Dec. 9, 1941. S. W. LONG 2,265,660

SWABBING VALVE

Filed Sept. 6, 1939 3 Sheets-Sheet 1

Fig. 1.

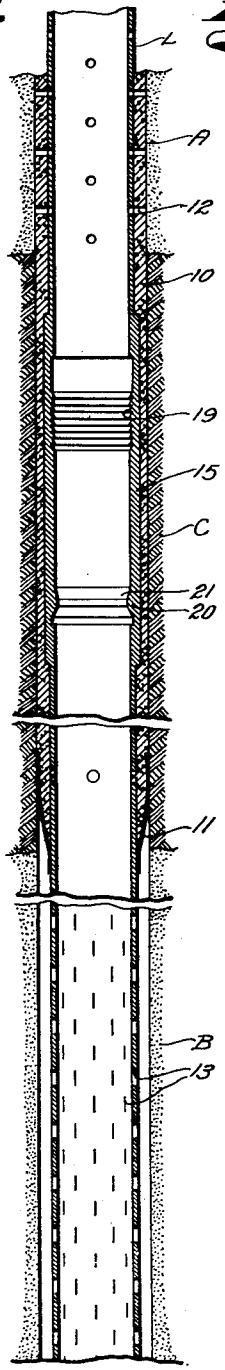


Fig. 2.

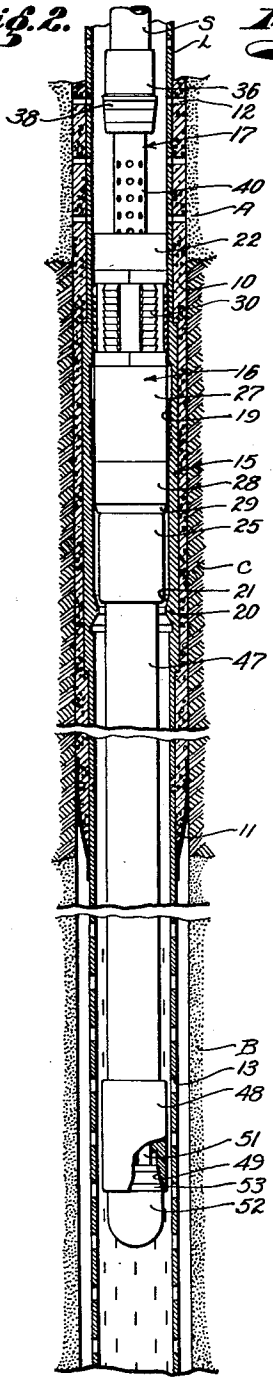
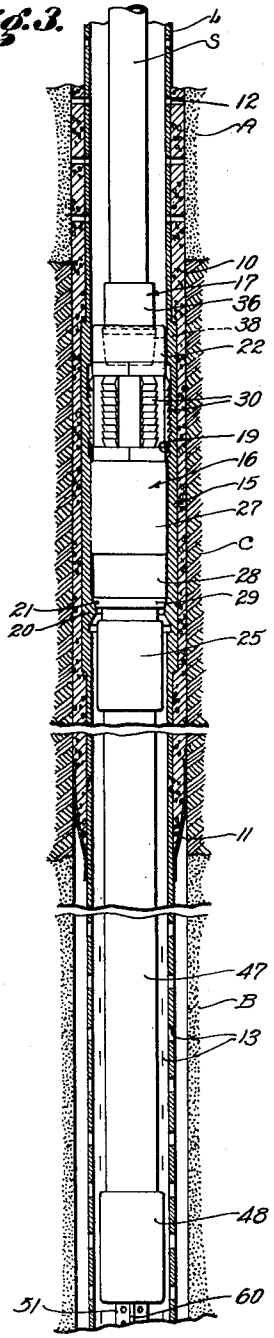


Fig. 3.



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Fig. 4.

