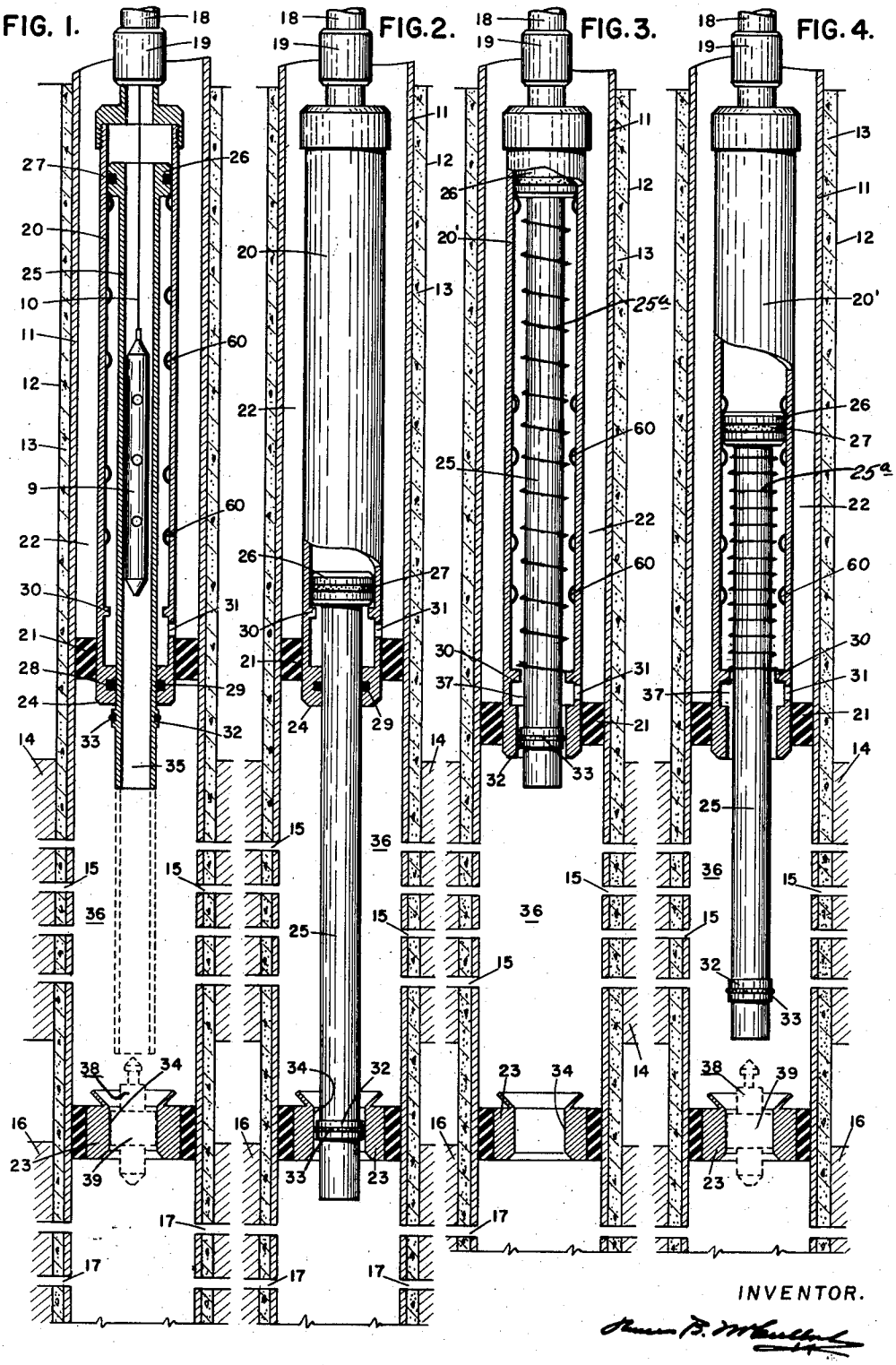
May 30, 1961 T. B. McCULLOCH 2,986,216

APPARATUS FOR USE IN WELLS COMPLETED IN A PLURALITY OF ZONES

Filed Dec. 16, 1957 3 Sheets-Sheet 1

FIG. 1. FIG. 2. FIG. 3. FIG. 4.



INVENTOR.

Thomas B. McCulloch

May 30, 1961 T. B. McCULLOCH 2,986,216

APPARATUS FOR USE IN WELLS COMPLETED IN A PLURALITY OF ZONES

Filed Dec. 16, 1957 3 Sheets-Sheet 2

FIG.5.

