Feb. 19, 1957 R. C. RUMBLE 2,781,852

WELL PACKER

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FIG. 1.

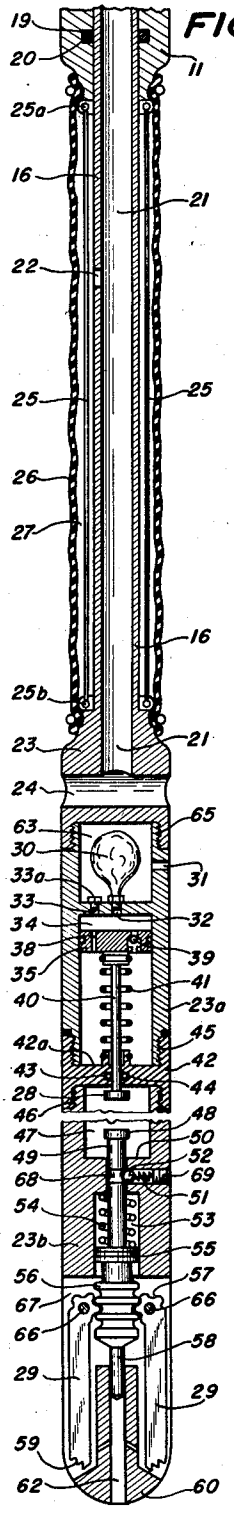


FIG. 3.

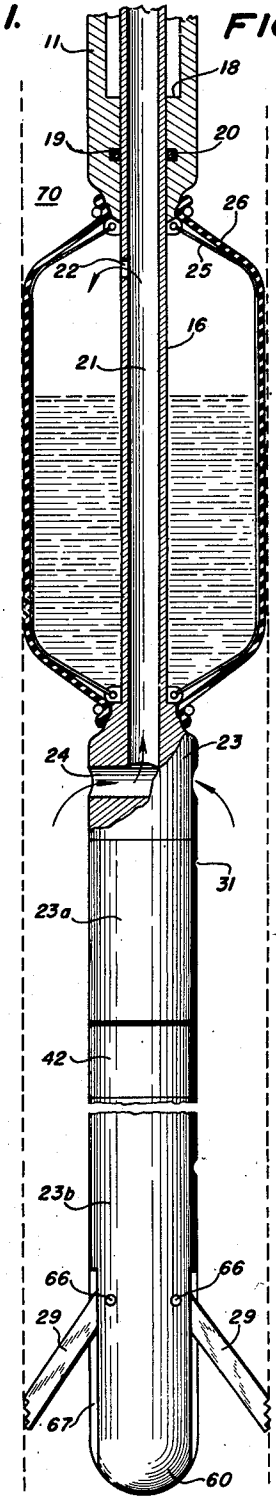


FIG. 4.

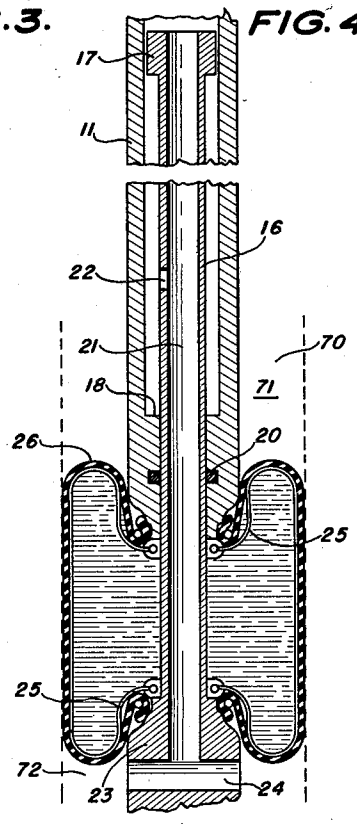
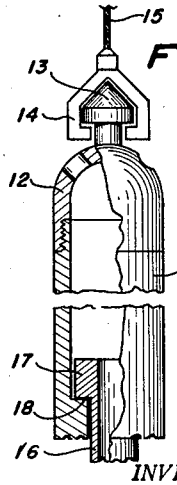


FIG. 2.



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WELL PACKER

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7 Claims. (Cl. 166—120)

The present invention is directed to a well packer suitable for use in well bores in subsurface earth formations. More particularly, the invention is directed to a well packer which will effectively seal against the well bore under low pressures. In its more specific aspects, the invention is directed to a well packer provided with a deformable packing member for use in well flow meters.

