

March 10, 1964

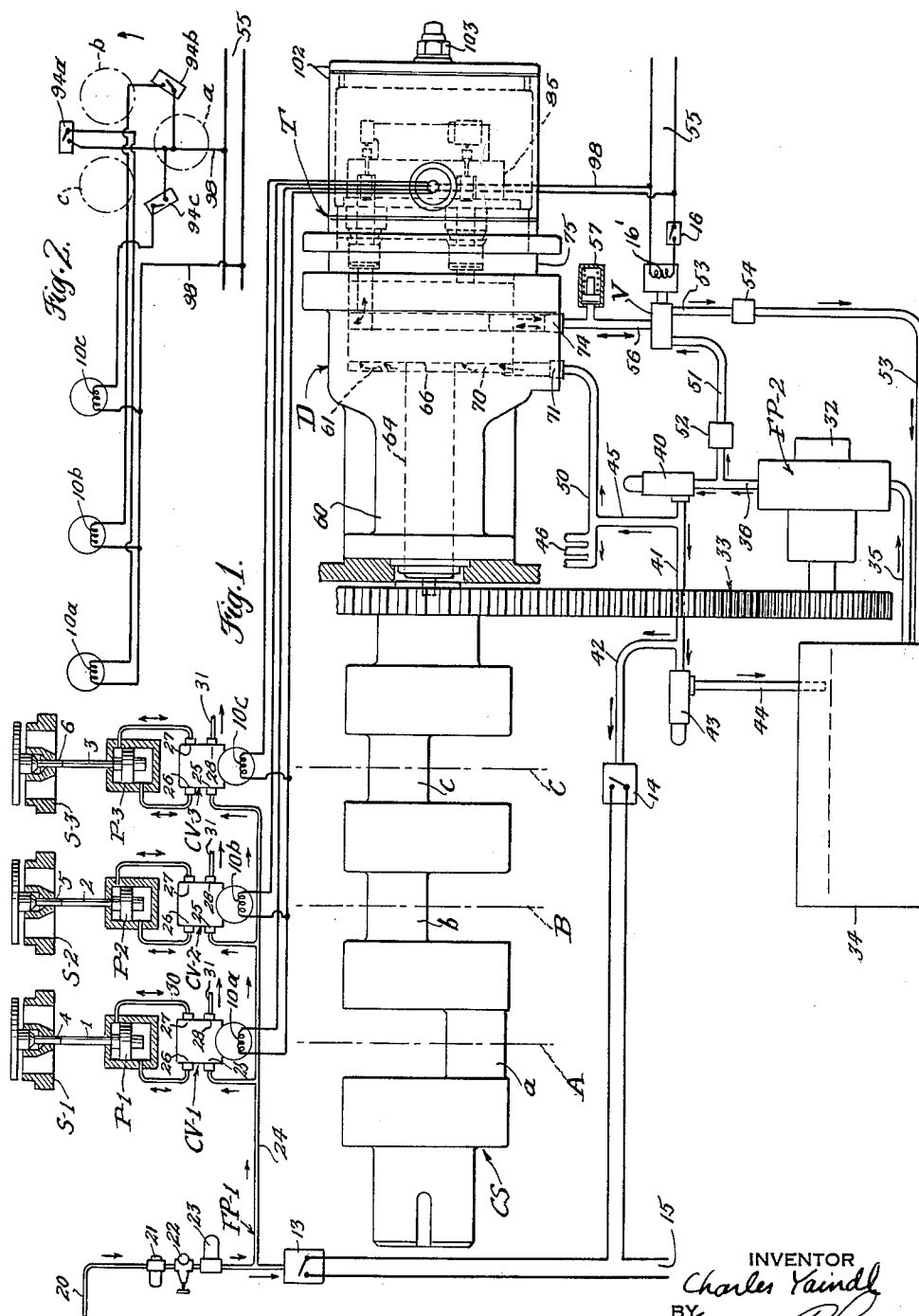
C. YAINDL

3,124,161

PRESSURIZED FLUID OPERATED DISTRIBUTOR-TIMER ASSEMBLY

Original Filed Jan. 21, 1958

5 Sheets-Sheet 1



INVENTOR

Charles Yaindl

BY

BY
Arthur Frederick

ATTORNEY

March 10, 1964

C. YAINDL

3,124,161