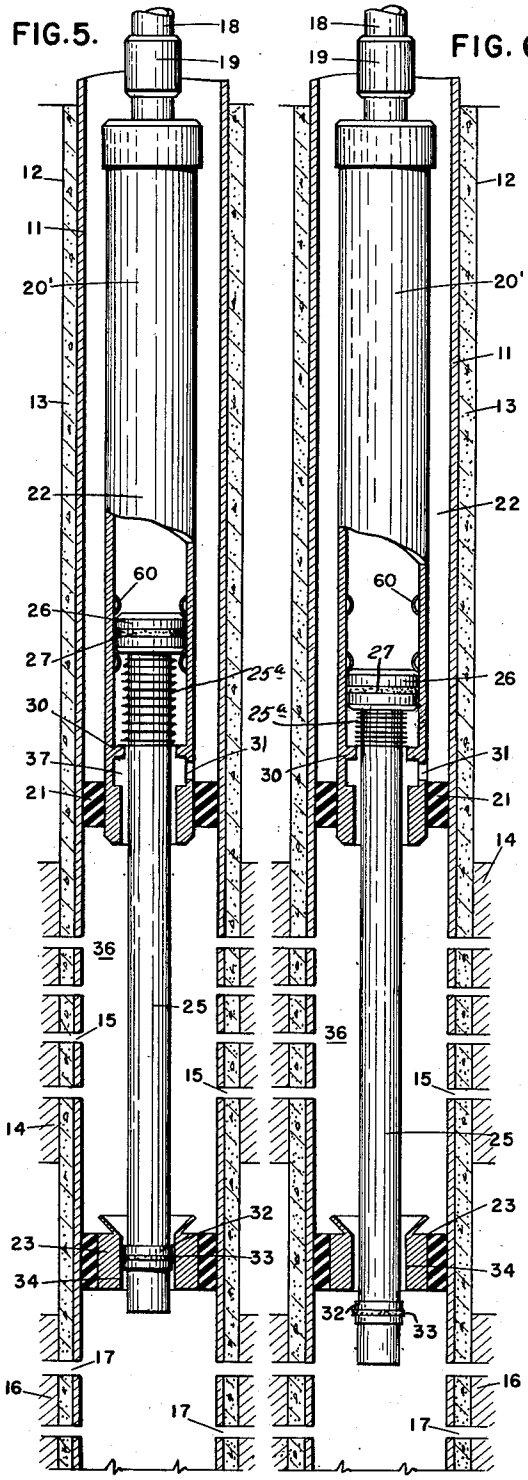


FIG. 6.

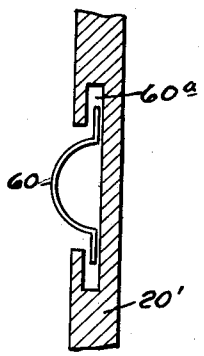


FIG.6A

INVENTOR.

Thomas B. McCulloch

May 30, 1961 T. B. McCULLOCH 2,986,216

APPARATUS FOR USE IN WELLS COMPLETED IN A PLURALITY OF ZONES

Filed Dec. 16, 1957

3 Sheets-Sheet 3

FIG. 7.

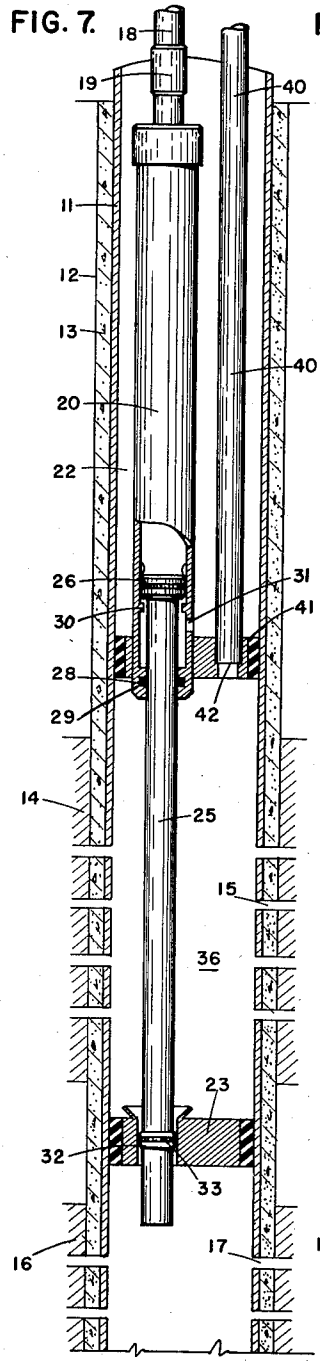


FIG. 8.

