United States Patent

[11] 3,633,668

[72] Inventors **Gonzalo Vazquez**
Dorking, England;
John V. Salerni, Whittier, Calif.

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[45] Patented **Jan. 11, 1972**
[73] Assignee **Baker Oil Tools, Inc.**
Commerce, Calif.
Original application Aug. 13, 1968, Ser. No. 752,366, now Patent No. 3,556,212. Divided and this application May 22, 1970, Ser. No. 39,636

[54] **DISASTER VALVE**
8 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **166/135,** 166/224
[51] **Int. Cl.** **E21b 33/10**
[50] **Field of Search** 166/72, 73, 135, 154, 194, 224, 226; 251/291, 343, 344

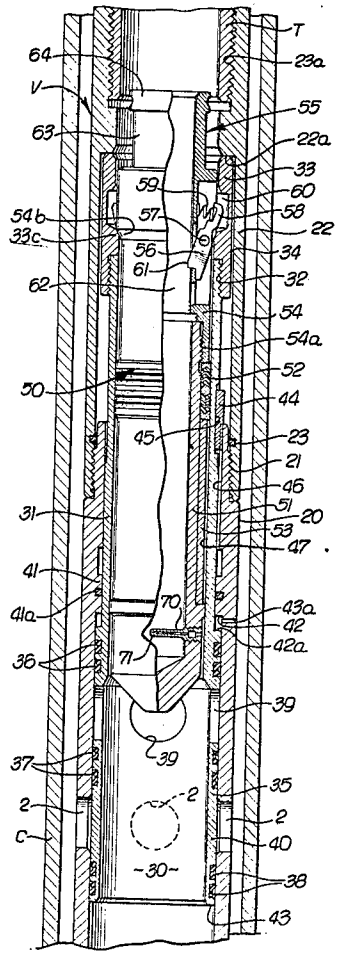
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Primary Examiner—Ian A. Calvert
Attorney—Bernard Kriegel

ABSTRACT: Disaster valve apparatus for gas or oil wells in which a well pipe is disposed for conducting production fluid to the top of the well, the disaster valve being adapted for location below the top of the well in a control fluid tubing string above a packer sealingly engaged with the well pipe, the disaster valve having a valve sleeve provided with a central bore closed by a releasable plug, control fluid pressure in the control fluid tubing holding the valve open against the pressure of well fluid tending to close the valve. Reduction in pressure in, or venting of, the control fluid tubing enables the production fluid pressure to close the disaster valve.



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SHEET 1 OF 3

FIG. 1.

