

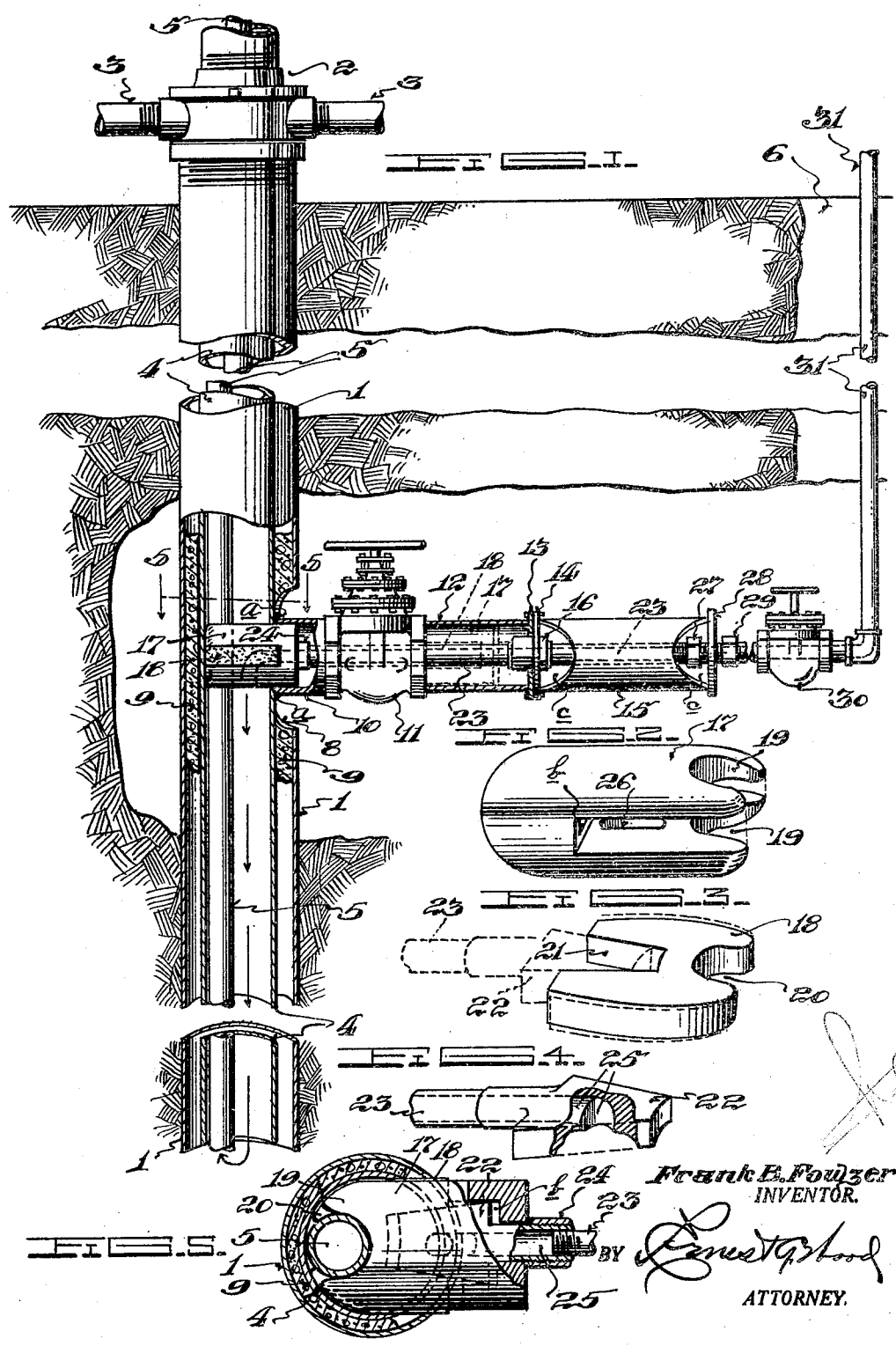
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METHOD AND APPARATUS FOR EXTINGUISHING THE
FLOW OF FLUID IN WELLS OUT OF CONTROL
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METHOD AND APPARATUS FOR EXTINGUISHING THE FLOW OF FLUID IN WELLS OUT OF CONTROL

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This invention relates to an apparatus and method for extinguishing the blaze in burning oil wells out of control and it has particular reference to an improved method involving the steps necessary to interrupt the flow of fluid from an oil well whether the latter is ignited or simply out of control of the operators.

The principal object of the invention resides in a method as specified characterized by first gaining access to the well pipes below the surface of the ground by tunnelling, excavating or the like and in tapping the pipes and afterwards packing the pipes against the upward flow of the fluid under pressure whereby to bring the fluid under control and in the case of an oil well fire, the source is removed, hence the fire is extinguished.