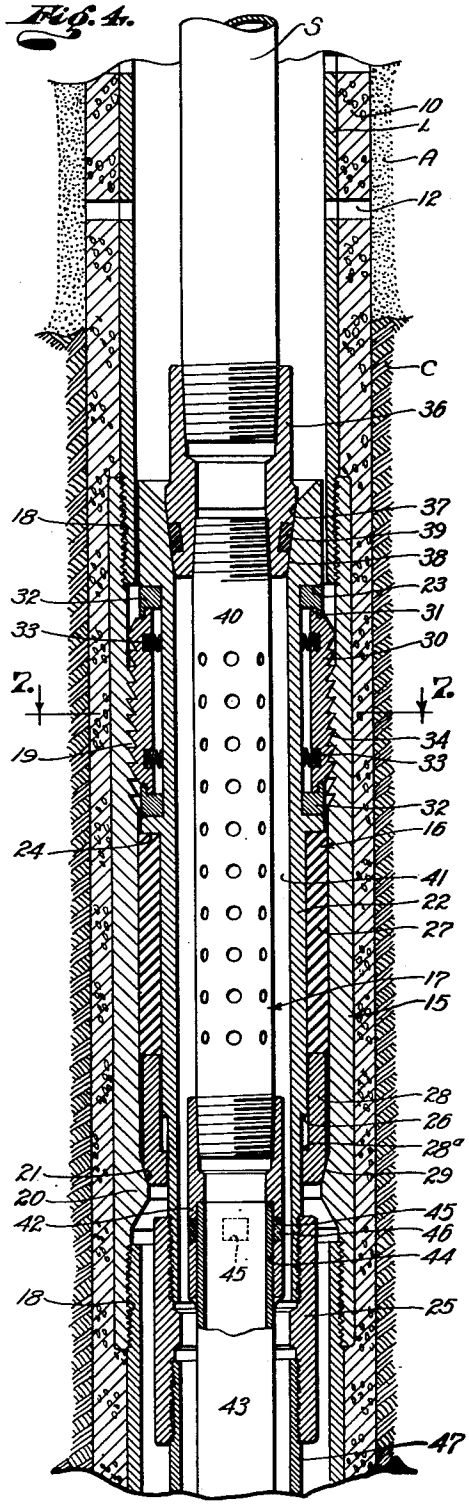
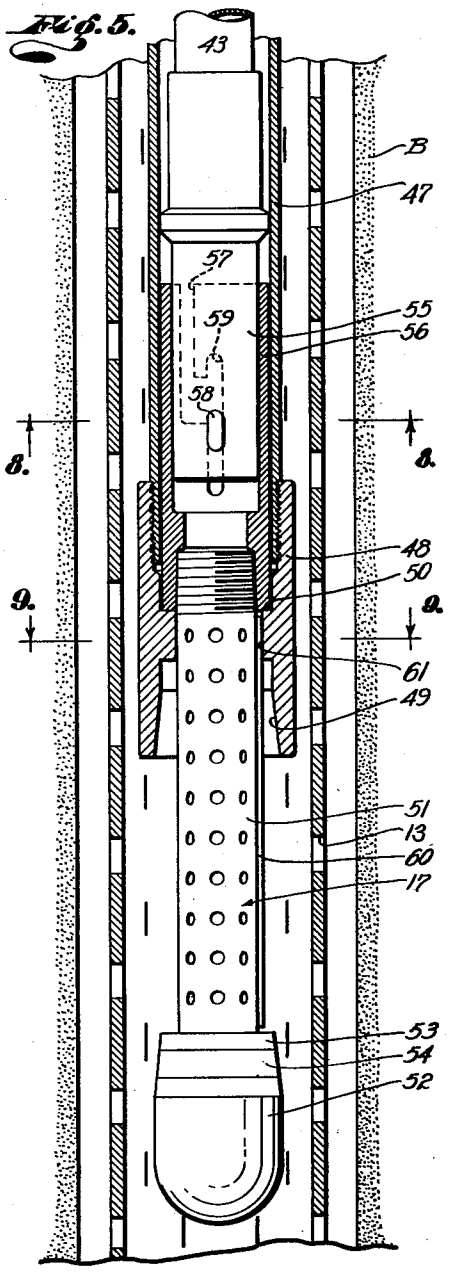


Fig. 5.



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Fig. 6.

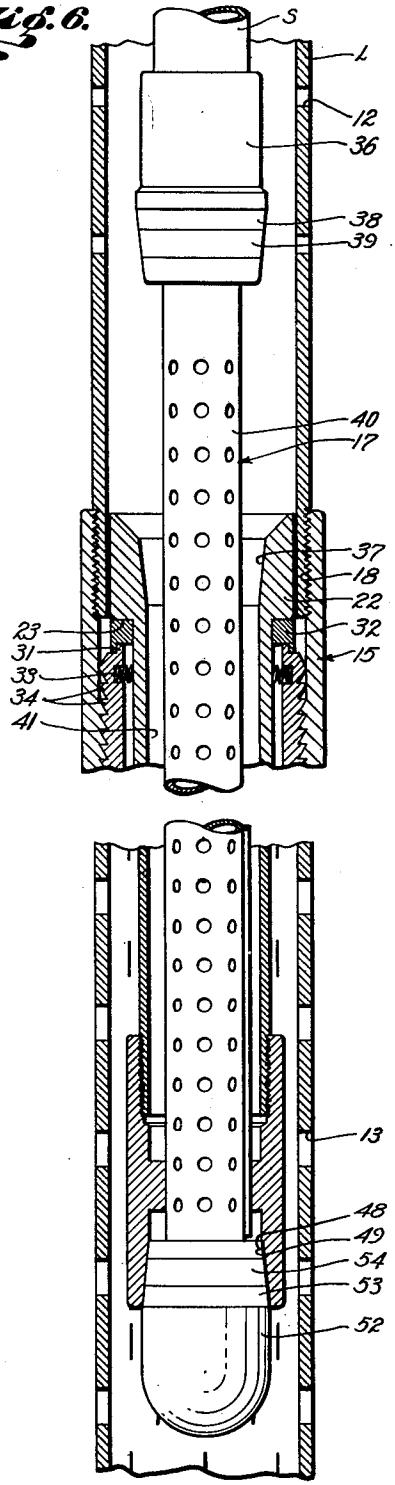


Fig. 7.