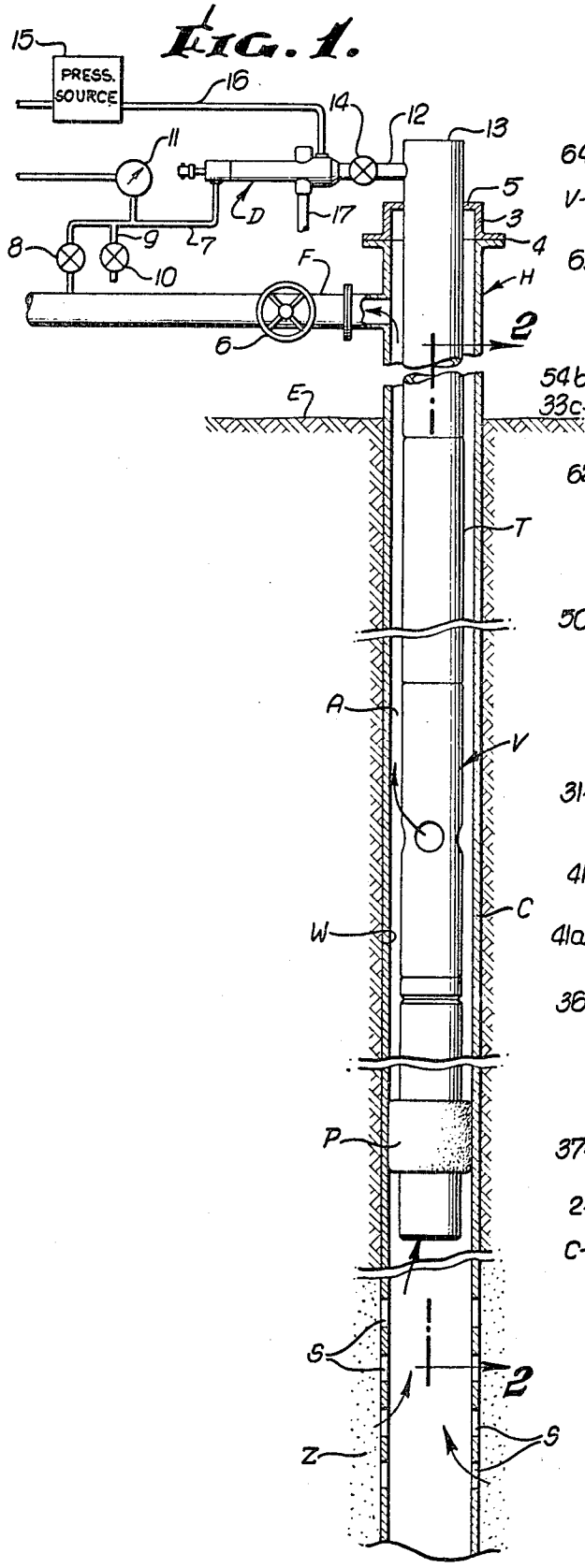
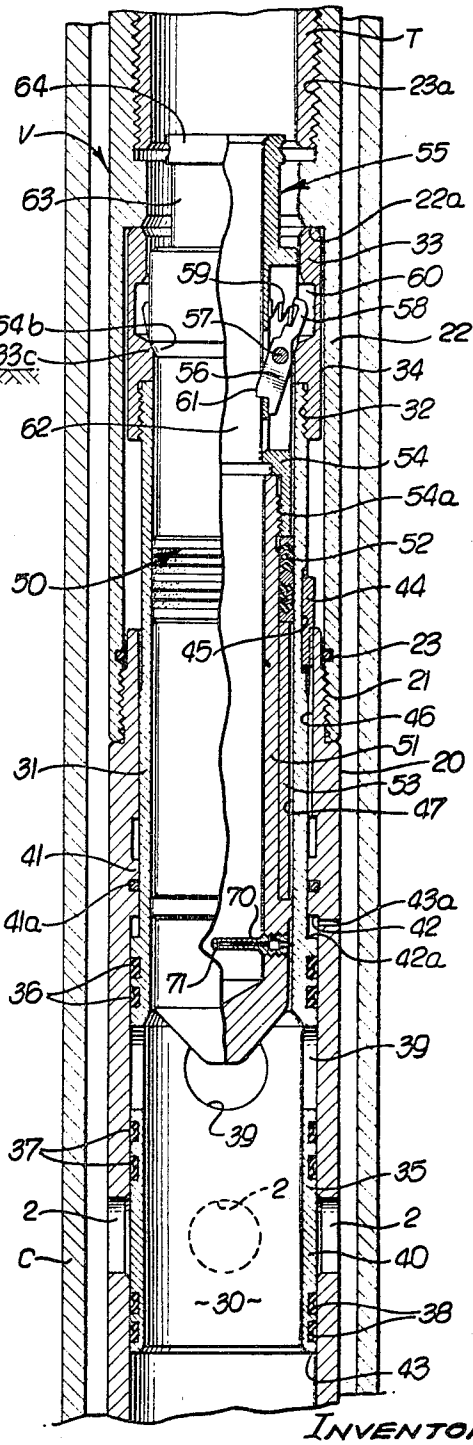


FIG. 3.



INVENTORS
GONZALO VAZQUEZ
JOHN V. SALERNI
By Bernard Kriegel
ATTORNEY

FIG. 2a.