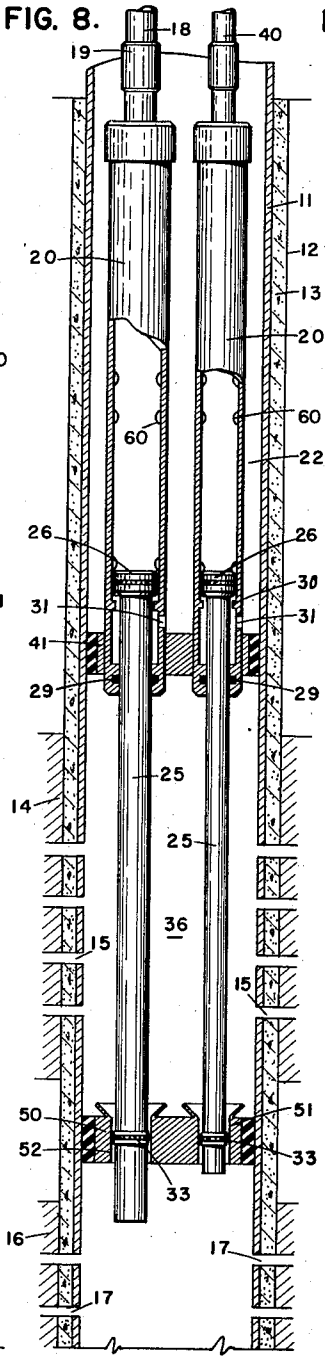
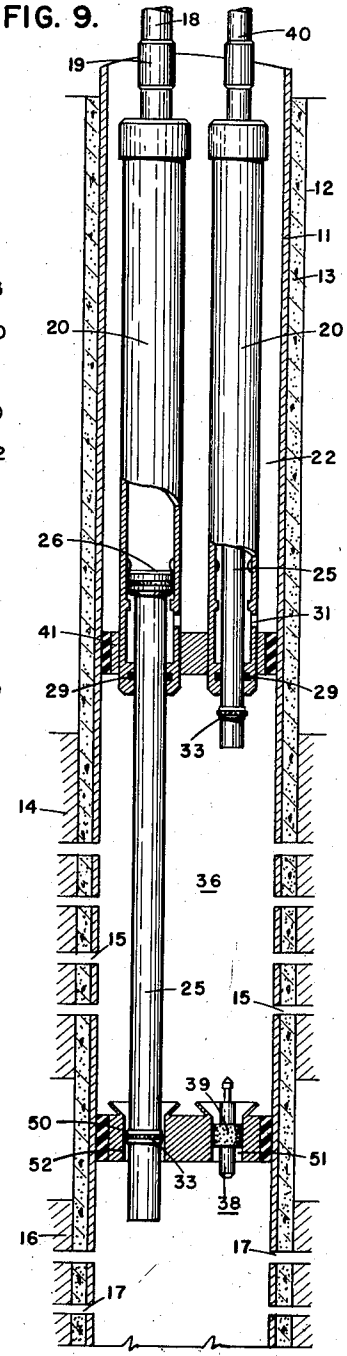


FIG. 9.



INVENTOR.

Thomas B. McCulloch

United States Patent Office 2,986,216 Patented May 30, 1961

2,986,216

APPARATUS FOR USE IN WELLS COMPLETED IN A PLURALITY OF ZONES

Thomas B. McCulloch, Houston, Tex., assignor, by mesne assignments, to Jersey Production Research Company, Tulsa, Okla., a corporation of Delaware

Filed Dec. 16, 1957, Ser. No. 702,852

8 Claims. (Cl. 166—114)

The present invention is directed to apparatus for producing hydrocarbons. More particularly, the invention is directed to apparatus for producing hydrocarbons from vertically spaced apart productive zones. In its more specific aspects, the present invention has to do with apparatus which is placed once in the lifetime of the well and may be manipulated to produce hydrocarbons from a plurality of zones and to allow workover operations.

