Jan. 13, 1959 J. B. PAYNE 2,868,296

DUAL SCREEN ASSEMBLY

Filed Feb. 14, 1956

FIG. 1.

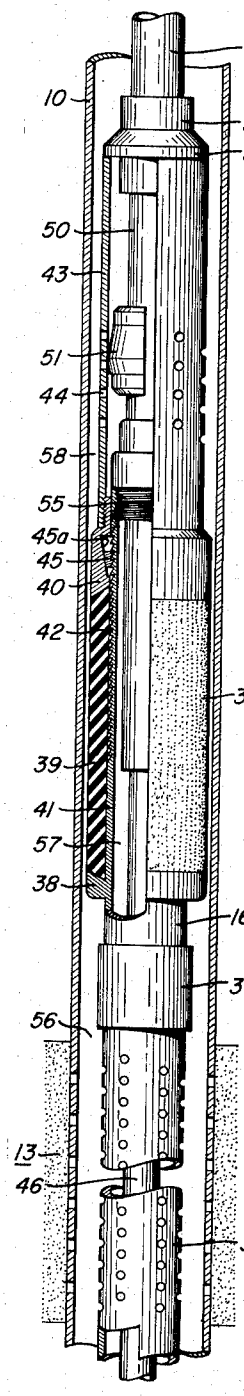


FIG. 2.

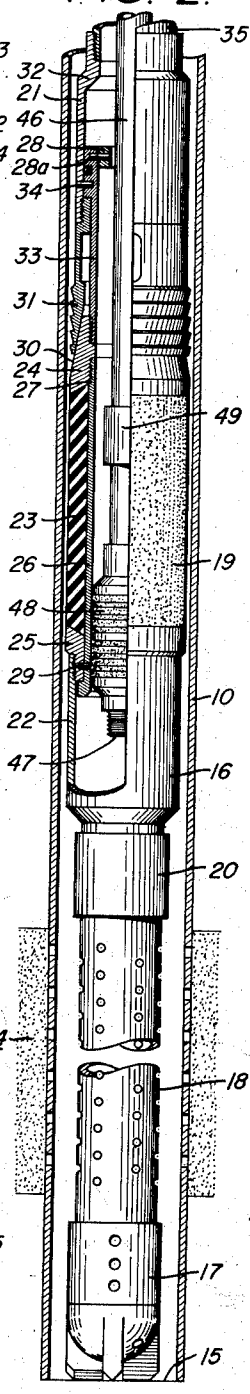


FIG. 3.

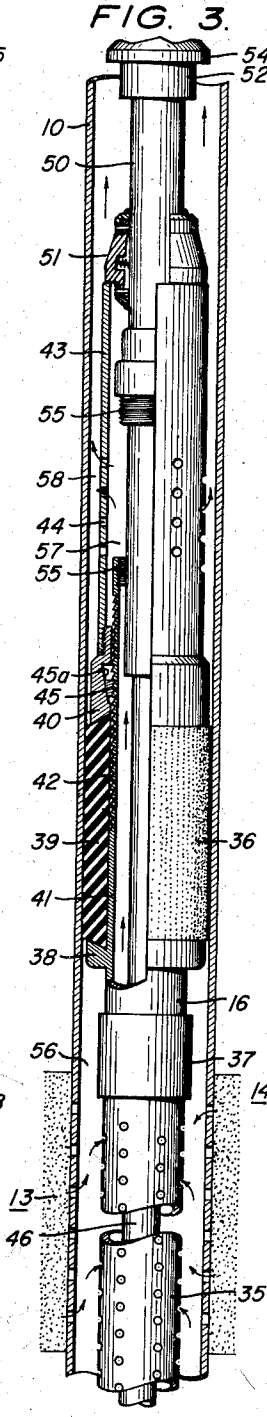
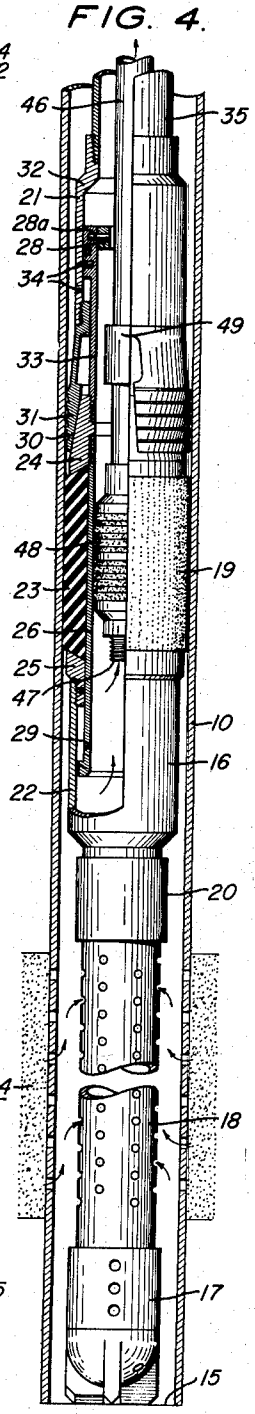


FIG. 4.