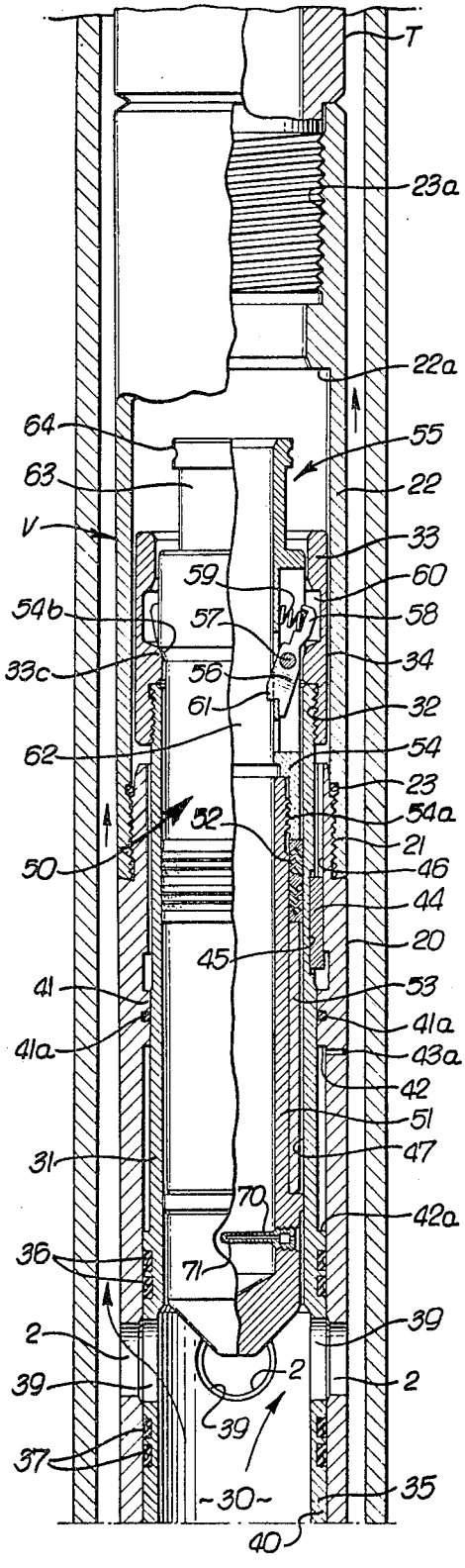
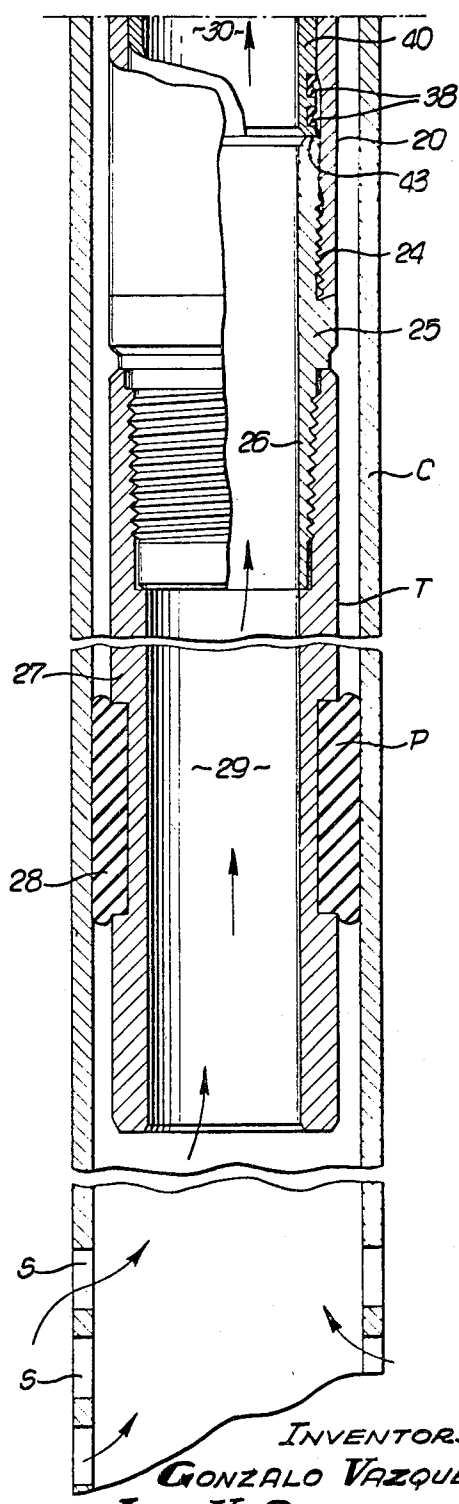


FIG. 2b.



INVENTORS.
GONZALO VAZQUEZ
JOHN V. SALERNI
By Bernard Kriegel
ATTORNEY

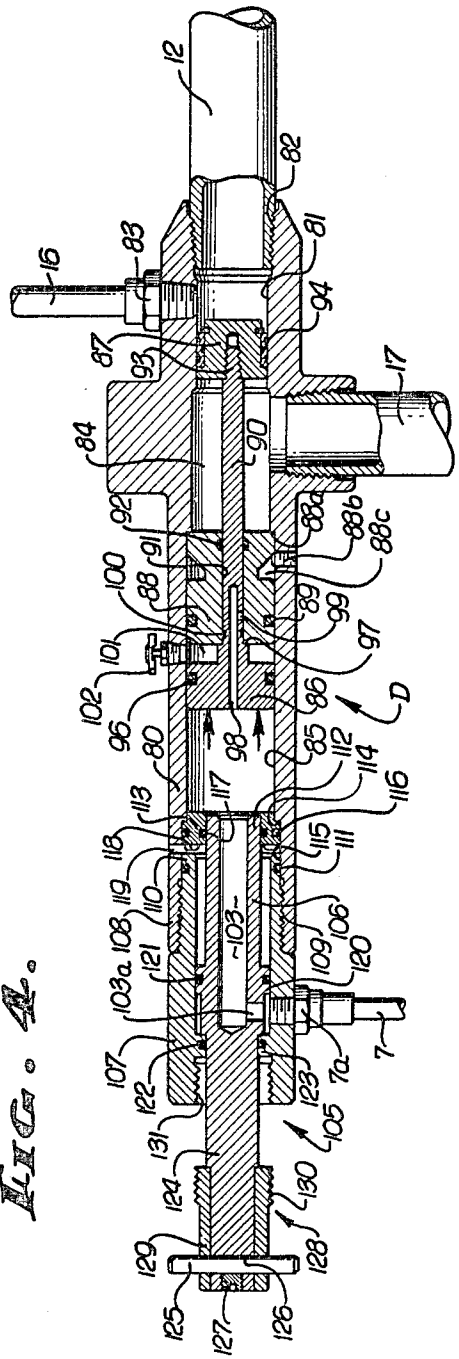


FIG. 4.