The present invention may be briefly described as apparatus for producing hydrocarbons from vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones. A tubing is arranged in the casing with its lower open end permanently placed above the upper of the zones. A mandrel is attached to and forms the lower end of the tubing, the mandrel having an internal diameter greater than the internal diameter of the tubing. A first packer is arranged on the mandrel adjacent its lower end and closing the casing-tubing annulus. A second packer is arranged below the lower end of the mandrel between the upper and the lower zones and serves to separate these two zones. The second packer has an open bore. A tubular member having an internal diameter substantially the same as the tubing is slidably arranged in the mandrel. The tubular member is provided with sealing means on its lower end for placement in the open bore of the second packer. The tubular member has a length at least co-extensive with the mandrel and a sufficient length to extend at least to the second packer. Means are provided for moving the tubular member from a first position in the mandrel to a second extended position whereby the lower end of the tubular member is sealingly arranged in the open bore of the second packer. A first flow path is thus provided through the tubular member and tubing in the lower zone to the earth's surface. A second flow path is also provided from the upper zone to the earth's surface and may include a port in the mandrel above the first packer or may be a second tubing string arranged with its lower open end above the upper of the plurality of zones.

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

Figs. 1 and 2 illustrate two positions of the apparatus of the present invention;

Figs. 3, 4, 5 and 6 represent various positions of a modification of the apparatus of Figs. 1 and 2;

Fig. 6*a* is an enlarged view of the springs shown in the drawing and illustrating the mounting thereof;

Fig. 7 illustrates another modification of the present invention; and

Figs. 8 and 9 show still another modification of the present invention.

Referring now to the drawing in which identical numerals will be employed to designate identical parts, numeral **11** designates a well casing which has been placed in a well bore **12** and which has been cemented

in place in cement **13** and perforated in an upper zone **14** with perforations **15** and in a lower zone **16** with perforations **17**. A tubing **18** is arranged in the casing **11** and has attached to it by means of pipe connecting means **19** a mandrel **20** which has a diameter greater than the diameter of the tubing **18**. The mandrel **20** forms part of the tubing **18**. A packer **21** is arranged on the mandrel **20** and serves to close the casing-tubing annulus **22**. A second packer **23** is arranged below the lower end **24** of the mandrel **20** and separates the upper zone **14** from the lower zone **16**. Slidably arranged within the mandrel **20** is an elongated tubular member **25** which is formed on its upper end to provide a piston **26** having a sealing member such as a sealing ring **27** to form a seal with the internal wall of the mandrel **20**. The mandrel **20** is provided with a sealing means **28** provided with a sealing ring **29** on its lower end which seals with the outer wall of the tubular member **25**. A stop member **30** is provided on the inner wall of the mandrel **20** above the packer **21**, the inner wall of the mandrel **20** also being provided with at least a port **31** which is above the packer **21** and serves to communicate the bore of the mandrel **20** with the tubing-casing annulus **22**.

It is to be noted that the internal diameter of the tubular member **25** is substantially the same as the internal diameter of the tubing **18** and allows the free passage of well tools such as a shaped charge or bullet gun perforator **9** attached to a wire line or cable **10** through the tubing **18** and the tubular member **25**.

It is to be noted that the lower end of the tubular member **25** is provided with a sealing member **32** having a sealing means such as ring **33**. The sealing member **32** and sealing ring **33** are adapted to sealingly engage with the wall of bore **34** of packer **23** as will be described further hereinafter.

Referring now to Fig. 2, it will be seen that the tubular member **25** is shown in its maximum extended position with the sealing member **32** and sealing ring **33** engaged with the bore **34** to form a seal therewith.

By virtue of an arrangement as shown with respect to Fig. 1, it is possible to produce simultaneously from the upper zone **14** and from the lower zone **16**, production fluids moving up through the passageway **35** comprised of tubular member **25**, the mandrel **20**, and the tubing **18** to the earth's surface.

In Figs. 3 to 6, inclusive, the mandrel **25** is provided with a helical coil spring **25***a* arranged embracingly thereon and bearing with its upper end against piston **26** and with its lower end against stop **30**. In the position of Fig. 3, simultaneous production from zones **14** and **16** may be had through the tubing **18**.

When it is desirable to plug off the upper zone **14** the lower zone may be isolated by placing a plug such as **38** in the bore of packer **23** and cement pumped in by way of tubing **18** and tubular member **25**. Excess cement may be washed out of the space **36** by extending the tubular member **25** as shown in Fig. 4 by applying fluid pressure against the upper side of piston head **26**. In this position the sealing means **32** has moved out of the mandrel **20'** thus allowing the washing-out fluids to be circulated down the tubing **18**, the tubular member **25** through the annulus **37**, out the port **31** and up the casing-tubing annulus **22**. It will be understood that this circulation may be reversed if desired. The tubular member **25** may be secured or latched in its various positions by means such as latch springs **60** positioned within the mandrel **20'** by engagement of springs **60** with the piston **26** as shown in Figs. 1, 4, and 5 of the drawing.

