Nov. 25, 1941. A. BOYNTON 2,263,565

FLOW INTERMITTER

Filed Nov. 28, 1938 4 Sheets-Sheet 1

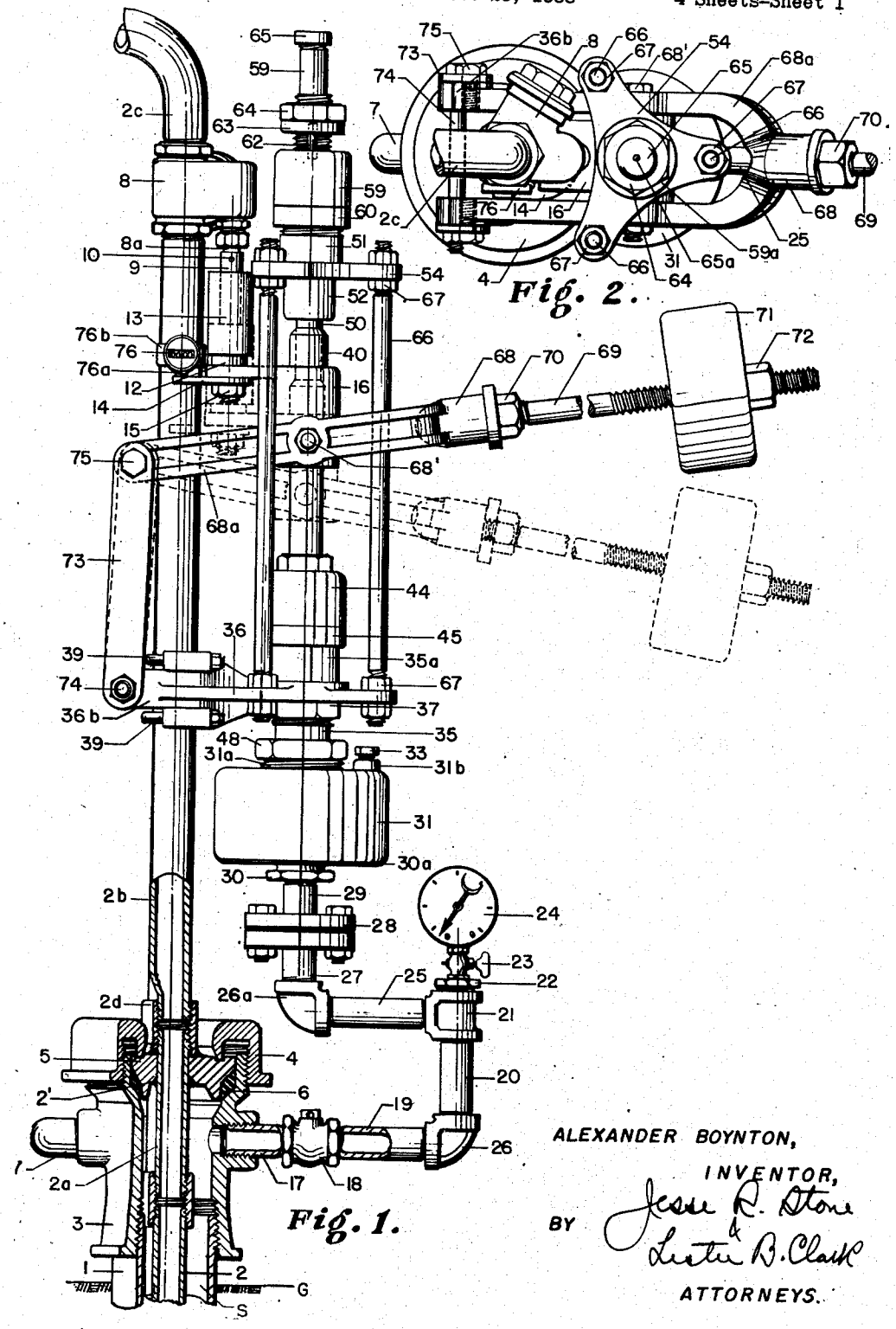


Fig. 2.

Fig. 1.

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FLOW INTERMITTER

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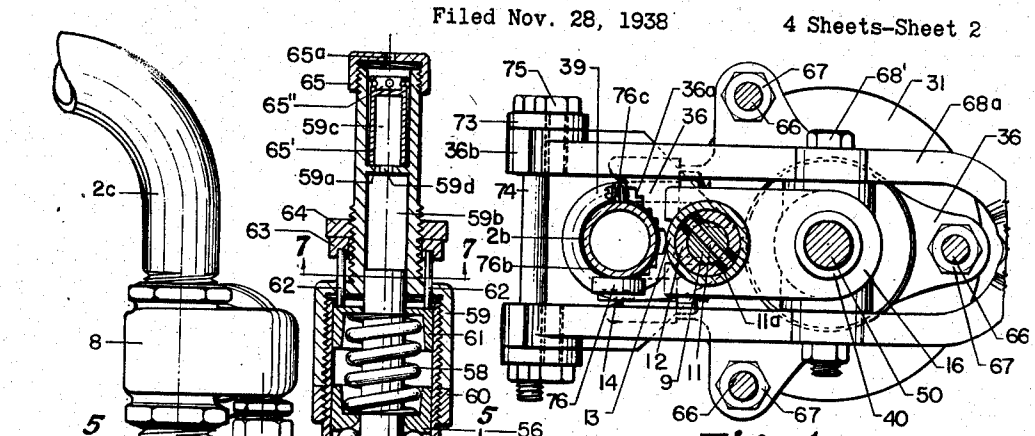


Fig. 4.

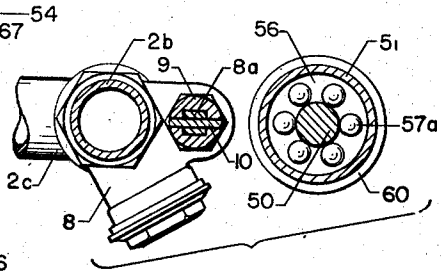


Fig. 5

Fig. 3.

