Jan. 17, 1939. H. F. CHAPMAN 2,143,974

APPARATUS FOR FLOWING WELLS

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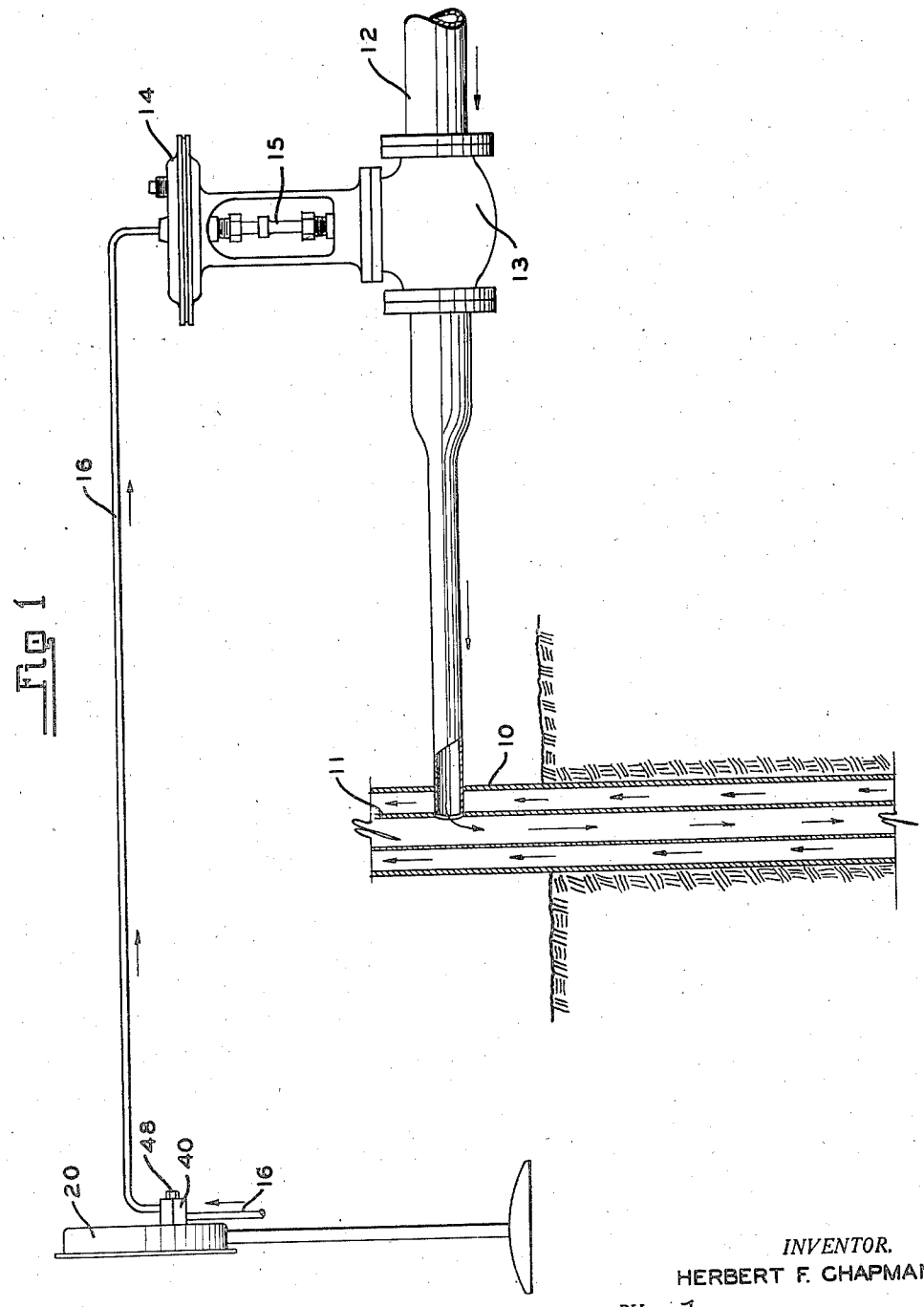