John B. Payne, INVENTOR.

BY John A. Schneider ATTORNEY.

United States Patent Office 2,868,296 Patented Jan. 13, 1959

2,868,296

DUAL SCREEN ASSEMBLY

John B. Payne, Beaumont, Tex., assignor, by mesne assignments, to Jersey Production Research Company, Tulsa, Okla., a corporation of Delaware

Application February 14, 1956, Serial No. 565,523

8 Claims. (Cl. 166—119)

This invention is directed to a dual screen assembly arranged in a well bore adjacent dual hydrocarbon production zones.

An object of this invention is the exclusion of sand in a dual production well. Another object of this invention is to protect the inner string of tubing from the abrasive and erosive action of sand as the well is produced from the upper sand formation.

Various protective coats of rubber, plastic and hard and soft metals have failed to prevent destruction of this tubing by sand from the upper zone impinging on the tubing as this sand enters the well bore with the formation fluid. This invention is adapted to screen the sand from the upper sand formation, as well as from the lower sand formation, and eliminates the destructive action of the sand thereby providing a method of operation and apparatus of great value and utility in oil field producing operations.

Briefly, this invention comprises apparatus for producing hydrocarbons from dual production zones in a cased borehole comprising inner and outer concentric tubular members positioned in the borehole providing a first annulus between the casing and the outer tubular member and a second annulus between the inner and outer tubular members, the outer tubular member extending from the upper zone to below the lower zone and being provided with spaced apart upper and lower perforated liners, the inner tubular member extending from above the upper liner to below the upper liner; first packer means are positioned on the outer tubular member between the upper and lower zones adapted to seal off the first annulus, and second packer means are positioned on the outer tubular member above the upper zone adapted to seal off the first annulus, and third packer means are positioned on the inner tubular member adjacent the lower end thereof adapted to seal off the second annulus.

Fig. 1 is an elevational view, partly in section, of the upper end of the apparatus in running in position.

Fig. 2 is an elevational view, partly in section, of the lower end of the apparatus of Fig. 1.

Fig. 3 is an elevational view, partly in section, of the apparatus of Fig. 1 in set position.

Fig. 4 is an elevational view, partly in section, of the apparatus of Fig. 2 in set position.

Referring to the drawing in greater detail wherein identical numerals designate identical parts: numeral **10** designates a casing set in a borehole, not shown, penetrating upper and lower production zones **13** and **14**, respectively. The lower end of the casing is set on the bottom **15** of the borehole. An outer tubing string generally designated **16** is shown arranged within casing **10**. Tubing string **16** includes a lower set shoe **17** which is adapted to seat on the bottom of the borehole **15**. A screen liner **18** is screw threadedly connected to the set shoe **17** and is positioned adjacent the lower production zone **14**. The upper end of liner **18** is connected to a lower packer means generally designated **19** by means of

coupling **20**. This lower packer means is a pin-type packer and includes an upper sleeve assembly **21** and a lower sleeve **22** having a deformable packer member **23** suitably formed of resilient material such as rubber or the like arranged therebetween. The packer member **23** is positioned between and affixed to upper and lower collar members **24** and **25**, respectively, to which upper sleeve assembly **21** and lower sleeve **22**, respectively, are screw threadedly connected. The inner surface of packer member **23** is retained and supported by an inner sleeve **26** which is screw threadedly connected to upper collar member **24** as at **27**. The lower end of inner sleeve **26** is connected to the lower collar member **25** by means of a frangible shear pin **29**. The upper end of upper collar member **24** is tapered upwardly and inwardly as at **30**. Slidably arranged on this tapered surface **30** are slip members **31**. Upper sleeve assembly **21** includes an upper section **32**, the lower end of which is screw threadedly connected to slip members **31** and an inner section **33**, the lower end of which is screw threadedly connected to upper collar member **24** and the upper end of which is connected to the lower end of section **32** by means of a frangible shear pin **34**. An inwardly extending stop ring **28** is affixed to inner section **33** adjacent its upper end by means of frangible pin member **28***a*. Screw threadedly connected to section **32** is an upper screen liner **35** positioned adjacent upper production zone **13**. An upper packer assembly generally designated **36** is screw threadedly connected by means of coupling **37** to upper screen liner **35**. Upper packer assembly **36** includes a lower collar member **38**, a deformable packer member **39**, formed of resilient material similarly as packer member **23**, and an upper collar member **40**. An upper portion **41** of tubular member **16** to which collar **38** is rigidly affixed is provided with downwardly directed wedge shaped indents **42**. An upper sleeve **43** screw threadedly connected to upper collar member **40** is provided with perforations **44**. Upper collar member **40** is provided with a tapered inner recess **45***a* in which is positioned an expansible lock ring **45** having upwardly directed wedge shaped indents engagedly connecting with wedge shaped indents **42**.