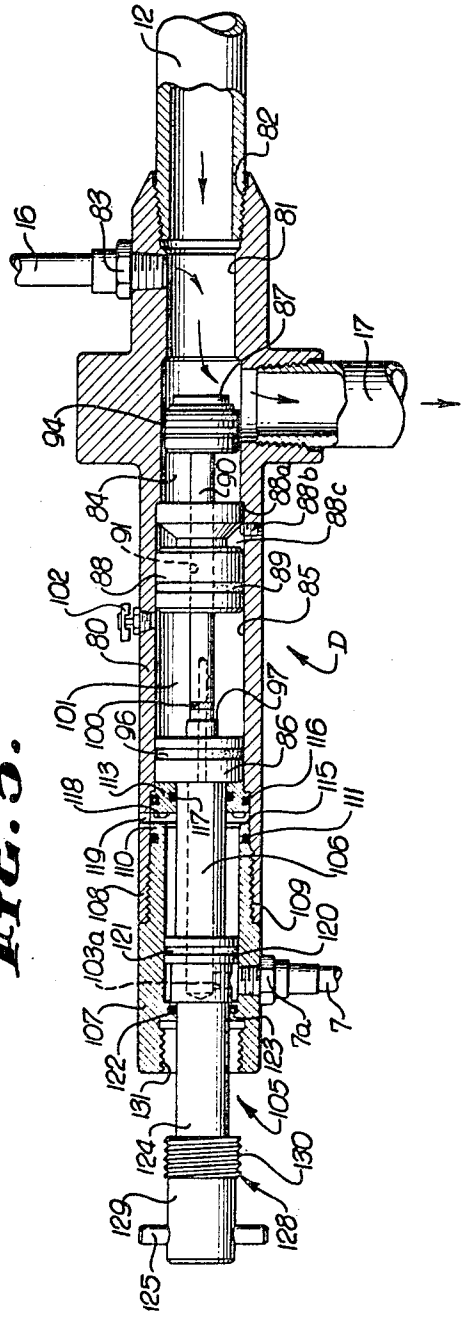


FIG. 5.

INVENTORS.
GONZALO VAZQUEZ
JOHN V. SALERNI
By Bernard Kriegel
ATTORNEY

DISASTER VALVE

The present application is a division of our application for "Disaster Valve," Ser. No. 752,366, filed Aug. 13, 1968, now U.S. Pat. No. 3,556,212.

In the production of certain oil and gas wells which naturally flow, it is sometimes desirable or necessary that the well be shut in, that is, be prevented from continuing to produce, in the event that some occurrence to the flow line or the collection tank would result in loss of production fluid if the well were not shut in.

Various well fluid pressure responsive valves have been provided in the past for accomplishing the shutting in of a well upon a change in pressure of the production fluid, but such valves have generally been so constructed as to be run into a well pipe on a tubing string and retrieved on the tubing string when various operations are to be performed in the well bore below the valve assembly, such as perforating, surveying or other operations requiring the running of a tool to a location lower than the valve. In other instances, special strings of tubing, including macaroni tubing, is run for conducting a control fluid to a subsurface location for controlling the valve, such macaroni string being difficult to run in combination with a conventional tubing string.

The present invention provides a sleeve valve apparatus adapted to be made up in a conventional tubing or pipe string with a packer, and to be run into the well in the tubing string. The normal central opening through the sleeve valve device is substantially as large as the opening in the tubing string, thereby enabling performance of fluid injection or wire line operations in the well below the valve assembly. The valve device is adapted to be conditioned for use by closing off its central passage by means of a closure plug. This plug is adapted to be run into the tubing string on a wire line for seating and anchoring coengagement with the valve sleeve device, so as to close off the opening therethrough, whereby the device is rendered responsive to the pressure of well fluid in the casing and responsive to the pressure of control fluid in the control tubing. Under these circumstances, a force applied to the valve sleeve device by well fluid pressure in excess of the force applied to the valve sleeve device by control fluid pressure will effect closure of the valve apparatus, shutting the well in; but, if the force applied to the valve sleeve device by the control fluid exceeds that applied by well fluid pressure, the valve apparatus will be held open to allow the continued flow of production fluid.

Among the objects of the invention is the provision of a rugged disaster valve which is easy to install and operate, requiring only the removal of the plug or closure for the valve sleeve device to permit the performance of downhole operations by wire line tools capable of passing through the valve sleeve device.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense.

Referring to the drawings:

FIG. **1** is a view, partly in section and partly in elevation, showing a well equipped with a disaster valve and dump unit in accordance with the invention;

FIGS. **2***a* and **2***b* together constitute an enlarged vertical section through the subsurface valve, FIG. **2***b* being a downward continuation of FIG. **2***a*, and showing the valve open;

FIG. **3** is a view corresponding to FIG. **2***a*, but showing the valve closed;

FIG. **4** is a vertical section showing the dump unit in condition for holding the subsurface valve open; and

FIG. **5** is a view corresponding to FIG. **4**, but showing the dump unit open to allow closure of the subsurface valve.

As seen in the drawings, and with particular reference to FIG. **1**, the invention involves the provision of subsurface or disaster valve means V installed in a string of tubing T disposed in a well W in which a casing string C has been set. The casing C at a lower section has been provided with perforations or slots S through which gas or oil may flow from a producing zone Z of the subsurface earth formation traversed by or into which the well W extends. Below the valve V, the tubing string has a typical casing packer P which is adapted to be set in sealing engagement with the wall of the casing C above the casing perforations or slots S so as to confine the flow of production fluid to a path extending into the lower end of the tubing string T.