Fig 1

INVENTOR.
HERBERT F. CHAPMAN

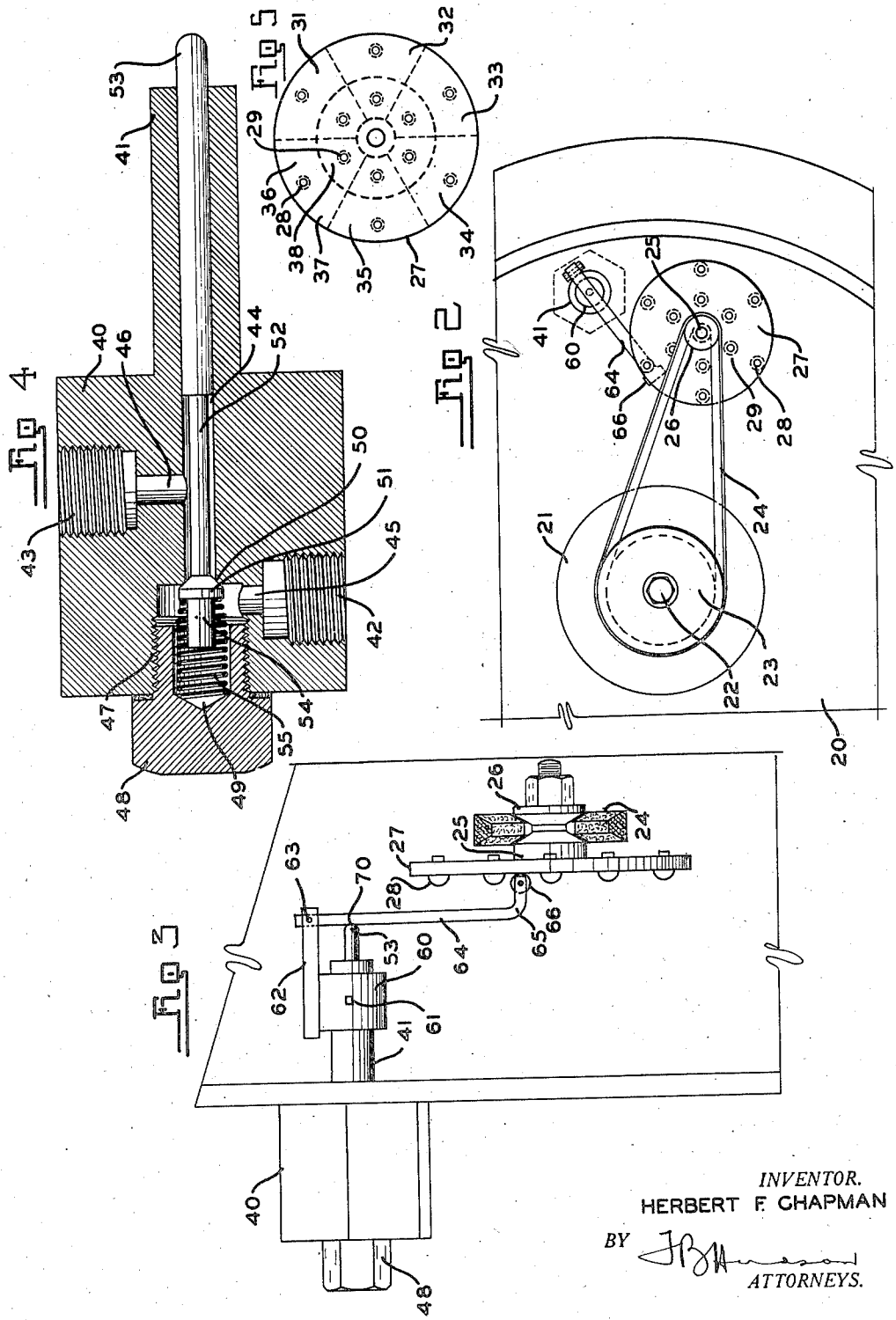
BY J. B. Anderson

ATTORNEYS.

