

Oct. 8, 1963

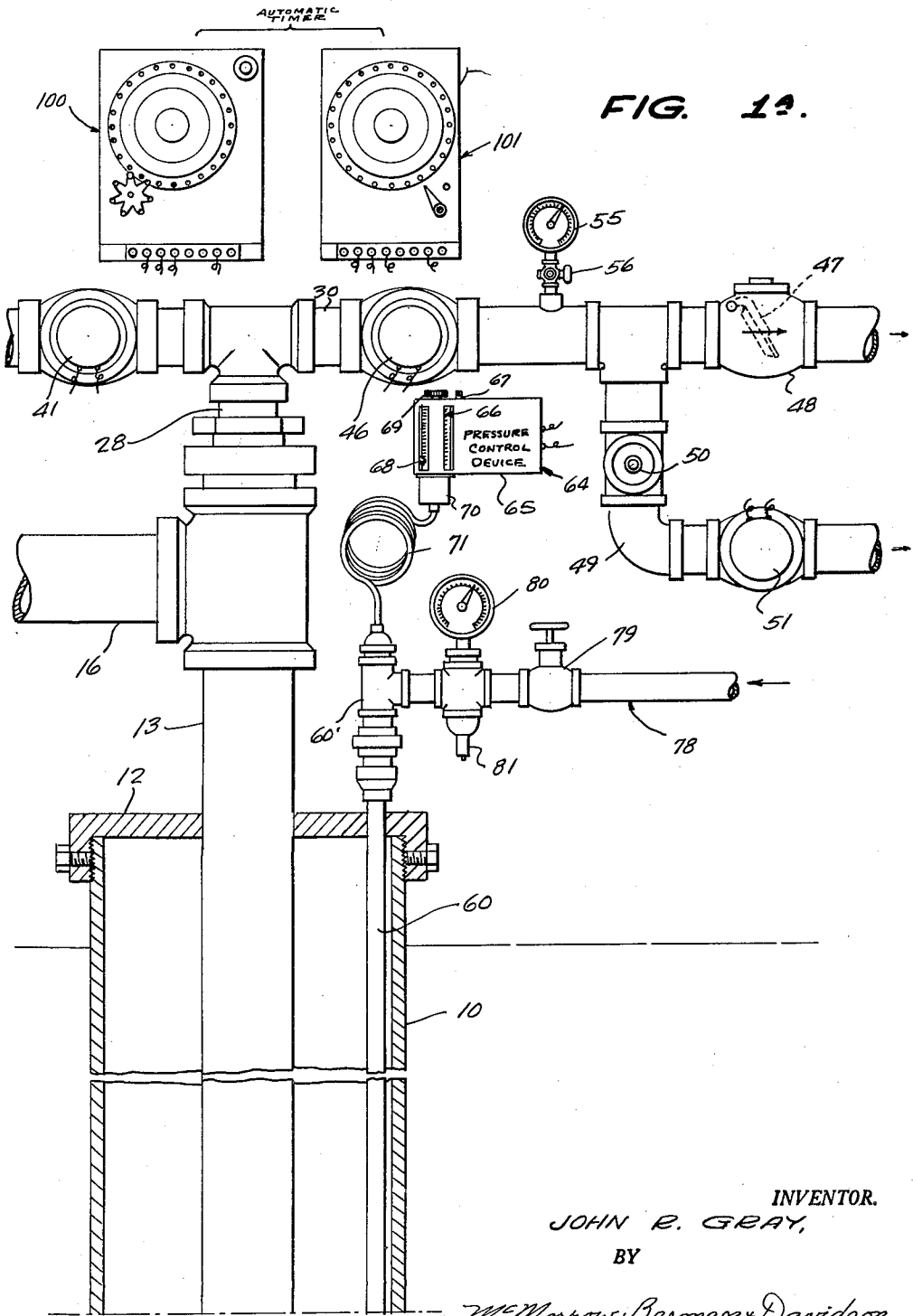
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3,106,170

APPARATUS FOR FLOWING OIL FROM A WELL

Filed Nov. 17, 1961

5 Sheets-Sheet 1



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FIG. 1B.

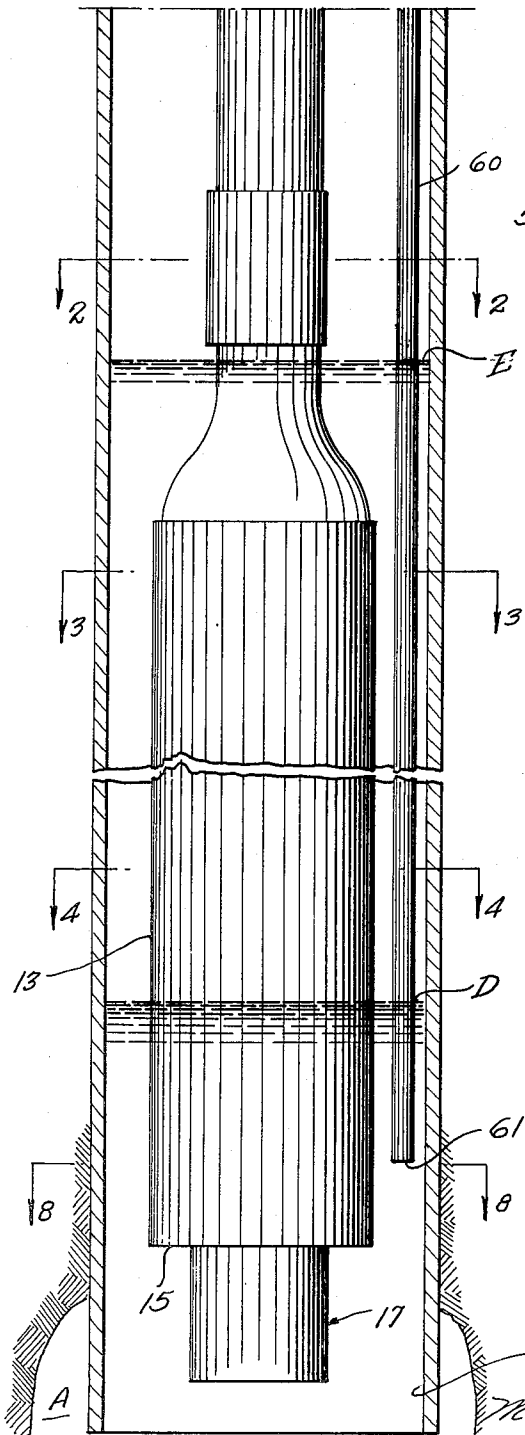


FIG. 2.