If it is contemplated to have isolated and simultaneous production from both of the zones **14** and **16** the tubular member may extend to the position shown in

Fig. 5. In this position production fluid from zone **14** can flow into the space **36** up the annulus **37** through port **31** and casing annulus **22** to the earth's surface, while production from zone **16** can flow through tubular member **25**, mandrel **20'** and tubing **18** to the earth's surface.

Fig. 6 illustrates the tubular member in its lowermost extended position. This position, as are the previously mentioned positions, is accomplished by exerting fluid pressure down the tubing **18** against the piston head **26**. With the apparatus in this position it is possible to work over the lower zone **16** with the workover fluid circulating down through tubing **18**, mandrel **20'**, tubular extension **25** and up through the bore **34** of packer **23**, space **36**, mandrel passage **37**, port **31** and up the casing annulus **22** to the earth's surface. This fluid circuit may be reversed if desired.

Referring now to Fig. 6*a*, it will be clear that springs **60** are arranged in recesses **60***a* of mandrel **20'** such that on exertion of pressure by piston **26** against springs **60**, they flatten and move slidably in recesses **60***a*. Thus, when it is desired to return the member **25** from the position shown in Fig. 5 or 6 with the bore **34** partially or completely closed to the position shown in Fig. 3 or 4, fluid pressure exerted against the underside of piston **26** through port **31** causes release from springs **60** and spring **25***a* then returns the member **25** to its first position.

The tubular member **25** of Figs. 3 to 6 is returned to its retracted position by the force of the spring **25***a* and sufficient fluid pressure exerted down the annulus **22** through port **31** against the underside of the piston head **26**. This total pressure overcomes springs **60** and returns the tubular member **25** to its retracted position as shown in Figs. 3 and 4. The tubular member **25** is maintained in its extended position by virtue of the fact that the force of the spring **25***a* is in itself insufficient to overcome the springs **60**. Thus, the springs **60** positively maintain the tubular member **25** in extended position, the tubular member **25** being extended by exerting sufficient fluid pressure against the upper side of the piston head **26** to overcome the combined force of springs **60** and spring **25***a*.

It will be seen that the apparatus of the present invention as described with respect to Figs. 1 to 6 is exceedingly versatile, advantageous and useful in workover of both upper and lower zones and in the production of hydrocarbons and the like such as oil and gas from the upper and lower zones simultaneously. The present invention, as exemplified by Figs. 1 to 6, does not require the use of wire line tools and can be employed with the tubing permanently arranged in place and also with the tubular member slidably and permanently arranged in the mandrel.

Referring now to Figs. 7, 8 and 9, another embodiment of the present invention will be described. In this embodiment of the present invention a plurality of tubing strings is arranged in the well casing **11** as shown with respect to Figs. 4, 5 and 6. The embodiment of Fig. 7 is identical to Figs. 1, 2 and 3 with the exception that a second tubing string **40** is arranged in a modified packer **41** with its lower open end **42** above the zones **14** and **16**. The modified packer **41** closes the annulus **22** between the mandrel **20** and the casing **11**, as well as the annulus between the tubing **40** and the casing **11**.

The embodiment of Fig. 7 is shown arranged with the tubular member **25** in its extended position with the sealing means **32** and sealing ring **33** in the bore **34** of packer **23** to provide communication with the zones **14** and **16** through perforations **15** and **17**, respectively. By allowing the flow from lower zone **16** to proceed through the tubular member **25** and upwardly through the mandel **20** and tubing **18** it is possible to obtain production from the zone **16** simultaneously with production from the upper zone **14**, the flow being through the perforations **15** into the space **36** and then through the tubing **40** to the earth's surface.

Workover operations may be conducted with the embodiment of Fig. 7 similarly with respect to Figs. 1 to 6 with the exception that the tubing **40** will be used as a separate flow path to the earth's surface rather than the casing-tubing annulus **22** as described with respect to Figs. 1, 2, and 3.

The embodiments of Figs. 8 and 9 are similar to the embodiments of Figs. 1 to 6 with the exception that in this embodiment the tubing **18** and **40** are both provided with mandrels **20** forming the lower end thereof having tubular members **25** arranged within the mandrels **20**. As shown with respect to Fig. 8, workover operations may be conducted by having the tubular members **25** in their extended position in a modified packer **50**, sealingly arranged therein by the sealing members **32** and sealing rings **33**. It is to be noted that the left hand tubular member **25** extends substantially below the packer **50** into the zone **16**. This allows workover fluid to be introduced down through the tubing **18**, mandrel **20**, and tubular member **25** on the left hand side with the workover fluids proceeding upwardly through the right hand tubular member **25**, mandrel **20** and tubing **40**.