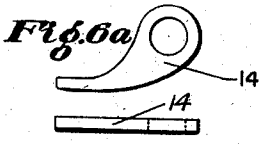


Fig. 6a

Fig. 6.

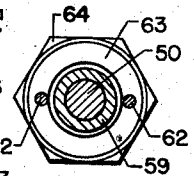


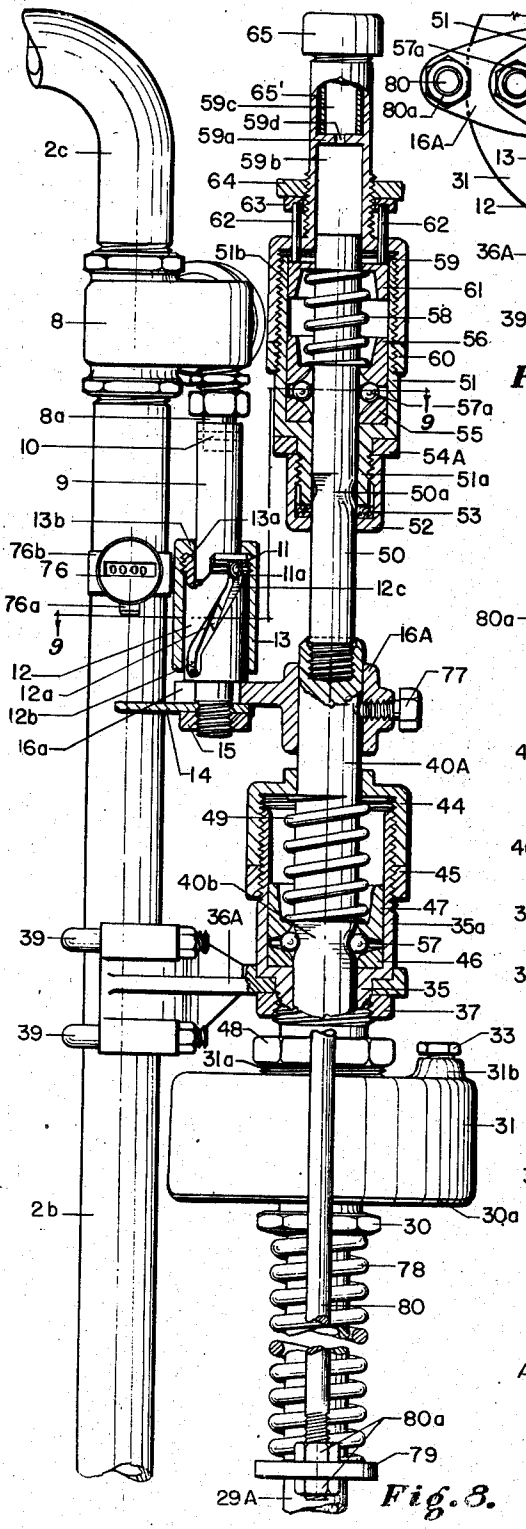
Fig. 7.

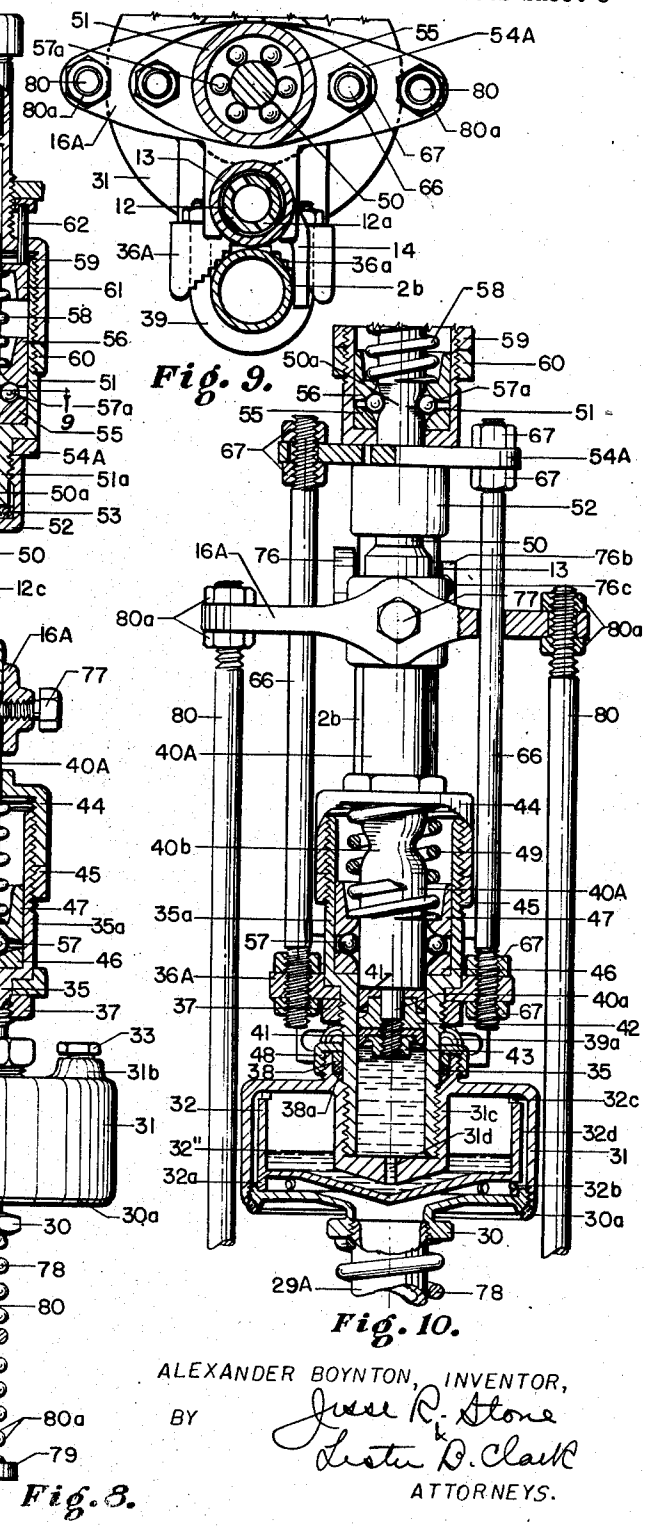
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FLOW INTERMITTER