Another object of the invention resides in the provision of certain novel equipment by which the method is carried out. This equipment consists primarily of a baffle or plug suitably constructed as to allow the same to be wedged in the production pipe of the well against the pressure of the fluid therein to thereby seal off the fluid preparatory to the injection of mud or other substance capable of resisting the pressure of the oil, aided by a suitable mud pump or other means of applying pressure.

Broadly, the invention comprehends an improved method for extinguishing oil well fires in a safe manner and supplants extremely hazardous methods commonly employed and minimizes the danger to human lives. At the same time, the invention successfully extinguishes oil well fires without the use of high explosives, which latter, when successfully used only extinguish the blaze and do not bring the flow of fluid under the control of the operators. Accordingly, while one hazard has been removed, another presents itself in the form of a "wild" well which is a constant fire hazard, not to mention the great waste due to the fact that the oil out of control flows over the territory immediately in the vicinity of the well into streams and the like which may be in the same vicinity.

With the foregoing objects as paramount, the invention has particular reference to the

novel steps of the method hereindescribed to become manifest as the description proceeds taken in connection with the accompanying drawing wherein

Figure 1 is an earth section, fragmentarily showing the surface casing, production pipe and tubing in their proper relationship in a well and illustrating the manner in which the invention interrupts the flow of fluid in the well.

Figure 2 is a perspective view of the plug or baffle used for interrupting or stopping the flow of the fluid.

Figure 3 is a perspective view of a packing member included in the construction of the plug shown in Figure 2.

Figure 4 is a perspective view of an expansion wedge co-operating with the packing member shown in Figure 3, and

Figure 5 is a view on lines 5—5 of Figure 1.

Continuing more in detail with the drawing, 1 designates the surface casing which is set up when the well is "spudded in" and carries a control head 2 at the surface. The control head 2 has one or more lateral pipes 3 leading therefrom which gives rise to the expression "Christmas tree" when referring to this particular element. Within the surface casing 1, the production pipe 4 sometimes referred to as the seven-inch pipe is set up as the well is being drilled. Within the production pipe 4 the tubing or drill stem assembly 5 is set up.

There are, of course, many ways in which a well may become ignited. The most frequent, however, is the striking of tools together forming a spark which ignites the oil or gas as the case may be. In some instances, the well unexpectedly blows in under high pressure and should it become ignited under these conditions, the loss of human life is almost inevitable. While the oil operators in some cases take the precaution of equipping the wells against such happenings, as explained in the foregoing, there is always the possibility of unexpected production.

If the gas or oil does not ignite, the flow may be brought under control by means of

suitable gate valves. It frequently occurs, however, that these gate valves freeze against terrific pressure and cannot be operated. Many other instances can be pointed out how the operators can lose control of a well and it is the prime object of the present invention to provide a method which will be applicable in practically all cases where a well blows in out of control or becomes ignited from some cause or another, irrespective of the surface equipment.

Accordingly, assuming that the well is ablaze, an excavation 6 is made at a safe distance from the well. It is not a matter of importance how this excavation is made but it must be of such depth as to allow a tunnel 7 to be several feet below the surface of the ground. If it happens that a crater is formed, the tunnel 7 must of course be well below the bottom of the crater. A distance of approximately 20 feet is found to be satisfactory in practice.

After having completed a tunnel to communicate with the surface casing 1, in the manner illustrated in Figure 1, provisions are made to insure safety to the men in the tunnel so that slush and water may be readily drained off preparatory to tapping the surface casing 1. First, a nipple or sleeve of a diameter equaling the diameter of the casing 1 is cut so that its end will conform with the exterior surface of the said casing. The conforming end of the nipple or sleeve is electrically welded to the casing, it being understood that a suitable gate valve is provided to control any pressure which might exist within the surface casing 1, although there is seldom ever any fluid under pressure in the casing. A circular milling tool of conventional design, not shown, is passed through the gate valve and the sleeve and through the medium of which an opening 8 is made in the surface casing. Should there be any pressure in the surface casing, the gate valve is closed against the pressure until a pressure pump connection can be made on the opposite side of the valve. A quantity of cement 9 is pumped through the opening 8 until a sufficient amount has been injected to create a plug in the annular area between the said casing and the production pipe 4. This cement plug obviously seals the annular opening mentioned so as to prevent upward passage or release of fluid or gas which might be in the surface casing 1. The sleeve above mentioned is then removed after having permitted the cement plug 9 to mechanically set.

The cement plug 9 is chiselled away to expose the production pipe 4 in the manner shown in Figure 1.

It will be noted that the sleeve, valve and cutter mentioned previously are not shown in the drawing, first for the reason that the invention does not claim any novelty

in these elements and for the further reason that the same method of tapping casing 1 is employed for tapping the production pipe 4. Therefore, to illustrate the elements claimed would be merely a repetition of the steps in the method to follow presently.

When the pipe 4 is exposed, a sleeve 10 is welded at *a* thereto in the manner shown. A gate valve 11 is threaded upon the protruding end of the sleeve 10 and another sleeve 12 is threaded into the opposite orifice of the gate valve 11. This latter sleeve has an integral flange 13 on its opposite end to which is affixed the flange 14 which is integral with the cylindrical member 15. It will be understood, however, that the cylindrical member 15 is not mounted in the manner shown until after the pipe 4 has been tapped.

A packing gland 16 is secured in the center of the flange 13 carried by the sleeve 14.

The process of tapping the pipe 4 is very similar to that employed in making the opening 8 in the casing which has been previously described. A circular milling tool of any conventional design is mounted in the sleeve 12 and its shaft passes through the packing gland 16 so as to seal off the pressure within the pipe 4 after an opening has been made therein by rotation of the cutter shaft not shown. The cutter is advanced upon the pipe 4 and rotated until an opening is made therein of a diameter equalling the inner diameter of the sleeves 10 and 12. The cutter is withdrawn into the sleeve 12 when such opening is made, and the pressure in the pipe 4 finds an outlet through the sleeve 10, which is cut off by closing the gate valve 11. After having closed the gate valve 11 the sleeve 12 may be removed to effect removal of the cutter or milling tool.

The foregoing description explains the manner in which the casing 1 and the production pipe 4 are tapped preparatory to the introduction of the plug or baffle which brings under control the fluid passing upward through the pipe 4. This plug or baffle is of peculiar design and must effectively seal the pipe 4 when in the position shown in solid lines in Figure 1. The plug is shown dismantled in Figures 2 to 4 inclusive and is comprised of a cylindrical body 17 slotted to receive the substantially flat packing member 18, composed of composition material of a resilient or flexible nature, preferably composition rubber. The body 17 of the plug is bifurcated at 19 to correspond with the bifurcation 20 in the end of the packing member 18. A V-shaped recess 21 is provided in the opposite end of the packing member 18 to receive an expansion wedge 22, whose relationship with the body 17 is shown in Figure 5. A hollow shaft 23 is threaded or otherwise secured to the expansion wedge 22 and a collar 24, as shown in Figures 1 and 5,

affords a stop by which to limit the sliding movement of the expansion wedge 22 within the body 17 of the plug for expanding the packing member 18 against the internal walls of the pipe 4, in the manner shown in Figure 5.

It has been stated that the shaft 23 is hollow. This shaft or pipe communicates with a fluid passage 25 in the expansion wedge 22 and the fluid passage 25 communicates with a slotted opening 26 in one side of the body 17 of the plug shown in Figure 2. The opening 26 is elongated so that it will always be in register with the fluid passage 25 of the expansion wedge 22 in view of the fact that the latter has limited sliding movement in the recess *b* in the plug 17. The hollow shaft or pipe 23 extends through the gate valve 11, the sleeve 12 and the packing gland 16, thence through the cylindrical member 15, previously referred to, which is mounted subsequent to the milling operation described above. The end of the hollow shaft 23 is threaded to receive a nut 27 within the cylindrical member 15 inside of the plate 28, while a similar nut 29 is threaded on to the shaft 23 on the opposite side of the plate 28. Recesses *c* are cut out of the ends of the tubular member 15 so that access may be gained to the packing gland 16 and to the nut 27. Rotation of the nut 27 with a suitable wrench or the like will advance the plug and its appurtenances from the position shown in the dotted lines in the sleeve 12 to the position shown in solid lines in Figure 1, it being understood that the plug must be advanced against the pressure which now exists in the sleeves 10 and 12, in view of the fact that the gate valve 11 must be opened to allow for free passage of the plug therethrough against the fluid or gas pressure as the case may be.

Plug and the attendant packing member 18 being bifurcated at 19 and 20, the tubing 5 is received in these bifurcations and by continued rotation of the nut 27, the hollow shaft 23 is non-rotatably moved longitudinally and the tubing 5 is urged against the walls of the production pipe 4 in the manner shown in Figures 1 and 5. At the same time, the pressure brought to bear upon the expansion wedge 22 will expand the packing member 18 outwardly against the inside walls of the production pipe 4 and as the tubing 5 is urged against the walls of the pipe 4, the resiliency of the material of which the packing member 18 is constructed will tend to fill the opening about the tubing in the manner shown in Figure 5 and thus cut off the upward flow of gas or fluid in the pipe 4.

Thus it may be seen that the maximum flow of fluid or gas is under control but there still remains the flow through the tubing 5 and it is now the purpose of the invention to stop this flow.