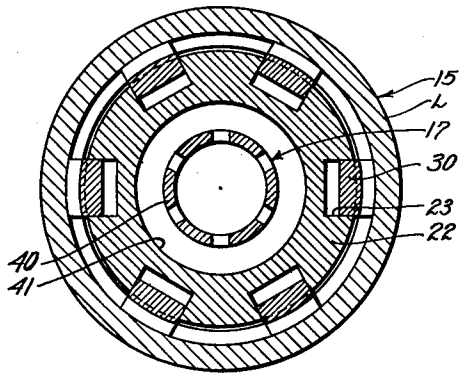


Fig. 8.

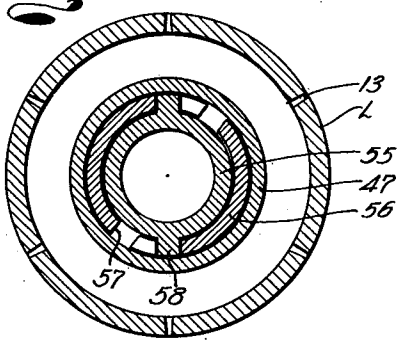
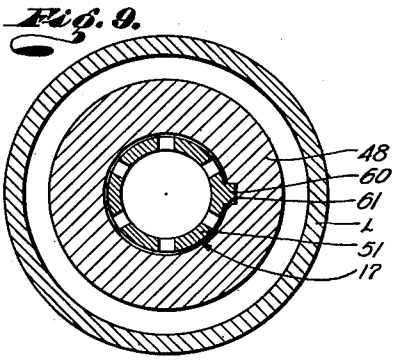


Fig. 9.



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UNITED STATES PATENT OFFICE

2,265,660

SWABBING VALVE

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Application September 6, 1939, Serial No. 293,592

14 Claims. (Cl. 166—1)

This invention relates to well equipment and relates more particularly to a device or valve useful in producing from a multiple zone well. A general object of the invention is to provide an effective, dependable swabbing valve that is easily and quickly installed and readily controlled.

In deep wells such as oil and gas wells the bore often penetrates two or more productive zones. Such wells are termed multiple zone wells. When producing from multiple zone wells it is highly desirable to maintain the productive zones separated or out of communication when the production or flow is swabbed in, and it is usually preferred to separately or independently produce from the spaced zones after production has been initiated.

An object of this invention is to provide a valve means for use in connection with the production string of a multiple zone well that permits the independent swabbing in or the establishment of flow from the spaced productive zones of the well.

Another object of this invention is to provide a device of the character mentioned that provides for the independent production of fluid from spaced productive zones through separate and distinct fluid conductors or, if desired, for the production of the fluid from two or more spaced zones through a single selected conductor or well tubing. The device of the present invention is such that one zone may be produced through the production tubing while the other zone is produced through the annulus between the tubing and well casing, or, if desired, both zones may be produced together through either the tubing or the said annulus.

Another object of this invention is to provide a device of the character mentioned that permits the running of a pressure bomb or other instrument to within a few feet of the bottom of the well. The valve device of the present invention does not obstruct or close off the production tubing and tools and instruments of various natures may be run through the tubing, as required.

Another object of this invention is to provide a swabbing valve of the character mentioned that may be run into the well with the production tubing and set, and fully governed by means of the production string, making it unnecessary to employ a separate running-in string or to employ a cable, or the like, for its control.

Another object of this invention is to provide a swabbing valve of the character mentioned that embodies a releasable connection allowing the production string to be readily withdrawn from the well as the occasion arises, and embodying a drillable anchoring means that may be drilled up following the withdrawal of the production tubing to free the remaining parts of the valve device for easy engagement and withdrawal by a suitable fishing tool.

Another object of this invention is to provide a swabbing valve of the character mentioned that embodies a novel anchoring means and packing means.

A further object of this invention is to provide a production valve or swabbing valve of the character referred to that may be fully controlled and operated by simple manipulations of the production string while the string remains in position in the well.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a vertical sectional view of a portion of a well showing a liner and the valve seat of the invention cemented therein. Fig. 2 is a view similar to Fig. 1 showing the packing means entering the valve seat. Fig. 3 is a view similar to Fig. 2 showing the packing means anchored in the seat and the valve parts finally set in the liner. Fig. 4 is an enlarged fragmentary vertical detailed sectional view of the upper portion of the valve device positioned in the well with the upper valve part closed, showing the upper valve nipple in elevation. Fig. 5 is an enlarged fragmentary vertical detailed sectional view of the lower portion of the valve device in position in the well with the lower valve part open and showing the lower valve nipple and other parts in elevation. Fig. 6 is an enlarged vertical detailed sectional view of the device showing the lower valve part closed. Fig. 7 is an enlarged horizontal detailed sectional view taken as indicated by line 7—7 on Fig. 4 and Figs. 8 and 9 are enlarged horizontal detailed sectional views taken as indicated by lines 8—8 and 9—9, respectively, on Fig. 5.