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APPARATUS FOR FLOWING WELLS

Herbert F. Chapman, Oklahoma City, Okla., assignor to Phillips Petroleum Company, Bartlesville, Okla., a corporation of Delaware

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4 Claims. (Cl. 137—145)

This invention relates to an automatic timing device and particularly to an automatic timing device especially adapted to automatically control the flow of oil from a well.

In flowing oil from wells it is necessary in many fields to raise the oil from the well hole by a fluid under pressure, such as air or gas, and such a method is commonly called an air, gas, or pressure lift. Due chiefly to the production restrictions put on the various oil fields and the individual wells, and to the manner in which the oil seeps from the oil bearing sands and accumulates in a well hole, it is not usually feasible to continuously flow the oil from the well. Therefore the practice now in many instances is to intermittently flow the oil from the well during relatively short controlled periods.

The object of this invention is to provide apparatus for controlling the flow of fluid.

Another object of this invention is to provide apparatus for intermittently controlling the flow of fluid.

Another object of this invention is to provide apparatus for automatically controlling the intermittent flow of fluid.

Still another object of this invention is to provide apparatus for automatically controlling and timing the flow of oil from a well.

A further object of this invention is to provide apparatus for predetermining the periods of oil flow from a well and automatically controlling and timing such periods.

Further objects and advantages of this invention will become apparent from a consideration of the following specification, and from a study of the attached drawings forming a part thereof, and wherein like reference numerals refer to like parts throughout the several views.

Fig. 1 illustrates a well flowing apparatus and control means therefor,

Fig. 2 is a plan view of an embodiment of the well flowing control means,

Fig. 3 is a view in perspective of the well flowing control means illustrated in Fig. 2,

Fig. 4 is a cross-sectional view of a detail of the well flowing control means illustrated in Figs. 2 and 3, and

Fig. 5 is a diagrammatic illustration of another detail of the well flowing control means shown in Figs. 2 and 3.

In Fig. 1 there is illustrated a portion of a well hole having secured therein the casing pipe 10 and the tubing pipe 11. A pipe 12 is adapted to supply fluid, such as air or gas, under pressure to the top of the tubing pipe 11. This fluid under pressure travels downwardly into the well hole through the tubing, as indicated by the arrows, and forces the oil in the bottom of the hole upwardly between the casing pipe 10 and tubing pipe 11 to the surface, as indicated by the arrows. Any suitable type of valve such as the one 13 is interposed in the line 12 for controlling the application of pressure to the well to cause the oil to flow therefrom. This method of flowing wells is old, and forms no part of the present invention.

A pressure actuated diaphragm 14, through the rod 15, controls the valve 13. Fluid under pressure is supplied through the pipe line 16 to operate the diaphragm 14, and when pressure is applied thereto the valve 13 will be opened to admit fluid under pressure to flow through pipe 12 into the tubing 11 and cause the well to flow in the manner described.

A control device housed in the casing 20 is interposed in the line 16 to control the flow of the fluid under pressure to the diaphragm 14 which controls the valve 13.

The device contained within the housing 20 is automatic in operation to control for certain periods and at predetermined intervals of time the flow of oil from the well. Briefly the control means consists of a pilot valve 40 for controlling the flow of fluid under pressure through the line 16 in the direction of the arrows, and includes an automatic time controlled mechanism for actuating the pilot valve.

With reference to Fig. 2, there is located within the casing 20 any suitable motor such as a clock mechanism, generally designated by the numeral 21, for driving the shaft 22 to which there is keyed a pulley wheel 23 having a groove in its peripheral edge to accommodate the belt 24. Also mounted within the casing 20 is a shaft 25 journaled in any suitable manner and to which is keyed a pulley wheel 26 also having a groove in its peripheral edge to accommodate the belt 24.

In lieu of the pulley wheels 23 and 26 and the belt 24 there may be provided gear wheels and a chain, or any other suitable means of transmitting the rotary motion of shaft 22 to shaft 25. Secured to and rotatable with the shaft 25 is a disc 27 having secured to one face thereof a set of removable and replaceable circumferentially aligned lugs or projections 28 which are equidistant from the center of the disc and from each other. This set of lugs 28 are arranged relatively close to the outer peripheral edge of the disc 27, and a second set of lugs 29 are arranged in substantially the same manner

except that they are closer to the center of the disc.

The motor 21 may be of any suitable type and speed described, but in order to present a concrete example of one embodiment of the present invention it will be described as a spring driven clock motor of such a speed that the shaft 22 and the pulley wheel 23 keyed thereto make one complete rotation in every twenty-four hours. In order to further and more comprehensively describe a complete and operable embodiment of this present invention the pulley wheel 26 will be described as having a ratio of four to one with the pulley wheel 23. As the disc 27 is keyed together with the pulley 26 to the shaft 25 and rotated therewith when driven by the wheel 23 through the belt 24, the disc 27 will therefore make four complete rotations to every one rotation of the wheel 23, or will rotate once in every six hours.

The disc 27 is divided into six sectors as indicated by the numerals 31 to 36, and shown by the dotted lines in Fig. 5. The disc is further divided into a plurality of concentric circular sections constituting areas within which the several sets of circumferentially aligned lugs are positioned. In Fig. 5 there is illustrated only two such areas, namely 37 and 38, in which are located the sets of lugs 28 and 29 respectively. The lugs constituting the set 28 are formed of such a size as to present circumferentially aligned raised surfaces which total one twenty-fourth of the circumferential path in which they are located. Stated differently, each of the several lugs of the set 28 presents a raised surface which is equal to one-fourth of the circumferential path through any of the sectors in which it is located. As previously stated the disc 27 makes one complete rotation every six hours, therefore each of the sectors 31 to 36 represents a one hour period, and each lug or projection of the set 28 represents a fifteen minute period.

The lugs of the set 29 are of such a size with relation to the length of the circumferential path in which they are aligned as to present raised surfaces which total one-twelfth of the entire circumferential path through these lugs. Therefore each lug represents a period of thirty minutes.

Various sets of circumferentially aligned rows of lugs positioned at varying distances from the diameter of disc 27 may be provided to effect other arrangements for controlling any desired period of time.

The sets of lugs 28 and 29 are adapted to intermittently control and actuate for predetermined periods the pilot valve contained within the housing 20, and so regulate the flow of fluid through the pipe 16 to diaphragm 14 and in this manner intermittently actuate at various time intervals the valve 13 and thereby causing the well to flow.

Secured to the housing 20 and actuated and controlled by mechanism there within is a pilot valve shown in detail in Fig. 4 which includes a valve body 40, interposed in the line 16, a neck 41 on the body, ports 42 and 43 constituting inlet and outlet ports respectively in connection with the line 16, and which are connected with an elongated bore 44 extending through the valve body 40 and neck 41, by means of the channels 45 and 46. One end of the valve body is formed with the partially screw threaded recessed portion 47 communicating with the bore 44 and channel 45, and which is sealed by the screw threaded plug 48, having formed therein the chamber 49. At one end the bore 44 is provided with a valve seat 50 for the valve head 51 which includes an elongated tapered pin or stem 52 extending into the bore 44 past the port 46, and which terminates in an enlarged stem 53 located within the neck 41 of the valve body. The valve head 51 is also provided with a short stub 54 which serves as a guide for the spring 55 contained within the chamber 49 and which bears against the valve head 51 to maintain it in place on the seat 50. A collar 60 is loosely mounted upon the neck 41 of the valve body and is held in position thereon by a set screw 61, and has formed therewith an upright member 62 to which is pivoted at 63 the arm 64. The arm 64 terminates in a head 65 carrying a roller 66 adapted to engage the face of disc 27 and the sets of lugs or projections carried thereon. As the collar 60 may be rotated with respect to the valve body neck 41 and held in position thereon at any desired place the arm 64 may be positioned so that the roller will be capable of contacting either of the lug sets 28 or 29, or any additional sets which may be placed on the disc 27.

From the disclosure immediately above it will be appreciated that the spring 55 bears upon the valve head 51 causing it to be pressed against the seat 50, and at the same time forces the valve stem 52 and the extension 53 thereof outwardly to bear against the arm 64 at a point 70, and thereby forces the head 65, of arm 64, and the roller 66 carried thereon, in contact with the disc 27 and any set of lugs carried thereby.