Above the packer P, the fluid entering the tubing T below the packer P may enter the annular space A, defined between the casing C and the tubing T, through valve ports **2** when the valve V is open, as will be hereinafter described. However, when the valve V is closed, the well is effectively shut in and flow of production fluid into the annulus A is prevented.

Above the surface of the earth, designated E, is a suitable wellhead equipment H. This equipment illustratively includes a head **3** secured, as at **4**, to the upper end of the casing C and having a sealing flange **5** disposed about the upper end of the tubing T to prevent the flow of well fluid therebetween. Below the head **3**, a flow line F leads from the casing C and communicates with the tubing casing annulus A, so as to conduct production fluid from the well to a pipeline or tank farm, as is well known. In the flow line F may be a shutoff valve **6** to enable manual shutting in of the well.

Interposed between the flow line F and the tubing T is a dump unit D which, in accordance with the invention, is responsive to well fluid pressure in the flow line F to allow the subsurface valve V to be closed by well fluid pressure when pressure in the flow line F varies. The dump unit D is connected by a conduit **7** to the flow line F, this conduit **7** having a shutoff valve **8** therein. Between the dump unit D and the shutoff valve **8** is a vent conduit **9** having a shutoff valve **10** for allowing venting of the conduit **7** and the adjacent end of the dump unit D for a purpose which will be hereinafter described. Between the dump unit D and the flow line F is a pressure gauge **11**. The dump unit D is also connected by a control fluid conduit **12** to the tubing T below a head **13** closing the upper end of the tubing T. A further shutoff valve **14** may be provided in the control fluid conduit **12**.

A pressure source **15** is provided and is connected by a conduit **16** to the dump unit D at the opposite end thereof from the conduit **7**. This pressure source **15** may be a suitable tank containing a quantity of fluid pressurized by air or gas so as to apply the desired pressure to control fluid in the tubing T. The dump unit is adapted to vent the control fluid pressure to atmosphere via a vent outlet **17**, when the pressure relationship of the production fluid in the flow line to the control fluid in the tubing T is such as to actuate the dump unit D, whereby the valve V in the tubing T will be caused to close by production fluid pressure in the well.

Referring now to FIGS. **2***a* and **2***b*, the disaster valve means V will be seen to comprise an elongated tubular body **20** having a threaded connection at **21** with an upper sub **22**, a seal **23** being provided at the threaded connection. The sub **22** is provided at its upper end **23***a* with internal threads for connection with the lower end of the tubing T. At its lower end, the body **20** is threadedly connected, as at **24**, with a connector sub **25** having a threaded pin **26** for connection with the tubing T therebelow. Beneath the valve V, the packer P is shown (FIG. **2***b*) as having a tubular body **27** provided with a resilient expansible packing element **28** sealingly engageable in the well casing C, the packer body **27** having a flow passage **29** communicating with a central bore or passage **30** extending through the valve assembly V. Slips, or the like, (not shown) anchor the packer to the well casing, in a known manner.

The valve assembly V further includes an inner sleeve **31** reciprocably disposed in the body **20**. Threadedly connected, as at **32**, to the upper end of the valve sleeve **31** is a seating

nipple 33 having an outer cylindrical wall 34 slidable in the body 20. At its lower end, the valve sleeve 31 has a cylindrical section 35 slidable in the body 20. This section 35 of the valve sleeve 31 has upper seal ring means 36 providing an upper sliding seal between the valve sleeve 31 and the body 20. Spaced below the seal ring means 36 is intermediate seal ring means 37 providing a sliding seal with the body 20. Below the seal ring means 37 is lower seal ring means 38 providing a lower sliding seal with the body 20. Between the upper and intermediate seal ring means 36 and 37, the valve sleeve 31 is provided with side openings or ports 39 adapted, when the sleeve 31 is in a first or lower position, to communicate with the ports 2 in the valve body 20. Between the intermediate seal ring means 37 and the lower seal ring means 38, the valve sleeve 31 includes an unported section 40 which, when the valve sleeve is in an upper or second position (FIG. 3), is adapted to close the ports 2 in the valve body 20.

Above the ports 2, the body 20 has an internal flange 41 carrying a seal ring 41*a* sealing against the valve sleeve 31. This flange provides a downwardly facing shoulder 42 opposed by an upwardly facing shoulder 42*a* formed about the valve sleeve 31, these shoulders being coengageable to limit upward movement of the valve sleeve 31, although upward movement can be limited by engagement of the upper end of the nipple 33 with a subshoulder 22*a*. A vent port 43*a* is provided in the body 20 between the shoulders 42 and 42*a* to prevent entrapment of fluid. Downward movement of the valve sleeve 31 is limited by engagement of the lower end face 43 of the sleeve 31 with the upper end of the lower connector sub 25.

In order to assure alignment of the ports 39 in the valve sleeve 31 with the body ports 2, when the sleeve is in the lower position, a key 44 may be provided in a seat 45 in the valve sleeve 31, the key being longitudinally slidable in a keyway 46 in the body 20 of the valve assembly V.