The present invention may be briefly described as a well packer which comprises, in combination, a mandrel provided with a central or longitudinal passageway having a port fluidly communicating the passageway with an exterior surface of the mandrel intermediate upper and lower ends of the mandrel. A body member is attached to the lower end of the mandrel and the body member is provided with a fluid entry port which communicates with the passageway. The body member is provided with engaging means for engaging the packer with the wall of the well. The mandrel is provided on its upper end with an external shoulder which rests upon an internal shoulder of a slidable sleeve mounted on the upper end of the mandrel above the port on the mandrel. Spring members are attached to the lower end of the slidable sleeve and to the upper end of the body member; surrounding the spring members is a deformable packing member attached at its upper end to the lower end of the slidable sleeve and by its lower end to the upper end of the body member. The deformable packing member encloses a space in communication with the port on the mandrel communicating with the passageway. The well packer is provided with means for inflating the deformable member to engage with the wall of the well and moving the slidable sleeve on the mandrel toward the body member to compress the spring members.

The packer of the present invention may suitably be used in oil wells to isolate a lower zone from an upper zone and to direct the flow of fluids through a selected route or channel. The invention has wide utility in well bores; thus by means of my invention it is possible to direct the flow from a lower section to an upper section of the well or vice versa, so that the rate of flow may be measured.

The invention will be further illustrated by reference to the drawing in which

Figs. 1 and 2 comprise a sectional view of the apparatus on lowering into a well bore;

Fig. 3 shows a view of the apparatus of Fig. 1 with the deformable packing member in partial expanded position; and

Fig. 4 is a sectional view of the packing member in completely expanded position effecting a seal.

Referring now to the drawing, numeral **11** designates a movable member or a slidable sleeve provided on an upper end thereof with a cage **12** to which is attached a fishing spear **13** shown suspended by an engaging means **14** from a wire line **15**, the spear **13** being releasably connected to the engaging means **14** and wire line **15**. The movable member or sleeve **11** is mounted on a mandrel **16** on an upper end of which is provided an external shoulder

17 which is designed to rest on an internal shoulder **18** of the slidable sleeve **11**. The sleeve **11** is provided with the recess **19** in which is arranged a packing member, such as an O-ring **20**, which makes a seal between the mandrel **16** and the member **11**.

The mandrel **16** has a central or longitudinal passageway **21** and is provided with a fluid port **22** which communicates the central passageway **21** with an external surface of the mandrel **16**. The mandrel **16** is connected to or made an integral part of the body member **23** which is provided with a fluid entry port **24** which communicates with passageway **21**. The lower end of the slidable sleeve **11** is connected by hinges **25***a* to a plurality of horizontally spaced apart spring members **25** which may be, for example, six in number spaced at intervals about the mandrel **16**. The spring members **25** connect on their lower end with the upper end of the body member **23** by hinges **25***b*.

Surrounding the spring members **25** and connected to the lower end of the sleeve **11** and the upper end of the body member **23** is a deformable packing member **26** which encloses a space **27** in communication through port **22** with the central passageway **21**.

The lower end of the body member **23** attaches by means of threads **65** with a dashpot release mechanism generally indicated by numeral **23***a*. Housing section **23***b* is similar to **23***a* to which it is joined by coupling member **42**. Housed in section **23***b* is an engaging means **29** for anchoring or latching the packing assembly against the wall of the well bore.

The dashpot release assembly **23***a* comprises a chamber **63** in which is mounted a pressure equalizing means **30** which may suitably be a bladder element or diaphragm which is in fluid communication through a port **31** with the well fluids. The interior of the bladder element **30** communicates by passageway **32** with a chamber **34** in the dashpot assembly **23***a* in which is arranged a piston **35** provided with port **38** and check valve **39**. Chamber **34** is equipped with filler port **33** and sealing plug **33***a*. Connected to the piston **35** is a longitudinal member **40** which extends through a wall member **42***a* and terminates in a button **28**. Wall member **42** engages housing **23***a* by means of threads **45**. The member **40** is suitably sealed against entry of fluids through the wall member **42***a* by means of an O-ring **43** arranged in a recess **44** in the wall member **42***a*.

The piston member **35** is urged in a downward direction by a biasing means, such as a helical coil tension spring **41**, which urges the piston **35** downwardly in the chamber **34**.

Protruding into a chamber **47** through a wall member **50** is an extension member **49** provided with an actuating button or member **48** which is arranged in operative relationship with actuating button or member **28** of the extension member **40**. The extension member **49** is connected to a spring retaining washer **55** arranged in a chamber **53** in body member **23***b*. The washer member **55** is normally urged in a downward direction by a biasing means, such as a helical coil spring **54** which is in contact with the upper end of chamber **53** and the washer **55**. The washer **55** is in operative relationship or may be connected to a rack member **56** provided with a guide member **58** which is designed to move in a channel **62** in the lower end **60** of body member **23***b*. A plurality of spaced apart setting dogs **29**, which may be three in number, are pivotally connected by means of pins **66** to the body member **23***b*. Body member **23***b* engages wall member **42***a* by means of threads **46**. The setting dogs **29** are provided with gripping or engaging means **59** for engaging the wall of the well bore and are normally arranged in a recess **67** of the body member **23***b*. The teeth

members 57 of the setting dogs engage with the rack 56 as shown.