PRESSURIZED FLUID OPERATED DISTRIBUTOR-TIMER ASSEMBLY

Original Filed Jan. 21, 1958

5 Sheets-Sheet 2

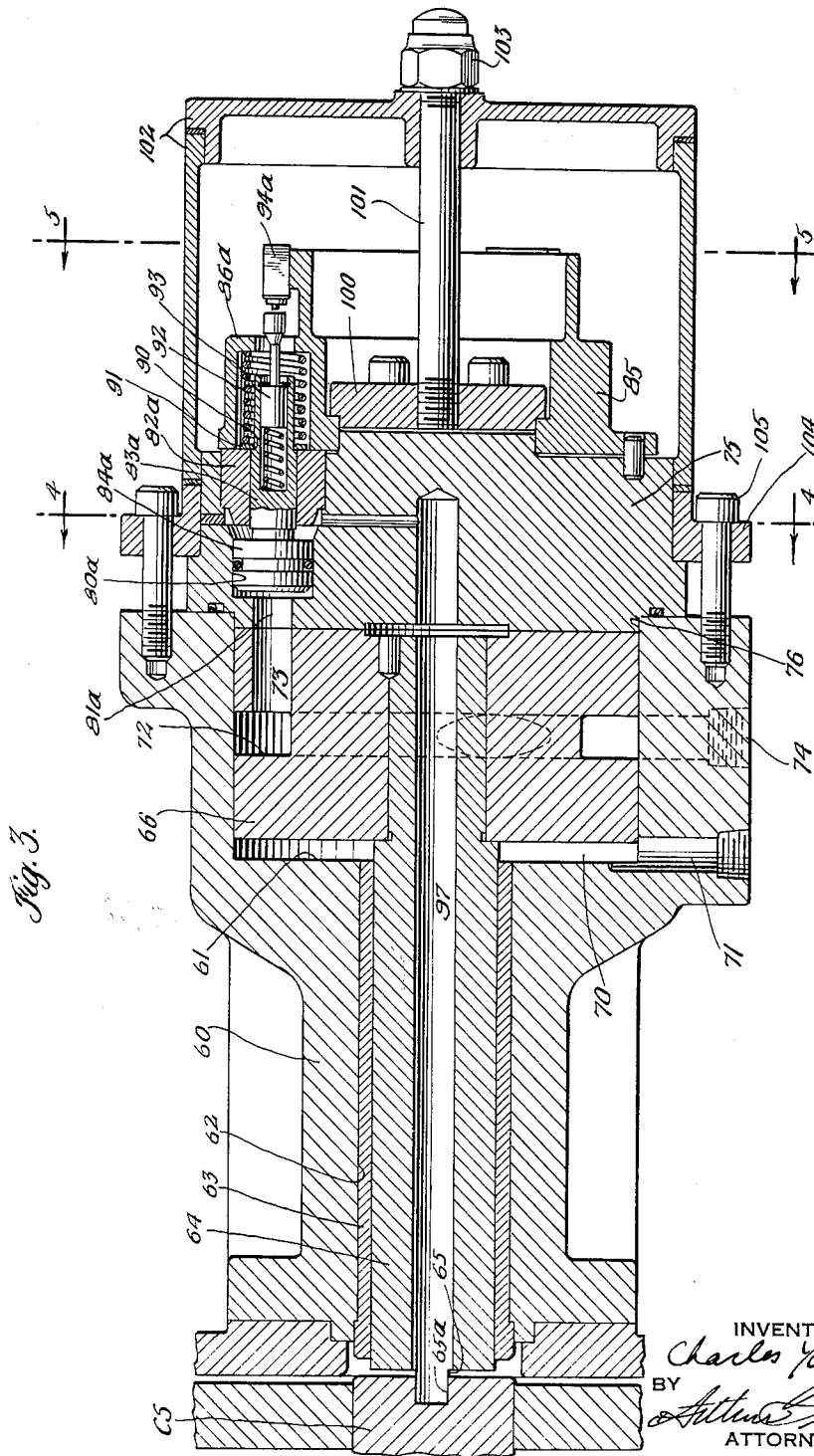


Fig. 3.

INVENTOR
Charles Yaindl
BY
Attorney
ATTORNEY

March 10, 1964

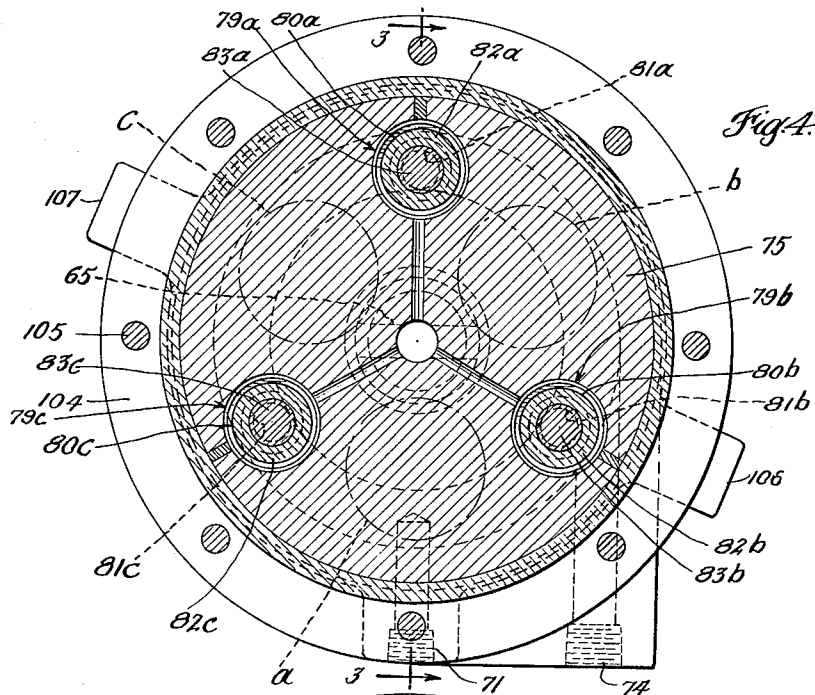
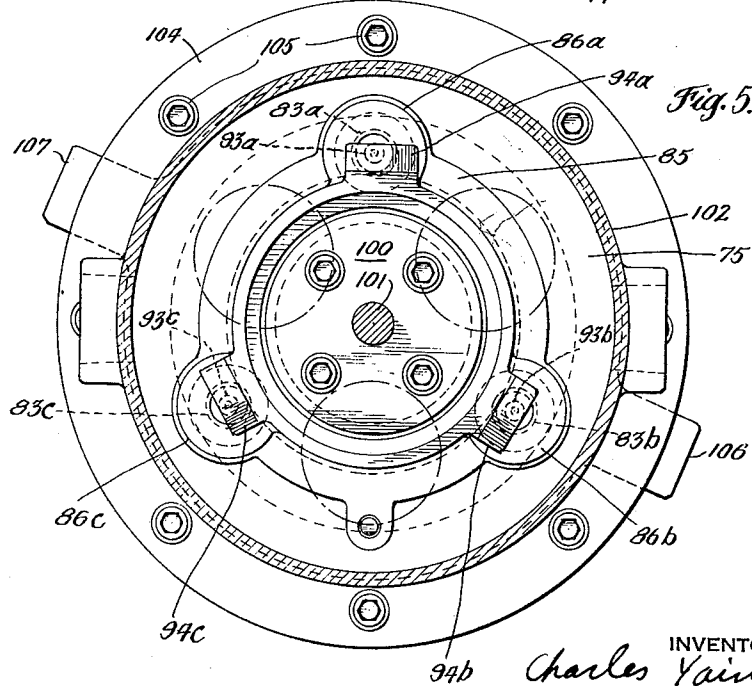
C. YAINDL