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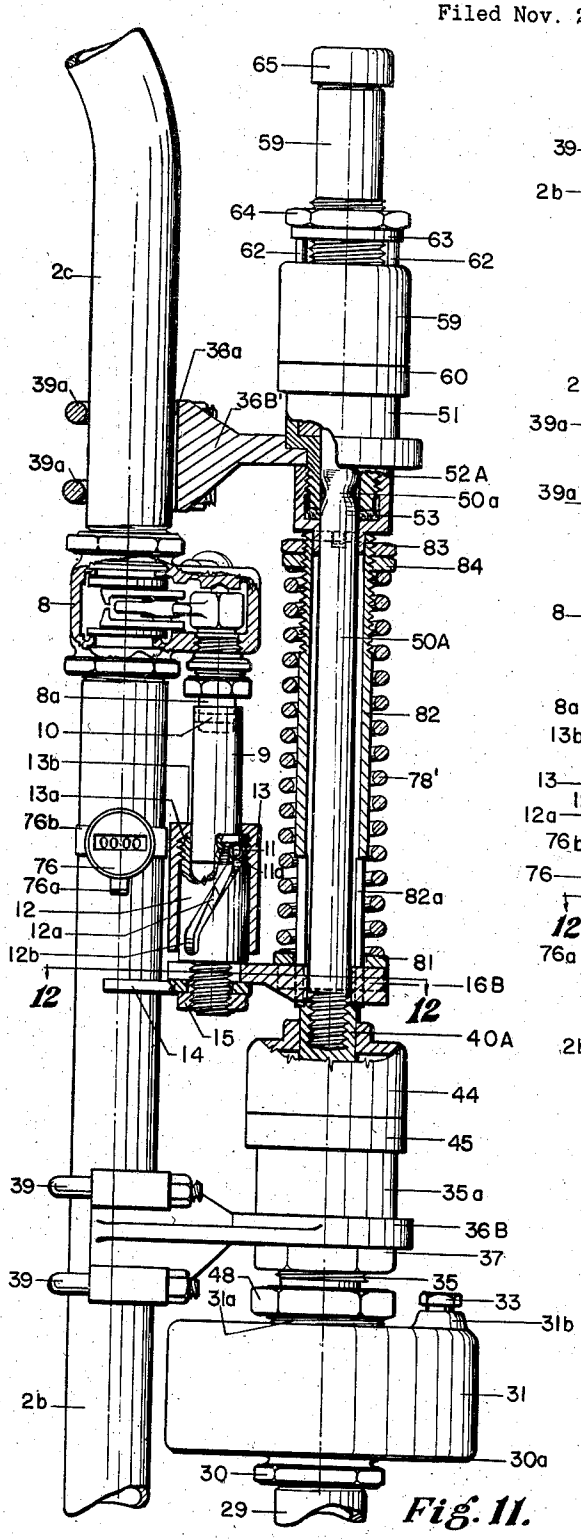


Fig. 11.

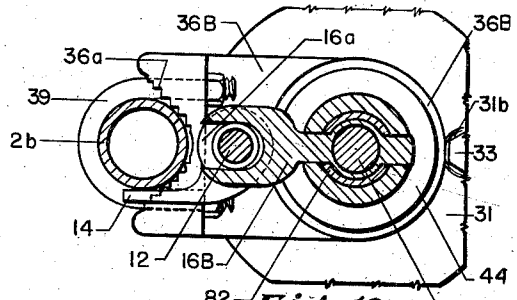


Fig. 12.

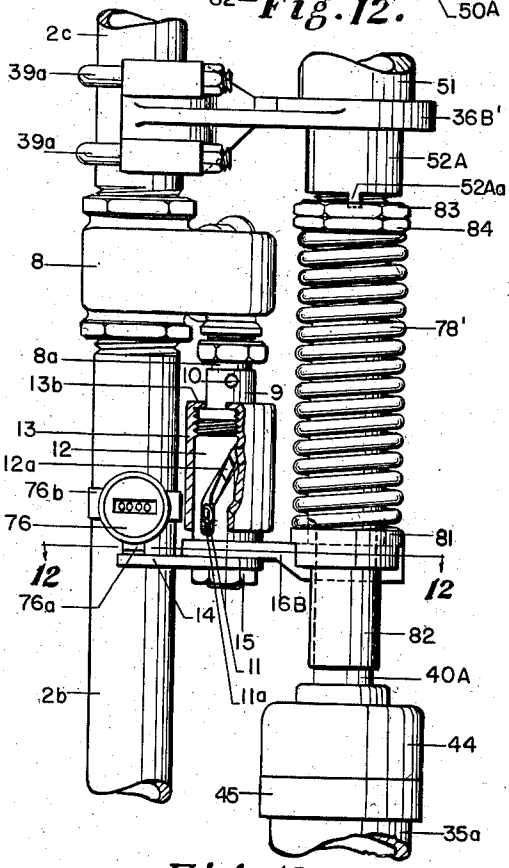


Fig. 13.

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Patented Nov. 25, 1941 2,263,565

UNITED STATES PATENT OFFICE

2,263,565

FLOW INTERMITTER

Alexander Boynton, San Antonio, Tex.

Application November 28, 1938, Serial No. 242,773

16 Claims. (Cl. 166—2)

My invention relates to flowing liquid from wells, particularly oil from deep wells, by means of intermittent flow using compressed air or gas as the lifting force. The flowing operation coincides with the existence of a relatively high air or gas pressure within the well casing exterior of the education tube, hereinafter referred to as the flow tubing; and the intermission coincides with the existence there of a relatively low air or gas pressure.

The invention may be used with or without flowing or aerating devices spaced at intervals in the flow tubing to enable the use of pressure fluid (compressed air or gas) as a lifting force, as the particular well condition may require.

