. When the packer has a great weight imposed upon it and especially when it has been set for a long time, the rubbers are frequently torn when the tubing is pulled, thereby ruining the rubber. It is an object of this invention to overcome the above difficulties.

Another object of the invention is to provide a cup-shaped lower packing to provide a lip which will be forced outwardly against the casing by any well fluid which may expand said lip. The upper packing ring of the packer is provided with an oppositely facing or downwardly extending lip which would be actuated into sealing engagement with the casing by any gas or liquid which tended to pass upwardly by the packer. It is well known that when such lips are used, the sealing engagement increases as the pressures increase, that is, the pressures act within the lip and tend to expand it.

In our improved construction the tubing and the packer are lowered in the casing with the well fluids by-passing between the packer and casing. At any desired point the operator can set the packer, and after it is set and assuming that there is a sufficient weight of fluid above the packer to hold the packer in set position, the operator may open the port leading from the exterior of the tubing to the interior thereof by simply raising the tubing. Of course, the said port will remain closed until the packer is set and will remain closed after it is set, unless we have both the condition that the downwardly extending pressure on the packer is sufficient to maintain it in set position, and that the tubing is raised by an amount sufficient to raise the said port above the upper end of the said packing.

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The invention may be better understood by referring to the attached drawings in which,

Figure 1 is a plan elevational view, partly in cross section, of our improved control head packer, the parts being in the position in which they would be when lowering the tubing in the well,

Figure 2 is a view similar to Figure 1 but showing the parts in set position,

Figure 3 is a view similar to Figure 2 but showing the ports open, the packing in expanded position and the slips retracted from engagement with the casing.

Figures 4, 5, 6 and 7 are cross-sectional views on the lines 4—4, 5—5, 6—6, and 7—7 respectively of Figure 1, and

Figure 8 is a perspective view of one of the reinforcing means in the packing.

In the drawings the tubing 1 is inserted in the casing 2 which extends to a point near the bottom of the well. The tubing 1 is connected to the mandrel 3 by means of a collar 4 provided with a shoulder 5. The mandrel 3 is provided with a recovery collar 6. A collar 7 is secured to the lower end of the mandrel 3, and the tubing 1 extends below the collar 7. The mandrel 3 is also provided with a gudgeon pin 8 which extends within a J-slot 9 in a cage 10 which is provided with the usual friction springs 11, adapted to engage the well casing 2. The cage 10 is positioned above the collar 7.

A slip cone 12 is provided with a shoulder 13 underlying and supporting the lowermost packing 14. Above the packing 14 is an intermediate packing 15, and an upper packing 16 is provided above the intermediate packing 15 and, when the parts are in the position shown in Figures 1 and 2, the upper portion of the packing 16 engages the said shoulder 5 of the collar 4. The slip cone 12 is provided with a shoulder 17 to engage the recovery shoulder 6 and to limit the downward movement of the slip cone while permitting the slip cone to move upwardly relative to the recovery ring 6 or into the position shown in Figure 2. The slip cone 12 is provided with the usual slips 18 which are connected to the cage 10 by means of the reins 19. The slips 18 are provided with the usual teeth 20.

The lower packing 14 has imbedded therein a ring 21 provided with eyes 22 into which are hooked the prongs 23 of the wires 24. It will be noted that these wires are held in the eyes 22, and the lower end of the wires is supported by the shoulder 13 while the mid portion of the wires

extends closely adjacent the outer periphery of the packing 14. It will also be noted that the upper end is bent inwardly and that the entire wires are imbedded in the packing. The wires will, of course, prevent cold flow of the packing.

The upper packing 16 is provided with spring wires 24 and a ring 21 which are identical with the ring and the wires in the packing 14, the only difference being that in the packing 16 the spring wires extend downwardly from the eyes 22; whereas, in the packing 14 they extend upwardly therefrom.

The mid packing 15 is provided with a ring 25, which ring is provided with holes 26. The ring 25 is molded in the packing 15 and the packing material extends through the holes 26 to make a better bond therewith. The ring 25 tends to pull the packing 15 towards the mandrel when the load on the packer is released. The upper packing 16 is provided with a downwardly extending lip 27, and the lower packing is provided with an upwardly extending lip 28. It will be noted that the upper portion of the packing 15 and the lower portion of the packing 16 are hollowed out forming a chamber 29, and the lower portion of the packing 15 and the upper portion of the packing 14 also provide a chamber 30. The lips 27 and 28 effectively seal these chambers against leakage between the said lips and the mandrel 3.

The mandrel 3 is provided with four holes 31. When the parts are in the position shown in Figures 1 and 2, the ring 21 covers these holes 31, but when the parts are in the position shown in Figure 3, the holes 31 communicate with the interior of the mandrel and the space between the tubing and casing above the packer.