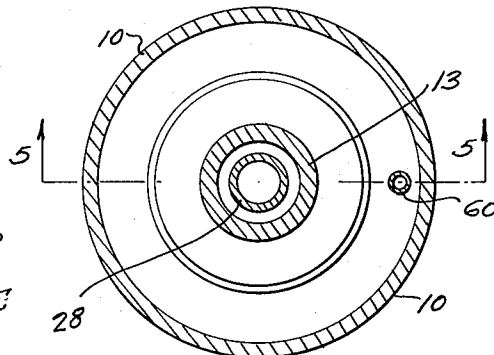


FIG. 3.

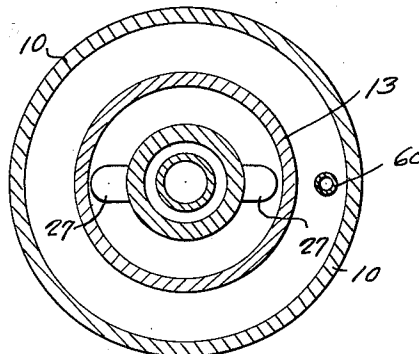
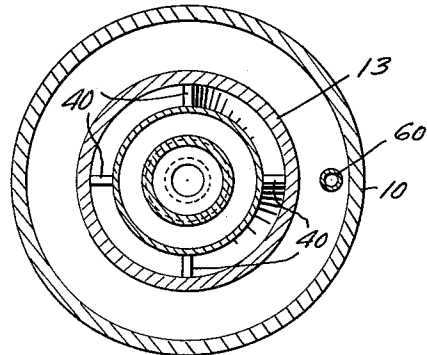


FIG. 4.



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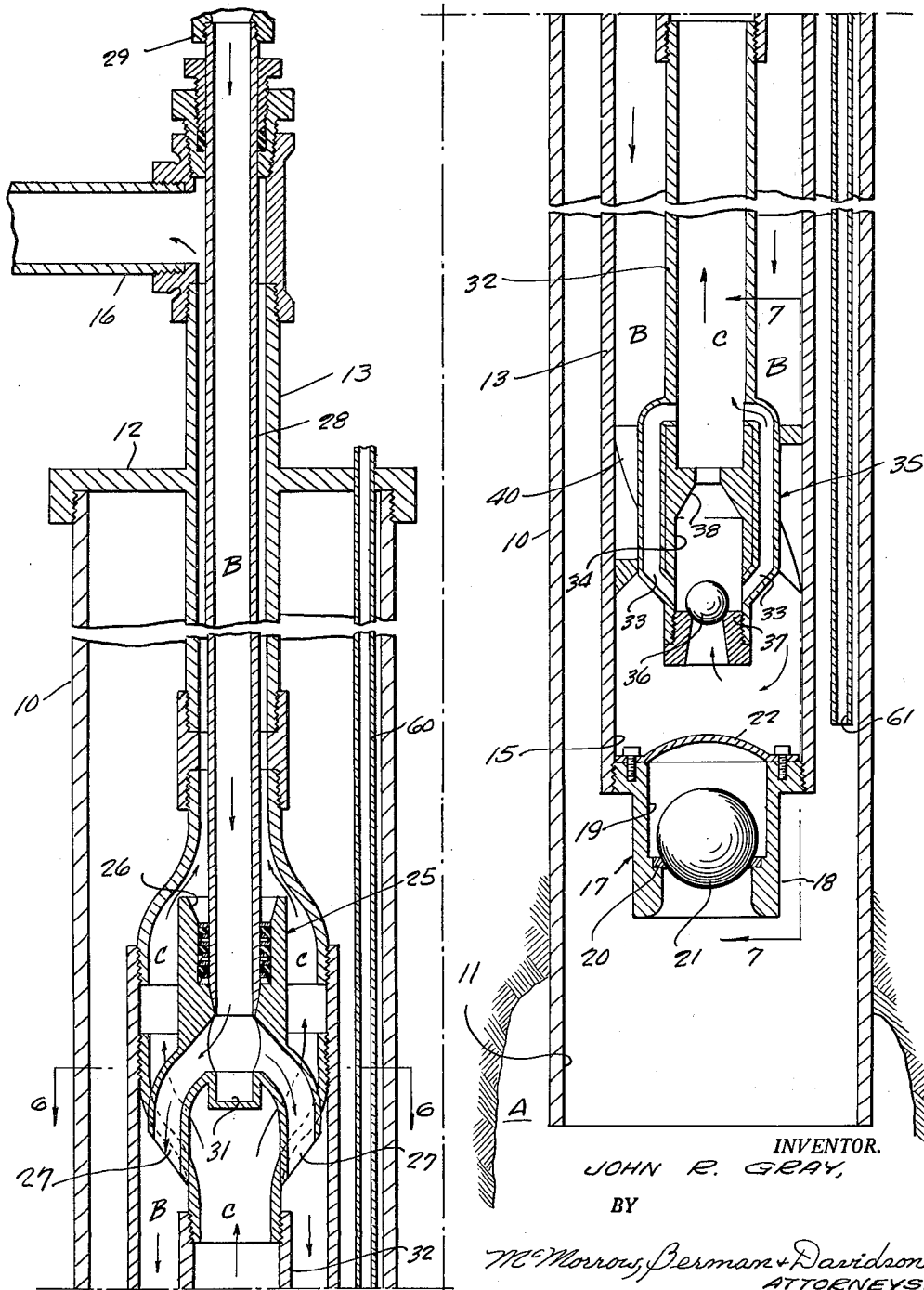
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FIG. 5.