Assuming that it is desired to cause the well to flow for a period of fifteen minutes once every hour, in such case the arm 64 would be in the position shown in Fig. 2 and the roller 66 in the circumferential path of the set of lugs 28. As the disc 27 rotates once every six hours, the arm will be raised six times during the course of this period at intervals of three-quarters of an hour and remain raised each time for fifteen minutes. When the arm 64 is raised by the lugs 28 the valve stem extension 53 is contacted at the point 70 and pushed into the valve body 40, thereby unseating the valve head 51 from the seat 51 and allowing the fluid under pressure to flow in line 16 through the valve body to diaphragm 14 thereby actuating the rod 15 to open the valve 13. With valve 13 open fluid under pressure flows through pipe 12 into the well to raise the oil to the surface. So long as the roller 66 is contacting one of the lugs of the set 28 the arm 64 will maintain the valve head 51 unseated, and the fluid under pressure flowing therethrough into the line 16 will serve as described to maintain valve 13 open, thus causing the oil to flow from the well. When the disc 27 has rotated sufficiently so that the roller 66 is not contacting one of the lugs of the set 28 as above described, the valve head 51 will be allowed to reseat itself and an interval of three-quarters of an hour will elapse before another lug of the set 28 is encountered by the roller 66 and the well caused to reflow.

It is to be understood that the arm 64, by virtue of being mounted on the rotatable collar 60, is capable of being shifted so that the roller 66 will be capable of engaging any sets of lugs or projections that may be positioned on the disc 27, and so control for any predetermined periods of time, and at any desired time intervals, the flow of oil from the well. For instance the set of lugs 29 are of such a size with respect to the length of the circumferential path in which they are

aligned that when the roller **66** is positioned to contact them it will do so approximately one-half of the time, thus giving alternate periods of one-half hour during which the well is flowing and not flowing.

It is to be understood that by modifying the disc **27**, the various sets of lugs, the speed of the motor, the size of either pulley wheels **23** and **24**, or the ratio therebetween, that endless arrangements may be had whereby the flow of the well can be controlled at predetermined periods, and for any desired lengths of time.

What I claim and desire to secure by Letters Patent is:

1. In an apparatus for controlling the admission of gas to a well hole for raising the fluid therein including a pipe for conducting gas to said well, a time controlled mechanism for intermittently controlling the admission of gas to said well, comprising a valve, means to actuate said valve at predetermined intervals including a disc driven at constant speed provided with radially spaced series of circumferentially aligned lugs and means operatively associated with said valve and adjustably mounted to contact a selected series of said lugs.

2. In an apparatus for controlling the admission of gas to a well hole for raising the fluid therein including a pipe for conducting gas to said well, in combination, a time controlled mechanism for intermittently controlling the admission of gas to said well comprising a valve, and means to actuate said valve at predetermined intervals comprising rotatable means driven at constant speed provided with radially spaced series of circumferentially aligned lugs and pivoted means operatively associated with said valve and movable into positions to contact a selected series of said lugs.

3. In an apparatus for controlling the admission of gas to a well for raising fluid therefrom including a pipe for conducting gas to said well, a time controlled mechanism for intermittently admitting gas to said well including, in combination a valve and means to actuate said valve at predetermined intervals comprising a rotatable element driven at constant speed provided with radially spaced series of circumferentially aligned lugs and means operatively associated with said valve and adjustably mounted to engage a selected series of said lugs.

4. In an apparatus for controlling the admission of gas to a well for raising fluid therefrom including a pipe for conducting gas to said well, a time controlled mechanism for controlling the admission of gas to said well comprising a valve provided with an operating stem, a rotatable disc, a series of circumferentially aligned lugs on said disc, a second series of circumferentially aligned lugs radially spaced from said first series, an arm pivotally mounted on said valve, a second arm pivotally mounted on said first arm and adapted to contact said operating stem and a selected series of said lugs to operate said valve at a selected time interval.

HERBERT F. CHAPMAN.