In order to obtain production with the assembly of Figs. 8 and 9, the tubular members **25** of Fig. 9 are shown, one in the extended position and the other in the retracted position. For example, the right hand tubular member **25** is shown retracted into its respective mandrel **20** while the left hand tubular member **25** is extended from the mandrel **20** and is sealingly arranged in the packer **50** as described with respect to Fig. 7, the bore **51** of the packer **50** being closed by a retrievable plug member **38** with a sealing ring **39** such as described with respect to Fig. 1, the bore **52** of the packer **50** being closed with the tubular member **25** on the left hand side to allow production from the lower zone while production from the upper zone proceeds through the perforations **15** and thence upwardly through the right hand tubular member **25** and the tubing **40** to the earth's surface as has been described.

It is to be noted with respect to the embodiments of Figs. 7 to 9 the second tubing **40** in either of the embodiments serves as a path of flow such as the casing-tubing annulus of Figs. 1 to 3, with workover and production operations being conducted as has been described.

Packers **21**, **23**, **41**, and **50** are described in the literature and are of the type shown in The Composite Catalog of Oil Field and Pipe Line Equipment, 21st edition (1955–56), copyright 1955, The Gulf Publishing Co., Houston, Texas. On page 849 of The Composite Catalog supra there is described a dual string packer and the operation thereof which may be employed as packers **41** and **50**. On pages 850 and 851 of the The Composite Catalog supra a Brown Duo-Pak packer is described along with the operation thereof which may be employed as packer **23**. Pages 537 to 539 of The Composite Catalog supra provide a description of a Baker Retainer Production packer suitable for use as packer **23**. The operation of said Baker packer is also described at pages 537 to 539 of The Composite Catalog supra.

The plug member **38** may be a plug lowerable through a tubing for expanding in a bore larger than the tubing such as of the type described in the patents to Rumble 2,781,852, Rumble et al. 2,781,853, and to Huber 2,831,540.

While the present invention has been illustrated as showing a fluid pressure operated means for moving the tubular members **25** from their first position retracted in the mandrel **20** to an extended position out of the mandrel **20**, other means may be used such as have been described in Serial No. 594,627, entitled "Permanent Well Completion" and filed June 28, 1956, in the name of the instant inventor. Such means may include a wire line lowerable and retrievable restriction means for restricting the passageway through the tubular member **25** on

application of fluid pressure thereagainst. Also, such means may include a wire line tool such as has been described in Serial No. 430,101, entitled "Extension of Effective Length of Tubing" and filed May 17, 1954, for the instant inventor, including a grab tool for engaging with the tubular member 25 for moving same from a first to a second position.

In conducting cementing operations in either the upper zone 14 or the lower zone 16, it is preferred to use a low strength, low water loss cement such as described in the patent to Salathiel, U.S. 2,582,459. However, while the Salathiel cement may be preferred, other commercially available low strength, low water loss cements may be used. For example, oil-emulsion cements and the like may also be employed in cementing operations using the apparatus of the present invention.

The apparatus of the present invention may be used in workover and servicing operations such as involving acidizing, gun perforating, cementing operations, in production of hydrocarbons, in well stimulating and any of the many operations which are conducted with respect to well completion, recompletion, servicing operations, as well as production simultaneously and separately from a plurality of vertically spaced apart hydrocarbon productive horizons.

The present invention is of considerable utility and is quite advantageous inasmuch as heretofore in conducting operations such as has been described herein, it has been necessary to lower a retrievable production tube through the tubing to extend to a second packer below the lower open end of the tubing. In the present invention the tubing is permanently arranged in place with a slidable member arranged in a mandrel of greater diameter than the tubing such that the slidable member may be positioned either by pressure or by other means to extend to the lower packer and to allow production simultaneously and separately from the two horizons, zones, strata, and the like of a well bore. Another advantage of the present invention is that the tubular member slidably arranged in the mandrel provides a full opening bore through which perforators, either gun, shaped charge, chemical, or mechanical, may be lowered therethrough to be operated between the spaced apart packers or below the lower of the packers for obtaining production from a different level than had been obtained prior to the servicing operations. Provision of the full opening bore is quite advantageous. In short, the present invention allows workover operations in the upper and in the lower zone through the tubing and tubular member without manipulation of the tubing or the tubular member excepting by imposition of pressure or other means that have been described.