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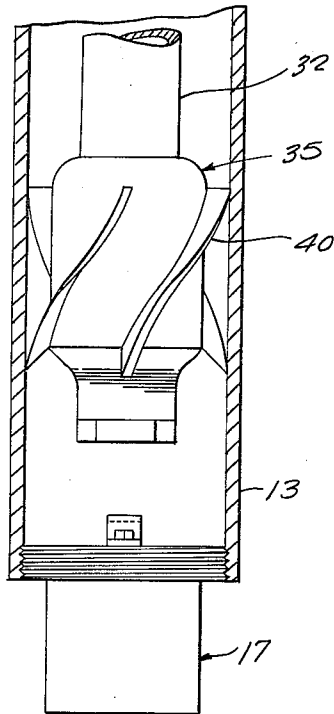


FIG. 7.

FIG. 6.

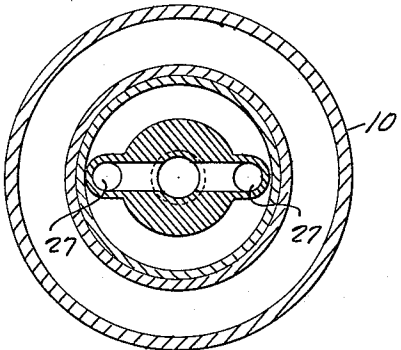


FIG. 8.

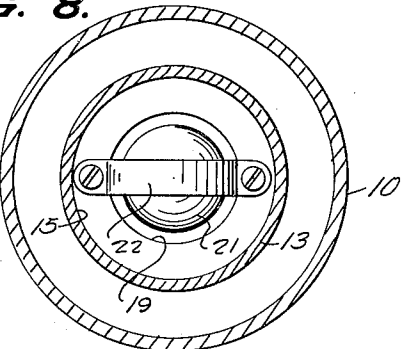
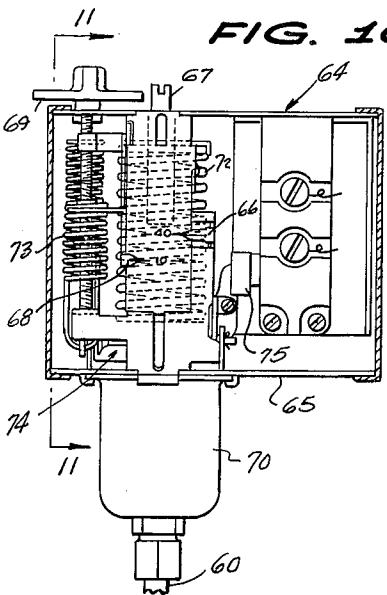


FIG. 10.

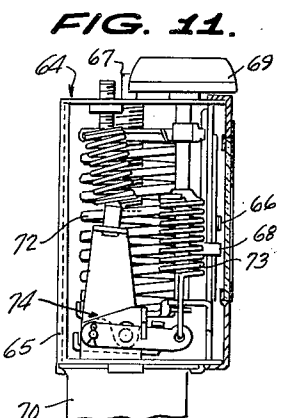
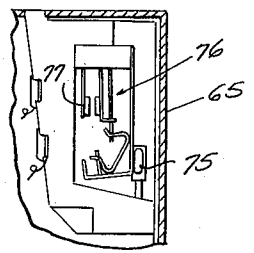


FIG. 11.

FIG. 12A.



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FIG. 9.