Extending longitudinally through the valve sleeve 31 is a passage or bore 47 which communicates with the body passage 30, and which is of a size or diameter at least substantially equaling the diameter of the opening or passage through the tubing T. Accordingly, well tools may be run through the tubing T and through the passage or bore 47 of the subsurface valve V to perform various wire line operations below the valve assembly V, without requiring removal of the valve assembly from the well. In addition, the passage 47 causes no significant restriction in the path of fluid pumped through the tubing T, in the event that fluid treatment of the well below the valve V may be necessary or desired.

In order to close the bore 47 through the valve sleeve 31, a plug device, generally denoted 50, is adapted to be releasably latched in sealing engagement in the bore 47. This plug device 50 comprises, in the illustrative embodiment, a hollow body 51 having an annular seal ring assembly 52 disposed thereabout for sealing engagement within the bore 47 of the valve sleeve 31. The seal ring assembly is disposed between the upper end of a spacer sleeve 53 and the lower end of a body 54 of a lock assembly 55, which body 54 is threaded, as at 54*a*, onto the upper end of the plug body 51.

The body 54 of the lock assembly 55 has a number of longitudinally extended laterally opening slots therethrough, in which locking dogs 56 and pivotally mounted on pins 57. These dogs 56 have upper ends 58 biased outwardly by springs 59 for interlocking engagement in an annular groove 60 in the seating nipple 33 of the valve sleeve 31. At their lower ends, the dogs 56 have inner cam portions 61 which project into the central bore 62 in the plug body 54. At its upper end, the body 54 of the latch or lock means 55 includes a hollow neck 63 projecting upwardly and having a flange 64 at its upper end. Thus, the plug assembly 50 is adapted to be run into the tubing T on a wire line (not shown) until its shoulder 54*b* engages a nipple shoulder 33*c*, the dogs 56 then automatically latching into the groove 60 of the nipple 33 of the valve sleeve 31, so as to effectively close off the passage or bore 47 through the valve sleeve 31. However, to remove the plug assembly 50, it is only necessary to run a retrieving tool of a well-known type into the tubing T to engage the neck 63 and the cam portions 61 of the latch dogs 56 to release the latter from the groove 60, allowing the plug 50 to be pulled from the valve sleeve 31 by the wire line.

At its lower end, the plug body 51 may be provided with an equalizer device 70 adapted to have its frangible part 71 broken off to establish communication between the portions of tubing T above and below the plug 50, thereby equalizing pressure and facilitating pulling of the plug 50 from the valve sleeve 31.

When the plug means 50 is in place in the bore 47 of the valve sleeve 31, the position of the valve sleeve in the valve body 20 is determined by pressure acting across the entire cross-sectional area of the sleeve 31 above the plug 50 in the tubing T and below the plug 50 entering the tubing T through the packer body passage 29. The present valve sleeve 31 has equal upper and lower end areas, so that if the pressure in the tubing T above the valve assembly is less than the well pressure, the valve sleeve 31 will be shifted to its upper position (FIG. 3), at which the ports 2 are closed by the section 40 of the valve sleeve, but if the control fluid pressure in the tubing T above the valve assembly exceeds the well pressure below the valve assembly, then the valve sleeve 31 will be held in its lower position (FIGS. 2*a* and 2*b*), at which the ports 2 in the body and ports 39 in the sleeve are in communication. Under the latter circumstances, fluid from the subsurface earth zone Z may flow upwardly through the valve assembly into the annulus A and thence to the flow line F.

In order to apply fluid under pressure to the top of the valve sleeve 31 when the plug 50 is in place, the tubing T may be filled with a suitable liquid, such as kerosene. Thereafter, air or gas may be applied to the liquid in the tubing T from the source 15 through the dump unit D.

Referring to FIGS. 4 and 5, it will be seen that the illustrative dump unit D comprises an elongated tubular body 80 having a bore 81 adjacent one end, the control fluid conduit 12 being connected to the body 80 as by a threaded joint 82, so as to communicate with the bore 81. The conduit 16 leads from the pressure source 15 to the bore 81, being connected to the body 80 by a connector 83. Spaced inwardly in the body 80 from the bore 81 is a vent chamber 84 with which the vent conduit 17 communicates. On the opposite side of the vent chamber 84 from the bore 81 is a bore 85. A piston 86 is reciprocable in the bore 85 and a piston 87 is reciprocable in the bore 81. The piston 86 is reciprocably supported by a member 88 providing a wall between the bore 85 and the vent chamber 84, the member 88 having a ring seal 89 engageable in the bore 85, and the piston 86 having a rod 90 shiftably disposed in a bore 91 in the wall member 88, a ring seal 92 also being provided between the rod 90 and the wall member 88. This rod 90 has one end 93 connected to the piston 87 which has a ring seal 94 engageable in the bore 81. The wall member 88 is held in the bore 85 against the shoulder 88*a* therein by means of a pin or setscrew 88*b* extending into an annular groove 88*c* in the outer periphery of the wall member 88. The rod 90 provides a shoulder 97 adapted to abut with the wall member 88 so that the pistons 86 and 87 are movable in one direction as a unit, together with the rod 90, to a limited extent, at which the piston 87 is in the bore 81, but the piston 86 and the piston 87 may move in the other direction relative to the wall member 88 for purposes of dumping control pressure.