The equipment or swabbing valve of the present invention may be employed under varying circumstances and may be used with equipment of different types. In the drawings I have illustrated a typical form of the invention used in connection with a set well liner L and a typical production string S. The liner L, as illustrated, is arranged in the lower portion of a well to

pass through two spaced productive zones A and B. The portion of the liner L in the upper production zone A and in the intermediate non-productive zone C, is set in a body of cement 10. The liner L may be provided with a suitable cement basket 11 or other appropriate means for confining the cement 10 to the zones A and C during the cementing operation. The cement 10 and the liner L have been perforated at the upper productive zone A by a gun perforator, or the like, to have perforations 12 for admitting the fluid from the zone A into the liner L. The cementing operations and the perforating operations referred to are well known to those skilled in the art. The portion of the liner L entering the production zone B is provided with the usual perforations 13 for admitting the fluid into the liner. The liner L is, of course, made up of any required number of lengths or sections connected by suitable couplings. Figs. 1, 2 and 3 of the drawings are more or less diagrammatic and do not include the liner couplings, etc.

The improved swabbing valve of this invention may be said to comprise, generally, a seat 15 connected in the liner L, a packer unit 16 adapted to be anchored in the seat 15 and a valve assembly 17 connected with the production string S and cooperable with the unit 16 to allow either productive zone A or B to flow independently through the string S, as desired.

The seat 15 is a tubular element to be connected in the liner L at the time of assembling of the liner. In practice the seat 15 may be in the nature of a one-piece collar or coupling having internal threads 18 at its opposite ends for connection with the sections of the liner L. The location of the non-productive zone C is determined by coring operations, or the like, prior to the assembling of the liner L and the seat 15 is connected in the liner L to occupy a position in the portion of the well penetrating the non-productive zone C when the liner is finally set. The seat 15 may have a plain cylindrical exterior. The interior of the seat 15 is provided with a series of annular ridges or wickers 19. The upper sides of the wickers 19 slope downwardly and inwardly while the lower sides of the wickers are substantially flat and horizontal. The interior of the seat 15 is further provided with a restriction 20 whose upper side forms an upwardly and inwardly facing annular shoulder 21. The shoulder 21 is spaced a considerable distance below the wickers 19.

The packer unit 16 is provided to engage and lock in the seat 15 and carries or provides certain elements of the valve means 17 as will be subsequently described. As illustrated, the packer unit 16 includes a tubular body 22 formed of drillable material such as aluminum, an aluminum alloy, cast iron, or the like, so that it may be drilled up by drilling tools operated in the well. The body 22 is proportioned to readily pass through the well casing and to freely enter the liner L. The upper portion of the body 22 is provided with a plurality of circumferentially spaced vertical grooves 23. The body 22 is reduced in external diameter below the grooves 23 to have a downwardly facing annular shoulder 24. A collar 25 is threaded on the lower end of the body 22 to facilitate connection with a part of the valve means 17, as will be later described. An external annular downwardly facing shoulder 26 is provided on the body 22 above the collar 25.

The packer unit 16 further includes packing 27. The packing 27 may be an annular or tubular body of synthetic rubber, or the like, that is unaffected by the fluids in the well. The packing 27 surrounds the body 22 below the shoulder 24. A shiftable sleeve 28 is arranged around the body 22 below the packing 27. The upper end of the sleeve 28 is engageable with the lower end of the packing 27. An inclined surface 29 is provided on the lower portion of the sleeve 28 and is adapted to seat on the shoulder 21 in the seat 15. The sleeve 28 is formed of steel or other material that will not readily drill up by drilling tools operated in the well. An annular upwardly facing shoulder 28a is formed in the sleeve 28 to oppose the shoulder 26.

The packer unit 16 further includes dogs 30 arranged in the vertical grooves 23. Reduced tongues 31 are provided on the opposite ends of the dogs 30 and split rings 32 are welded or otherwise secured in the end portions of the grooves 23 to be engaged by the tongues 31 to limit the outward movement of the dogs 30. The split rings 32 are inserted and welded in place following the insertion of the dogs 30. The dogs 30 are urged outwardly by coiled springs 33 arranged under compression between the bottoms of the grooves 23 and the inner sides of the dogs 30. The inner sides of the dogs 30 may be recessed or bored out to partially receive the springs 33. Teeth 34 are provided on the outer sides of the dogs 30 to cooperate with the wickers 19. The teeth 34 have substantially flat or horizontal upper faces and sloping lower sides. The dogs 30 and the split rings 32 are constructed of cast iron, an aluminum alloy, or the like, so that they may be drilled up while the packer unit 16 is in the well.