3,124,161

PRESSURIZED FLUID OPERATED DISTRIBUTOR-TIMER ASSEMBLY

Original Filed Jan. 21, 1958

5 Sheets-Sheet 3



INVENTOR
Charles Vainell
BY
Arthur Speerick
ATTORNEY

March 10, 1964

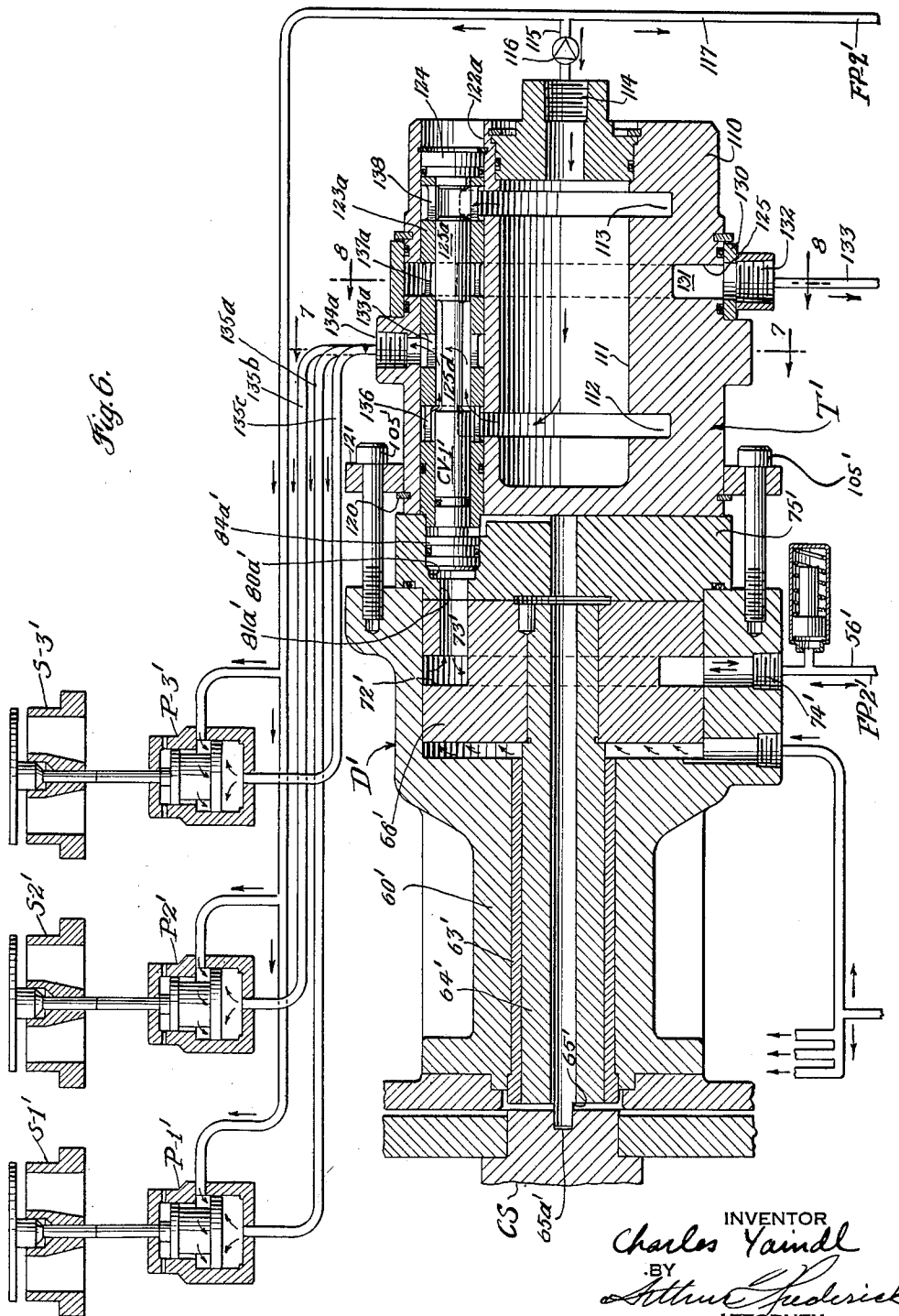
C. YAINDL \

3,124,161

PRESSURIZED FLUID OPERATED DISTRIBUTOR-TIMER ASSEMBLY

Original Filed Jan. 21, 1958

5 Sheets-Sheet 4



INVENTOR
Charles Yaindl
BY
Arthur Frederick
ATTORNEY

March 10, 1964

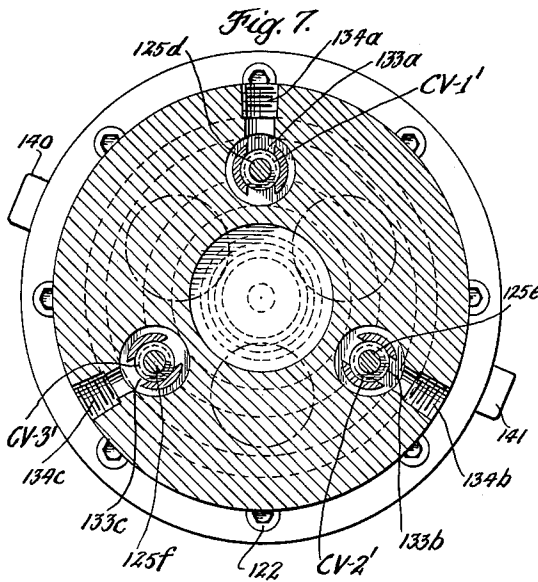
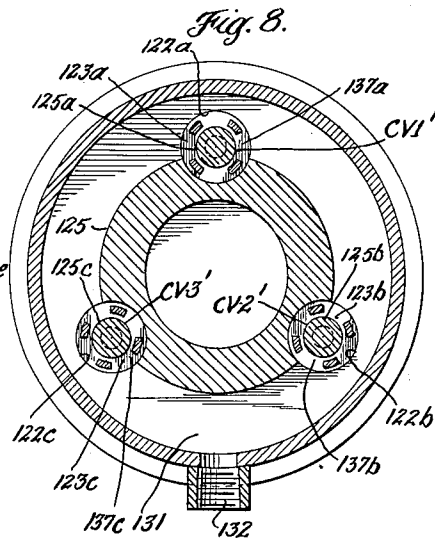
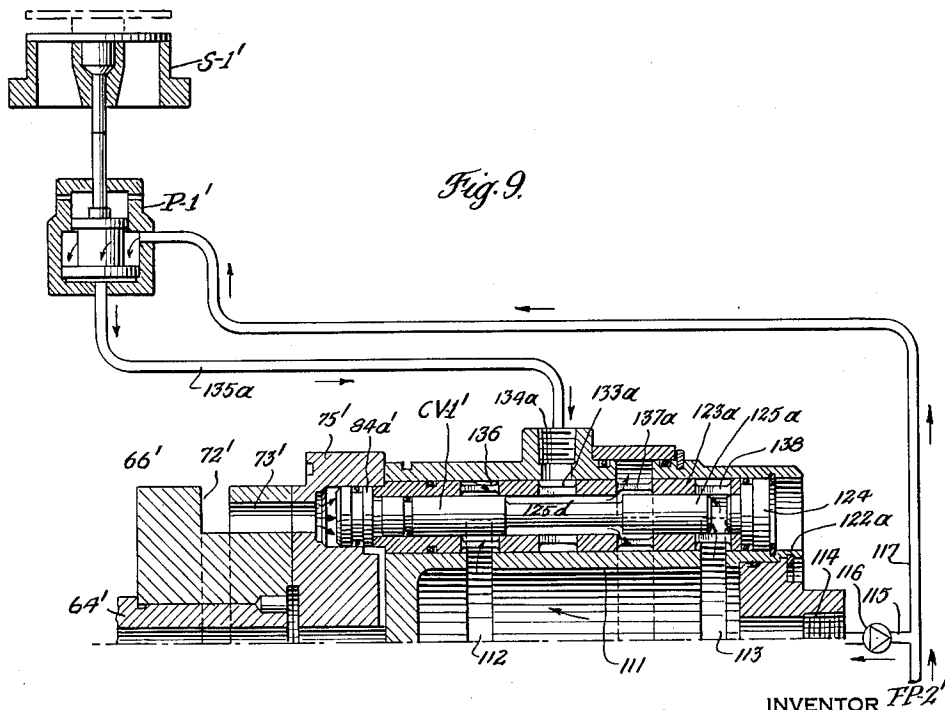
C. YAINDL