An inner tubular member **46** is also arranged in the casing **10** and extends into outer tubing **16** from above to below upper screen liner **35**. The lower terminal open end **47** of tubular member **46** has a chevron-type packer **48** secured adjacent thereto which is adapted to seal off the annulus between the lower end of tubular member **46** and the inner sleeve **26** of packer member **19**. Tubing string **46** also has provided thereon a stop member **49** which may suitably be a collar or ring, which is adapted to abut against stop ring **28** upon upward movement of tubular member **46**.

The upper end of tubing string **46** is provided with a setting tool generally designated **50**. Tubular member **46** is initially secured to sleeve **41** by means of the threaded connection **55**. The setting tool member **50** is provided with outwardly biased expansible dogs **51** and an upper collar member **52**. Tubing string **53** is threadedly connected to collar **52**. Collar **52** is provided with an annular shoulder **54** which is adapted to engage with the upper end of sleeve **43**. Tubing string **53** extends to the earth's surface and is employed in manipulating the setting tool and associated assembly of elements and in producing operations.

In operation, as seen more clearly in Figs. 1 and 2, the inner and outer tubings including the set shoe, packers, and setting tool are lowered into the well bore by means of tubing string **53** until the set shoe **17** is landed on bottom **15**. Weight through tubing string **53** exerts force upon the attached inner sleeve portion **41** of tubing string **16** through the threaded connection **55**, liner **35**,

upper, outer and inner sleeves 32 and 33, respectively, and upper collar 24 of lower packer 19. This force causes frangible pin 29 to shear thereby moving upper collar 24 and connected inner sleeve 26 downwardly relative to lower collar 25 and sleeve 22 connected thereto. Packer member 23 is thereby collapsed sealing off the annulus between the casing 10 and the outer tubular member 16. This packer seal may be tested by applying fluid pressure on the casing and determining any pressure in the tubing which would indicate leakage past the packer.

Additional weight applied to the upper sleeve 43 will cause shear pin 34 to fracture thereby permitting sleeve 32 and connected slips 31 to move downwardly with respect to sleeve 33 to thereby set slip members 31.

After setting the lower packer 19 and the slips 31, inner tubular member 46 is rotated by means of tubing 53 to release the setting tool member 50 from its threaded connection 55 with sleeve member 41. The tubing string 53, with the attached setting tool 50, is picked up sufficiently far to permit dogs 51 to expand outwardly above the upper end of sleeve 43 and then lowered to permit the setting tool dogs 51 to rest on the upper end of sleeve 43. Upward movement of the setting tool 50 beyond that necessary to release dogs 51 causes collar stop 49 on tubular member 46 to abut against stop ring 28. This prevents further upward movement of tubular member 46 in order to maintain packer 48 within sleeve 26 at all times. Removal of tubular member 46 from tubing 16 may be made by applying sufficient upward force on tubing string 53 to fracture frangible pin 28*a*.

With dogs 51 resting on the upper end of sleeve 43 weight or force is applied through tubing 53 to the upper sleeve 43 which collapses the upper packer member 39 when upper sleeve 43 slides downwardly relative to inner sleeve 41. The upwardly directed indents on lock ring 45 and the downwardly directed indents 42 on sleeve 41 engage as packer 39 expands outwardly and sets. This operation is more clearly seen in Figs. 3 and 4.

The arrows in Figs. 3 and 4 indicate the paths of fluid flow from each production zone. Production from the lower zone 14 flows into tubular member 16 through screen liner 18 and thence upwardly into tubular member 46 and connected tubing string 53 to the surface of the earth. Production from the upper zone 13 flows into the annulus 56 between upper and lower packers 36 and 19, respectively, through screen liner 35, and then into the annulus 57 between the inner and outer tubular members 46 and 16, respectively, and thence upwardly and through perforations 44 in sleeve 43 to the annulus 58 between casing 10 and tubing string 53 to the earth's surface.