The springs 33 urge the dogs 30 outwardly and the outer sides of the dogs or the teeth 34 ride down the internal wall of the liner L when the valve device is lowered to position. The teeth 34 are formed and proportioned to mate with the wickers 19 and when the dogs 30 enter the upper portion of the seat 15 the dog teeth 34 come into mating cooperation with the wickers 19. The engagement of the teeth 34 with the wickers 19 positively prevents upward movement of the packer unit 16 and the parts connected therewith. As best illustrated in Fig. 4 of the drawings the engagement of the teeth 34 with the wickers 19 is such that the teeth may ratchet downwardly on the wickers when the packer unit 16 is lowered or advanced into the seat 15. With the teeth 34 in cooperation with the wickers 19 the packer unit 16 is dependably anchored against upward movement and pressures acting upwardly on the sleeve 28 compress the packing 27 so that the packing effectively seals with the interior of the seat 15.

The valve means or valve assembly 17 includes a structure extending longitudinally through the packer unit 16 and includes elements associated with the packer unit. The means 17 includes a valve part 36 connected with the lower end of the tubing or production string S. As illustrated, the valve part 36 may be screwed on the lower portion of the string S. The part 36 is cooperable with a tapered internal seat 37 formed in the upper end of the body 22. The valve part 36 has a tapered surface 38 and an annular groove carrying packing 39 for sealing with the seat 37. A perforated nipple 40 extends downwardly from the valve part 36 to pass into the body 22. The nipple 40 may be screwed in the lower end of the valve part 36 to communicate

with the string S. The nipple 40 passes into the body 22 with substantial clearance leaving an annulus 41 in the body. A coupling or collar 42 is screwed on the lower end of the valve nipple 40. A connecting tube 43 extends downwardly from the collar 42. The length of the tube 43 depends upon the space or distance between the productive zones A and B and to facilitate the assembly of the tool at the well it is preferred to provide an unthreaded socket 44 in the lower end of the collar 42 to receive the upper end part of the connecting tube 43. Radial openings 45 are formed in the walls of the collar 42 to receive welding 46 for connecting the tube 43 with the collar 42. When the device is to be run into the well the tube 43 may be cut to the correct length and then secured to the collar 42 by inserting it in the socket 44 and providing the welding 46 in the openings 45. The connecting tube 43 may be of substantially the same external diameter as the valve nipple 40.

The valve means or valve assembly 17 further includes a spacer pipe 47 carried by the body 22 of the packer unit 16. The spacer pipe 47 is screwed in the lower end of the collar 25 and is adapted to extend downwardly through the liner L with substantial clearance. The length of the spacer pipe 47 depends upon the spacing of the productive zones A and B and upon the extent of the zone B. A sub or end member 48 is screwed on the lower end of the spaced pipe 47. The member 48 has a tapered valve socket 49 in its lower end and has an annular upwardly facing internal shoulder 50 spaced above the socket 49. The connecting tube 43 described above extends downwardly in the spacer pipe 47 with clearance and carries a valve nipple 51 and a lower valve part 52. The valve part 52 has a tapered surface 53 and an annular groove carrying sealing material 54 for sealing with the wall of the socket 49. The lower end of the valve part 52 is closed. The nipple 51 is perforated to admit fluid when the valve part is open or out of the socket 49.

In accordance with the invention a releasable connection is provided between the connecting tube 43 and the valve nipple 51 so that the production string S, the connecting tube 43, the collar 42, the nipple 40 and the valve part 36 may be recovered from the well as a unit in the event that it is necessary to pull the string S and remove the device. The releasable connection comprises a mandrel 55 screwed or otherwise secured to the lower end of the connecting tube 43 and a tubular adapter 56 screwed on the upper end of the valve nipple 51. The adapter 56 is provided with a pair of diametrically opposite modified J-slots 57 extending into it from its upper end. Diametrically opposite lugs 58 are provided on the mandrel 55 and project radially or laterally to cooperate with the slots 57. The lugs 58 are adapted to pass through the upper ends of the slots 57 to positions in the offset lower parts of the slots. The offset lower parts of the J-slots 57 have upwardly and downwardly extending branches 59 for receiving the lugs 58. With the lugs 58 engaged in the branches 59 the valve nipple 51 and the valve part 52 are dependably connected with the tube 43 and the string S. The lugs 58 may be freed from the slots 59 by turning movement of the string S accompanied by or followed by upward movement of the string. Means is provided for holding or keying the adapter 56 against turning so that the lugs 58 may be disengaged from the slots 57 when the tool is in the well. A longitudinal key 60 is provided on the valve nipple 51 and slidably cooperates with a keyway 61 in the member 48 to hold the adapter 56 against turning.