3,124,161

PRESSURIZED FLUID OPERATED DISTRIBUTOR-TIMER ASSEMBLY

Original Filed Jan. 21, 1958

5 Sheets-Sheet 5



INVENTOR *Charles Yaindl*
BY *Arthur Frederick*
ATTORNEY

1

3,124,161

PRESSURIZED FLUID OPERATED DISTRIBUTOR-TIMER ASSEMBLY

Charles Yaindl, Allentown, Pa., assignor to The Aldrich Pump Company, Allentown, Pa., a corporation of Pennsylvania

Original application Jan. 21, 1958, Ser. No. 710,274, now Patent No. 3,039,393, dated June 19, 1962. Divided and this application Feb. 28, 1962, Ser. No. 176,342 10 Claims. (Cl. 137-624.18)

This invention relates to control mechanisms and more particularly to a pressurized fluid operated distributor-timer assembly.

This application is a divisional application of co-pending application Serial No. 710,274, filed January 21, 1958, and now Patent No. 3,039,393, dated June 19, 1962. The pressurized fluid operated distributor-timer assembly forming the subject matter of this application may be employed in conjunction with apparatuses other than multi-plunger type pump installations for control of suction valves as disclosed in the aforementioned parent application and as hereinafter disclosed for purposes of illustration. It is believed obvious that the pressurized fluid operated distributor-timer assembly according to this invention has application to many types of apparatuses wherein a source of fluid under pressure is available and it is desired to sequentially control, either electrically or pneumatically, operation of other components or devices.

It is therefore an object of the present invention to provide a distributor-timer assembly which is of relatively simple and inexpensive construction and capable of quickly and accurately sequentially controlling the operation of other devices to which it is connected.

The distributor-timer assembly according to one embodiment of this invention comprises a housing having a chamber adapted to receive a rotor therein. The rotor is drivably connected to a suitable source of rotary power, as for example, a crankshaft of an internal combustion or gas engine, a shaft of an electric or fluid motor, for rotation within the chamber. A timer head is secured to the housing to form one wall of the chamber. The means for securing the timer head to the housing is constructed and arranged to permit angular adjustment of the timer head relative to the housing. The rotor is dimensioned with respect to the size of the chamber so that when the rotor is in close association with the surface of the timer head, it is spaced from and forms with the chamber wall opposite the timer head a secondary chamber. The secondary chamber is connected through conduit means to a suitable source of fluid under pressure to receive pressurized fluid therein and thereby force and maintain the rotor in close association with the timer head. A plurality of circumferentially spaced recesses or channels are provided in the timer head, each of which communicates with the rotor chamber. A piston is reciprocally mounted in each of the recesses which piston is yieldably biased, as by a spring in a direction toward the rotor. To provide for flow of pressurized fluid to the recesses, the rotor is provided with passage means which communicates with a source of fluid under pressure or a zone of lower pressure depending upon the position of a control valve. With the control valve adjusted in one position, the passage means is continuously in communication at one end with the source of fluid under pressure as the rotor rotates and at the opposite end sequentially communicates with the recesses in the timer head as the rotor rotates relative to the timer head. Each of the pistons is adapted to actuate a suitable control means, such as an electrical switch, when moved away from the rotor under pressure of fluid conducted to the

2

recess upon registry of the recess with the passage means of the rotor. Each of the pistons is returned toward the rotor and its initial position under the urging of the biasing springs when the control valve is actuated to communicate the passage means with the low pressure zone to thereby release the pressure in each of the recesses as the latter communicates with the passage means.

In the distributor-timer assembly according to a second embodiment of the present invention, the timer head is modified to comprise a valve connected to each piston so that movement of each piston actuates the valve associated therewith to control flow of pressurized fluid through ports and passages interconnecting a pressurized fluid chamber formed in the timer head with an outlet opening in the timer head. The second embodiment also provides for each piston a pressurized fluid means for yieldably biasing the pistons in a direction toward the rotor.

The invention will be more fully understood from the following detailed description thereof when considered in connection with the accompanying drawing wherein two embodiments of the invention are illustrated by way of example and in which:

FIG. 1 is a view in elevation of the distributor-timer assembly, according to one embodiment of the present invention, schematically shown connected to a control mechanism of a multi-plunger type pump, the relation of the components being shown for the unload condition of the suction valves and the double acting pistons and the distributor-timer assembly being supplied from independent sources of pressurized fluid;

FIG. 2 is a schematic view showing in particular the electrical connections between certain of the components of the mechanism of FIG. 1;

FIG. 3 is a longitudinal sectional view of the distributor-timer assembly shown in FIG. 1;

FIG. 4 is a cross section taken on the lines 4-4 of FIG. 3;

FIG. 5 is a cross section taken on the lines 5-5 of FIG. 3;

FIG. 6 is a longitudinal sectional view of a distributor-timer assembly according to a second embodiment of the present invention, which is schematically shown connected to a multi-plunger type pump for control of suction valves, the relationship of the components being illustrated for the unload condition of the suction valves and the pressurized fluid for the double acting pistons and the distributor-timer assembly being supplied from the same source;

FIG. 7 is a cross-section taken on the lines 7-7 of FIG. 6;

FIG. 8 is a cross section taken on the lines 8-8 of FIG. 6; and

FIG. 9 is a partial view of certain of the components of FIG. 6 illustrating another operative position of the distributor-timer assembly shown in FIG. 6.

The distributor-timer assembly of the present invention will be described as it may be utilized in a triplex or three plunger pump, for example a pump such as shown in the Shelly Patent 2,243,888, assigned to the same assignee as this application. Pumps of this nature are well known by those skilled in the art and, therefore, need not be described in detail herein. Suffice it to say that such pumps comprise in general a power section and pumping section, both being mounted on a frame with the power section having a crankshaft and drive motor together with connecting rods which couple the crankshaft with the plungers in the pumping section.

While the invention herein will be described in connection with a three plunger type pump, it is to be understood that the invention is applicable where the pump may contain one or any number of plungers and to ap-

paratuses other than pump installations. It is contemplated that the distributor-timer assembly according to the present invention may be applied to any apparatus where sequential control of the operation of other components or devices is desired and wherein a source of fluid under pressure may be available or made available.

For purposes of clarity, the components of the pump installation to which the distributor-timer assembly is connected for illustration purposes will be described prior to describing in detail the construction of the distributor-timer assembly.