Some wells, herein termed "high pressure wells," will yield their production satisfactorily if air or gas at high pressure is applied above the liquid in the annular space between the well casing and the flow tubing. Other wells, herein termed "low pressure wells," will not yield satisfactory production if flowed by compressed air or gas unless the same is prevented from exerting its force upon the producing formations of the wells. In such a well, a string of pressure tubing having the flow tubing within it and a bottom seal between them may be employed to contain the pressure fluid, and thus prevent it from retarding inflow of well liquid. Such installations are shown in my Patents Nos. 1,968,633, 2,006,909, 2,010,135, 2,042,583.

This invention will function equally well whether the pressure fluid to operate it comes from the annular space between the well casing and the flow tubing, as in high pressure wells, or from the annular space between the pressure tubing and the flow tubing, as in low pressure wells.

This specification will describe and the drawings will illustrate the device as installed upon a high pressure well employing pressure fluid from the annular space between the well casing and the flow tubing to operate the same. It is understood that the installation may be also made upon low pressure wells by using pressure fluid to operate the device from the annular space between the pressure tubing and the flow tubing.

There is a so-called "critical point" in the pressure, that is the pressure at which a well will yield its production by use of the least amount of pressure fluid. This relation between the amount of well liquid produced and the amount of gas used to produce it is commonly referred to as the "gas-oil ratio." This device may be adjusted to open at any pressure and to close at any lesser pressure, allowing some difference, of course, for friction which in this mechanism, is slight.

One of the objects of this invention is to provide automatic means for flowing oil wells at as near as possible to the critical point, as defined in the preceding paragraph. If, for example, the critical point is 300 pounds, this device may be set to open the valve in the flow tubing to initiate flow at 320 pounds, and to close at 280 pounds—20 pounds on either side of the critical point.

A further object of the invention is to regulate the pressure at which gas wells or storage reservoirs of gas or liquids can be made to discharge gas or liquids into a line or other receptacle at a predetermined relatively low pressure existing in the line or receptacle, and to cut off the discharge into same at a relatively higher pressure obtaining therein by slightly changing the installation plan as will be later explained.

Another object of this invention is to provide means for closing valves to prevent wastage from bursted pipe lines.

Other objects of this invention are to provide means to propel a solid or liquid body of material by intermittently discharging high pressure air or other fluid substance behind them.

In accomplishing the foregoing objects, a cased well, having a flow tubing extending to proximate the bottom thereof and with a hermetic seal provided between them proximate the ground surface, has a valve in the flow tubing above the casing head with a shell having oppositely inclined spiral openings on opposite sides fitting over the valve stem with a transverse pin through it engaged with the spiral openings of the shell, the shell actuating the valve by means of a piston which is moved to open the valve by pressure exterior of the flow tubing within the well and later moved to close it by weight or spring after the pressure in the well has decreased to a predetermined value below that which obtained when the valve opened.

Many other uses than herein enumerated can be made of this invention without requiring inventive skill to apply it, as will be more apparent from an examination of the accompanying drawings in which:

Fig. 1 is an elevation of the device and partial section of the upper end of a well.

Fig. 2 is a plan view of the device shown in Fig. 1.

Fig. 3 is a partial sectional elevation of the device shown in Fig. 1.

Fig. 4 is a section on the line 4—4, Fig. 3.

Fig. 5 is a section on the line 5—5, Fig. 3.

Fig. 6 is a plan and side elevation of the counter actuating finger in Figs. 1 and 3.

Fig. 7 is a section on the line 7—7, Fig. 3.

Fig. 8 is a partial sectional elevation of the first modified form of the invention.

Fig. 9 is a section on the line 9—9, Fig. 8.

Fig. 10 is a quarter turn partial section and partial elevation of a portion of the device shown in Fig. 8.

Fig. 11 is a partial sectional elevation of the second modified form of the invention.

Fig. 12 is a section on the line 12—12, Figs. 11 and 13.

Fig. 13 is a quarter turn elevation of a portion of the invention as shown in Fig. 11, showing a partial section of the valve operating mechanism.

Identical characters of reference refer to similar parts throughout the several views.

The first form of the invention is shown in Fig. 1, in which well casing 1 has a flow tubing 2 extending central thereof to proximate the bottom of the well. The nipple 2*a* is welded at 2' to plate 5 and is threadedly joined with nipple 2*b* by coupling 2*d*.

The casing head assembly composed of base 3, cap 4, plate 5, and packing 6 afford well known means for accomplishing a hermetic seal between the well casing and flow tubing proximate ground surface G. Bull plug 7 may be used to close the unused opening of the casing head.

Upon the upper end of nipple 2*b*, valve 8 is unreadedly engaged. The bent nipple 2*c* engaged upon the other end of the valve has connection with a line leading to a tank or other storage.

Valve stem 8*a*, rotatable in one direction to open valve 8 and to close it by rotation in the opposite direction, is secured within extension 9 by a pin 10. The lower end of extension 9, slidable within shell 12 and through internal flange 13*b*, has pin 11 tightly engaged within it. The ends of this pin protrude equally on opposite sides of extension 9 so as to be flush with the outside of shell 12. Over the ends of pin 11, rollers 11*a* have free rotatable engagement and have slight clearance within the slots 12*a* of shell 12 which is firmly secured upon its carrier 16 by nut 15 which locks the finger 14 between it and carrier 16. Slot 16*a* serves to allow shell 12 to be moved away from nipple 2*b* as may be necessary to cause it to register with the valve stem extension 9 if a larger valve than the one shown at 8 should be employed. A hood 13 has threaded engagement upon the upper end of shell 12, the unthreaded portion having slight clearance over the other portion of the shell in order to hold the rollers within the slots 12*a* and otherwise house the mechanism. The sloping internal circular shoulder 13*a* of the internal flange 13*b* engages the upper end of shell 12 so as to force the mating threads in firm contact with each other, thereby preventing distortion of the slotted shell as is apparent in Figs. 3, 8 and 11.

It will be noted that slots 12*a* (Fig. 3) are oppositely inclined and positioned exactly opposite each other in the shell 12 so that pin 11 and rollers 11*a* will impart rotation to valve stem extension 9 as the shell 12 is moved upward or downward.

Cylinder bracket 36, having bolts 39 rigidly engaging teeth 36*a* upon the nipple 2*b*, supports cylinder 35 to which it is locked in a fixed position by nut 37. Bracket 36 and nipple 17, respectively, provide means for supporting the mechanism and holding it parallel with nipple 2*b*, as shown in Fig. 1.

Nipple 17 threadedly connected within an opening in the casing head, stop cock or valve 18, nipple 19, elbow 26, nipple 20, T 21, nipple 25, elbow 26*a*, nipple 27, union 28, nipple 29, and lubricator shell base 30, all threadedly joined together, afford a hermetically sealed tubular communication between the annular space S within the casing and the interior of lubricator shell 32, base 30 and shell 31 being hermetically joined together by weld 30*a*. Central of, and extending downward from the upper end of shell 31 is a cylindrical extension 31*c* (Figs. 3 and 10) having threaded engagement with cylinder 35 within which piston 40 is freely movable.

The latch spacer bolts 66, secured upon bracket 36 and upon latch housing holder 54 by nuts 67, serve to support latch housing holder 54 which receives through a central opening the lower threaded extension 51*a* of latch housing 51 secured upon the holder 54 by latch lock cap 52. The upper latch housing cover 59, closed at its upper end by cap 65, is threadedly engaged over the upper end of latch housing 51 and secured in proper position by lock ring 60.

Rocker arms 73 are hinged upon arms 36*b* of bracket 36 by bolt 74 and hinged upon prongs 68*a* of the weight lever 68 by bolts 75. Bolt 68' has a close fit through piston 40 and the member 16 and has a free fit through the prongs 68*a*, thus providing a fulcrum for the lever 68. Extension rod 69 is threadedly engaged with the member 68, the engagement being secured by lock nut 70. Weight 71 is engaged over the other end of rod 69 by threads adapted to allow the weight to be moved inward or outward to exert more or less force upon piston 40, as will be later explained. Lock nut 72 obviously serves to secure the weight 71 in a fixed position.

Over the lower end extension 40*a* of the piston, cups 41 are fitted and spaced apart by cup spacer 42, nut 43 serving to lock them in position as shown in Fig. 3. The nut 43 is of such length as will not allow the end cup to strike the landing below. The tubular extension 32*a* holds the base 30 spaced apart from the lower end of shell 32, a hermetic closure between base 30 and inner shell 32 being provided by threads and weld shown at 30*a*. Packing 38*a*, compressed by gland 38 engaged with cap 48 which in turn has a threaded engagement over extension 31*a*, prevents possible leakage of fluid past the external threads on lower end of cylinder 35.

Pressure fluid communication between the lower end of cylinder 35 and the annular space S within the well is provided through opening 31*d*, the space interior of shell 32, the openings 32*c*, the annular space 32*d*, the openings 32*b*, the nipple 29 appearing in Fig. 3, and the lower connections shown in Fig. 1. The pressure gauge 24, having communication with the pressure fluid within the T 21, via valve 23 and bushing 22, obviously indicates the operating pressures.

Within the shell 32 is placed a liquid lubricant that will freely pass through the opening 31*d*, the level of which lubricant is shown at 32'. Plug 33 and packing 34 within boss 31*b* provides means for replenishing the lubricant and producing a hermetic seal.

Within the enlarged upper extension 35*a* of cylinder 35, a latch is provided by means of ball floor 46, balls 57, ball roof 47 slidable within the chamber, and spring 49 free all around and compressible upon the ball roof by cap 44, slidable

over piston 40. The cap may be locked in position to produce proper compression of the spring by lock ring 45. The balls 57 are adapted to become engaged with a portion of reduced diameter 40b of the piston when the piston is in its lower position as shown in Fig. 3.

Latch housing 51 contains another latch assembly consisting of ball floor 55, balls 57a, ball roof 56, the latter being slidable within the housing, and spring 58, free all around. This latch engages the turned down portion 50a of shaft 50 at the upper end of the piston travel. Latch housing cover 59, threadedly connected over latch housing 51 and locked in place by lock ring 60, has an upper threaded portion over which pin base ring 63 is slidable. The pins 62 pressed in, welded, or otherwise secured upon ring 63, register with and are slidable within the openings in cover 59. The lower end of these pins contact spring rider 61. Spring compression nut 64 may, therefore, be raised or lowered to cause proper compression of spring 58 upon ball roof 56 as appears in Fig. 3.

It will be understood that the ball roof and ball floor of each latch are formed adjacent to the balls with arcuate surfaces adapted to urge the latch balls inwardly as is apparent in Figs. 3, 8 and 10. It will also be understood that piston 40 and shaft 50 are freely movable through all associated parts in their indicated path of travel except through shell carrier 16 to which piston 40 is fastened by bolt 68'.

The chamber 59b may be filled with a lubricant which will cushion the upward stroke of piston 40 by the lubricant being forced through the opening of restricted diameter 59d in plate section 59a by latch shaft 50. The opening 65a provides air circulation in and out of the chamber 59c. Baffle tube 65', closed proximate its upper end and above the closure having a perforated tubular portion 65'', prevents the lubricant from wasting through the opening 65a as it is forced under pressure by shaft 50 through the opening 59d. Packing 53 prevents the lubricant from escaping downward.

The piston travel is determined at its upper end by the engagement of shaft 50 upon plate section 59a. Screwing the cover 59 upward or downward and locking it in correct position with ring 60 provides the necessary stroke to operate the valve 8. Manifestly, the assembly must be positioned by U bolts 39 and bracket 36 so that valve 8 will be closed when the piston is at the lower end of its travel as shown in Fig. 3.

The oppositely inclined slots 12a are of such pitch and length as will actuate valve 8 so as to open it on the up-stroke of shell 12 and close it on the down stroke. The vertical ends 12b and 12c of the slots provide that the piston travel may be more than enough to actuate the valve without imparting unnecessary strain upon the valve. The vertical portions 12b and 12c may, however, be omitted; and the slots 12a may be longer and have more pitch than is required to actuate the valve 8. In such case the piston travel should be accurately adjusted to land shaft 50 on plate 59a as soon as the valve is open, and to land piston 40 upon base connection 31c on its downward stroke as soon as the valve is closed.

The lower latch should be adjusted by providing sufficient compression upon spring 49 that weight 71 will be quickly raised to the upper position shown in Fig. 1 when this latch is sprung. The upper latch will then engage. The upper latch should be adjusted by providing sufficient compression upon spring 58 that the weight 71 will quickly drop to the dotted position shown in Fig. 1 when this latch is sprung.

The weight and position of member 71 on rod 69 manifestly governs the pressure at which the mechanism will operate. Moving the weight outward increases this pressure, and vice versa, as is apparent. The rod 69 should preferably be approximately horizontal when the piston is midway of its stroke.

In explaining the operation, it will be assumed: That valve 18 (Fig. 1) is closed with gas at a pressure of 320 pounds (all pressures being per square inch) confined within the annular space S; that weight 71 is in the lower position and will resist rising by 300 pounds pressure under the piston; that the lower latch is adjusted to hold against 20 pounds under the piston independent of weight 71; and that the upper latch will hold by the equivalent of 20 pounds pressure under the piston.

Valve 18 is now opened. Pressure builds up on top of the oil or other lubricant having its level at 32' within shell 32 (Fig. 3). This pressure transmits through opening 31d to the piston and cups. At 320 pounds pressure the lower latch is sprung. The piston rises until shaft 50 strikes plate 59a. The shell 12 is at the same time raised from its lower position and opens valve 8 (Fig. 1). The lubricant in shell 32 follows the piston, lowering the lubricant level in shell 32 to the horizon 32'' (Fig. 10), thus affording lubrication for the cups 41 in their return movement. The pressure fluid in the annular space S forces the well liquid out through the flow tubing. When the pressure drops in space S to 280 pounds the upper latch is sprung by weight 71 and the piston returns to the position shown in Fig. 3, restoring the oil level to the horizon 32'. This completes the operating cycle. The lower end extension 40a of the piston partly closes the passage 31d slightly before the piston reaches its lowermost position and thereby further aids said comparatively small passage to further cushion the impact. Manifestly, the annular space S may be supplied with pressure fluid from an outside source by means of a connection replacing the bull plug 7.

In the foregoing example, the grip or freeze of the cups 41 against the cylinder wall was not taken into account; because in this construction the piston should be of comparatively small diameter, 2'' being ample for the installation upon an oil well as illustrated. Whatever the force of this freeze may be will aid the lower latch and impede the upper latch. Both latches can readily be adjusted accordingly.

If the well will not flow at the pressures available, aerating devices may be installed at intervals in the flow tubing. Such devices are described in my Patents Nos. 1,470,053, 1,517,611, 1,686,262, 1,712,418, 1,747,570, 1,747,571, 1,747,572, 1,749,124, 1,767,201, 1,767,202, 1,768,109, 1,768,110, 1,770,023, 1,772,036, 1,773,942, 1,773,943, 1,779,726, 1,779,727, 1,784,720, 1,793,671, or 1,952,581.

A counter, such as shown at 76, many types thereof being manufactured, may be engaged upon the nipple 2b by clamp 76b, secured by clamp bolt 76c. The counter actuator 76a is adapted to be engaged by the finger 14 proximate the extreme upper end of the valve opening upward stroke of piston 40, for the obvious purpose of recording the number of each valve opening or flowing operation.

The first modified form of the invention is shown in Figs. 8, 9, and 10. In this modification

a coiled spring 78 is substituted for weight 71 in the first form. U bolts 39 serve to secure the bracket 36A upon nipple 2b in proper position to actuate valve 8, as was explained in connection with Figs. 1 and 3. Bracket 36A, having openings registering with similar openings of latch housing holder 54A, space these members apart by means of bolts 66 extending through the openings and secured by nuts 67. Arms of spiral shell carrier or crosshead 16A, registering with similar arms of spring base 79, are spaced apart by bolts 80 and nuts 80a, these bolts passing through shell carrier 16A as appears in Fig. 10. The coiled spring 78, free over nipple 29A, is engaged between lubricator shell base 30 and spring base 79, slidable over nipple 29A. Nipple 29A (Figs. 8 and 10) is longer than nipple 29 in Fig. 3 but otherwise the same. Set screw 77 secures the shell carrier 16A upon piston 40A which operates the same as piston 40 in Fig. 3, with which it is identical except that it is somewhat longer and has no transverse opening for the bolt 68' as in Fig. 3.

All other parts are the same and operate the same as was described for the first form of the invention. It is apparent that the spring 78 will be compressed when the piston moves upward; this compressed spring functions to oppose the upward movement of the piston 40A in the lower position and to urge it downward from its upper position in the same manner as weight 71 functions in the preceding form of the invention.

In order that this spring will not build up too much resistance during the upward stroke of the piston, and corollarily that it will not lose too much force during the downward stroke of the piston, it is important that the free length of the spring should be comparatively great and that it be installed under considerable compression. If the piston stroke is 4'', the spring should preferably have approximately 4 feet free length and be installed under approximately 2 feet of compression. The above is especially true if small difference between the pressures at which valve 8 will open and close is desired. Adjustments of the spring compression may be made by turning lower nuts 80a upward or downward as is apparent. Manifestly, a weight having a central opening through it and slidable over the nipple 29A could be substituted for the spring 78 if sufficient space be provided between the weight and shell base 30 to allow for proper travel of the shaft 50.

The second modified form of the invention is shown in Figs. 11, 12 and 13, wherein spring 78', somewhat differently installed, serves the same purpose as spring 78 in Figs. 8 and 10. Shell carrier 16B has a two pronged portion within which the lower threaded extension of shell member 12 is engaged as in the preceding forms. The other end of shell carrier 16B is formed into an arm having an enlarged circular portion which receives through a central vertical opening the latch shaft 50A, somewhat longer than the shaft 50 in the other forms of the invention, but otherwise the same.

A slotted ring 81 with its slots receiving the arm of the shell carrier 16B on either side of its enlarged circular portion rests upon the circular portion to form a base for spring 78'. The lower end of spring adjuster guide pipe 82 has slots 82a with clearance over the arm of shell carrier 16B on either side of its enlarged portion, and the lower end of pipe 82 has slight clearance within the spring base 81 so that pipe 82 is vertically movable as can be seen in Figs. 11, 12 and 13. Spring 78' has free clearance over pipe 82 and may have its compression adjusted by nut 84 locked by nut 83, both nuts having threaded engagement over the upper end of pipe 82. Latch lock cap 52A, otherwise the same as lock cap 52 in the preceding forms, has tongue like extensions 52Aa which engage with mating slots within the upper end of pipe 82, co-acting with slots 82a over the arm of shell carrier 16B, in order to prevent rotation of the shell carrier 16B due to the rotary thrust transmitted by shell 12 as its spiral slots cause valve actuation. Cylinder bracket 36B, having no extensions or bolt connections as had the corresponding part 36 in Figs. 1 and 3, and 36A in Figs. 8 and 10, serves only to support the cylinder 35. Cylinder bracket 36B', secured upon nipple 2c by U bolts 39a, serves as an upper support for the assembly corresponding to members 54 and 54A respectively in the preceding forms. Piston 40A is the same in all respects as the piston employed in the first modified form except that it is somewhat shorter. To avoid needless repetition, all parts bearing the same reference characters, being substantially the same in construction and purpose throughout all forms of the invention, are discussed with reference to the first form only.

If, by way of illustrating other uses of this invention, it should be desired to augment the supply of gas discharged from a reservoir into a pipe line, for example, and hold the pressure in the line constant between a predetermined high and low value, the mechanism, herein shown and described, may be installed to actuate a valve 8 such as shown, the high pressure or intake end of the valve being toward the reservoir and the low pressure and discharging into the pipe line. In such installation the valve must open at a predetermined low pressure under the piston 40 and close at a predetermined high pressure under it, this being the reverse order of pressures from that hereinbefore described. To accomplish such result, it is merely necessary to reverse the direction of oppositely inclined slots 12a.

It will be understood that the foregoing drawings and specifications are illustrative, and are not intended to limit the construction or uses of this invention, which may be greatly varied within its contemplated scope and purposes.

I claim:

1. A flow control for wells having a casing and tubing, a valve to control the discharge of produced fluid from said tubing, and means to control the operation of said valve including a differentially pressure actuated mechanism wherein the force to open is a source of fluid under pressure and the force to close is mechanical in combination with means for causing the opening and closing movements of said valve to be quickly completed.

2. A flow control for wells having a casing and tubing, a valve to control the discharge of produced fluid from said tubing, and means to control the operation of said valve including a differentially pressure actuated mechanism wherein the force to open is a source of fluid under pressure and the force to close is mechanical, said pressures being opposed to each other so that when said fluid pressure drops below a predetermined value said mechanical pressure will close the valve, in combination with latching means for causing the opening and closing movements of said valve to be quickly completed.

3. A flow control for wells having a casing and tubing, a valve to control the discharge of produced fluid from said tubing, and means to control the operation of said valve including a differentially pressure actuated mechanism wherein the force to open is a source of fluid under pressure and the force to close is mechanical, said means including a fluid pressure connection to said casing, a piston within a cylinder, and means for causing the opening and closing movements of said valve to be responsive to the movements of said piston.

4. A flow control for wells having a casing and tubing, a valve to control the discharge of produced fluid from said tubing, and means to control the operation of said valve including a differentially pressure actuated mechanism wherein the force to open is a source of fluid under pressure and the force to close is mechanical, said pressures being opposed to each other so that when said fluid force drops below a predetermined value said mechanical pressure will close the valve, said means including a weight upon one end of a fulcrumed lever to create said mechanical force, the other end of said lever being hinged upon a rocker arm.

5. A flow control for wells having a casing and tubing, a valve to control the discharge of produced fluid from said tubing, and means to control the operation of said valve including a differentially pressure actuated mechanism wherein the force to open is a source of fluid under pressure and the force to close is mechanical, said forces being opposed to each other so that when said fluid pressure decreases below a predetermined value said mechanical force will close the valve, by means including a spring to create the mechanical force.

6. A flow control for wells having a casing and tubing, a valve to control the discharge of produced fluid from said tubing, and means to control the operation of said valve including a differentially pressure actuated mechanism wherein the force to open is a source of fluid under pressure and the force to close is mechanical, said forces being opposed to each other so that when said fluid pressure drops below a predetermined value said mechanical force will close the valve, by means including a spring to create the mechanical force, in combination with latching means to cause said force to be applied suddenly.

7. A flow control for wells having a casing and tubing, a valve to control the discharge of produced fluid from said tubing, and means to control the operation of said valve including a differentially pressure actuated mechanism wherein the force to open is a source of fluid under pressure and the pressure to close is mechanical, said forces being opposed to each other so that when said fluid pressure drops below a predetermined value said mechanical force will close the valve, by means including a spring to create the mechanical pressure disposed with latching means to cause said force to be applied suddenly, and means for cushioning the impact of said differentially operated mechanism when it opens and closes said valve.

8. A flow intermitter for wells having a casing and tubing therein, sealing means between said casing and tubing proximately above said casing, an annular space within said casing, a valve in said tubing above said sealing means, a conduit connected to said sealing means and having communication with said annular space, a cylinder communicating with said conduit, a piston slidable in said cylinder and having an extension outward thereof, means for lubricating said piston, means for opening and closing said valve, said means being operable by said piston; a shell surrounding said piston extension above said cylinder, a spring loaded latch assembly within said shell, said latch being to force balls inwardly into engagement with said piston; an annular recess around said piston, said recess being for latching engagement with said balls when said piston is in its lowermost position; a latch housing surrounding said piston above said first latch and containing another spring loaded latch assembly having other balls adapted to move into latching engagement within another recess around said piston when the same is in its uppermost position, a dashpot secured above and independent of said piston to limit its upstroke and to cushion the impact thereof, means for securing said piston and extension thereof upon said tubing and in spaced relation to said tubing and valve, pressure fluid to move said piston in one direction to open said valve at a predetermined value of said fluid, and a weight to move said piston in the other direction to close said valve at a predetermined different value of said fluid.