The piston 86 and rod 90 have a central passage 98 leading from the bore 85 and a lateral port 99 communicating with the passage 98, a seal ring 100 being provided on the rod 90 to form a seal in the bore 91 of the wall member 88, when the piston 86 is positioned as seen in FIG. 4 relative to the wall member 88. However, movement of the piston 86 away from the member 88 will open the port 99 into an annular space 101 defined between the wall member 88 and the piston 86, the body 80 having a vent valve 102 for selectively venting the annular space 101.

A passage 103 leads from the conduit 7 to the bore 85 of the dump unit. Therefore, the piston 86 in the bore 85 is subjected to the pressure of fluid derived from the flow line F; while the piston 87 in the bore 81 is subjected to control fluid pressure from the source 15. In the illustrative embodiment, the pistons 86 and 87 provide a differential assembly, the piston 86 being larger than the piston 87. If the force derived from production fluid pressure admitted to the bore 85 from conduit 7 and acting on the piston assembly 86 to move the latter, together with the rod 90 and the piston 87, to the right exceeds the force derived from control pressure admitted to the bore 81 and acting on the piston 87 to move the latter, together with the rod 90 and the piston 86, to the left, then the dump unit will, as seen in FIG. 4, maintain the control fluid pressure in the conduit 12 leading from the control tubing. Thus, such control fluid pressure will be imposed on the hydrostatic column in the control tubing T. This control pressure from the source 15 previously referred to is, therefore, selected to provide a total pressure capable of holding the subsurface disaster valve sleeve 31 in its lower position against counterpressure of the production fluid tending to move the valve sleeve 31 to the upper position, at which the valve means V is closed.

When flow line pressure applied to the bore 85 of the dump unit D, via the conduit 7, drops to a value such that control fluid pressure in bore 81 can force the piston 87 to the left, to the position shown in FIG. 5, then control fluid pressure is vented to atmosphere through vent conduit 17. Thus, the pressure of production fluid in the well casing C below the valve V will act on the valve sleeve 31 to force the same upwardly to the position shown in FIG. 3, whereby the well may be shut in. The dump valve releases the control pressure very quickly, since a short travel of the piston 87 and its rod 90 to the left shifts the port 99 into the annular space 101, equalizing the pressure on both sides of the piston 86 by flow through the passage 98 and port 99. The pressure force on the piston 86 opposing movement of the piston 87 to the left is thus reduced to a very great extent, allowing the pressure in the bore 81 to rapidly shift the piston 87 fully to the left, as seen in FIG. 5.

Included in the dump unit D are means 105 for resetting the well flow control system following venting of the control pressure system and closure of the valve V. This resetting means includes a bar or rod 106, which is reciprocably disposed in an end cap 107 connected to the end 108 of the dump unit body by threads 109. The inner cylindrical end 110 of the cap 107 has a ring seal 111 engaged in the body 80 of the dump unit. At its inner end 112, the bar 106 extends through an annular insert 113 which shoulders at 114 in the counterbore 115 into which the cap 107 is threaded. This insert 113 has an outer ring seal 116 sealingly engaged in the counterbore 115, and an inner ring seal 117 sealingly engaged with the bar 106. Between the seal insert 113 and the inner end 110 of the cap 107 is a gap 118, and the body 80 has a port 119 communicating the gap 118 to atmosphere.

Intermediate its ends, the bar 106 has a sealing flange 120 provided with a ring seal 121 sealingly engaged within the cap 107 at one side of the flow line or production fluid pressure inlet fitting 7*a*, which connects the conduit 7 to the dump unit. At the other side of the fitting 7*a*, a ring seal 122 is provided in an internal flange 123 in the cap 107. Between the ring seals 121 and 122, the bar has a radial port 103*a* for establishing communication between the conduit 7 and the passage 103 in the bar 106, whereby flow line or production fluid pressure is admitted to the bore 85 between the seal ring insert 113 and the piston 86.

The bar 106 has its outer end 124 projecting outwardly from the cap 107 to enable actuation or reciprocation of the bar. A handle 125 in the form of a diametrically extended pin disposed in a hole 126 in the bar end 124 is provided for facilitating manual reciprocation of the bar 106. This handle 125 is held in place by suitable means, such as a socket-headed setscrew 127, threaded into the extremity of the bar end 124.

Releasable latch means 128 are provided for holding the bar in an inward position when desired. This latch means includes an annular latch body 129 disposed on the end 124 of the bar 106 and keyed in place by means of the handle pin 125. The latch body 129 has an external thread 130 thereon engageable in an internal thread 131 in the adjacent end of the cap 107. Thus, the latch means 128 are engageable and releasable responsive to rotation of the handle 125 and bar 106.