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

1. Apparatus for servicing, completing, and producing wells in vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones and having a tubing with its lower open end permanently arranged above the upper of said zones which comprises a mandrel attached to and forming the lower end of said tubing, said mandrel having an internal diameter greater than the internal diameter of said tubing, a first packer arranged on said mandrel adjacent its lower end closing the casing-tubing annulus, a second packer arranged in said casing below the lower end of the mandrel to seal with the wall of the casing between said upper and lower zones, said second packer having an open bore, and a tubular member slidably arranged and maintained in said mandrel, said tubular member being provided with sealing means on its lower end and having a length at least co-extensive with the mandrel and being of sufficient length to extend at least to said second packer, a piston member formed on the upper end of said tubular member and provided with means sealingly engaging with the inner wall of said mandrel, said tubular member being movable from a first position in said mandrel to a second extended position by exerting fluid pressure downwardly through said tubing against the piston member whereby the lower end of said tubular member is sealingly arranged in the open bore of said second packer and whereby a flow path through said tubular member and tubing from the lower zone to the earth's surface is provided, and means in said mandrel for supporting said tubular member in its first and second positions.

2. Apparatus for servicing, completing, and producing wells in vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones and having a tubing with its lower open end permanently arranged above the upper of said zones which comprises a mandrel attached to and forming the lower end of said tubing, said mandrel having an internal diameter greater than the internal diameter of said tubing, a first packer arranged on said mandrel adjacent its lower end closing the casing-tubing annulus, a second packer arranged in said casing below the lower end of the mandrel to seal with the wall of the casing between said upper and lower zones, said second packer having an open bore, a tubular member slidably arranged and maintained in said mandrel, said tubular member being provided with sealing means on its lower end and having a length at least co-extensive with the mandrel and being of sufficient length to extend at least to said second packer, a piston member formed on the upper end of said tubular member and provided with means sealingly engaging with the inner wall of said mandrel, said tubular member being movable from a first position in said mandrel to a second extended position by exerting fluid pressure downwardly through said tubing against the piston member whereby the lower end of said tubular member is sealingly arranged in the open bore of said second packer and whereby a first flow path through said tubular member and tubing from the lower zone to the earth's surface is provided, means in said mandrel for supporting said tubular member in its first and second positions, and port means in said mandrel communicating with the casing-tubing annulus and forming a second flow path from the upper zone to the earth's surface.

3. Apparatus for servicing, completing, and producing vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones and having a first tubing with its lower open end permanently arranged above the upper of said zones which comprises a mandrel attached to and forming the lower end of said tubing, said mandrel having an internal diameter greater than the internal diameter of said tubing, a first packer arranged on said mandrel adjacent its lower end closing the casing-tubing annulus, a second packer arranged in said casing below the lower end of the mandrel to seal with the wall of the casing between said upper and lower zones, said second packer having an open bore, a tubular member slidably arranged and maintained in said mandrel and provided with sealing means on its lower end, said tubular member having a length at least co-extensive with the mandrel and being of sufficient length to extend at least to said second packer, a piston member formed on the upper end of said tubular member and provided with means sealingly engaging with the inner wall of said mandrel, said tubular member being movable from a first position in said mandrel to a second extended position by exerting fluid pressure downwardly through said tubing against the piston member whereby the lower end of said tubular member is sealingly arranged in the open bore of said second packer and whereby a first flow path through said tubular member and tubing from the lower zone to the earth's surface is provided, means in said mandrel for supporting said tubular member in its first and second positions, and a second tubing with its lower open end permanently arranged in the casing above the upper of said zones, the lower open end of said second tubing extending through said first packer and

forming a second flow path from the upper zone to the earth's surface.

4. Apparatus for servicing, completing, and producing wells in vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones and having a tubing with its lower open end permanently arranged above the upper of said zones which comprises a mandrel attached to and forming the lower end of said tubing, said mandrel having an internal diameter greater than the internal diameter of said tubing, a first packer arranged on said mandrel adjacent its lower end closing the casing-tubing annulus, a second packer arranged in said casing below the lower end of the mandrel to seal with the wall of the casing between said upper and lower zones, said second packer having an open bore, a tubular member slidably arranged and maintained in said mandrel and provided with sealing means on its lower end, said tubular member having a length at least co-extensive with the mandrel and being of sufficient length to extend at least to said second packer, a piston member formed on the upper end of said tubular member and provided with means sealingly engaging with the inner wall of said mandrel, said tubular member being movable from a first position in said mandrel to a second extended position by exerting fluid pressure downwardly through said tubing against the piston member whereby the lower end of said tubular member is sealingly arranged in the open bore of said second packer and whereby a first flow path through said tubular member and tubing from the lower zone to the earth's surface is provided, means in said mandrel for supporting said tubular member in its first and second positions, and means forming a passageway through said first packer providing a second flow path from the upper zone to the earth's surface.