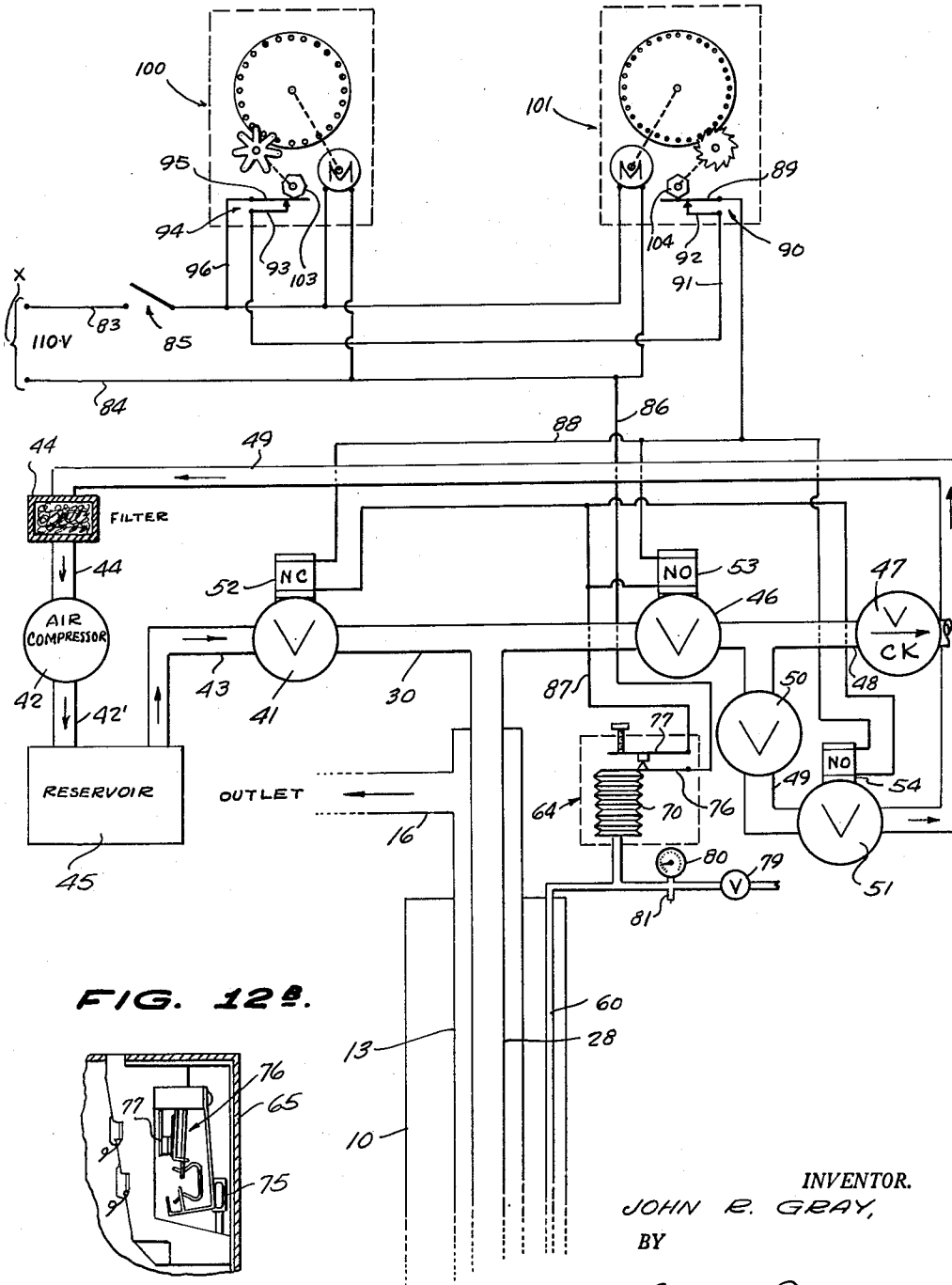


FIG. 12.

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**APPARATUS FOR FLOWING OIL FROM A WELL**  
John R. Gray, Palestine, Tex., assignor of one-third to William George, Jr., and one-third to Johnnie Alex Elfarr, both of Palestine, Tex.  
Filed Nov. 17, 1961, Ser. No. 153,030  
7 Claims. (Cl. 103—234)

This invention relates to an apparatus for flowing oil from a well.

An object of the present invention is to provide an apparatus for flowing oil from a well in which the flow of oil is effected by the direct imposition of fluid under pressure upon oil contained in a well casing mounted in direct communication with the well.

Another object of the present invention is to provide an apparatus for flowing oil from a well in which the flow of oil is controlled between predetermined set high and low levels of oil contained in the well casing mounted in direct communication with the well.

A further object of the present invention is to provide an apparatus for flowing oil from a well which enables the flow of oil from a well casing only during certain selected days of a week and at certain intervals of time in a single day.

A still further object of the present invention is to provide an apparatus for flowing oil from a well which includes only a single pump for effecting the flow of oil from a well casing mounted in direct communication with the well.

A still further object of the present invention is to provide an apparatus for flowing oil from a well in which there is provided only a single pressure-imposing chamber and a single cooperating oil-flow chamber.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIGURES 1A and 1B illustrate the apparatus, with parts broken away, for flowing oil from a well according to the invention.

FIGURE 2 is a transverse sectional view taken on the line 2—2 of FIGURE 1B.

FIGURE 3 is a transverse sectional view taken on the line 3—3 of FIGURE 1B.

FIGURE 4 is a transverse sectional view taken on the line 4—4 of FIGURE 1B.

FIGURE 5 is a longitudinal sectional view taken on the line 5—5 of FIGURE 2.

FIGURE 6 is a transverse sectional view taken on the line 6—6 of FIGURE 5.

FIGURE 7 is a fragmentary sectional view taken on the line 7—7 of FIGURE 5.

FIGURE 8 is a transverse sectional view taken on the line 8—8 of FIGURE 1B.

FIGURE 9 is a diagrammatic view of the control means for operating the apparatus shown in FIGURES 1A and 1B.

FIGURE 10 is a sectional view through the pressure-control device of the apparatus shown in FIGURE 1A.

FIGURE 11 is a sectional view taken on the line 11—11 of FIGURE 10, and

FIGURES 12A and 12B are fragmentary views of the control device of FIGURE 10, but showing the contact points in the "off" and "on" positions respectively.

Referring to the drawings, and with particular reference to FIGURES 1A and 1B, and FIGURE 5, the apparatus for flowing oil from a well comprises a well casing 10 which has one end 11 open and the other end 12 closed, the well casing being adapted to be disposed in an upright position in a well from which oil is to be extracted. The well casing 10 is positioned in the well A so that the open end 11 extends into the well A and the closed

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end 12 is spaced above the well. An outer pipe 13 extends longitudinally through the casing 10 and has the upper end portion projecting through and exteriorly of the closed end 12 of the casing 10, and has the lower end 15 inwardly of and spaced from the open end of the casing 10, the upper end portion being provided with an outlet 16 for the discharge of oil therethrough. A main valve 17 normally closes the lower end 15 of the outer pipe 13 and is operable to open position upon the impact of fluid thereagainst. Specifically, the main valve 17 comprises a valve body 18 provided with an opening 19 extending axially therethrough, there being a valve seat 20 provided within the opening 19 intermediate the ends thereof, a ball valve 21 normally seating upon the valve seat 20 and closing the opening, and a strap member 22 extending across the end of the opening 19 above the ball valve 21 to retain the latter within the body 18, the valve 21 being operable to shift off the seat 20 and open the opening 19 upon impact of oil thereagainst.

In the outer pipe 13 below and spaced from the closed end 12 of the casing 10, FIGURE 5, is a first plug 25, the plug 25 being provided with an axial bore 26 and having diverging passages 27 which project from one end of the bore 26. The plug 25 is disposed within the outer pipe 13 so that the bore 26 extends longitudinally of the outer pipe 13 with the passages 27 facing toward the lower end 15 of the pipe 13. On the lower end of the plug 25 is a baffle embodying an upstanding cup 31, the cup 31 facing toward the convergent ends of the diverging passages 27 of the plug. The purpose of this baffle is to impede the flow of fluid under pressure into the convergent ends of the diverging passages 27 of the plug 25.

A first inner pipe 28, FIGURE 5, is disposed within and is spaced from and extends longitudinally through the upper end portion of the outer pipe 13 and into the part of the outer pipe below the closed end 12 of the casing 10, and has the upper end portion projecting above the upper end portion of the outer pipe 13, the lower end of the inner pipe 28 extending into the bore 26 of the plug 25 and being connected in communication with the said one end of the bore 26 or the convergent ends of the passages 27.

A conduit 30, FIGURE 1A, is disposed above the inner pipe 28 and contains fluid under pressure, such as compressed air, the upper end 29 of the first inner pipe 28 being connected in communication with the interior of the conduit 30.

A second inner pipe 32, FIGURE 5, is disposed below the first plug 25 and extends longitudinally of the outer pipe 13 and has the upper end detachably attached to the lower end of the plug 25 between the diverging passages 27 of the plug 25 with the lower end portion adjacent and inwardly of the main valve 17.

A second plug 35, FIGURE 5, is disposed on the lower end of the second inner pipe 32. The plug 35 is provided with an axial bore 34, the bore having a first valve seat 37 adjacent one end thereof and a second valve seat 38 adjacent the other end thereof. A subsidiary valve 36 normally seats upon the first valve seat 37 and closes said one end of the bore 34, and is operable to open position upon impact of fluid thereagainst. The second plug 35 is disposed on the lower end of the second inner pipe 32 so that the first and second valve seats 37 and 38 and the auxiliary valve 36 are in axial alignment with and adjacent to the main valve 17. A plurality of longitudinal by-passes 33 are in the second plug 35, the by-passes extending from above and adjacent the first valve seat 37 and terminating into the interior of the second inner pipe 32 above the second valve seat 38. Specifically, the subsidiary valve 36 is of the ball type, the ball valve 36

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normally seating upon the valve seat 37 and closing the one end of the bore 34 adjacent the main valve 17, and being movable from the valve seat 37 to seat upon the seat 38 and close the other end of the bore 34 or the end remote from the main valve 17.

It is to be noted, FIGURE 5, that the first inner pipe 28, the bore 26, and diverging passages 27, the first plug 25, the space between the second inner pipe 32 and the adjacent portion of the outer pipe 13 form a pressure-imposing chamber B and indicated by the downstream arrows for flowing fluid under pressure from the conduit 30 and discharging upon oil admitted to the lower end portion of the outer pipe 13 through the main valve 17. The bore 34 and the by-passes 33 of the second plug 25, the second inner pipe 32, the space between the first plug 25 and the outer pipe 13, and the space between the first inner pipe 28 and the adjacent portion of the outer pipe 13 forming an oil-flow chamber C and indicated by the upstream arrows for flowing oil under the impact of the fluid under pressure from the lower end portion of the outer pipe 13 and discharging same out of the outlet 16.

The plug 35, FIGURES 5 and 7, is provided with a spiral fin 40 which extends exteriorly and longitudinally along the plug 35 and engages the wall of the outer pipe 13, the fin with the adjacent portion of the wall of the outer pipe 13 forming helical passageways for imparting a helical twist to the oil admitted to the pressure-imposing chamber B through the main valve 17.

The conduit 30, FIGURES 1A and 9, has a first normally closed control valve 41 therein for controlling the admission of fluid or air under pressure from the reservoir 45 located on the output side of a compressor 42, the output side of the compressor 42 being connected by a branch conduit 42' to the reservoir 45 and the reservoir 45 being connected by a branch conduit 43 to the normally closed valve 41. The input side of the compressor 42 is connected by a branch conduit 44' to a filter 44. In the conduit 30 there is a second normally open control valve 46 which serves to either vent the conduit 30 of air under pressure contained therein to the atmosphere by swinging of the check valve 47 contained in the branch conduit 48 to the open or dotted-line position shown in FIGURE 1A or to flow the air under pressure discharged from the second valve 46 in a closed cycle back to the filter 44 to provide a vacuum as by a by-pass conduit 49 extending from the conduit 30 between the second control valve 46 to the filter 44. The check valve 47 is of the type which swings open upon imposition of air pressure thereagainst and which remains closed under suction or vacuum. It is to be noted that the by-pass conduit 49 has a manually-operable gate valve 50 which is set for the proper amount of vacuum desired in the by-pass conduit 49, and permit the air under pressure vented through the second valve 46 to be directed into the by-pass conduit 49, and also a third control valve 51 which is normally open and which is shiftable to closed position when the second control valve 46 is shifted to closed position. Each of the valves 41, 46 and 51 is controlled by an electrically-operable solenoid, the valve 41 having a solenoid 52 operatively connected thereto, the valve 46 having a solenoid 53 operatively connected thereto, and the valve 51 having a solenoid 54 operatively connected thereto. The solenoids 52, 53 and 54, of the valves 41, 46 and 51, are electrically connected together so that the aforesaid valves when electrically actuated simultaneously shift from the normally closed position of valve 41 and the normally open positions of valves 46 and 51 to the open position of valve 41 and the closed positions of valves 46 and 51, and when again electrically actuated simultaneously shift from the open position of valve 41 and closed positions of valves 46 and 51 to the normally closed position of valve 41 and the normally open positions of valves 46 and 51. To the conduit 30 between the connection of the by-pass conduit 49 and the second control valve 46 is connected a

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vacuum gauge 55 which may be placed into or out of communication with the interior of the conduit by appropriate turning of the valve 56 operatively connected thereto to open or closed positions respectively.

In the apparatus according to the present invention there is provided a first means for automatically controlling the flow of oil from the well A between predetermined set high and low levels of oil in the well casing 10, with a second means operatively connecting the first means to the first, second and third control valves 41, 46 and 51, so that when the level of oil in the well casing 10 is at the set high level and between the set high and low levels the first, second and third control valves 41, 46 and 51 are shifted simultaneously to and remain in the open and closed positions respectively to flow oil from the well casing 10 through the oil flow chamber C and discharge the oil out of the outlet 16, and when the level of oil in the casing 10 is at the set low level the first, second and third control valves 41, 46 and 51 are shifted simultaneously to the closed and open positions respectively to arrest flow of fluid under pressure through said pressure-imposing chamber B and thereby stop the flow of oil from the oil casing 10 through the oil-flow chamber C and out of the outlet 16. By reference to FIGURE 1B it will be observed that in the well casing 10 there is a predetermined set low level of oil indicated by the letter D, and a predetermined set high level of oil indicated by the letter E. Specifically, the aforesaid first means comprises a standpipe 60 disposed within the well casing and spaced from the outer pipe 13 and extending longitudinally of the well casing 10 and has a lower end 61 projecting below the predetermined set low level of oil indicated by the letter D, and has the upper end portion extending through and protruding above the closed end 12 of the well casing 10, and a pressure-control device 64 having low and high level settings corresponding to predetermined pressures at set levels, the control device being operatively connected to the upper end portion of the standpipe 60. The pressure-control device 64 comprises a case 65 having on its face a high-pressure setting 66 which is operated by an adjusting screw 67, and a low-pressure setting 68 which is operated by an adjusting knob 69. To the bottom of the case 65 and in vertical alignment with the settings 66 and 68 is a bellows 70, the bellows 70 being connected to the upper end of the standpipe 60 by means of a coiled tube 71. To the settings 66 and 68 are operatively connected heavy and light tension springs 72 and 73, respectively, and such springs are operated by pressure housed within the bellows 70 and which pressure is imposed upon pivoted levers 74 supporting the base ends of the springs 72 and 73. Disposed within the case 65 is a rockable contact lever 75, FIGURES 10, 12A, 12B, which is operatively connected to the springs 72 and 73, and which is operable responsive to pressure imposed thereon and contained in the bellows 70 to rock the lever 75 and shift the toggle-carrying contact 76 from the out-of-contact position of FIGURE 12A to the circuit-closing position of FIGURE 12B wherein the contact 76 is in contact with the cooperating contact member 77.

To the upper end of the standpipe 60 is connected a manifold 60' which includes a branch conduit 78, the branch conduit 78 being provided with a hand-operable valve 79 for controlling the discharge of pressure from the standpipe 60, and also a pressure gauge 80 for indicating the pressure contained in the standpipe 60. It is to be noted that the valve 79 is normally closed, and the gauge 80 is provided with a bleed valve 81 for obtaining a correct reading on the gauge.

The aforesaid second means or means which connects not only the pressure-control device 64 to the first, second and third valves 41, 46 and 51 comprises an electrically-operated means and includes, FIGURES 1A and 9, a source of electric current indicated by the letter X and having conductors 83 and 84, the conductor 83 be-

ing provided with a master switch 85 for closing the circuit. A conductor 86 connects the conductor 84 to the toggle-carrying contact 76 of the pressure-control device 64, and a conductor 87 connects the contact member 77 of the pressure-control device 64 to one side of the solenoids 52, 53 and 54 of the valves 41, 46 and 51. A conductor 88 connects the other sides of the solenoids 52, 53 and 54 of the valves 41, 46 and 51 to one of the contacts 89 of a first switch 90, and a conductor 91 connects the other contact 92 of the first switch 90 to one of the contacts 93 of a second switch 94, the other contact 95 of the switch 94 being connected to the conductor 83 by means of a conductor 96.

The apparatus of the present invention also provides a first electrically-actuable timer 100 which is selectively operable to circuit-closing position on only certain days of each week and a second electrically-actuable timer 101 which is selectively operable to circuit-closing position for intervals of time in a single day, the first and second timers being connected to the solenoids 52, 53 and 54 of the first, second and third control valves 41, 46 and 51 to operate with the latter. Specifically, the first timer 100 is connected by a first rotatable cam 103 to the contact 95 of the second switch 94, and the second timer 101 is connected by a second rotatable cam 104 to the contact 89 of the first switch 90.

In operation, with the well casing 10 set up so that the lower end extends into the well A, and the outer pipe 13, the first and second plugs 25 and 35, the first and second inner pipes 28 and 32, and the main and subsidiary valves 17 and 36, are disposed within the well casing to form the pressure-imposing and oil-flow chambers B and C, the static level of the oil contained within the well casing is determined as its hydrostatic pressure and when this pressure has been determined, the high pressure setting 66 on the pressure-control device is set for such pressure. This is done by positioning the standpipe 60 within the well casing 10 so that the lower end 61 is adjacent to and above the main valve 17 resulting in oil flowing from the well casing 10 into the standpipe. With the oil in the standpipe 60 the upper end of the standpipe is connected to the upper end of the manifold 60', the upper end of the manifold being disconnected from the coiled tube 71 and being closed by a detachable closure cap. The valve 79 in the branch conduit 78 is opened, and a source of air under pressure is attached to the conduit 78 and the air permitted to flow down the standpipe 60 until all of the oil in the standpipe is forced back into the well casing 10, whereupon the valve 79 is closed, the source of air disconnected from the conduit 78, and a reading on the pressure gauge 80 is taken. This pressure reading corresponds to the predetermined set high level of oil, and the high-pressure setting 66 on the pressure-control device is set accordingly by means of the adjusting screw 67. With the first timer 100 set to operate to circuit-closing position on only certain days of a week, and the second timer 101 set to operate to circuit-closing positions for intervals of time in a single day, the master switch 85 is closed, setting the apparatus in operation. With the operation of the first and second timers to the circuit-closing positions the valves 41, 46 and 51 are shifted from closed and open positions to open and closed positions, respectively, resulting in the flow of oil from the well casing 10 through the oil-flow chamber C and out of the outlet 16 under the imposition of fluid under pressure delivered through the pressure-imposing chamber B. This operation is continued until a reading on the pressure gauge 80 is at approximately zero, whereupon the master switch 85 is opened, stopping the operation of the apparatus. The level of the oil in the well casing 10 is then adjacent the lower end 61 of the standpipe 60. The bleed valve 81 is then opened, and permitted to remain open until the gauge 80 shows a low pressure reading of say 8 to 10 pounds, whereupon the bleed valve 80 is closed. This

low pressure reading corresponds to the predetermined low level of oil, and the low-pressure setting 68 on the pressure control valve 65 is set accordingly by means of the adjusting knob 69. The master switch 85 is then closed, setting the apparatus in operation, resulting in the flow of oil from the well casing 10 through the oil flow chamber C and out of the outlet 16 under the imposition of fluid under pressure delivered through the pressure-imposing chamber B.

By virtue of the second plug 35 with its by-passes 33 and spiral fin 40 and the main valve 17 of the recited construction a twist is imparted to the oil admitted to the lower end of the outer pipe 13 causing sand and other foreign substances to be thrown out of the oil without abrasive action upon the ball 21 of the main valve 17, and direct the oil, freed of sand and other impurities, to flow smoothly and with precision up through the bypasses 33 and along the rest of the oil-flow chamber C and out of the outlet 16. In addition, the first plug 25 with its pair of diverging passages 27 and the cup 31 permits the fluid under pressure to impede the flow of such pressure sufficiently to cause it to enter the passages 27 with ease and facility.

By the apparatus of this invention the flow of oil from the well is effected by direct imposition of fluid under pressure upon the submerged body of oil and directs such body of oil upwardly to an outlet located on the ground surface, and further, only a single pump is required for effecting this flow. In addition, such apparatus provides only a single pressure-imposing chamber and a single cooperating oil-flow chamber for effecting the flow of oil from the well to the ground surface, and the flow of oil from the well casing is effected between predetermined set high and low levels in the well casing mounted in direct communication with the well.

What is claimed is:

1. In an apparatus for flowing oil from a well, a well casing having one end open and the other end closed adapted to be disposed in an upright position in a well from which oil is to be extracted with the open end extending into the well and with the closed end spaced above the well, an outer pipe extending longitudinally through said casing and having the upper end portion projecting through and exteriorly of the closed end of said casing and having the lower end inwardly of and spaced from the open end of said casing, a main valve normally closing the lower end of said pipe and operable to open position upon impact of fluid thereagainst, a first plug provided with an axial bore and having diverging passages projecting from one end of said bore disposed in said pipe below and spaced from the closed end of said casing so that the bore extends longitudinally of said pipe with the passages facing toward the lower end of said pipe, said upper end portion of said outer pipe being provided with an outlet, a first inner pipe spaced from and extending longitudinally through the upper end portion of said outer pipe and into the part of said outer pipe below the closed end of said casing and having the upper end portion projecting above the upper end portion of said outer pipe and having the lower end extending into the bore of said plug and connected in communication with said one end of said bore, a conduit above said inner pipe for containing fluid under pressure, the upper end of said first inner pipe being connected in communication with the interior of said conduit, a second inner pipe positioned within and spaced from said outer pipe below said plug and extending longitudinally of said outer pipe and having the upper end detachably attached to the lower end of said plug between the diverging passages of said plug and having the lower end portion adjacent and inwardly of said main valve, a second plug provided with an axial bore, said bore having a first valve seat adjacent one end thereof and a second valve seat adjacent the other end thereof,

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a subsidiary valve normally seating upon said first valve seat enclosing said one end of the bore and operable to open position upon impact of fluid thereagainst to thereby seat upon said second valve seat and close the other end of the bore, said second plug being disposed in the lower end of said second inner pipe so that said first and second valve seats and said auxiliary valve are in axial alignment with and adjacent to said main valve, a plurality of longitudinal by-passes in said second plug extending from above and adjacent said first valve seat and terminating into the interior of said second inner pipe above said second valve seat, said first inner pipe, the bore and diverging passages of said first plug, and the space between said second pipe and the adjacent portion of said outer pipe forming a pressure-imposing chamber for flowing fluid under pressure from said conduit to and discharging upon oil admitted to the lower end portion of said outer pipe through said main valve, and the bore and by-passes of said second plug, said inner pipe, the space between said first plug and outer pipe, and the space between said first pipe and the adjacent portion of said outer pipe forming an oil-flow chamber for flowing oil under pressure from the lower end portion of said outer pipe and discharging same out of said outlet.

2. In an apparatus for flowing oil from a well, a well casing having one end open and the other end closed adapted to be disposed in an upright position in a well from which oil is to be extracted with the open end extending into the well and with the closed end spaced above the well, an outer pipe extending longitudinally through said casing and having the upper end portion projecting through and exteriorly of the closed end of said casing and having the lower end inwardly of and spaced from the open end of said casing, a main valve normally closing the lower end of said pipe and operable to open position upon impact of fluid thereagainst, a first plug provided with an axial bore and having diverging passages projecting from one end of said bore disposed in said pipe below and spaced from the closed end of said casing so that the bore extends longitudinally of said pipe with the passages facing toward the lower end of said pipe, said upper end portion of said outer pipe being provided with an outlet, a first inner pipe spaced from and extending longitudinally through the upper end portion of said outer pipe and into the part of said outer pipe below the closed end of said casing and having the upper end portion projecting above the upper end portion of said outer pipe and having the lower end extending into the bore of said plug and connected in communication with said one end of said bore, a conduit above said inner pipe for containing fluid under pressure, the upper end of said first inner pipe being connected in communication with the interior of said conduit, a second inner pipe positioned within and spaced from said outer pipe below said plug and extending longitudinally of said outer pipe and having the upper end detachably attached to the lower end of said plug between the diverging passages of said plug and having the lower end portion adjacent and inwardly of said main valve, a second plug provided with an axial bore and having a plurality of longitudinal by-passes extending from one end of said bore and terminating into the interior of said second inner pipe above said second plug, a subsidiary valve normally closing said one end of the bore of said second plug and operable to open position upon impact of fluid thereagainst, said second plug being disposed in the lower end of said second inner pipe so that said one end of the bore thereof and said subsidiary valve are in axial alignment with and adjacent to said main valve, said first inner pipe, the bore and diverging passages of said first plug, and the space between said second pipe and the adjacent portion of said outer pipe forming a pressure-imposing chamber for flowing fluid under pressure from said conduit to and discharging

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upon oil admitted to the lower end portion of said outer pipe through said main valve, and the bore and by-passes of said second plug, said inner pipe, the space between said first plug and outer pipe, and the space between said first pipe and the adjacent portion of said outer pipe forming an oil-flow chamber for flowing oil under pressure from the lower end portion of said outer pipe and discharging same out of said outlet, and a spiral fin extending exteriorly and longitudinally along the second plug and engaging the wall of said outer pipe, said fin with the adjacent portion of said outer pipe forming helical passageways for imparting a helical twist to the oil admitted to the pressure-imposing chamber through said main valve.

3. In an apparatus for flowing oil from a well, a well casing having one end open and the other end closed adapted to be disposed in an upright position in a well from which oil is to be extracted with the open end extending into the well and with the closed end spaced above the well, an outer pipe extending longitudinally through said casing and having the upper end portion projecting through and exteriorly of the closed end of said casing and having the lower end inwardly of and spaced from the open end of said casing, a main valve normally closing the lower end of said pipe and operable to open position upon impact of fluid thereagainst, a first plug provided with an axial bore and having diverging passages projecting from one end of said bore disposed in said pipe below and spaced from the closed end of said casing so that the bore extends longitudinally of said pipe with the passages facing toward the lower end of said pipe, said upper end portion of said outer pipe being provided with an outlet, a first inner pipe spaced from and extending longitudinally through the upper end portion of said outer pipe and into the part of said outer pipe below the closed end of said casing and having the upper end portion projecting above the upper end portion of said outer pipe and having the lower end extending into the bore of said plug and connected in communication with said one end of said bore, a conduit above said inner pipe for containing fluid under pressure, the upper end of said first inner pipe being connected in communication with the interior of said conduit, a second inner pipe positioned within and spaced from said outer pipe below said plug and extending longitudinally of said outer pipe and having the upper end detachably attached to the lower end of said plug between the diverging passages of said plug and having the lower end portion adjacent and inwardly of said main valve, a second plug provided with an axial bore and having a plurality of longitudinal by-passes extending from one end of said bore and terminating into the interior of said second inner pipe above said second plug, a subsidiary valve normally closing said one end of the bore of said second plug and operable to open position upon impact of fluid thereagainst, said second plug being disposed in the lower end of said second inner pipe so that said one end of the bore thereof and said subsidiary valve are in axial alignment with and adjacent to said main valve, said first inner pipe, the bore and diverging passages of said first plug, and the space between said second pipe and the adjacent portion of said outer pipe forming a pressure-imposing chamber for flowing fluid under pressure from said conduit to and discharging upon oil admitted to the lower end portion of said outer pipe through said main valve, and the bore and by-passes of said second plug, said inner pipe, the space between said first plug and outer pipe, and the space between said first pipe and the adjacent portion of said outer pipe forming an oil-flow chamber for flowing oil under pressure from the lower end portion of said outer pipe and discharging same out of said outlet, a first normally closed control valve in said conduit for controlling the admission therein of fluid under pressure, a second normally open control valve in said conduit for discharg-

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ing therefrom fluid under pressure contained in said conduit, a first means for automatically controlling the flow of oil from said well casing between predetermined set high and low levels of oil, and a second means operatively connecting said first means to said first and second control valves so that when the level of oil in said casing is at the set high level and between the set high and low levels the first and second control valves are shifted simultaneously to and remain in the open and closed positions respectively to flow oil from the well casing through said oil-flow chamber and discharge out of said outlet and when the level of oil in said casing is at the set low level the first and second control valves are shifted simultaneously to closed and open positions respectively to arrest flow of fluid under pressure through said pressure-imposing chamber and thereby stop flow of oil from said well casing through said oil-flow chamber and out of said outlet.

4. The apparatus according to claim 3 wherein said first means comprises a standpipe disposed in said casing and spaced from said outer pipe and extending longitudinally of said casing and having the lower end projecting below the predetermined set low level of oil in said casing and having the upper end portion extending through and protruding above the closed end of said well casing, and a pressure-control device having low and high level settings corresponding to predetermined pressures at said levels and operatively connected to the upper end portion of said standpipe.

5. The apparatus according to claim 3 wherein each of said first and second control valves is controlled by an electrically-operable solenoid, said first means comprising a standpipe spaced from said outer pipe and extending longitudinally through said casing and having

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the lower end projecting below the predetermined set low level of oil in said casing and having the upper end portion extending through and protruding above the closed end of said well casing, and a pressure-control device having high and low-level settings corresponding to predetermined pressures at said levels and operatively connected to the upper end portion of said standpipe, and said second means is electric means operatively connecting the solenoids of said first and second control valves together and to said control device.

6. The apparatus according to claim 4 wherein each of said first and second control valves is controlled by an electrically-operable solenoid, and which includes in addition a first electrically-actuable timer selectively operable to circuit-closing positions on only certain days of a week and a second electrically-actuable timer selectively operable to circuit-closing positions for intervals of time in a single day, said first and second timers being electrically connected to the solenoids of said first and second control valves to operate with the latter.

7. The apparatus according to claim 6 which includes in addition a reservoir for fluid under pressure adjacent said conduit, a pump having the input side connected to said reservoir and having the output side connected to said conduit outwardly of said first control valve, and conduit means connecting said conduit outwardly of said second valve to said reservoir.

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