The extension member 49 has a recessed portion 68 to receive a latching sphere or detent 52 which is biased or urged into the recess 68 by means of a biasing means, such as a spring 51, arranged in the recess 69. The biased sphere 52 serves to hold the extension member 49 in a latched position when the setting dogs 29 are inoperative.

The dashpot assembly 23*a* is made operative by filling it with a hydraulic fluid such as a silicone fluid and the like having a viscosity of about 45,000 SSU at 100° F. The fluid is introduced through port 33 fitted with closing plug 33*a* so as to displace all the air in pressure equalizing means 30 and chamber 34 in which moves piston 35.

Prior to lowering the device in the well, the instrument would be opened between wall member 42*a* and body member 23*b* by disengaging threads 46. In member 23*b* button 48 would be retracted until rod 49 was held by spherical means 52 resting in groove 68 of rod 49. The dashpot would be cocked by depressing button 28 to force piston 35 upward so that the hydraulic fluid would flow downward through port 38 and check valve 39 in piston 35. The exact time would be noted after button 28 had been forced inward to contact wall member 42 and was released. The instrument would be immediately reassembled by engaging threads 46 and would be lowered on the wire line 15, as shown in Figures 1 and 2 to the desired depth in a well such as 70 shown in Figure 3.

During the lowering of the instrument into the well and subsequently until a definite time interval after cocking the dashpot has transpired, the piston 35 in chamber 34 moves downward urged by biasing means 41 as hydraulic fluid flows upward through port 38 but not through check valve 39. During the downward movement of piston 35, button 28 approaches and contacts button 48 and forces it downward. This moves groove 68 away from ball 52 so that rack 56 is forced downward being urged by spring 54 so as to cause dogs 29 to swing outward to engage the wall of well 70. This prevents further lowering in the well of the body members 16, 23, 23*a*, and 23*b* comprising the rigid lower portion of the instrument.

Slackening off slowly on supporting line 15 causes member 11 to move downward with reference to mandrel 16 and body member 23 supported in the well bore by dogs 29. This movement of member 11 with respect to member 23 places leaf springs 25 under a compressional force so that they bow outward against form 26 to cause well fluids to enter through port 22 until member 11, springs 25, and form 26 assume the position shown in Figure 3.

Further slackening off on wire line causes O-ring 20 in member 11 to move downward past port 22 and trap the fluid under bellows or diaphragm 26 so that as member 11 continues to move downward toward and into contact with member 23 the entrapped fluid will be compressed to stretch bellows member 26 and force it into sealing contact with the walls of well 70 as shown in Figure 4. In this manner, a tight seal is effected isolating the upper portion 71 from lower portion 72 of well 70.

When it is desired to change the position of the packing assembly of the present invention or remove it from the well 70, the movable sleeve 11 may be raised by taking up slack on the wire line 15. The fluid in the space 27 then escapes through the port 22 which would be uncovered by the sleeve 11 forcing the fluid through the central passageway 21 and outward through port 24 into the well.

The dogs drag the bore hole wall as the instrument is raised to a higher level. The instrument may be reset at any higher level by slackening off on the line at the desired level. The latching dogs 29 are forced back into the recess 67 when the instrument enters the tubing.

The device of the present invention is particularly suitable for use as a wire line tool which may be lowered through a tubing or pipe string and the like, the outer diameter of the body member 23 being suitably sized to allow free passageway through a tubing even though the well be flowing. Of course the sleeve 11 would also be of a diameter no greater than the diameter of the body member 23.

The spring members 25 are suitably connected to the sleeve 11 and the body member 23 such as by hinging the spring members thereto. These spring members may be flat leaf springs of suitable construction to bow outwardly against the deformable member 26 prior to entry of fluid into the space 27.

The bladder member 30 should be suitably sized with respect to the working area of the cylinder chamber 34 to allow for temperature expansion of the hydraulic fluid in the dashpot.

Although I have illustrated my invention by a particular dashpot release mechanism, it is to be understood that other dashpot release assemblies may be used. Also while I have illustrated the invention by latching dogs, other engaging means may be used to engage with the wall of the well and to anchor the apparatus.