Accordingly, another gate valve 30 is

mounted in such manner that the hollow shaft or pipe 23 will pass therethrough so as to communicate with the pump line 31. A mud pump of any suitable design may be used to pump this fluid through the pipe 31 and the hollow shaft 23, through the fluid passage in the wedge 22, thence through the elongated opening 26 of the plug 17 and downward into the pipe 4 as shown by the arrows in Figure 1. The mud pumping process continues until the fluid pressure in the pipe 4 has been overcome and the level of the fluid is gradually lowered until the mud or other sealing agent is enabled to rise within the tubing 5. When a sufficient amount of mud has been pumped into the tubing 5, the flow of inflammable fluid is stopped.

All methods which involve the use of high explosives, such as nitro-glycerin and the like, require that the explosive be directed in the vicinity of the flames. This being true, all equipment on the surface must be removed so that the fluid will not be re-ignited after the flame has been blasted. In using the explosive method, it is obvious that the surface casing, production pipe and tubing are injured beyond repair and although the flame is extinguished in many cases by explosives, the well still runs wild until brought under control, which is a difficult matter in view of the impaired condition of the pipes. In view of the fact that the present invention cuts off the flow of fluid or gas below the surface, the surface equipment remains untouched so that when the flow has ceased, operations may immediately continue and such equipment as may be found necessary to return the well to normal condition may be installed without further fear of fire hazard.

It is understood that the invention involves a method for extinguishing oil well fires and brings under control "wild" wells, and to carry out the method, certain mechanical equipment is employed, and that it is not intended that the invention be limited to the specific equipment shown and described since this equipment may be obviously altered and yet be equally as effective, and the invention is not therefore limited except by the wording of the annexed claims therefor:

What is claimed is:

1. A method for interrupting the flow of fluid in a well comprising a casing, production pipe and tubing characterized by tapping and sealing off said casing at a point below the head, in tapping said production pipe and in inserting a plug and finally in injecting a stream of fluid into said production pipe below said plug under pressure to resist the pressure of the natural fluid in said production pipe and in continuing the process of injection until the rejected fluid enters said tubing to seal the same.

2. A method of controlling the flow of fluid in wells having a casing and a production

pipe characterized by tapping said casing and introducing a self hardening sealing agent to isolate the pressure therein, then in tapping said production pipe and finally in
 5 introducing a pumpable sealing fluid into the production pipe below the point of tapping thereof under pressure to resist the pressure of the natural fluid in said production pipe and in continuing to introduce said sealing
 10 fluid until the flow of fluid from the top of the well has ceased.

3. A method of stopping the flow of fluid in wells having a casing, production pipe and tubing which consists in tapping said casing
 15 at a point below the head, in sealing off said surface casing from the production pipe, in tapping said production pipe and in introducing a plug in the opening made thereby to cut off the upward flow of natural fluid in
 20 said production pipe and finally in pumping sealing fluid through said plug against the resistance of the natural fluid in said production pipe until said latter fluid is forced to a point below the tubing in said production
 25 pipe whereby to fill said tubing with said sealing fluid to suspend the flow of natural fluid from the top of said well.

4. A method of controlling a well comprising a pipe which consists initially in tapping
 30 the pipe at a point below the head, in plugging the opening against the upward flow of natural fluid, in introducing a fluid sealing medium under pressure below said plug to resist the pressure of natural fluid within said
 35 pipe and in continuing with the introduction of said sealing medium until the flow from the head has ceased.

5. A method for stopping the flow of fluid from wells having a production pipe which
 40 consists initially in tapping the production pipe at a point below the head, in sealing off the natural fluid in said introduction pipe, in introducing a fluid sealing medium under pressure to resist the pressure of the natural
 45 fluid within said production pipe and in continuously introducing said fluid medium until the natural fluid has ceased to flow from said head.

6. A method for extinguishing fires by cutting off the flow of inflammable fluids from
 50 wells having fluid pipes which consists in making a hole in the pipe at a point below the head, in packing off the inflammable fluid at said hole, in introducing non-inflammable
 55 fluid below said packing under pressure and in continuously introducing said non-flammable fluid until the inflammable fluid ceases to flow from the head.

7. A method for extinguishing the blaze
 60 in oil and gas wells having fluid pipes which consists in making a hole in the pipe below the discharge point of the well fluid, in packing off the well fluid at said hole and finally
 65 in introducing a fluid seal under a pressure

greater than the pressure of the well fluid within the said pipe.

8. A method for extinguishing gas and oil fires in a well having a pipe consisting initially in making a hole in the pipe through
 70 which the oil and gas is passed, in temporarily closing the opening against the escape of well fluid therethrough, and to seal off the well fluid in the pipe at said opening and finally in introducing a fluid sealing medium
 75 into said pipe through said opening and under a pressure greater than the pressure of the well fluid in said pipe to stop the upward flow thereof.

In testimony whereof I affix my signature. 80
 FRANK B. FOWZER.

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