As shown in FIG. 1, the novel pressurized fluid operated distributor-timer assembly according to this invention is shown connected to a pump for changing the pump from load to unload condition, when any one pump plunger (designated by dot-dash lines A, B, or C) is substantially near the end of the discharge stroke or at the beginning of the suction stroke. The suction valves for the pump are designated as S-1, S-2 and S-3 and have double acting pistons P-1, P-2, and P-3, the movement of each piston to assume load and unload conditions being controlled by control valves CV-1, CV-2, and CV-3. The control valves effect transfer of fluid as between the double acting pistons and a source of fluid pressure generally designated FP-1. In the load condition, piston rods 1, 2, and 3 disengage from valve stems 4, 5, and 6 when the solenoids are energized so that the suction valves are free to seat and unseat depending upon the action of the plungers A, B, and C.

The distributor-timer assembly comprises, in general, a timer mechanism T, a distributor mechanism D which is connected to a source of fluid pressure designated by FP-2 which, in this instance, is independent of the source FP-1. The distributor-timer assembly is connected to and operated in synchronism with the rotation of the crankshaft CS for the pump or with the reciprocating motion of the plungers. The distributor mechanism D operates to transfer fluid as between the source FP-2 and the timer mechanism T to cause the same appropriately to energize and de-energize the solenoids 10a, 10b, and 10c which control the actuation of control valves CV-1, CV-2, and CV-3, respectively. It is contemplated that the distributor and timer assembly be relatively adjustable so that the change from load to unload conditions can be effected within certain limits, for example, extending near the end of the discharge stroke to slightly after the beginning of the suction stroke.

In FIG. 6 the elements described above have been designated by corresponding primed letters and numerals, for example, the suction valves are designated as S-1', S-2' and S-3'; the double acting pistons by P-1', P-2', and P-3', with their control valves, one of which is shown at CV-1'. The timer mechanism is designated by T', the distributor mechanism by D' and the source of fluid pressure for the distributor and double acting pistons by FP-2', as in this arrangement the same source is used.

Referring again to FIG. 1, the numeral 13 designates a fluid pressure operated switch which is connected with the source FP-1 and the numeral 14 designates a pressure operated switch which is connected to the source FP-2. When the sources FP-1 and FP-2 are activated, both of these switches are closed. These switches are in series and are interconnected to the holding circuit for the controller of the motor driving the crankshaft CS via the power lines 15. Thus, if there is a failure of sources FP-1 or FP-2, to operate properly, one or the other or both of the switches are open and immediately stop the operation of the pump.

In connection with FIG. 6, there is only a single source of fluid pressure FP-2' and, therefore, it is only necessary to use a single switch such as 14 in the pump motor holding circuit.

In general the operation of the elements of FIGS. 1 and 6 are as follows:

In FIG. 1 a switch designated 16 controls a valve V.

When the switch is in the normally open position, the valve V operates so that there is no fluid pressure transferred from the source FP-2 to the distributor mechanism D. At this time the solenoids 10a, etc., are de-energized, the effect of which is to arrange the pump in the unload condition. When it is desired to load the pump, the switch 16 is closed. This effects a transfer of fluid pressure from the source FP-2 to the distributor mechanism D which transfers fluid to the timing mechanism T which operates to energize the solenoids 10a, etc. The energizing of the solenoids effects a transfer of fluid between the source FP-1 and the pistons P-1, etc., so that the same cause the suction valves S-1, etc., to assume the load condition. When it is desired to unload the pump, the switch 16 is opened.

In FIG. 6 a switch and valve similar to switch 16 and valve V are used. When the switch is in the opened condition there is no transfer of fluid pressure from the source FP-2' to the distributor. However, the control valves CV-1', etc., are arranged so that fluid is transferred to the pistons P-1', etc., in a manner to operate the same so that the suction valves S-1', etc., are in unload condition. When the switch 16 is closed, fluid is transferred to the distributor and thence to the timer which causes operation of the control valves to effect a transfer of fluid as between the source FP-2' and the double acting pistons P-1', etc., in a manner so that the pistons are moved to cause the suction valves to assume a load condition. When it is desired to unload the pump, the switch is opened.

Having described in general the components and the manner of operation, I will now go into a more detailed description.

In FIG. 1 the source of fluid pressure FP-1 may be of the air type. Assuming the source FP-1 to be of the air type it then includes an air supply line 20, an air filter 21, an air pressure regulator 22, an air lubricator 23 together with a line 24 interconnected to each of the control valves CV-1, etc. Each of the control valves has ports 25, 26, 27 and 28, the port 25 in each valve being connected to the line 24. When the respective solenoids, 10a, etc., of the control valves are in de-energized condition, the valve interconnects ports 25 and 26 so that air is supplied to the lower side of the pistons and air exhausted from the upper side via the line 30, the interconnected ports 27 and 28 and exhaust line 31. When the solenoids of the valves are energized, the ports 25 and 27 are interconnected so that fluid is supplied to the top side of the pistons and the ports 26 and 28 are interconnected so that the lower side of the pistons is connected to exhaust line 31. The line 24 is also connected to the switch 13 which is set so that if the air pressure in the line 24 drops below a certain minimum value, the switch will be open. This, of course, constitutes an interlock or a fail safety device.

The fluid pressure source FP-2 which may be hydraulic includes a pump 32 driven by gears 33 interconnected to the crankshaft CS. Fluid for the pump is supplied from the oil sump 34 via line 35. As mentioned heretofore, the source FP-2 supplies fluid to the distributor-timer assembly and the lines supplying this fluid are interconnected to the fail safe switch 14 which is arranged so that if the pressure drops below a certain minimum, the switch will open to stop the operation of the motor driving the crankshaft CS. This connection is explained as follows. It will be seen that discharge line 36 of the pump is connected to a regulating valve 40 which in turn is connected to lines 41 and 42, the line 42 being connected to the switch 14. The line 41 is connected to a regulating valve 43 having a return 44 to the sump 34. The line 41 from the valve 40 is also interconnected to a line 45 supplying fluid to certain pump lubrication lines 46, and line 50 supplies fluid to the distributor D for reasons which will be explained shortly.

The manner in which fluid is supplied from the source FP-2 to the distributor-timer assembly will now be de-

scribed. The discharge line 36 of the pump is connected to a line 51 provided with a variable throttle 52 which can be set so as to vary the rate of fluid flow through the line 51. The return line 53, which is connected to the sump 34, includes a variable throttle 54 which can be adjusted so as to vary the rate of fluid flow through the line 53. Both the lines 51 and the line 53 are interconnected to the valve V which is operated by a solenoid, the coil of which is indicated at 16'. This coil is in series with the switch 16 and both elements are connected to a source of power via the lines 55. When the switch 16 is open (unload condition of the pump), the solenoid is de-energized and the valve V is closed to supply line 51 and open from line 56 to line 53. At this time any fluid in line 56 (which is connected to the distributor mechanism D) may flow through the valve V to sump line 53. When the switch is closed (load condition of pump), the solenoid is energized and the valve V is operated so as to interconnect the line 51 with the line 56.

