

June 25, 1963

M. F. BRAMLETT

3,095,040

ACCESS VALVE FOR COMPLETING OIL WELLS

Filed June 30, 1961

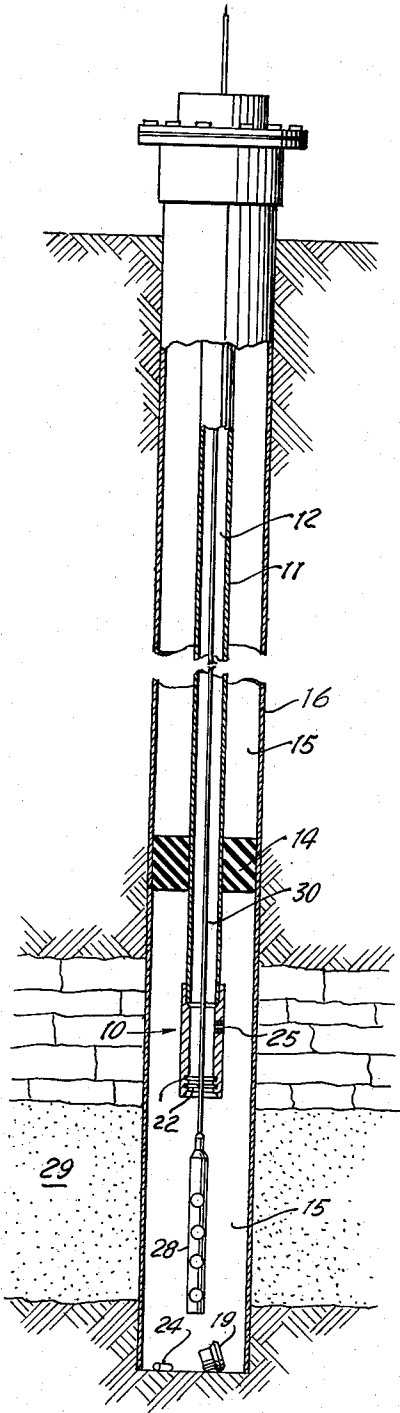


Fig. 1

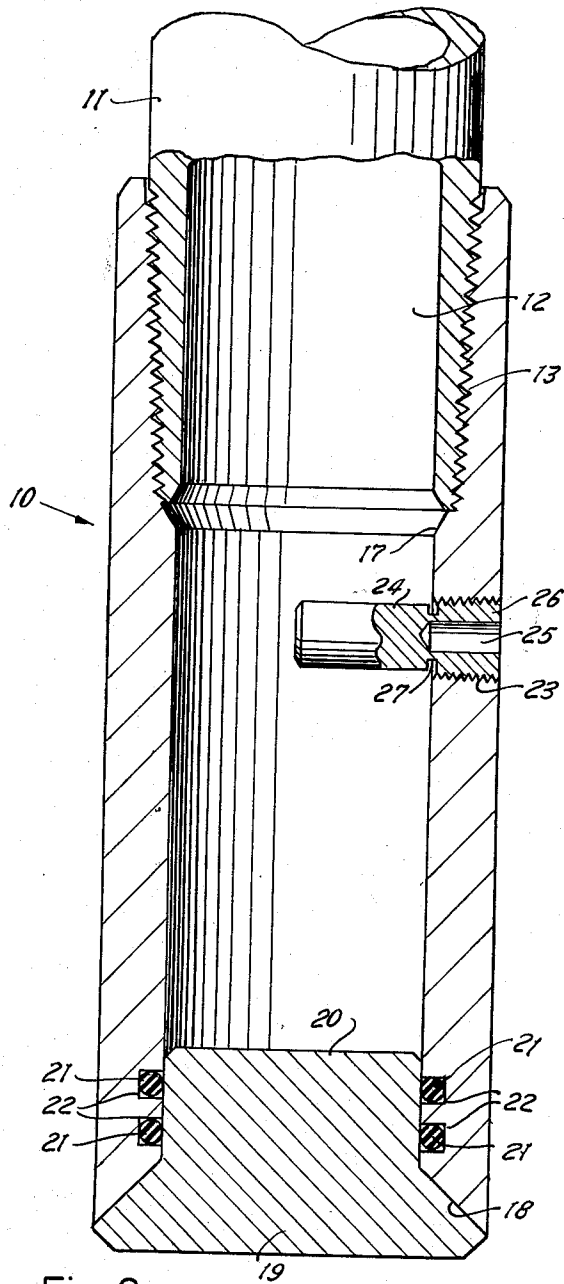


Fig.2

INVENTOR

Merlin F. Bramlett

BY

Cecil L. Wood

ATTORNEY

1

3,095,040

ACCESS VALVE FOR COMPLETING OIL WELLS
Merlin F. Bramlett, Tyler, Tex., assignor to Bramlett Oil
Field Service, Inc., Tyler, Tex., a corporation of Texas
Filed June 30, 1961, Ser. No. 121,099
4 Claims. (Cl. 166-224)

This invention relates to apparatus for the completion of oil, gas and water wells, and it has particular reference to a valve adapted to be installed on the lower end of a well conduit, such as a flow tube, whereby perforating operations, and the like, can be performed in the well and the oil or gas can be caused to flow without swabbing the well.

A prime object of the invention resides in the provision of a valve of simple and economical design and structure which, while closed to the well fluids when installed, as when the tubing is lowered into the well, is adapted to be rendered fully open, and the conduit is completely unobstructed, whereby the producing zone can be perforated and the well caused to flow without the usual swabbing operation.

Another object of the invention is that of providing means whereby the tubing can be installed in a well in a so-called "dry" state, or containing a predetermined or controlled column of fluid whose hydrostatic head is less than the formation pressure whereby the producing zone can be more effectively perforated and afford greater penetration of the producing formation.

It is a further object of the invention to provide a valve of the character described which is adapted to be employed with a packer element in the casing annulus whereby to seal off the well fluids therein above the packer and thus minimize the hydrostatic pressure encountered when lowering various tools, such as a perforating gun, gamma ray, or the like, into the formation inside the casing.

The valve embodying the invention is designed to be attached to a retrievable packer assembly, if desired, or to form a part of such assembly so that, as a self-contained unit, the retrievable packer and the valve can be installed on the lower end of a tubing string when the tubing is lowered into the well to the desired depth to seal off or isolate the casing annulus or formation area below the packer.

It is an important object of the invention to provide an apparatus by which the hydrostatic pressure in the formation zone can be sealed off and equalized with that of the pressure of the tubing column, while pressure in the casing annulus above the packer is restrained, and whereby such pressures, when equalized, will favor maximum effectiveness of the perforating shots, and also whereby the hydrostatic pressure at the producing zone in the casing is always less than the formation pressure so that when the well is perforated no well fluid can flow into the formation from the well annulus.

Broadly, the invention contemplates the provision of a valve for closing the lower end of a flow tube in an oil or gas well while the tube is being installed therein, and adapted for use with a packer in the casing annulus, and capable of being fully opened to formation pressure when the hydrostatic value thereof has been minimized below the packer, and affording unobstructed access to the producing zone of the well.

While the foregoing objects are paramount, other and lesser objects will become manifest as the description proceeds, taken in connection with the appended drawings wherein:

FIGURE 1 is a longitudinal sectional illustration of the invention in a typical installation in an oil well, the tubing and packer element being also shown in section, and

FIGURE 2 is an enlarged longitudinal sectional view

2

of the invention showing the closure plug for the lower end of the valve and the break-off plug.

In oil well perforating operations it is desirable to reduce, as much as possible, the hydrostatic pressure of well fluids which exist at the production level so that minimum resistance is encountered and greater penetration of the perforating shots can be accomplished. By removing this obstacle, as by first sealing off the fluid column in the casing annulus by a packer of conventional design, and closing the lower end of the tubing string when it is installed, below the packer, the hydrostatic column in the tubing and the bottom-hole pressure can be readily controlled, and prevent the well from producing too rapidly or prematurely.

Such conditions are desirable especially where bentonite, and similar elements, are commingled with the drilling fluids and present some resistance to the penetration of shots into the producing formation. It is common knowledge that greater penetration is possible where the least amount of hydrostatic pressures prevail either in the tubing or in the well casing below the packer in the area where the perforation operation is to be performed.

The invention, as typified in the drawing, comprises a cylindrical body 10 having an internal diameter substantially the same as the tubing or flow duct 11, to which it is attached whereby the passage 12 through the tubing 11 and the body 10 is unobstructed.

The body 10, having a greater exterior diameter than the tubing 11, is internally threaded at its upper end at 13 to receive the externally threaded end of a section of tubing 11, or the tubular body (not shown) of a retrievable packer assembly which may be employed instead of the conventional stationary packer element 14, shown in FIGURE 1, embracing the tubing 11 in the annulus 15 of the casing 16. The shoulder 17 formed about the base of the internal threads 13 is bevelled to present a relatively smooth internal bore and avoid impediments in the movement of tools through the assembly.

The lowermost end 18 of the body 10 is also internally bevelled to facilitate the operation of tools into and out of the well tube 11, and is closed by a plug 19 whose head 20 is shaped to be seated against the bevelled surface 18, in the manner shown in FIGURE 2, while the plug 19 is fitted snugly into the member 10 and surrounded by a plurality of O-rings 21 arranged in conforming grooves 22 formed internally of the body 10. Hydrostatic pressure in the producing zone below the plug 19 will also exert a force thereon to retain it against its seat, while the tubing string is lowered into the well, and this pressure must be reduced, or equalized with the tubing pressure, to enable the plug 19 to be dislodged with greater ease.