Having fully described the objects, structure and method of operation of my invention, I claim:

1. Apparatus for producing hydrocarbons from upper and lower dual production zones in a cased borehole comprising inner and outer concentric tubular members positioned in said borehole providing a first annulus between said casing and said outer tubular member and a second annulus between said inner and outer tubular members, said outer tubular member extending from above said upper zone to below said lower zone and being provided with upper and lower perforated liners adjacent each of said production zones, said inner tubular member extending from above to below said upper liner, said outer tubular member including a first movable sleeve having first and second positions, a first expansible packer positioned on said outer tubular member between said upper and lower zones adapted to seal off said first annulus and connected to said first movable sleeve whereby said first packer is retracted when said first sleeve is in said first position and expanded when said first sleeve is in said second position, anchoring means arranged on said outer tubular member adapted to engage said casing, a second expansible packer positioned on said outer tubular member above said upper zone adapted to seal off said first annulus when expanded, a second movable sleeve connected to said second packer and having first and second positions whereby said second packer is retracted when said second sleeve is in said first position and expanded when said sleeve is in said second position, a third packer positioned on said inner tubular member adjacent the lower end thereof adapted to seal off said second annulus, frangible means releasably securing said first sleeve in said first position adapted to fracture when downward force is applied to the upper end of said outer tubular member while the lower end of said outer tubular member is maintained stationary, releasable means interconnecting said inner and outer tubular members and means attached to said inner tubular member adapted to engage the upper end of said second sleeve when said inner and outer tubular members are disconnected and said inner tubular member is moved upwardly relative to said outer tubular member whereby when said inner and outer tubular members are connected a downward force applied to the upper end of said inner tubular member exerts force on the upper end of said outer tubular member to fracture said frangible means and move said first sleeve from said first to said second position and an additional force applied to the upper end of said inner tubular member exerts force on the upper end of said outer tubular member to cause said anchoring means to engage said casing and whereby when said inner and outer tubular members are disconnected a downward force applied to the upper end of said inner tubular member moves said second sleeve from said first to said second position.

2. A device as recited in claim 1 wherein said means to engage the upper end of said second sleeve is expansible and contained within said second sleeve when said inner and outer tubular members are interconnected.

3. A device as recited in claim 2 wherein said second sleeve is provided with perforations.

4. A device as recited in claim 3 wherein said inner tubular member and said outer tubular member are provided with abutting stop means adapted to limit upward movement of said inner tubular member.

5. Apparatus for producing hydrocarbons from upper and lower dual production zones in a cased borehole comprising inner and outer concentric tubular members positioned in said borehole providing a first annulus between said casing and said outer tubular member and a second annulus between said inner and outer tubular members, said outer tubular member extending from above said upper zone to below said lower zone and being provided with upper and lower perforated liners adjacent each of said production zones, said inner tubular member extending from above to below said upper liner, said outer tubular member including first and second movable sleeves, each having first and second positions, a first expansible packer positioned on said outer tubular member between said upper and lower zones adapted to seal off said first annulus when expanded and connected to said first movable sleeve whereby said first packer is retracted when said first sleeve is in said first position and expanded when said first sleeve is in said second position, anchoring means arranged on said outer tubular member and connected to said second movable sleeve whereby said anchoring means is disengaged from the casing when said second sleeve is in said first position and is engaged with the casing when said second sleeve is in said second position, a second expansible packer positioned on said outer tubular member above said upper zone adapted to seal off said first annulus when expanded, a third movable sleeve connected to said second packer and having first and second positions whereby said second packer is retracted when said third sleeve is in said first position and expanded when said third sleeve is in said second position, a third packer positioned on said inner tubular member adjacent the lower end thereof adapted to seal off said second annulus, first frangible means releasably securing said first sleeve in said first position adapted to fracture when

downward force is applied to the upper end of said outer tubular member while the lower end of said outer tubular member is maintained stationary, second frangible means securing said second sleeve in said first position adapted to fracture when additional downward force is applied to the upper end of said outer tubular member while the lower end of said outer tubular member is maintained stationary, means interconnecting said inner and outer tubular members whereby a downward force applied to the upper end of said inner tubular member exerts force on the upper end of said outer tubular member to fracture said first frangible means and move said first sleeve from said first to said second position and to fracture said second frangible means and move said second sleeve from said first to said second position, releasable means interconnecting said inner and outer tubular members, means attached to said inner tubular member adapted to engage the upper end of said second sleeve when said inner and outer tubular members are disconnected whereby a downward force applied to the upper end of said inner tubular member moves said second sleeve from said first to said second position.

6. A device as recited in claim 5 wherein said means to engage the upper end of said second sleeve is expansible and contained within said second sleeve when said inner and outer tubular members are interconnected.

7. A device as recited in claim 6 wherein said second sleeve is provided with perforations.

8. A device as recited in claim 7 wherein said inner tubular member and said outer tubular member are provided with abutting stop means adapted to limit upward movement of said inner tubular member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,107,655	Vogt et al.	Feb. 8, 1938
2,368,428	Saurenman	Jan. 30, 1945
2,433,942	Works	Jan. 6, 1948
2,702,598	Gannon	Feb. 22, 1955
2,717,041	Brown	Sept. 6, 1955
2,766,831	Otis	Oct. 16, 1956