The details of construction of the distributor-timer assembly, according to one embodiment thereof, and the manner in which the same is operated by the fluid pressure from line 56 or from source FP-2 will be described in connection with FIGS. 3, 4 and 5.

As shown in FIG. 3, a housing generally designated 60 has an internal bore forming a chamber 61 and a reduced bore 62 having a sleeve 63 supporting a shaft 64 which is connected to the crankshaft CS as by jaws 65 of the shaft 64 fitting a groove 65a in the crankshaft. Fixedly connected to the shaft 64 and disposed within the chamber 61 is a rotary distributing valve 66. It will be noted that the rotor 66 has an axial length which is shorter than the chamber 61 so that there is a space 70 open to a port 71 in the housing. This port 71 is interconnected to the line 59, as indicated in FIG. 1. Fluid from the source FP-2 is transferred to the space 70 for a purpose as will be described hereinafter.

The rotor 66 has formed on the periphery thereof a groove 72 which is interconnected to an axially extending passage 73. The groove 72 is open to a port 74, which as seen in FIG. 1, is connected to the line 56.

Disposed on the housing is a disk-like distributor head 75, a shoulder 76 of which extends slightly into the chamber 61. The head is provided with three bores 79a, 79b and 79c which, as indicated in FIG. 4, are arranged concentrically with the axis of the rotor and spaced 120° apart. The innermost portion of each bore forms the channels 81a, 81b and 81c, all of which are adapted to register with the passage 73 in the rotor 66 as the same is rotated. The outermost part of each bore mounts bushings 82a, 82b and 82c which respectively slidably support the piston stems 83a, 83b and 83c of control pistons respectively connected thereto. These pistons, one of which is indicated at 84a in FIG. 3, are disposed respectively in the intermediate sections 80a, 80b and 80c of the bores 79a, 79b and 79c, the intermediate sections forming chambers or cylinders for the pistons. Secured to the distributor head is a cap 85 having three hollow sections 86a, 86b and 86c (FIGS. 3 and 5), the piston stems 83a, 83b and 83c respectively extending to the hollow sections. As best seen in FIG. 3, the stem 83a is provided with a shoulder 90 and around the stem is disposed a washer 91 and a return spring 92 is disposed between the washer and the hollow portion 86a. The spring is arranged so as to urge the piston 84a toward the left or as shown in the position of FIG. 3. The stem 83a is bored and in the bore is mounted a spring loaded contactor 93a. The three pistons 84a, 84b and 84c are similarly arranged, the contactor 93b and 93c being indicated in FIG. 5.

The cap 85 mounts three switches 94a, 94b and 94c. In the position of the parts as shown in FIG. 3, the pistons 84a, 84b and 84c and the respective contactors 93a, 93b and 93c are moved to the left so that each contactor is spaced away from its switch. When a piston is moved to

the right, its contactor engages its switch so as to close the same.

The cap 85 is held fast on the distributor head 75 by a plate 100 and attached to the plate 100 is a stud 101 supporting a two part cover 102 held on the stud by the nut 103. The cover 102 abuts a securing ring 104 which is held fast on the housing 60 by the screws 105. When the screws 105 are pulled up tight, the ring holds the distributor head firm against the housing and when the nut 103 is pulled up tight, the cover 102 is held fast against the ring 104.

Referring back to FIG. 3, the space 70 in the housing 60, fluid from the source FP-2 enters the space and acts to press the rotor 66 firm against the head 75. Also, leakage of this fluid about the rotor 66 serves as a lubricant and this leakage fluid is handled by the passage 97 and port 74.

Referring to FIG. 2, it will be seen that the switches 94a, 94b and 94c are interconnected to the solenoid coils 10a, 10b and 10c; each coil and its switch are series connected across the power supply lines 55 via the lines 98.

In general, the timer-distributor assembly as applied to the pump installation, herein described and illustrated, operates in the following manner. The switch 16 is closed so that the valve V permits fluid from the source FP-2 to flow into the line 56 and thence into the groove 72, hence into the passage 73. The registry of the passage 73 with any one of the channels 81a, etc., will cause fluid to react against the control piston and move the same to the right. This movement of the piston will cause the actuator to contact its switch to close the same and hence supply power to one of the solenoids 10a, etc. The pressure fluid trapped in channels 81a, etc., when the passage 73 in rotor 66 rotates out of registry with the channels, maintains control pistons 80a, etc., to the right so that switches 94a, etc., keep the solenoids energized and thereby valves S-1, etc., in a loaded condition of operation. When the switch 16 is open so that the groove 72 and line 56 are connected to sump via the line 53, registry of the passage 73 with any one of the channels 81a, etc., will relieve the fluid acting on the piston so that the piston will be moved to the left by the action of its return spring.

The channels 81a, 81b and 81c in the timer mechanism T and the passage 73 in the distributor mechanism D are arranged with respect to the crankshaft so that when the crank is in a rotary position whereby its connected plunger is at the end of the discharge stroke, the passage 73 will be in registry with the particular channel associated with the plunger. Thus when the portion of the crankshaft labeled a is in its lowermost position (as shown), the interconnected plunger is at the end of the discharge stroke and at this time the passage 73 is in registry with the channel 81a so that fluid can be supplied (assuming the pump to be load) to move the piston 84a whereby to close the switch and energize the solenoid 10a. When that part of the crankshaft labeled b is in its bottommost position, its associated plunger is also at the end of the discharge stroke and the passage 73 is lined up with the channel 81b so that the piston 84b will be actuated. When the portion of the crankshaft c is in its lowermost position, the passage 73 is in registry with the channel 81c so that the piston 84c will be actuated. As will be apparent, the unloading of the pump also takes place when the portions a, b, and c of the crankshaft are in their lowermost positions.

Under the usual condition of pump operation, the fluid from FP-1 is kept energized so that the suction valves are kept in unload condition. When loading is called for, the switch 16 is closed and when the same is subsequently opened, the pump returns to no-load condition. The switch 16 may be manually or automatically operated.

One of the features of the distributor-timer assembly is that the relative positions of the channels 81a etc.

with respect to the passage 73 can be adjusted. This adjustment feature in the installation herein described permits loading or unloading of the suction valves. As seen in FIG. 5, the timer head 75 is provided with a pair of ears 106 and 107. Now, if the screws 105 are loosened and the ears 107 tapped lightly, the timer head 75 can be moved clockwise or counter-clockwise, hence change its relative position with respect to the passage 73 or the crankshaft CS. For example, assuming clockwise rotation of the crank, as viewed in FIG. 4, when the portion *a* of the crank has reached the lowermost position, the associated plunger is at the end of the discharge stroke or at the beginning of the suction stroke. If the timer head has been previously moved clockwise, the crank must continue its motion (and its associated plunger will have started the suction stroke) before there is a registry between the passage 73 and the channel 81*a*. On the other hand, if the timer head had been moved counter-clockwise, then it will be seen that registry of the passage 73 and a channel 81*a* would take place just prior to the portion *a* reaching the lowermost position or when its plunger is near the end of its discharge stroke.