Located above the plug 19, and preferably just below the shoulder 17 of the body 10, is an internally threaded port 23 in which is threaded a break-off plug 24 which projects into the body 10 and has a concentric bore 25 which extends from its outer end 26 inwardly beyond the inner wall of the body 10. The break-off plug 24 has a circumferential groove 27 formed thereon near the inner end of the bore 25 to provide a weakened area whereby the internally projecting portion of the plug 24 can be broken off by a tool, such as the perforating gun 28 shown in FIGURE 1, or similar device, when it is lowered through the tubing and the member 10. The plug 19 is also dislodged by a tool in the same manner to open the tubing 11 to the annulus zone 15 whereby to equalize the pressure below the plug 19 with the hydrostatic head in the well tubing 11.

The plug 19 in the lower end of the valve body 10, as well as the break-off plug 24, may be formed of any suitable type of corrosible or frangible material, such as aluminum, or certain types of plastics, whose presence in

3

the well will not damage or impair the productive formation or tools which may be lowered into the well.

In operation, when it is desirable to complete the well for production, the valve unit embodying the invention is installed on the lower end of a string of tubing 11, either in a retrievable packer assembly or as a separate installation, and lowered into the cased well bore, as illustrated in FIGURE 1. The valve unit is installed below the packer 14 and since the plugs 19 and 24 are in place, and the lower end of the tubing 11 is thus sealed off from the producing zone, the greater portion of the well fluids are trapped in the casing annulus 15 and the tubing 11 is substantially "dry," or contains a predetermined amount of fluid "cushion."

The break-off plug 24 can be detached by dropping a go-devil (not shown) or any other type of tool, such as the perforating gun 28, on a line 30, through the tubing 11. This operation can be accomplished to break off the plug 24 without dislodging the plug 19, if desired, so that the hydrostatic head in the annulus 15 and in the tubing can be equalized. Both plugs 19 and 24 will drop out and find their way to the bottom of the well bore to be disintegrated or broken up by the tools used in the various operations.

The invention is simple in design and structure, and may obviously be changed or modified by persons skilled in the art without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. An access valve for temporarily closing a flow tube in an oil well having a casing, and a packer in said casing about said tube, a tubular body having means thereon for threaded attachment to the lower end of said flow tube below said packer, the said body having a smooth internal bore equal in diameter to that of said flow tube and having an internally beveled seat formed in its lowermost end, sealing means internally of said body adjacent to said beveled seat, a plug having a flanged portion on said beveled seat and extending into said body closing the same, the said body having a port in one side above said beveled seat, and a break-off plug closing said port capable of being broken away to open said port by the force of a tool lowered into said flow tube.

2. A valve for temporarily closing the lower end of a flow tube in an oil well having a casing and a packer on said flow tube defining annular chambers above and below said packer, the said valve comprising a tubular body having means thereon for threaded attachment to the said flow tube, and having a smooth internal bore equal in

4

diameter to that of said flow tube and co-extensive therewith, a beveled seat formed internally of the lowermost end of said body and sealing means in said bore above said seat, a removable plug formed with a flange engageable with said beveled seat and extending into said bore and embraced by said sealing means, the said body having a threaded port in one side above said seat and a break-off plug closing said port and capable of being broken away by a tool lowered into said flow tube.

3. In a valve for temporarily closing a flow tube in an oil well having a casing and a packer in said casing about said flow tube, the said valve comprising a tubular body formed with means for threaded attachment to the lower end of said flow tube and having a smooth internal bore, constant in diameter throughout its length, and coextensive with the diameter of said flow tube, a beveled seat formed on the lowermost end of said body and sealing means in said bore above said seat, a removable flanged plug closing the lowermost end of said body and engaging said beveled seat, the said body having a port in one side above said beveled seat and sealing means, and a break-off plug closing said port capable of being broken away by a tool lowered into said flow tube.

4. A valve for temporarily closing a flow tube in an oil well having a casing and a packer on said flow tube in said casing, the said valve comprising a cylindrical body having means for attachment to the lower end of said flow tube below said packer, and having a smooth constant internal diameter throughout its length equal to and co-extensive with the internal diameter of said flow tube, a beveled seat formed internally of the lower end of said body and sealing means above said seat about the internal surface of said body, a flanged plug removably seated on said beveled seat and extending into said body closing its lower end, the said body having a port in one side above said seat and a detachable plug closing said port, the said detachable plug and said flanged plug being capable of removal from said body by a tool lowered into said flow tube.

References Cited in the file of this patent

UNITED STATES PATENTS

1,854,477	McKissick	Apr. 19, 1932
2,690,807	Moosman	Oct. 5, 1954
2,903,074	Layton et al.	Sept. 8, 1959
2,922,479	Kinley	Jan. 26, 1960
3,003,565	Courtney	Oct. 10, 1961
3,029,875	Moller	Apr. 17, 1962