5. Apparatus for servicing, completing, and producing wells in vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones and having a tubing with its lower open end permanently arranged above the upper of said zones which comprises a mandrel attached to and forming the lower end of said tubing, said mandrel having an internal diameter greater than the internal diameter of said tubing, a first packer arranged on said mandrel adjacent its lower end closing the casing-tubing annulus, a second packer arranged in said casing below the lower end of the mandrel to seal with the wall of the casing between said upper and lower zones, said second packer having an open bore, a full opening tubular member having an internal diameter substantially the same as the tubing slidably arranged and maintained in said mandrel and provided with sealing means on its lower end, said tubular member having a length at least co-extensive with the mandrel and being of sufficient length to extend at least to said second packer, a piston member formed on the upper end of said tubular member and provided with means sealingly engaging with the inner wall of said mandrel, said tubular member being movable from a first position in said mandrel to a second extended position by exerting fluid pressure downwardly through said tubing against the piston member whereby the lower end of said tubular member is sealingly arranged in the open bore of said second packer and whereby a first flow path through said tubular member and tubing from the lower zone to the earth's surface is provided, means in said mandrel for supporting said tubular member in its first and second positions, and tubular means extending through said first packer and forming a second flow path from the upper zone to the earth's surface.

6. Apparatus for servicing, completing, and producing wells in vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones and having a tubing with its lower open end permanently arranged above the upper of said zones which comprises a mandrel attached to and forming the lower end of said tubing, said mandrel having an internal diameter greater than the internal diameter of said tubing, a first packer arranged on said mandrel adjacent its lower end closing the casing-tubing annulus, a second packer arranged in said casing below the lower end of the mandrel to seal with the wall of the casing between said upper and lower zones, said second packer having an open bore, a tubular member having an internal diameter substantially the same as the tubing slidably arranged and maintained in said mandrel and provided with sealing means on its lower end, said tubular member having a length at least co-extensive with the mandrel and being of sufficient length to extend at least to said second packer, a piston member formed on the upper end of said tubular member and provided with means sealingly engaging with the inner wall of said mandrel, said tubular member being movable from a first position in said mandrel to a second extended position by exerting fluid pressure downwardly through said tubing against the piston member whereby the lower end of said tubular member is sealingly arranged in the open bore of said second packer and whereby a first flow path through said tubular member and tubing from the lower zone to the earth's surface is provided, means in said mandrel for supporting said tubular member in its first and second positions, and tubular means extending through said first packer and forming a second flow path from the upper zone to the earth's surface.

7. Apparatus for servicing, completing, and producing wells in vertically spaced apart productive horizons penetrated by a well bore having a casing arranged therein perforated in upper and lower zones and having a tubing with its lower open end permanently arranged above the upper of said zones which comprises a mandrel attached to and forming the lower end of said tubing, said mandrel having an internal diameter greater than the internal diameter of said tubing, a first packer arranged on said mandrel adjacent its lower end closing the casing-tubing annulus, a second packer arranged in said casing below the lower end of the mandrel to seal with the wall of the casing between said upper and lower zones, said second packer having an open bore, a tubular member having an internal diameter substantially the same as the tubing slidably arranged and maintained in said mandrel and provided with sealing means on its lower end, said tubular member having a length at least co-extensive with the mandrel and being of sufficient length to extend at least to said second packer, a piston member formed on the upper end of said tubular member and provided with means sealingly engaging with the inner wall of said mandrel, said tubular member being movable from a first position in said mandrel to a second extended position by exerting fluid pressure downwardly through said tubing against the piston member, means in said mandrel for latching said tubular member in its first and second positions, the lower end of said tubular conduit being sealingly arranged in the open bore of said second packer in its second position whereby a first flow path through said tubular member and tubing from the lower zone to the earth's surface is provided, and tubular means extending through said first packer and forming a second flow path from the upper zone to the earth's surface.

8. Apparatus in accordance with claim 1 in which the tubular member is provided with spring means bearing against the underside of the piston member and against a stop member in the lower end of the mandrel for returning the tubular member from the second to the first position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,448,931	Penick	Nov. 22, 1949
2,749,989	Huber	June 12, 1956
2,776,013	Tausch	Jan. 1, 1957
2,785,754	True	Mar. 19, 1957
2,798,558	McCulloch	July 9, 1957