The construction of the distributor-timer assembly according to another embodiment of this invention shown in FIGS. 6-9 will be explained. The parts of FIGS. 6-9 which correspond to those of FIGS. 1-5 are identified by the same numerals and letters but having a prime mark.

In the embodiment and arrangement of FIGS. 6-9, the various control valves CV-1', etc., are formed integrally with the distributor-timer assembly and a single source of fluid pressure is used for the double acting pistons P-1', etc., and for operating the distributor mechanism D' and the timer mechanism T'.

In FIG. 6 the line 56' is connected to the source FP-2' in the same manner as line 56 as explained in connection with FIG. 1. The line 56' is also connected to the port 74' which is open to the channel 72' in a rotor 66', the channel being connected to the passage 73'. The timer head 75' has three bores which form three channels, one of which is indicated at 81*a*' and form the cylinders, one of which is indicated at 80*a*'. Each of the cylinders has a control piston, one of which is indicated at 84*a*'.

On the timer head 75' is mounted a housing 110 which has a central bore 111 having annular ports 112 and 113 and an end port 114. The port 114 is connected to a line 115 provided with a check valve 116. Line 115 is connected to a line 117 which is connected to the discharge side of the pump of fluid pressure source FP-2', line 51 in FIG. 1. The housing 110 holds the distributor head 75' fast against the housing 60', the housing 110 in turn being held fast to the housing 60' by way of the rings 120 and 121 pulled into engagement with the screws 105'.

The housing 110 is provided with three bores 122*a*, 122*b* and 122*c* which are in registry with the cylinders 80*a*', etc. Each of these bores has a bushing identified by 123*a*, 123*b* and 123*c*. As best seen in FIG. 6, the shoulder end of each bushing extends into the corresponding cylinders 80*a*', etc. The outer end of each bore 122*a*, etc., is provided with a plug, one of which is indicated at 124 in FIG. 6. Each of the bushings 123*a* slidably supports the spools 125*a*, 125*b* and 125*c*, each having a reduced section 125*d*, 125*e* and 125*f*. The spools are respectively connected to the control pistons 84*a*', 84*b*' and 84*c*'. The spools respectively form the control valves CV-1', CV-2' and CV-3'. On the periphery of the housing 110 is a slot 125 having a cover 130 which forms a chamber 131 having a port 132 connected to a line 133 in turn connected to the oil sump 34 in FIG. 1.

As indicated in FIGS. 6 and 7, the midsection of each of the bushings is apertured at 133*a*, 133*b* and 133*c* so as to be opened to a plurality of ports 134*a*, 134*b* and 134*c* which are in turn connected to a plurality of fluid

lines 135*a*, 135*b* and 135*c* which run directly to the lower side of the pistons P-1', P-2' and P-3'.

The bushings are also apertured so as to be open to the slot 112, the aperture for the bushing 123*a* being indicated at 136. Each of the bushings is also apertured at 137*a*, 137*b* and 137*c* so as to be open to the chamber 131. The bushings are also apertured so as to be open to the slot 113, the apertures for the bushing 123*a* being indicated at 138.

The position of the parts as shown in FIG. 6 is for the unload condition wherein the suction valves S-1', etc., are raised from their respective seats. For unload condition the line 56' is interconnected to line 53 in FIG. 1 so that any fluid in the slot 72', passage 73', and channel 81*a* is free to go to sump. The line 117 is connected to the source FP-2' and transfers fluid to the upper side of the pistons P-1', P-2' and P-3'. Fluid from the line 117 moves through the check valve 116, through the port 114 into the port 113, through the aperture 138 and reacts on the right-hand end of each spool 125*a*, 125*b* and 125*c* to move the same to the left. Fluid also will flow through the port 112 and into apertures 136 and the position of each spool (see spool 125*a*) permits fluid to flow from the apertures 136 into the space provided by the reduced sections 125*d*, etc., of the spool, through the aperture 133*a*, etc., through the ports 134*a*, etc., and then into the lines 135*a*, 135*b* and 135*c* to the lower side of the piston P-1', etc. Substantially the same unit pressure is acting on both sides of the pistons, but the area on the lower side is much greater than that on the upper side; there will be a resultant force tending to move the piston upwardly to unseat the valve.

For load conditions line 56' and groove 72' are supplied with fluid from the source FP-2' and when the passage 73' comes in registry with the channels 81*a*', etc., the pistons 84*a*', etc., will be moved to the right and held in that position by the pressure of the fluid trapped in channels 81*a*', etc., when the passage 73' rotates out of registry with the channels. (This will cut off the flow of fluid from the port 112 and interconnect the lines 135*a*, etc., through port 137*a*, with the chamber 131 which is connected to sump. The position of the spools to effect this transfer is shown in FIG. 9. With the lower sides of the pistons P-1', etc., interconnected to sump, fluid from the line 117 reacting on the upper sides of the pistons will move the same downwardly and the piston rods disengage from the suction valve stems. The suction valves are then free to seat and unseat as dictated by the positions of their respective plungers.

The distributor mechanism D' and timer mechanism T' may be adjusted relative to each other so as to control the time when the loading or unloading takes place in a manner similar to that described above. This is accomplished by loosening the screws 105' and tapping the ears 140 or 141 as indicated in FIG. 7.

The period of time for loading and unloading with respect to the revolutions of the crankshaft or the reciprocation of the pump plungers is accomplished by variable throttles (similar to throttles 52 and 54 connected to the line 56') and by the bias force on the spools, for example, by making the area of the end of the spool smaller so that more time is required for the fluid to move the spool to the left.

Although two embodiments of the invention have been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes can be made in the arrangement of parts without departing from the spirit and scope of the invention, as the same will now be understood by those skilled in the art.

I claim:

1. A distributor-timer assembly comprising a housing having a chamber therein, a rotor disposed for rotation within said chamber, rotary power means for rotating said rotor, a member connected to said housing to form

one wall of said rotor chamber, the rotor being dimensioned in relation to the chamber so that when said rotor is in close association with said member a secondary chamber is defined between the rotor and the wall of said chamber opposite from said member, conduit means in said housing communicating with a source of fluid under pressure and said secondary chamber to supply the latter with pressurized fluid to maintain the rotor in close association with said member, said member being provided with at least one piston cylinder communicating with said chamber, a piston reciprocally mounted in said piston cylinder, passage means in said rotor communicating at one end with a source of pressurized fluid and intermittently communicating at the opposite end with said piston cylinder as the rotor rotates to supply pressurized fluid to said piston cylinder and thereby cause movement of the piston, a control mechanism operative in response to movement of said piston, and means for relieving the pressure in said passage means and said piston cylinder so that said piston is allowed to return to its initial position.