It will now be understood that, when the piston 86, the piston rod 90, and the piston 87 of the dump unit D are moved to the left, as seen in FIG. 5, to vent control pressure through the vent 17, the bar or rod 106 may be moved axially to the right to reset the piston 95 and the piston 87 to the positions shown in FIG. 4. At this time, the latch means 128 may be engaged by threading the latch body 129 into internal thread 131 to hold the piston 87 in the bore 81 so as to prevent venting of the control fluid pressure. With the piston so held, control fluid pressure may be applied in the tubing T to open the disaster valve V. After production of the well is established through the valve V, pressure of the production fluid will be applied through the conduit 7, port 103*a*, and passage 103 to the bore 85 to maintain the pistons 86 and 87 in the position of FIG. 4, and, thereafter, the latch means 128 may be released by unthreading the body 129 from the bore 131 to allow for subsequent venting of the control tubing responsive to a drop in the pressure of production fluid in the flow line.

In the installation of the system in a wellhead and flow line assembly, the latch means 128 may be initially engaged, to hold the piston 87 in a nondumping position until control fluid pressure opens the subsurface valve V and production fluid pressure is present in the flow line conduit 7. The pressure in the flow line may be a function of a choke in the line F downstream from the conduit 7, and, in any event, the pressure will be indicated on the gauge 11. When such pressure is known, the required control pressure may also be determined and established so as to effect opening of the vent 17 at a desired low point in the production fluid or flow line pressure.

Thereupon, the latch means 128 may be released and the rod or bar 106 retracted. To test the balance and operability of the system, the shutoff valve 8 in the conduit 7 may be closed, and the vent valve 10 may be opened to bleed off pressure from the bore 85 of the dump unit. As such pressure bleeds off, the dump unit will open the vent 17, allowing the subsurface disaster valve to close.

Thereafter, the rod 106 is employed to reset the dump unit, as previously described, the shutoff valve 8 opened, and the vent valve 10 closed; whereupon the control tubing T may be repressured to reopen the valve V, and well production resumed. Thereafter, a drop in the pressure of production fluid in the flow line F to a predetermined value will result in the automatic closure of the subsurface valve V.

We claim:

1. In a valve assembly for controlling fluid flow through a tubular string extending to the top of a well bore: tubular body means adapted to form part of the tubular string and having one or more side ports; valve means shiftable in said body means to open and close said one or more side ports and having a central passage; and plug means adapted to be releasably latched in said valve means to close said passage and located in said valve means substantially completely above said one or more side ports to retain said central passage in a fully opened condition at least up to said one or more side ports.

2. In a valve assembly as defined in claim 1; said valve means having one or more ports adapted to be located selectively out of or in communication with said one or more side ports of said body means upon shifting of said valve means in said body means, said plug means also being located in said valve means substantially completely above said one or more side ports of said valve means.

3. In a valve assembly as defined in claim 1; said plug and valve means being responsive to fluid pressure in said central passage to be shifted in said body means by such fluid pressure between positions opening and closing said one or more side ports.

4. In a valve assembly as defined in claim 1; said plug and valve means being responsive to fluid pressure in said central passage to be shifted longitudinally in said body means by such fluid pressure between positions opening and closing said one or more side ports.

5. In a valve assembly as defined in claim 1; said valve means including a portion extending in said body means above said one or more side ports; and means for releasably latching said plug means to said portion.

6. In a valve assembly for controlling fluid flow: an elongate tubular body having a central bore therethrough; means at the ends of said body adapted to connect said body in a tubing to be disposed in a well bore; said body having a lateral port; a valve sleeve axially shiftably disposed in said bore in said body for closing off and opening said port to communication with said bore and having a central passage therethrough; said valve sleeve having a seating nipple portion; and blanking plug means having a portion sealingly engageable in said passage in said valve sleeve to close said passage; said blanking plug means and said seating nipple portion having cooperative latch means for releasably holding said plug means in said valve sleeve; said blanking plug means being located in said valve sleeve substantially completely above said lateral port to retain said central passage in a fully opened condition at least up to said lateral port.

7. In a valve assembly as defined in claim 6; said valve sleeve including axially spaced ported and unported sections; sealing means between said sleeve and said body at opposite sides of said ported and unported sections, said ported section having a port adapted to communicate with said port in said body movement of said sleeve in one direction, said unported section closing said port in said body movement of said sleeve in the other direction; said blanking plug means also being located in said valve sleeve substantially completely above said ported section of said valve sleeve.

8. In a valve assembly as defined in claim 6; said valve sleeve including axially spaced ported and unported sections; sealing means between said sleeve and said body at opposite sides of said ported and unported sections, said ported section having a port adapted to communicate with said port in said body upon movement of said sleeve in one direction, said unported section closing said port in said body upon movement of said sleeve in the other direction; said blanking plug means also being located in said valve sleeve substantially completely above said ported section of said valve sleeve; and cooperable key and keyway means in said body and sleeve for aligning said port in said ported section of said sleeve with said port in said body upon movement of said sleeve in said one direction.

* * * * *

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,633,668 Dated January 11, 1972

Inventor(s) GONZALO VAZQUEZ and JOHN V. SALERNI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 5, after "body" insert --upon--;
line 7, after "body" insert --upon--.

Signed and sealed this 12th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents