

[54] **WELLBORE SAFETY VALVE**
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[52] U.S. Cl..... **166/65 R, 137/71, 166/72,**
166/224
[51] Int. Cl..... **E21b 35/00**
[58] Field of Search..... 166/63, 65 R, 224;
137/68, 72, 74, 75, 76

[56] **References Cited**

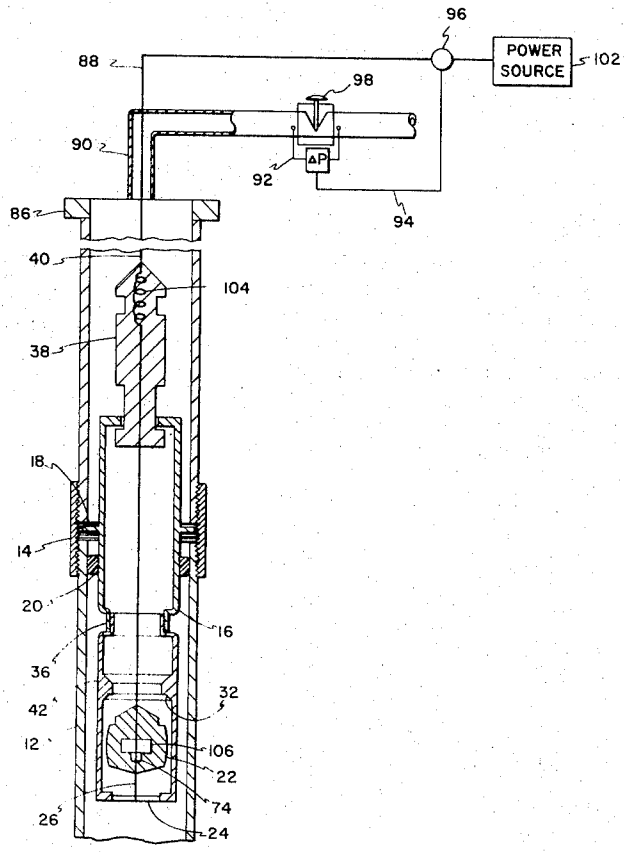
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[57] **ABSTRACT**
A wellbore safety valve system includes a plug held by a retention spider, a plug seat separated from and located above the plug, and a controlled release section for separating the spider from the plug so that the plug can engage the plug seat. The controlled release section may be responsive to electrical energy from the surface, flow rate in the well, or acoustical energy.

12 Claims, 7 Drawing Figures



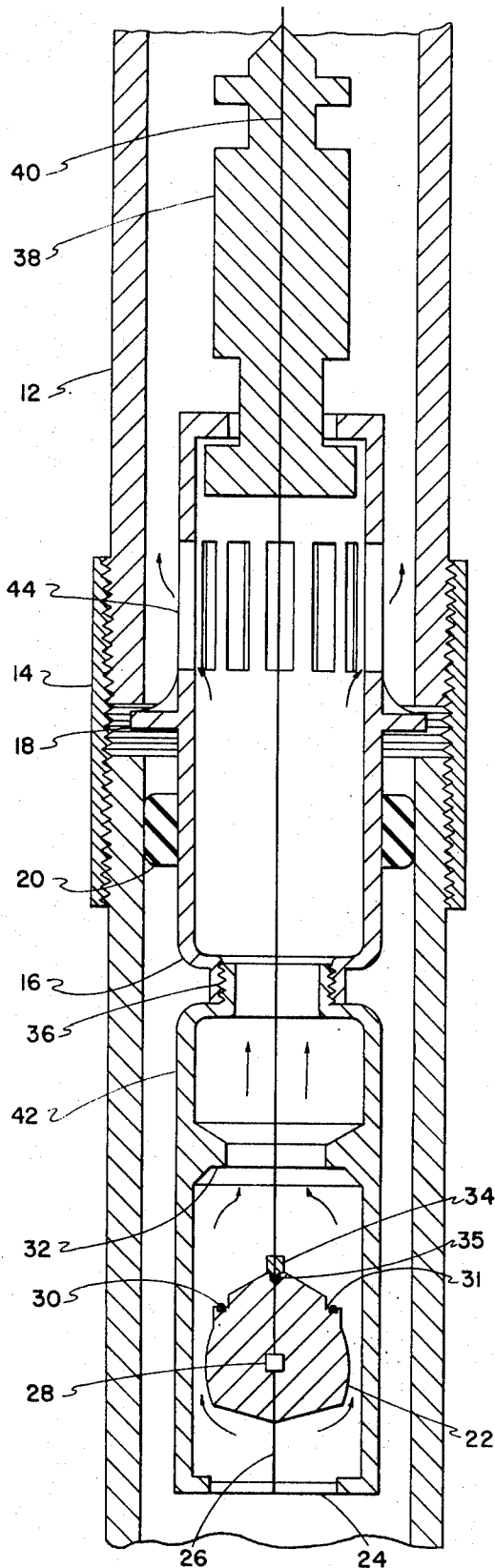


FIG. 1

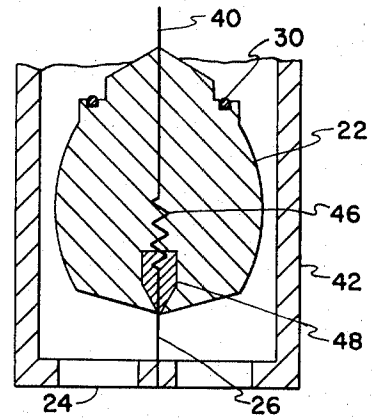


FIG. 2

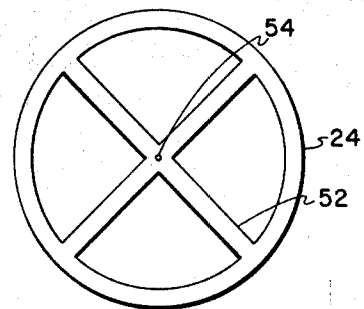


FIG. 2A

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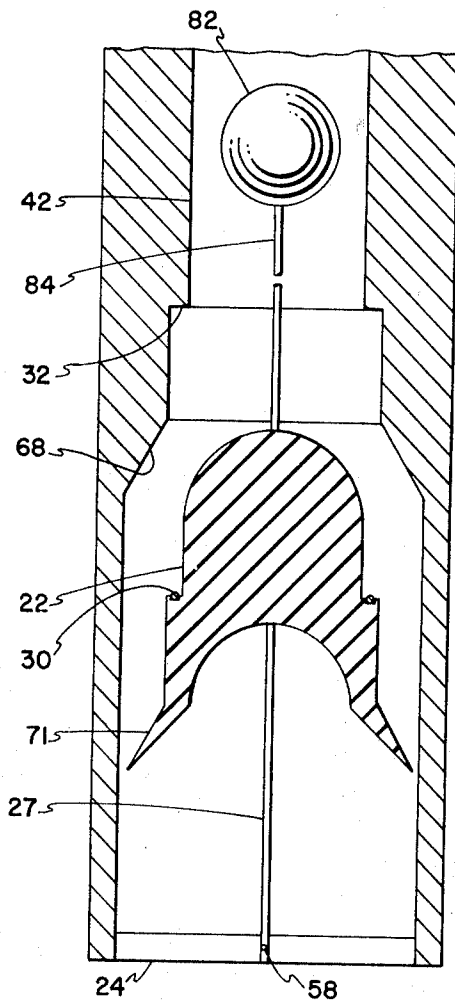


FIG. 3

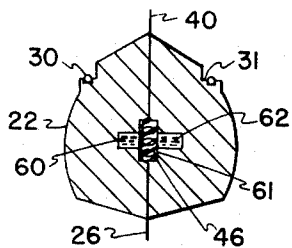


FIG. 4

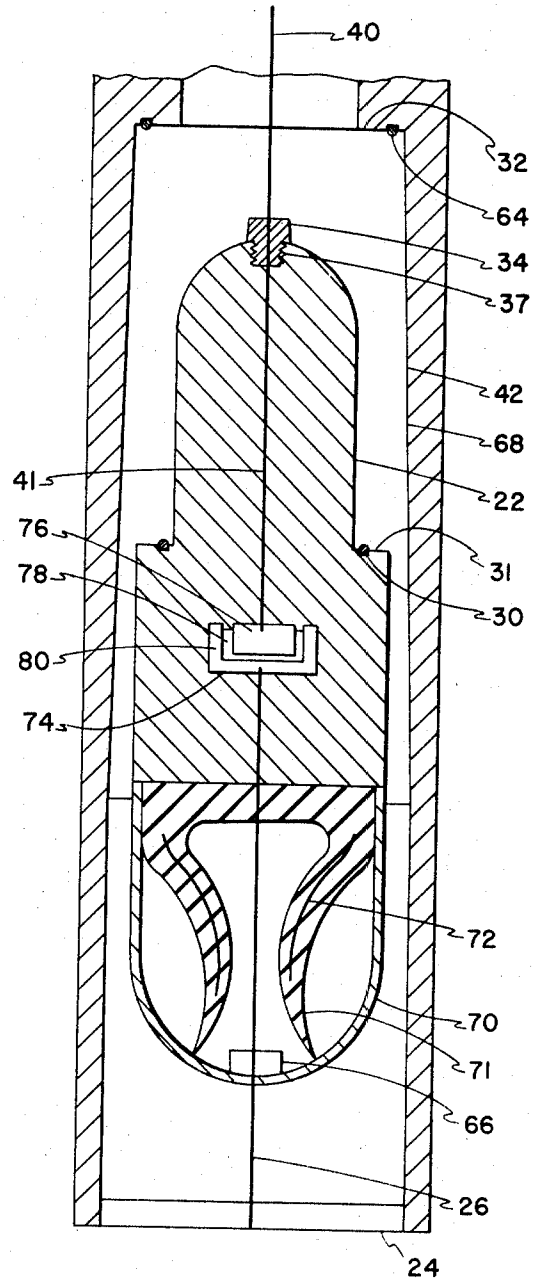


FIG. 5

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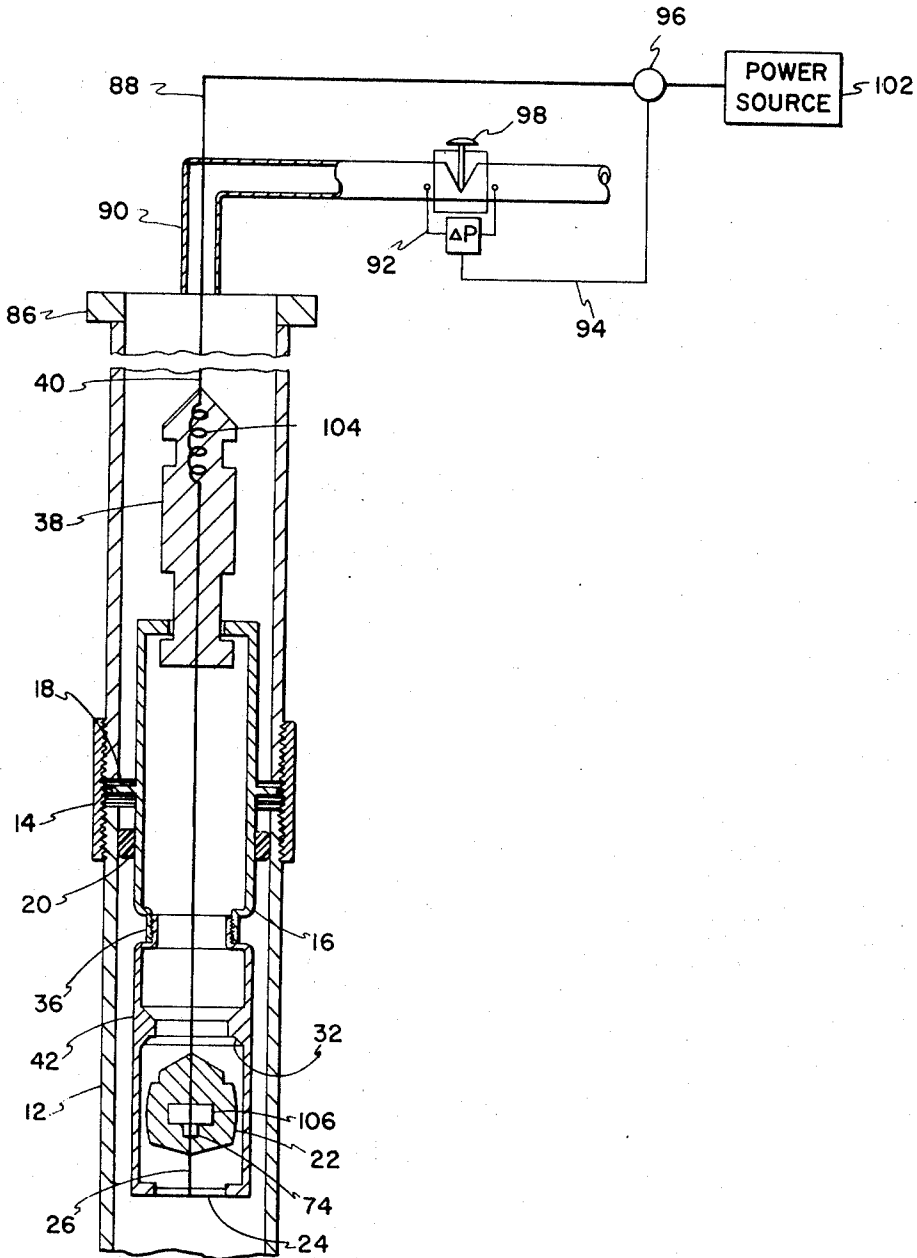


FIG. 6

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WELLBORE SAFETY VALVE

BACKGROUND OF THE INVENTION

This invention relates to apparatus for closing in wells below the wellhead when desired, or upon the occurrence of abnormal operating conditions.

At the present time, there are several types of wellbore safety valves. These valves are designed to automatically shut in a well either when the rate of production from the well exceeds a predetermined rate, or when damage to surface equipment causes a draw-down of the bottom hole pressure. There are presently two basic methods of closing in a well with such a safety valve, because of excessive flow rate.

One of the methods used to close in a well employs a valve mechanism operated by a velocity float in that when the velocity of produced fluids exceeds a predetermined level for which the float has been designed, the upward movement of the float causes the valve to close. The velocity float is itself the closing member, and is one of the first mechanisms utilized in closing in a well.

The most common system of closing in tubing due to excessive producing rates utilizes a pressure differential across an orifice for activating a spring which closes a conventional valve or rotates a ball valve having a flow channel therethrough so that the flow channel no longer is aligned with the path of produced fluids.

There are a few valves available which are responsive to surface conditions. One such valve operates when the well pressure drops below a predetermined amount. Thus, if the wellhead or flow lines are damaged and result in a decline in well pressure, the valve will close. This is usually accomplished by precharging a chamber so that the pressure in the chamber and the pressure in the tubing is equal. Upon a drop in well pressure, differential pressure between the precharged chamber and the pressure in the tubing activates a piston to close the valve.

Another surface condition reactive valve which is also operated from the surface has been made available by Otis Engineering Corporation. The Otis valve utilizes a hydraulic line which extends from the surface to the downhole valve. Surface monitoring equipment or manual controls can act on the hydraulic system to close the valve. The hydraulic line extends down the side of the tubing and is attached to a special sub which houses the valve. Various valves are available on the market which operate utilizing a hydraulic system; however all these valves have metal to metal movement which can become eroded or jammed by sand or other wellbore contaminants.

It is an object of the present invention to provide a new and improved wellbore valve.

SUMMARY OF THE INVENTION

With this object in view, the present invention contemplates providing a wellbore valve located in well pipe below the surface and positioned near the surface, which is responsive to abnormal well conditions and is made up of a plug member, a plug seat spaced from the plug member, means to retain the plug member so that it is spaced from the plug seat, and a means for releasing the plug member from the retainer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a downhole fail-safe choke seated in tubing;

FIG. 2 is a cross-section of an alternative embodiment of the plug shown in FIG. 1;

FIG. 2A is a plan view of a retention spider;

FIG. 3 is an elevational view of a velocity float activated valve;

FIG. 4 is a cross-section of an alternative embodiment of the plug shown in FIG. 1;

FIG. 5 is a cross-section of an electromagnetically operated valve; and

FIG. 6 is a cross-section of a valve assembly seated in tubing and a schematic illustration of surface equipment for activating the valve.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1 of the Drawings, there is shown in cross-section, a downhole valve assembly located in a wellbore. The downhole valve assembly consists of valve section 42, packer section 16, and wire-line retrieval section 38. The valve assembly is located in the interior of tubing 12, and is positioned therein by tubing collar locking dogs 18, which engage the space between adjacent tubing collars 14. The rubber packer element 20 located on the outside periphery of the valve assembly extends between the outside wall of the valve assembly and the interior wall of the tubing 12. This rubber packer element 20 is made of a high strength resilient material so as to serve as a seal between the tubing wall and the valve assembly. Located above the tubing collar locking dogs 18 are flow openings 44 which are ports for permitting communication between the interior of the valve assembly and the tubing interior above the packer element 20.

The valve section 42 is threadedly attached to the packer section 16 at 36. The valve section 42 has a plug member 22 which is fixedly attached by retaining wire 26 to a retention spider 24. The retaining wire 26 is a small diameter high tensile strength wire which is attached in any conventional manner to spider 24. Spider 24 is comprised of two rigid wire-like members which cross each other at right angles and connect with retaining wire 26 at such crossing point. The spider 24 is attached to the outer wall of the valve assembly in any conventional manner, such as welding or force fit. Formed in the upper portion of the valve section 42 is seal seat 32. Seal seat 32 is a metallic flat smooth surface defining an annular sealing surface. This seal seat 32 may be cast as an interior protrusion in the wall of the valve section, or it may be an annular member welded to the interior wall of the valve section 42.

The plug member 22 has a substantially solid outer surface and sections taken parallel to its horizontal axis are circular. The plug member 22 also has an annular sealing surface 31 located on its upper side. Embedded in such annular sealing surface 31 is annular O-ring 30. This O-ring 30 is made of a conventional material for withstanding high pressures. The retaining wire 26 extends up into the plug member 22 and is attached adjacent to an explosive charge 28. This charge is sized to destroy the connection between retaining wire 20 and plug member 22. Connected with explosive charge 28 is shielded electrical conductor line 40 which also is sized so that it may be used to retrieve the entire valve

assembly. This shielded electrical conductor line connects with electrical disconnect plug 34 which is threadedly attached to plug member 22 and 35. Between the wireline retrieval section 38 and plug member 22 the conductor line 40 is in tension.

In the operation of the apparatus of FIG. 1, the valve assembly is lowered into the tubing to a point between the surface and the producing horizon. Upon reaching the desired location, the valve assembly is locked into the tubing by tubing collar locking dogs 18. These locking dogs 18 engage the recess formed at the collar connection 14 between individual joints of tubing 12. The packer is activated so as to expand the rubber packer element 20 into the annular space between the interior wall of the tubing 12 and the exterior wall of the valve assembly. This packer prevents wellbore fluids from by-passing the interior of the valve assembly. The well fluids flow path through the valve assembly is indicated by the arrows shown ascending through spider 24, around plug member 22, through the opening defined by seal seat 32 and out flow openings 44.

The valve assembly may be lowered into the wellbore by conventional wireline methods or it may be run in on the shielded electrical conductor line 40 which is connected to electrical disconnect plug 34. An extension of the electrical conductor line connects with the explosive charge 28 which may be activated from the surface, since its explosive property is responsive to electrical energy.

Monitors located at the surface which are not shown in FIG. 1 may be arranged to determine when such things as line pressure, temperature, vibration, and other conditions are outside acceptable standards. Upon the occurrence of such an unacceptable condition, an electrical control signal from the monitor initiates passage of a current down electrical conductor line 40 to activate the explosive charge 28. The explosion severs the attachment of the retaining wire 26 to the plug member 22 to allow the plug member 22 to move upward and engage seal seat 32. The tension in the conductor line 40 causes the plug member 22 to move toward the seal seat 32. Upon the plug member 22 contacting seal seat 32, reservoir pressure will maintain the plug member in position. Annular O-ring 30 insures a tight seal to prevent leakage of wellbore fluids past the valve section 42. In the event of the occurrence of a fire at the surface, a seal which substantially eliminates all wellbore fluids from reaching the surface is imperative.

After surface damage has been repaired, the valve assembly may be retrieved from the tubing by conventional wireline methods or utilization of the electrical conductor line 40. Upon reattaching the plug member 22 to the retention spider 24 by a retaining wire 26, the valve assembly may be run back into the tubing for re-use. In the event that the seal seat 32 or the plug member 22 has been badly pitted or eroded, they may be easily replaced. A new valve section 42 can be attached to the valve assembly by disconnecting the old valve section at threaded attachment 36 and attachment of the new valve section.

Because of the swabbing action created when retrieving the valve assembly with the valve in a closed position, it may be preferable to provide an internal fishing neck rather than the external fishing neck used in the wireline retrieving section 38 shown in FIG. 1. This would allow the use of a probe to mechanically unseat the plug member 22 from the seal seat 32. This probe

could be attached to the fishing tool and extend below the tool a sufficient distance to accomplish the mechanical opening of the valve by forcing the plug member 22 downward to disengage the plug 22 from seal seat 32.

Referring next to FIG. 2, there is seen an alternative embodiment of the plug member 22 shown in FIG. 1. The lower portion of valve section 42 contains the plug member 22 with a retaining wire 26 attached thereto extending downwardly to connect with retention spider 24. The shielded electrical conductor line 40 extends down into the interior of plug member 22. Retaining wire 26 is attached to the lower side of plug member 22 and is embedded in a low melting point section 48. This low melting point section 48 is made of a material, which upon being heated above a predetermined level will melt. The electrical line 40 terminates in a resistance heating coil 46, which extends into the low melting point section 48. Located on the upper side of the plug member 22 is annular O-ring 30, whose function has been previously described in FIG. 1. The operation of the mechanism in FIG. 2 is basically the same as that described in FIG. 1. Upon locking the valve assembly into position in the tubing, a signal from the surface acting in response to surface conditions outside acceptable ranges will result in a current flowing down shielded electrical conductor line 40. When the current flows down shielded electrical conductor line 40, it acts to provide energy to heat the resistance heating coil 46 so as to melt the low melting point section 48 and thereby free the plug member 22 from the retaining wire 26. Thus, the plug member 22 may then move upward to engage the seal seat 32 described in FIG. 1 to close off the flow in the tubing 12.

FIG. 2A illustrates an alternative embodiment of the spider 26 shown in FIGS. 1 and 2. Spider 24 is an annular member having rigid cross pieces 52 which extend across the bore of the annular member 50 and divide the bore into four sections. The cross pieces 52 are at right angles to one another and intersect at 54 which is the point of attachment of retaining wire 26 shown in FIGS. 1 and 2. A hole may be drilled through such intersection point to facilitate attachment of the retaining wire. The cross pieces 52 define four pie shaped openings to allow passage of wellbore fluids therethrough.

Referring next to FIG. 3, there is seen an alternative embodiment of the plug members 22 shown in FIGS. 1 and 2. Additionally, the seal seat 32 has been modified to accommodate the modified plug member 22. Valve section 42 contains plug member 22, spider 24, valve seat 32, and annular O-ring 30, which have been previously discussed. In lieu of the retaining wire 26 of FIGS. 1 and 2 there is substituted mechanical pull rod 27 which is attached to the plug member 22 and the spider 24. The attachment to spider 24 includes a shear pin 58. This shear pin 58 is of a conventional design, and may be sized in proportion to normal well fluid flow rates. The plug member 22 has a bulbous portion which is basically a hard surfaced substantially solid member. Extending downwardly and outwardly from the bulbous portion is a secondary seal portion 71. This portion has some flexibility, and is flared outwardly so as to provide a surface which will conform with a secondary seal seat which has been shown at 68. The seal seat 32 and secondary seal seat 68 are both smooth solid surfaces for engaging the plug member 22. Located directly above the plug member 22 is velocity float 82,

which has a size and weight which is designed to have buoyancy when a predetermined flow rate presses upwardly against it. This velocity float 82 is attached by mechanical rod 84 at the top of the bulbous portion of plug member 22. This attachment may be of any conventional design, such as welded, a threaded attachment, or similar union.

In the operation of the apparatus shown in FIG. 3, after the valve assembly has been located in the tubing and locked into position as was described in FIG. 1, the valve section is then responsive to excessive flow rates. Well fluids ascend upwardly through openings in retention spider 24, around plug member 22 and past velocity float 82. Under normal conditions, the formation fluids flowing up the tubing will not apply sufficient pressure to the velocity float 82 to overcome the shear strength of shear pin 58. If, however, the flow rates exceed a predetermined rate, which may be translated into the design of the shear pin 58 or velocity float 82 or both, the rate of flow will provide sufficient force against velocity float 82 to transmit an upward force on mechanical rods 84 and 27 to shear the pin located at 58 which will release plug member 22. When the plug member is freed from the retention spider 24, it is propelled upwardly by the pressure of wellbore fluids to engage seal seats 32 and 68. The upward force of the reservoir pressure will press the secondary seal portion 71 of plug member 22 against secondary seal seat 68, and the annular O-ring 30 aids in the prevention of leakage past the valve section 42.

It is conceived that in lieu of the velocity float 82, a mechanical linkage such as a cable could be attached to the plug member and extend to the surface. In such an event, the valve would be operable from the surface either manually or in response to automated platform monitors. It would also be possible to combine the two, i.e., the velocity float and the cable to the surface so that they would act independently.

Referring next to FIG. 4, there is shown an additional alternative embodiment of the plug member 22 described in FIGS. 1, 2, and 3. This plug member 22 also has an annular sealing surface 31 with an annular O-ring embedded therein. Additionally, the body of the plug member 22 is designed similarly to that shown in FIG. 1 in that sections taken parallel with the horizontal axis are basically circular, with the circular sections increasing in size as the sealing surface 31 is approached. A portion of the shielded electrical conductor line 40 which was shown in FIG. 1 is shown entering the top of the plug member 22. Also a portion of the retaining wire 26 is shown entering the bottom of the plug member 22. The retaining wire 26 is attached in any conventional manner in the interior of the plug member 22; however, a portion of the retaining wire 26 is coated with a plastic 61 which may be teflon. A portion of the plastic coated area is encircled by an acid section 60 containing acid 62, which may be a 15 percent hydrochloric solution. The electrical conductor line 40 which extends into the upper portion of plug member 22 terminates in a resistance heating coil 46 which is arranged to provide heat to the plastic 61 when current is supplied to the conductor line 40.

In the operation of this plug member the valve assembly is run into the wellbore and locked into position in the manner described in FIG. 1. When automated monitors at the surface respond to an abnormal surface condition, electrical energy is supplied to electrical

conductor line 40 and resistance heating coil 46. When the coil 46 resists the current passing therethrough, heat is generated which melts the plastic 61. When the plastic 61 is no longer available to protect the retaining wire, the acid 62 is able to attack the retaining wire 26. In a very short time, the acid will eat through the retaining wire 26 and thereby free plug member 22 so that it will engage in a seal seat located directly above it, thereby closing the well.

Reference is now made to FIG. 5, which depicts an alternative embodiment of the plug member 22 and the mechanism contained therein for releasing the plug member from the retaining wire 26. A portion of valve section 42 is shown with only the retention spider 24, retaining wire 26, plug member 22 and the sealing seats depicted. Plug member 22 has a bulbous upper portion similar to that described in FIG. 3, and an annular primary sealing surface 31 which has a groove for accommodating annular O-rings 30. The lower end of the plug member 22 has a secondary seal 71 which is flexible member having a spring steel 72 embedded therein. The secondary seal 71 is confined in secondary seal protector 70, which is preferably made of a hard plastic material which is resistant to corrosive well fluids. The secondary seal protector 70 is fixedly attached to the retaining wire 26 by retainer device 66 which may operate by use of a set screw or other common attachment. As in previous embodiments, the retainer wire 26 is attached to spider 24. This spider 24 is a cross-sectional elevation view of the spider shown in FIG. 2A. Located on the top of the bulbous portion of the plug member 22 is electrical disconnect 34 which is threadedly attached to the bulbous portion at 37. Shielded electrical conductor line 40 extending from the surface is attached to the electrical disconnect 34 and an electrical line 41 extends from the electrical disconnect 34 to an electromagnet 74. The electromagnet 74 is comprised of electrical insulating material 80 surrounding pole piece 78 in which an armature 76 is positioned. The armature 76 has a large number of turns in the coil so as to give the electromagnet sufficient strength to support the weight of the plug member 22. Located above the plug member 22 is primary seal seat 32 which is a smooth hard annular surface having an annular O-ring 64 embedded therein. Extending downwardly and outwardly from the primary seal seat 32 is secondary seal seat 68, which is also hard smooth annular surface.

The valve assembly of FIG. 5 is run into the tubing and seated as previously described in FIG. 1. The electromagnet, when supplied with electric current through conductor line 40 keeps the plug member in a position spaced from the seal seats 32 and 68 because the retention wire is attached to pole piece 78 which is magnetically attracted to armature 76. The electrical conductor line 40 extends to the surface where it is connected with monitoring devices which continually check such things as line pressure, temperature, and vibration. When the monitors sense an abnormal situation, the electrical energy flowing through electrical conductor line 40 is interrupted. When the electrical energy is interrupted, the electromagnet 74 is deactivated, which separates the plug member 22 from the retaining wire 26 because the retaining wire 26 is connected with the pole piece 78. Either through spring action or fluid flow pressure or both, the plug member 22 moves upward. Since the secondary seal protector is attached to the

retaining wire 26, the upward movement of the plug member acts to free the secondary seal portion 71 from the secondary seal protector 70. When the secondary seal exits the secondary seal protector 70, the spring steel 72 acts to open up the secondary seal portion 71 so that when the plug member 22 ascends to the point that primary sealing surface 31 engages primary seal seat 32, the secondary seal 71 is engaged with the secondary seal seat 68. The system described in FIG. 5 thus would insure closing in of the well, even in the event of catastrophic occurrences such as a major explosion at the surface because of the disruption of electrical current in such event.

Another fail-safe system which is operable in the event of surface damage or wellbore damage recognizable at the surface is described in FIG. 6. FIG. 6 depicts a schematic illustration of surface monitoring equipment and a cross-section of wellbore tubing containing a valve assembly. As in FIG. 1, the valve assembly is shown positioned in the tubing 12 by tubing collar locking dogs 18, which are located between joints of tubing in the space between the tubing collars 14. A rubber packer element 20 seals the space between the interior of tubing 12 and the exterior of the valve assembly. The valve assembly has three main parts, those being the valve section 42, which is threadedly connected at 36 to packer section 16. Above packer section 16 is wireline retrievable section 38. The wireline retrievable section 38 depicts an external fishing neck which for certain purposes may preferably be an internal fishing neck. The valve section 42 has a seal seat 32 which is a hard smooth annular surface designed to provide a sealing surface when in contact with plug member 22. Plug member 22 is shown as having two systems for disconnecting the plug member 22 from the retaining wire 26, which is connected to the spider 24. One of the disconnect assemblies is shown at 74 and is an electromagnet similar to the one described in FIG. 5. The other disconnect assembly is an acoustical energy receiver assembly 106 which comprises an acoustical receiver, an electrical motor which is operable by the acoustical receiver, a release mechanism which operates in response to the electric motor, and an independent electrical energy source for powering the electric motor. Similar mechanisms are available to the petroleum industry for operating valves on sea floor wellheads.

Connected to electromagnet 74 is shielded electrical conductor line 40 which extends to the surface and connects with surface monitoring equipment. In the valve assembly located above the seal seat 32, the shielded electrical conductor line is coiled to act as a spring. The spring like portion of the conductor line 40 is in tension prior to actuation of the valve closure mechanism. Such coil is shown at 104.

Located at the surface is conventional wellhead 86 having flow line 90 attached thereto for delivering well fluids to separators, storage tanks, or the like. An orifice 98 is interposed in such flow line 90 and pressure readings are continuously taken at each side of the orifice 98 to determine the differential pressure across the orifice 98. This differential pressure is compared with a predetermined acceptable differential pressure range at 92. In the event the differential pressure across orifice 98 falls outside of the acceptable pressure range an electrical impulse is initiated and flows through an electrical connecting line 94 which is attached to such dif-

ferential pressure comparison equipment 92 and extends to switch 96. Such electrical impulse acts to operate switch 96 which is located in series between electrical energy source 102 and shielded electrical conductor line 40. Surface electrical line 88 connects the electrical source 102 with the shielded electrical conductor line 40.

In the operation of the apparatus shown in FIG. 6, the valve assembly is run into the tubing 12 and locked into position by tubing collar locking dogs 18. The rubber packer element 20 is expanded into the area between the interior wall of tubing 12 and the exterior of the valve assembly, to provide a seal therebetween. After the valve assembly has been seated, the electrical energy being supplied by electrical energy source 102 serves to activate electromagnet 74 by keeping the valve in an open position. In the event of a surface line break, such a break would cause the differential pressure across the orifice 98 to be in excess of acceptable limits. This condition would cause an electrical impulse to be generated by the differential pressure comparison equipment 92. The electrical impulse acts as a control signal for actuating switch 96 through control line 94. When switch 96 is closed electrical energy from the electrical energy source 102 can no longer travel through surface electrical line 88 and shielded electrical conductor line 40 to supply the electrical energy necessary to keep electromagnet 74 activated. Upon the occurrence of the deactivation of the electromagnet 74, the plug member 22 is released from the retaining wire 26 as previously described in the discussion of FIG. 5. The plug member 22 is then free to move upward to contact seal seat 32 and close in the tubing 12. To aid such upward movement, the spring like portion 104 of conductor line 40 will act to pull the plug member 22 upward into the seat 32.

Besides the monitor 92 for determining abnormal line pressure, there may be other monitors used to keep check on things such as temperature and vibration. These monitors would also act to interrupt such electrical energy flowing from electrical energy source 102 to the electromagnet 74.

In the event of occurrences which would not cause the monitors to malfunction and which would not permit personnel to manually activate the switch 96, a back up system is provided utilizing the acoustical energy receiver assembly 106. If, for example, a poisonous gas were escaping to the surface from one of a multiplicity of offshore wells using a common platform, with the acoustical energy receiver 106, the well might be shut in by personnel located in waters adjacent the platform. The acoustical energy receiver assembly 106 thus is designed such that it is capable of receiving signals from the surface through a water medium earth and well pipe. Also, the acoustical receiver 106 has a capability to activate the motor control to release the retaining wire 26 from plug member 22. In the event fluid flow pressure in the tubing is insufficient to force the plug member 22 up into seal seat 32, besides the spring coil 104 made out of the shielded electrical conductor line 40 a standard spring can be used to pull the plug member 22 up into the seal seat 32.

Thus, it is seen that the apparatus shown in FIG. 6 can be operated from the surface immediately adjacent the wellbore through the use of surface monitoring equipment or the tubing may be shut in by the use of

an acoustical energy sending mechanism to activate the release of plug member 22.

While particular embodiments of the present invention have been shown and described, it is apparent that changes and modifications may be made without departing from this invention in its broader aspects, and therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

What is claimed is:

1. A fail-safe system for bringing a well under control comprising: well pipe extending from the earth's surface to a subsurface earth strata; a retrievable plug assembly located in the well pipe below the surface, a plug member and seat in the assembly, said plug member being spaced from the seat and arranged to engage the seat in sealing relationship to close off the well pipe; means for retaining the plug member in its spaced position from the plug seat so that the plug member does not normally engage the plug seat; means for releasing the plug member from the retaining means including electrical energy means connected with the releasing means, wherein the releasing means is adapted to function in response to the electrical energy means; means at the surface for monitoring fluid flow conditions; and means responsive to said monitoring means for controlling the electrical energy means.

2. The system of claim 1 wherein the releasing means is an electromagnet, the deenergization of which releases the plug member from the retaining means.

3. The system of claim 1 wherein the releasing means is adapted to be responsive to acoustical energy.

4. The apparatus of claim 1 wherein the assembly is located in a housing and includes housing retrieval means attached to the upper end of the housing.

5. The apparatus of claim 4 including annular seal means between the housing and well pipe for providing a fluid tight seal between the housing exterior and the interior wall of the well pipe.

6. The apparatus of claim 1 wherein the retaining means includes a section adapted to separate in response to the releasing means.

7. The apparatus of claim 1 wherein said releasing means includes an explosive charge which is detonated in response to the operation of the electrical energy means, and wherein the retaining means comprises a retaining member adapted to separate upon detonation of the explosive charge.

8. The apparatus of claim 1 wherein the retaining means includes a low melting point wire and wherein

the releasing means includes electrical means for heating the low melting point wire above its melting point.

9. The apparatus of claim 1 wherein the retaining means includes a plastic coated acid dissolvable retaining member and the releasing means comprises an encapsulated acid surrounding the plastic coated portion of the retaining member.

10. The apparatus of claim 9 including a resistance heating coil connected with the electrical energy means and located adjacent the plastic coated portion of the retaining member, wherein electrical energy supplied to the resistance heating coil acts to melt the plastic coated on the dissolvable retaining member.

11. A fail-safe system for sealing a wellbore having well pipe therein extending from the surface of the earth to an earth formation comprising: housing means detachably fixed to the interior wall of the well pipe, said housing having a fluids flow channel therethrough; a seal assembly located in the housing including a plug member positioned in the fluids flow channel and a plug seat which is annular and defines an opening which is part of the fluids flow channel; means normally urging said plug member to engage said plug seat; means for restraining the plug member from engaging said plug seat; and means for releasing the restraining means from the plug member; said releasing means including an acoustical energy responsive means and means responsive to the acoustical energy responsive means for disengaging the plug member from the restraining means.

12. A fail-safe system for bringing a well under control having well pipe extending downwardly from the surface of the earth into subsurface formations, comprising:

housing means detachably fixed to the interior wall of the well pipe, said housing having a fluids flow channel therethrough; a seal assembly in the housing including an annular seat positioned in the fluids flow channel and a plug member sized for mating reception with said seat to form a closure in said fluids flow channel; means for releasably holding said plug member in a position spaced from said seat; means for normally urging said plug into a sealing position with said seat; and means for releasing said holding means said releasing means including an electrically operated means which is arranged to release said plug upon the absence of electrical energy and an auxiliary releasing system which operates said releasing means in response to an acoustical energy transmission.

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