It is desirable that the deformable packing member be pre-formed to approximate the diameter of the well bore or hole into which the instrument is to be run. This allows pressure to be exerted to seal the hole.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

1. A well packer which comprises, in combination, a mandrel provided with a longitudinal passageway for flow of fluids therethrough and having a port fluidly communicating said passageway with an exterior surface of the mandrel, a body member attached to the mandrel, a slidable member mounted on the mandrel, a plurality of circumferentially spaced apart spring members attached to said slidable member and to said body member, and a deformable packing member attached to said slidable member and to said body member surrounding said spring members and enclosing a space in communication with the port on the mandrel communicating with the passageway whereby movement of said slidable member toward the body member expands said spring members laterally thereby to permit well fluids to enter filling said space through said port, and further movement of said slidable member past said port toward said body member entraps said well fluid in said space and expands the deformable packing member against the wall of the well.

2. A well packer which comprises, in combination, a mandrel provided with a longitudinal passageway for flow of fluids therethrough and having a port fluidly communicating said passageway with an exterior surface of the mandrel, a body member attached to the mandrel, movable means arranged on said body member for engaging with the wall of the well, means operatively connected to said well wall engaging means adapted to move said well wall engaging means into engagement with said well wall, a slidable member releasably mounted on the mandrel, a plurality of circumferentially spaced apart spring members attached to said slidable member and to said body member, a deformable packing member attached to said slidable member and to said body member surrounding said spring members and enclosing a space in communication with the port on the mandrel communicating with the passageway whereby movement of said slidable member toward the body member expands said spring members laterally thereby to permit well fluids to enter filling said space through said port and further movement of said slidable member past said port toward said body member entraps said well fluid in said space

and expands the deformable packing member against the wall of the well.

3. A well packer which comprises, in combination, a mandrel provided with a longitudinal passageway for flow of fluids therethrough and having a port fluidly communicating said passageway with an exterior surface of the mandrel, a body member attached to the mandrel and provided with a fluid entry port communicating with said passageway, movable means arranged on said body member for engaging with the wall of the well, delayed action means operatively connected to said wall engaging means adapted to move said wall engaging means into engagement with said well wall, a slidable member mounted on the mandrel above the port on the mandrel, a plurality of circumferentially spaced apart spring members attached to said slidable member and to said body member, a deformable packing member attached to said slidable member and to said body member and surrounding said spring members and enclosing a space in communication with the port on the mandrel communicating with the passageway whereby movement of said slidable member toward the body member expands said spring members laterally thereby to permit well fluids to enter filling said space through said port and further movement of said slidable member toward said body member entraps said well fluids in said space and expands the deformable packing member against the wall of the well, and means for lowering and raising said slidable member.

4. A well packer in accordance with claim 3 in which the wall engaging means comprises at least a dog and means for urging said dog into contact with the wall of the well.

5. A well packer which comprises, in combination, a mandrel provided with a longitudinal passageway for flow of fluids therethrough and having a port fluidly communicating said passageway with an exterior surface of the mandrel, a body member attached to the mandrel and provided with a fluid entry port communicating with said passageway, means arranged on said body member for engaging with the wall of the well comprising a plurality of dogs and a dashpot assembly provided with a piston operatively connected to said dogs for urging said dogs into contact with the wall of the well, a slidable member mounted on the mandrel, a plurality of circumferentially spaced apart spring members attached to said slidable sleeve and to said body member, a deformable packing member attached to said slidable member and to said body member and surrounding said spring members and enclosing a space in communication with the port on the mandrel communicating with the passageway

whereby movement of said slidable member toward the body member expands said spring members laterally thereby to permit well fluids to enter filling said space through said port and further movement of said slidable member toward said body member entraps said well fluid in said space and expands the deformable packing member against the wall of the well, and means for lowering and raising said slidable member.

6. A well packer which comprises, in combination, a mandrel provided with a longitudinal passageway for flow of fluids therethrough and having a port fluidly communicating said passageway with an exterior surface of the mandrel, a body member attached to the first end of the mandrel and provided with a fluid port communicating with said passageway, means arranged on said body member for engaging with the wall of the well comprising a plurality of dogs and a dashpot assembly provided with a piston operatively connected to said dogs for urging said dogs into contact with the walls of the well, a slidable sleeve mounted on the mandrel and having an internal shoulder arranged adjacent an end thereof and being provided with a releasable connecting means on said end, said mandrel having an external shoulder on an end thereof engageable with said internal shoulder of the slidable sleeve, a plurality of circumferentially spaced apart spring members attached to said slidable sleeve and to said body member, a deformable packing member attached to said slidable sleeve and to said body member and surrounding said spring members and enclosing a space in communication with the port on the mandrel whereby movement of said slidable sleeve toward the body member expands said spring members laterally to permit said well fluids to enter filling said space through said port and further movement of said slidable sleeve closes said port and entraps said well fluid in said space, expanding the deformable packing member against the wall of the well, and means attached to said releasable connecting means for raising and lowering said slidable sleeve.

7. A well packer in accordance with claim 6 in which the releasable connecting means is a fishing spear.

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