In operation the parts are in the position shown in Figure 1 when the packer is being lowered in the casing. As the packer is lowered, the well fluid can pass between the packer and the casing, for there is ample space forming a passageway therefor, as is shown in Figure 1. When the operator has lowered the packer to the position where he desires to set the same, he rotates the tubing 1 and mandrel 3 to the right, as viewed in Figure 1, so as to remove the gudgeon 8 into the long arm of the J-slot 9. He then lowers the tubing so that the gudgeon pin 8 travels downwardly in the slot 9 and the springs 11 hold the cage 10 stationary. The slip cone 12 moves downwardly with the tubing, and the slips 18 are moved outwardly into engagement with the casing. Further downward movement of the tubing and mandrel will cause the recovery shoulder 6 to move away from the shoulder 17 of the slip cone, and the shoulder 5 will compress the packings so that the parts are moved into the position shown in Figure 2, the ports 31 being closed during this entire period of time. When the parts are in the position shown in Figure 2, there might be some tendency for the upper packing to flow into the holes 31, but this is prevented by the ring 21. It will also be noted that the wires 24 prevent the upper packing from flowing upwardly around the shoulder 5 and prevent the lower packing from flowing downwardly by the shoulder 13. When the packer has been set and assuming that there was an excessive downward pressure of well fluid, some of the said well fluid would pass into the chambers 29 and 30 and would tend to expand the outer skirt 32 of the packing ring 14 and the skirt 33 of the packing ring 15 into engagement with the casing and would also tend to move the lip 28 against the mandrel. The greater this downward pressure, the more tightly would be the sealing engagement. Likewise, if there was an excessive upwardly directed pressure of fluid, some of the said fluid would tend to go into the chambers 29 and 30 and would move outwardly the skirt 34 of the packing ring 15 and the skirt 35 of the packing ring 16, pressing these two skirts tightly against the casing, and also pressing the lip 27 inwardly against the mandrel. The higher the pressure thus exerted, the greater would be the sealing effect. If the operator desires to open the ports 31, he can do so by simply raising the tubing and mandrel into the position shown in Figure 3. The pressure of the well fluid on the upper portion of the upper packing 16 will cause the packing to remain in the position shown in Figure 3, but the ports 31 will be moved upwardly beyond the ring 21 so that well fluid could flow downwardly around the shoulder 5 and through the ports 31 into the mandrel and thence down the tubing.

Having now described our invention, we claim:

1. A well packer adapted to be lowered on a well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, resilient packing surrounding said mandrel and being of such a length as to engage both shoulders when the packer is being lowered in the well tubing, means to move the movable shoulder towards the fixed shoulder to set said packing to seal the passageway between the tubing and casing, and means to prevent the cold flow of said packing around one of said shoulders.

2. A well packer adapted to be lowered on a well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, a resilient packing surrounding said mandrel and being of such a length as to engage both shoulders when the packer is being lowered in the well tubing, means to move the movable shoulder towards the fixed shoulder to set said packing to seal the passageway between the tubing and casing, and springs embedded in the packing to prevent the cold flow of said packing around one of said shoulders.

3. A well packer adapted to be lowered on a well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, resilient packing surrounding said mandrel and being of such a length as to engage both shoulders when the packer is being lowered in the well tubing, means to move the movable shoulder towards the fixed shoulder to set said packing to seal the passageway between the tubing and casing, and springs embedded in the packing and supported by one of said shoulders to prevent the cold flow of said packing around the shoulder supporting said springs.

4. A well packer adapted to be lowered on a well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, resilient packing surrounding said mandrel and being of such a length as to engage both shoul-

ders when the packer is being lowered in the well tubing, means to move the movable shoulder towards the fixed shoulder to set said packing to seal the passageway between the tubing and casing, a ring slidably mounted on said mandrel immediately above said movable shoulder, said ring being embedded in the lower portion of the packing, eyes forming a part of said ring, and spring wires embedded in the packing and hinged in said eyes and supported by said movable shoulder and serving as a means to prevent the cold flow of said packing downwardly between the movable shoulder and the casing.

5. A well packer adapted to be lowered on a well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, resilient packing surrounding said mandrel and being of such a length as to engage both shoulders when the packer is being lowered in the well tubing, means to cause a relative movement between the fixed shoulder and the movable shoulder to set said packing to seal the passageway between the tubing and casing, a ring slidably mounted on said mandrel immediately below said fixed shoulder, said ring being embedded in the upper portion of the packing, eyes forming a part of said ring, and spring wires embedded in the packing and hinged in said eyes and supported by said fixed shoulder and serving as a means to prevent the cold flow of said packing upwardly between the fixed shoulder and the casing.

6. A well packer adapted to be lowered on a well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, resilient packing surrounding said mandrel and being of such a length as to engage both shoulders when the packer is being lowered in the well tubing, means to move the movable shoulder towards the fixed shoulder to set said packing to seal the passageway between the tubing and casing, means to prevent the cold flow of said packing downwardly between the movable shoulder and the casing, and means to prevent the cold flow of said packing upwardly between the fixed shoulder and the casing.

7. A well packer adapted to be lowered on a

well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, resilient packing surrounding said mandrel and being of such a length as to engage both shoulders when the packer is being lowered in the well tubing, means to move the movable shoulder towards the fixed shoulder to set said packing to seal the passageway between the tubing and casing, said packing being provided with an internal pocket and a lip projecting into said pocket and contacting said mandrel to prevent the passage of fluid between the mandrel and packing.

8. A well packer adapted to be lowered on a well tubing into a well casing including a mandrel on said tubing, a fixed shoulder on said mandrel, there being a drainage port through said mandrel below the fixed shoulder, a movable shoulder movable relative to said mandrel, means to limit the movement of the movable shoulder away from the fixed shoulder, a resilient packing surrounding said mandrel and being of such a length as to extend over said drainage port and to engage both shoulders when the packer is being lowered in the well tubing, means to move the movable shoulder towards the fixed shoulder to set said packer to seal the passageway between the tubing and casing, means to prevent the cold flow of said packing around one of said shoulders, said port being opened by raising said mandrel a definite extent after the packing is set, provided there is a sufficient weight of fluid above the packing to maintain the packing in set position.

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