In accordance with the invention the parts are related so that the upper valve part 36 is above its seat 37 when the lower valve part 52 is in cooperation with the socket 49 and so that the lower valve part 52 is below the socket 49 when the upper valve part 36 is sealing with its seat 37. This relationship of parts is illustrated in Figs. 4, 5 and 6 of the drawings. When the lower valve part 52 is sealing in its socket 49 the valve nipple 40 extends above the body 22 so that its interior is in communication with the space or annulus between the string S and the liner L and fluid from the productive zone A may pass through the perforated nipple 40 into the production string S. When the upper valve part 36 is sealing with its seat 37 the valve nipple 51 extends downwardly beyond the member 48 so that fluid from the productive zone B may flow through its perforations into the connecting tube 43 to pass upwardly through the string S. It will be apparent that the string S may be brought to a position where both the upper and lower valve parts 36 and 52 are open, in which case fluid from both of the productive zones A and B may flow through the string S or through the annulus between the string S and the liner L.

In the use or operation of the swabbing valve the seat 15 is connected in the liner L when the liner is assembled, to occupy a position in the previously located non-productive zone C and the liner is run into the well and set in any preferred or required manner. After the liner L has been set and the well has been conditioned to receive the tubing or production string S, the packer unit is entered in the well and is supported by slips or other suspension means at the mouth of the well. The assembly of the valve part 52, the valve nipple 51, the adapter 56, the member 48 and the pipe 47 is associated with the packer unit 16 when the latter is introduced into the well. The lower end of the adapter 56 may rest on the shoulder 50 to support the lower valve assembly on the packer unit 16. The connecting tube 43 provided with the mandrel 55 is then passed into the suspended packer unit 16 and lowered to a position where the lugs 58 are adjacent or in engagement with the upper end of the adapter 56. The tube 43 is then turned slowly to the right and lowered to enter the lugs 58 in the J-slots 57. The valve nipple 40 and the valve part 36 are preferably connected with the tube 43 at the time of introduction of the tube into the packer unit 16. Following the connection of the tube 43 with the packer unit 16 by means of the lugs 58 engaging in the slots 57 the packer unit 16 may be suspended from the tube 43 by the engagement of the valve part 52 in the socket 49.

The string S is then connected with the valve part 36 and run into the well in the usual manner to lower the assembly to its position. During the downward movement of the assembly through the well casing and liner L the dogs 30 are held out by the springs 33 but do not project a sufficient distance to contact the interior of the casing. The teeth 34 of the slips 33 may engage the interior of the liner L but move through the liner without interfering with the lowering of the equipment. When the assembly reaches its position the packer unit 16 enters the seat 15 as

illustrated in Fig. 2 of the drawings, and the downward movement of the string S is continued until the teeth 34 of the dogs 30 ratchet into engagement with the wickers 19 and the surface 29 of the sleeve 28 seats on the shoulder 21. The weight of the assembly and a portion of the weight of the string S may be imposed on the body 22 to compress the packing 27. The dog teeth 34 engaging the wickers 19 ratchet over the wickers to retain the body 22 in its lowermost position where the packing 27 is properly compressed to seal with the interior of the seat 15.

When it is desired to bring in the productive zone A the tubing or string S is raised to bring the valve part 52 into sealing cooperation with the socket 49. Swabbing operations are then begun to initiate the production or flow from the zone A. The flow from the productive zone A may enter the perforations of the nipple 40 and pass upwardly through the production string S. Thus the upper production zone A may be swabbed in through the string S. When a flow has been established from the zone A the tubing head outlets are opened and the tubing or string S is lowered to bring the valve part 36 into sealing cooperation with the seat 37. This cuts off the flow from the zone A through the string S and the flow from the zone A is directed upwardly through the annulus between the string S and the liner L, and thence through the annulus between the string S and the well casing to the tubing head. The lower zone B is then swabbed in to produce through the valve nipple 51, the tubing 43 and the string S. Under normal production conditions it is usually preferred to leave the parts in the positions illustrated in Figs. 4 and 5 of the drawings where the upper zone A produces through the space between the liner L and the string S and then through the space between the string S and the casing, and the lower zone B produces through the string S. If desired the string S may be raised from the position just mentioned to bring the two valve parts 36 and 52 to open positions so that both zones A and B may produce either through the string S or the annulus between the string S and the liner L.

If it becomes desirable or necessary to remove the string S and the swabbing valve from the well the string is subjected to a lefthand torque and is raised. This moves the lugs 58 upwardly out of the J-slots 57 to disconnect the tubing 43, the collar 42, the nipple 40, the valve part 36 and the string S from the packer unit 16. The string S is free to be withdrawn from the well to recover the mandrel 55, the tube 43, the collar 42, the nipple 40 and the valve part 36. A suitable drilling tool is then operated in the well to drill up the body 22, the dogs 30, etc. The drilling operation is continued until the drilling tool strikes the upper end of the sleeve 28. The sleeve 28 is formed of a material that is not readily drilled up by drilling tools and the engagement resists the operation of the drilling tool to inform the operator that a sufficient amount of the equipment has been drilled up. With the above parts drilled up the body 22 may drop so that the shoulder 26 comes into engagement with the shoulder 28a of the sleeve 28 which is resting on the shoulder 21. This supports the body 22 and the connected parts in the liner L. When the drilling tool has been removed from the well a suitable fishing tool such as a spear is run in and engaged in the remaining part of the body 22 or the pipe 47 and then raised to recover the remaining parts from the well. In this connection it is to be observed that the adapter 56, the nipple 51 and the valve part 52 remain suspended from the member 48 by the engagement of the adapter with the shoulder 50 that these parts are recovever with the pipe 47, the member 48 and the remaining part of the body 22.