9. A flow intermitter for wells having a casing and tubing therein, sealing means between said casing and tubing proximately above said casing, an annular space within said casing, a valve in said tubing above said sealing means, a conduit connected to said sealing means and having communication with said annular space, a cylinder communicating with said conduit, a piston slidable in said cylinder and having an extension outward thereof, means for lubricating said piston, means for opening and closing said valve, said means being operable by said piston; a shell surrounding said piston extension above said cylinder, a spring loaded latch assembly within said shell, said latch being to force balls inwardly into engagement with said piston; an annular recess around said piston, said recess being for latching engagement with said balls when said piston is in its lowermost position; a latch housing surrounding said piston above said first latch and containing another spring loaded latch assembly having other balls adapted to move into latching engagement within another recess around said piston when the same is in its uppermost position, a dashpot secured above and independent of said piston to limit its upstroke and to cushion the impact thereof, means for securing said piston and extension thereof upon said tubing and in spaced relation to said tubing and valve, pressure fluid to move said piston in one direction to open said valve at a predetermined value of said fluid, and a spring to move said piston in the other direction to close said valve at a predetermined different value of said fluid.

10. A flow intermitter for wells having a casing and tubing therein, sealing means between said casing and tubing proximately above said casing, a space for fluid within said casing, a valve in said tubing exterior of said casing, a conduit having communication with said space, a cylinder communicating with said conduit, a piston slidable in said cylinder and having an extension outward thereof, means for lubricating said piston, means for opening and closing said valve, said means being operable by said piston; a shell surrounding said piston extension beyond said

cylinder, a spring loaded latch assembly within said shell, said latch being to force balls inwardly into engagement with said piston; an annular recess around said piston, said recess being for latching engagement with said balls when said piston is in its lowermost position, means for securing said piston and extension thereof upon said tubing and in spaced relation to said tubing and valve, pressure fluid to move said piston in one direction to open said valve at a predetermined value of said fluid, and means to move said piston in the other direction to close said valve at a predetermined different value of said fluid.

11. A flow intermitter for wells having a casing and tubing therein, sealing means between said casing and tubing proximately above said casing, a space for fluid within said casing, a valve in said tubing exterior of said sealing means, a tubular conduit having communication with said space, a cylinder communicating with said conduit, a piston slidable in said cylinder and having an extension outward thereof, means for lubricating said piston, means for opening and closing said valve, said means being operable by said piston; pressure fluid to move said piston in one direction to open said valve at a predetermined value of said fluid, and a spring to move said piston in the other direction to close said valve at a predetermined different value of said fluid.

12. In a flow intermitter for wells, the combination of a casing and tubing, sealing means between said casing and tubing exterior of said casing, a space for fluid within said casing, a valve in said tubing exterior of said sealing means, a tubular conduit having communication with said sealing means and with said space, a reservoir connected to said conduit, a shell within said reservoir, said shell having side and bottom clearance with said reservoir; openings for pressure fluid proximate the upper end of said shell, a lubricant within said shell, a cylinder secured upon said reservoir, a piston slidable within said cylinder and having an extension beyond the same, means for securing said piston and extension thereof upon said tubing and in spaced relation to said tubing and valve, and means for opening and closing said valve, said means being controlled by said piston responsive to the differential force exerted thereon from said annular space.

13. In a flow intermitter for wells, a valve opening and closing means consisting of a shaft adapted to open a valve by limiting rotation in one direction and to close said valve by similarly limited rotation in the other direction, a pin secured transversely through said shaft and having ends extending therefrom, a shell having oppositely disposed spiral slots engageable over the ends of said pins, said shell being longitudinally movable over said shaft to impart such limited rotation to said shaft when said shell is moved telescopically over same a predetermined distance in one direction and to impart similarly limited rotation thereto in the other direction when said shell has equal movement over said shaft in the opposite direction.

14. In a flow intermitter for wells, a valve opening and closing means consisting of a shaft adapted to open a valve by limited rotation in one direction and to close said valve by similarly limited rotation in the other direction, a pin secured transversely through said shaft and having ends extending therefrom, a shell having oppositely disposed spiral slots engageable over the ends of said pins, said shell being longitudinally movable over said shaft to impart such limited rotation to said shaft when said shell is moved telescopically over same a predetermined distance in one direction and to impart similarly limited rotation thereto in the other direction when said shell has equal movement over said shaft in the opposite direction, and a mechanical counter for numerically recording the operations of said valves.

15. In a flow intermitter for wells, the combination of a cylinder having communication with the interior of a well, a piston in said cylinder, a valve on a tube having communication with the interior of said well, means for securing said piston relative to said valve, means for operating said valve by movement of said piston, tubular means connecting said cylinder to the interior of said well, pressure fluid in said well to move said piston in one direction and to operate said valve in one direction, and pressure means acting upon said piston to force it in the reverse direction to operate said valves in the reverse direction when said pressure fluid force changes to another predetermined value.

16. In a flow intermitter for wells, the combination of a cylinder having communication with the interior of a well, a piston in said cylinder, a valve on a tube having communication with the interior of said well, means for securing said piston relative to said valve, means for operating said valve by movement of said piston, tubular means connecting said cylinder to the interior of said well, pressure fluid in said well to move said piston in one direction and to operate said valve in one direction, pressure means acting upon said piston to force it in the reverse direction to operate said valve in the reverse direction when said pressure fluid force changes to another predetermined value, a second valve and a pressure gauge in said tubular means, and a mechanical counter to numerically record the operations of said first valve, said counter being operable by means attached to said piston.

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