Having described only a typical preferred form and application of my invention I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims:

Having described my invention, I claim:

1. Apparatus for use in a well having spaced productive zones comprising a packer unit to be anchored in the well between said zones, a tubular production string to be installed in the well, and valve means connected with the string operable by vertical movement of the string to simultaneously place both of said zones in communication with the string and to place either of said zones in communication with the string while preventing fluid from the other zone from entering the string.

2. Apparatus for use in a well having spaced productive zones comprising a packer unit to be installed in the well between said zones, a tubular production string for installation in the well, and valve means extending vertically through the packer unit and operable by vertical movement of the string between a position where one zone produces into the string and the other zone is kept out of communication with the string and a position where the said other zone produces into the string and the first named zone is kept out of communication with the string and operable by vertical movement of the string to a position where both of said zones simultaneously communicate with the string.

3. Apparatus for use in a well having spaced productive zones comprising a packer unit to be installed in the well between said zones, a tubular production string for installation in the well, and valve means comprising valve seats on the upper and lower ends of the packer unit, a ported tube connected with the string to be moved thereby and extending through the packer unit, a valve part on the tube cooperable with the seat on one end of the packer unit, and a valve part on the tube cooperable with the seat on the other end of the packer unit, the valve parts being related so that one part is out of engagement with its valve surface when the other part is cooperating with its respective surface whereby either zone may be placed in communication with the string while the other zone is maintained out of communication with the string.

4. Apparatus for use in a well having spaced productive zones comprising a tubular packer for installation in the well between said zones, a tubular production string for arrangement in the well, a tube connected with the string and extending through the packer, the tube being vertically movable in the packer and having a port open to the well when in a raised condition and having a port open to the well when in a lowered condition, a lower valve surface on the packer, an upper valve surface on the packer, a lower valve part engageable with the lower valve surface when the first named port is open to the well so that the upper zone produces into the string and the lower zone is out of communication with the string, and an upper valve part

engageable with the upper valve surface when the second named port is open to the well so that the lower zone produces into the string and the upper zone is out of communication with the string.

5. A swabbing valve for use with a tubular production string and a well liner having vertically spaced fluid inlets, the valve comprising a seat installed in the liner between said inlets, a packer for engagement on the seat and for sealing with the liner, a vave tube connected with the string and movable vertically in the packer, the tube being ported to communicate with the liner above and below the packer and being in communication with the string, and valve means on the packer and tube controlling the communication of the tube with the liner and operable by manipulation of the string to place the ported tube in communication with the liner at either end of the packer while keeping the tube out of communication with the liner at the other end of the packer.

6. A swabbing valve for use with a tubular production string and a well liner having vertically spaced fluid inlets, the valve comprising a seat in the liner between said inlets, a packer for engagement on the seat and for sealing with the liner, internal teeth in the seat, toothed dogs on the packer for cooperating with the teeth to anchor the packer in the seat, a valve tube connected with the string and movable vertically in the packer, the tube being ported to communicate with the liner above and below the packer, and being in communication with the string, and valve means on the packer and tube controlling the communication of the tube with the liner and operable by manipulation of the string to place the ported tube in communication with the liner at either end of the packer while keeping the tube out of communication with the liner at the other end of the packer.

7. A swabbing valve for use with a tubular production string and a well liner having vertically spaced fluid inlets, the valve comprising a seat in the liner between said inlets, a packer for engagement on the seat and for sealing with the liner, a valve tube connected with the string and movable vertically in the packer, the tube being ported to communicate with the liner above and below the packer and being in communication with the string, and valve means on the packer and tube controlling the communication of the tube with the liner and operable by manipulation of the string to place the ported tube in communication with the liner at either end of the packer while keeping the tube out of communication with the liner at the other end of the packer, said valve means including engageable parts on the packer and tube operable to support the packer on the tube whereby the packer may be run into the well on the string and tube.

8. A swabbing valve for use with a tubular production string and a well liner having vertically spaced fluid inlets, the valve comprising a seat in the liner between said inlets, a tubular packer, means for anchoring the packer in the seat, a tubular assembly connected with the string and movable through the tubular packer, said assembly having spaced ports for communicating with the liner above and below the packer, and sets of valve parts carried by the packer and said assembly, one set of valve parts being engageable by manipulation of the string to prevent fluid from the liner from entering one of said ports while the other port is open, and the other set of valve parts being engageable by manipulation of the string to prevent fluid from the liner from entering the said other port while the first named port is open.

9. A swabbing valve for use with a tubular production string and a well liner having vertically spaced fluid inlets, the valve comprising a seat in the liner between said inlets, a tubular packer, means for anchoring the packer in the seat including wickers in the seat, and toothed dogs on the packer engageable with the wickers, a tubular assembly connected with the string and movable through the tubular packer, said assembly having spaced ports for communicating with the liner above and below the packer, and sets of valve parts carried by the packer and said assembly, one set of valve parts being engageable by manipulation of the string to prevent fluid from the liner from entering one of said ports while the other port is open, and the other set of valve parts being engageable by manipulation of the string to prevent fluid from the liner from entering the said other port while the first named port is open.

10. Apparatus for use in a well having spaced productive zones comprising a tubular packer for installation in the well between said zones, a tubular production string for arrangement in the well, a tubular assembly movable vertically in the packer and connected with the string to be operated thereby, an upwardly facing valve face on the packer, a downwardly facing valve face on the packer, the tubular assembly comprising an upper valve part adapted to seal with the upwardly facing valve face, a lower valve part adapted to seal with the downwardly facing valve face, and a ported structure connecting the valve parts so that downward movement of the string brings the upper valve part into cooperation with the upwardly facing face and moves the lower valve part away from the downwardly facing face to place the ported structure in communication with the liner below the packer and so that upward movement of the string brings the lower valve part against the downwardly facing face and moves the upper valve part away from the upwardly facing face to place the ported structure in communication with the liner above the packer.

11. Apparatus for use in a well having spaced productive zones comprising a tubular packer for installation in the well between said zones, a tubular production string for arrangement in the well, a tubular assembly movable vertically in the packer and connected with the string to be operated thereby, an upwardly facing valve face on the packer, a downwardly facing valve face on the packer, the tubular assembly comprising an upper valve part adapted to seal with the upwardly facing valve face, a lower valve part adapted to seal with the downwardly facing valve face, and a ported structure connecting the valve parts so that downward movement of the string brings the upper valve part into cooperation with the upwardly facing face and moves the lower valve part away from the downwardly facing face to place the shorted structure in communication with the liner below the packer and so that upward movement of the string brings the lower valve part against the downwardly facing face and moves the upper valve part away from the upwardly facing face to place the ported structure in communication with the liner above the

packer, said structure including a connection releasable by manipulation of the string whereby the string may be recovered from the well independently of the packer.

12. Apparatus for use in a well having spaced productive zones comprising a tubular packer for installation in the well between said zones, a tubular production string for arrangement in the well, a tubular assembly movable vertically in the packer and connected with the string to be operated thereby, an upwardly facing valve face on the packer, a downwardly facing valve face on the packer, the tubular assembly comprising an upper valve part adapted to seal with the upwardly facing valve face, a lower valve part adapted to seal with the downwardly facing valve face, and a ported structure connecting the valve parts so that downward movement of the string brings the upper valve part into cooperation with the upwardly facing face and moves the lower valve part away from the downwardly facing face to place the ported structure in communication with the liner below the packer and so that upward movement of the string brings the lower valve part against the downwardly facing face and moves the upper valve part away from the upwardly facing face to place the ported structure in communication with the liner above the packer, said structure including a connection between the valve parts releasable by manipulation of the string whereby the string and the upper valve part may be recovered independently of the packer, and surfaces on the packer and said structure engageable to support the lower valve part and the remaining portion of said structure on the packer when the connection is released.

13. A swabbing valve for use with a tubular production string and a well liner having vertically spaced fluid inlets, the valve comprising a seat in the liner between said inlets, a packer for engagement on the seat and for sealing with the liner, the packer including gripping elements for gripping the seat, and a valve assembly movable in and cooperable with the packer and operable by the string between a position where it puts the string in communication with the inlets above the packer and a position where it puts the string in communication with the inlets below the packer, the valve assembly including upper and lower parts and a releasable connection between the parts releasable by manipulation of the string whereby the string may be recovered from the well independently of the packer, said gripping elements, and the adjacent parts of the packer, being drillable whereby the packer may be freed for recovery from the well.

14. A swabbing valve for use with a tubular production string and a well liner having vertically spaced fluid inlets, the valve comprising a seat in the liner between said inlets, a packer for engagement on the seat and for sealing with the liner, the packer including gripping elements for gripping the seat, and a valve assembly movable in and cooperable with the packer and operable by the string between a position where it puts the string in communication with the inlets above the packer and a position where it puts the string in communication with the inlets below the packer, the valve assembly including upper and lower parts and a releasable connection between the parts releasable by manipulation of the string whereby the string may be recovered from the well independently of the packer, said gripping elements, and the adjacent parts of the packer, being drillable whereby the packer may be freed for recovery from the well, and cooperable shoulders on the said lower part and on the portion of the packer remaining following said drilling operation adapted to support the said lower part in the seat for subsequent removal.

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