2. A distributor-timer assembly comprising a housing having one end open, a wall member sealingly secured to the open end of said housing to form a cylindrical chamber within said housing, a rotor disposed for rotation within said chamber, rotary power means for rotating said rotor, said rotor having a diameter slightly smaller than the diameter of said cylindrical chamber to provide a close running fit with the chamber and having a longitudinal dimension smaller than the longitudinal dimension of said cylindrical chamber so that a secondary chamber is formed between an end wall of said chamber and the rotor, said housing having a port therein communicating with a source of pressure fluid and with the secondary chamber to supply pressure fluid to the latter and thereby force and maintain said rotor in abutment against said wall member during rotation of the rotor, said member having at least one piston cylinder communicating with said chamber, a piston disposed in said piston cylinder for reciprocation therein, passage means in said rotor in communication at one end with a source of pressure fluid and intermittently communicating at the other end with said piston cylinder as the rotor rotates to supply pressure fluid to said piston cylinder and thereby cause movement of the piston, a control mechanism operative in response to movement of said piston, and means for relieving the pressure in said passage means and said piston cylinder so that said piston is allowed to return to its initial position.

3. A distributor-timer assembly comprising a housing having one end open, a wall member secured in a fluid tight manner to the housing to close said open end thereof and to form a cylindrical chamber within the housing, a cylindrical shaped rotor rotatably mounted in said chamber, the rotor having means for connection with a source of rotary power so as to be rotated by the latter, said rotor having a longitudinal dimension smaller than the longitudinal dimension of said cylindrical chamber so that said rotor and an end wall of the chamber opposite said member define therebetween a secondary chamber, said housing having a port therein communicating with a source of pressurized fluid and with the secondary chamber to supply pressure fluid to the latter and thereby bias said rotor in abutment against said wall member, said member having at least one piston cylinder for reciprocation therein, passage means in said rotor in communication at one end with a source of pressurized fluid and intermittently communicating at the other end with said piston cylinder as the rotor rotates to supply pressurized fluid to said piston cylinder and thereby cause movement of the piston, means for yieldably biasing the piston in a direction toward the rotor, a control member operative in response to movement of said piston, and means for relieving the pressure fluid in said passage means and said

piston cylinder so that the biasing means is effective to return the piston to its initial position.

4. The apparatus of claim 3 wherein said biasing means is a spring.

5. The apparatus of claim 3 wherein said biasing means includes a pressure surface connected to said piston and means for supplying pressurized fluid to said pressure surface.

6. A distributor-timer assembly comprising a housing having a chamber therein, a rotor disposed for rotation within said chamber, rotary power means for rotating the rotor, a wall member secured to said housing to form one wall of said chamber, said rotor having a dimension along its axis of rotation smaller than the longitudinal dimension of said chamber so that a space is formed between the rotor and the wall of said chamber opposite the wall member, a port in said housing communicating at one end with said space and at the opposite end with a source of pressurized fluid to receive and pass pressurized fluid into said space to thereby bias said rotor in abutment against said member, said wall member having a plurality of circumferentially spaced piston cylinders communicating with said chamber, a piston reciprocally mounted in each of the piston cylinders, passage means in said rotor communicating at one end with a source of pressurized fluid and sequentially communicating with each of the piston cylinders as the rotor rotates to sequentially supply pressurized fluid to each of said piston cylinders and thereby effect sequential movement of each of the pistons, means for biasing each of the pistons in a direction toward the rotor, a control mechanism for each of said pistons operative in response to movement of a piston associated therewith, and means for releasing the pressure fluid in said passage means and in each of said piston cylinders as each piston cylinder communicates with said passage means so that the biasing means is effective to return each of the pistons to its initial position.

7. The apparatus of claim 6 wherein said wall member is a timer head having a pressurized fluid chamber therein and inlet ports connected to receive pressurized fluid and outlet ports to discharge pressurized fluid therefrom, and wherein said control mechanism for each of the pistons is a valve for controlling flow of pressurized fluid through an outlet port.

8. A distributor-timer assembly comprising, a housing formed with a chamber and a pair of fluid ports for conducting fluid to said chamber, a cylindrically-shaped rotor rotatably mounted in said chamber and having a peripheral groove open to one of said ports and having a passage extending substantially parallel to the axis of said rotor from one end of said rotor to said peripheral groove, a disk-like timer head mounted on the housing and covering one end of said chamber, the rotor being of an axial length shorter than said chamber whereby fluid entering the other of said ports urges the rotor into close association with the timer head, means for holding the timer head firm against the housing but providing for the same to be angularly adjustable, a plurality of channels in said timer head, each adapted to register with the passage in said rotor as the same is rotated; for each channel, a control piston movable back and forth therein, means yieldably biasing each control piston toward the rotor, and each piston being adapted to be moved away from the rotor when fluid in said groove is transferred to the piston by the registry of the channels and passage, control mechanism operated by the motion of said pistons away from the rotor, and means for relieving the pressure fluid in the passage in the rotor and in each of said channels as the channels register with the passage in the rotor so that each of the biasing means is effective to move each of the control pistons toward the rotor.

9. A distributor-timer assembly comprising, a housing formed with a chamber and a pair of fluid ports for conducting fluid to said chamber, a cylindrically-shaped rotor rotatably mounted in said chamber and having a peripheral groove open to one of said ports and having an axial-

11

ly extending passage open to the groove, a disk-like timer head mounted on the housing and covering the mouth of said chamber, the rotor being of an axial length shorter than said chamber whereby fluid entering said second port urges the rotor in close association with the timer head, means for holding the timer head firm against the housing but providing for the same to be angularly adjustable, a plurality of channels in said timer head, each adapted to register with the passage in said rotor as the same is rotated; for each channel, a control piston movable back and forth therein; for each piston, a spring yieldably biasing the same toward said rotor and each piston being adapted to be moved away from the rotor when fluid in said groove is transferred to the piston by the registry of said channels and said passage, a control mechanism including a plurality of switches, one for each piston, mounted on the timer head and each adapted to be actuated by the movements of its associated piston, and means for relieving the fluid pressure in said axial passage, the groove, and in each of the channels as the axial passage registers with each of the channels to allow the springs to move each of the pistons associated therewith toward the rotor.

10. A distributor-timer assembly comprising, a housing formed with a chamber and a pair of fluid ports for conducting fluid to said chamber, said chamber having a mouth, a cylindrically-shaped rotor rotatably mounted in said chamber and having a peripheral groove open to one of said ports and having an axially extending passage

12

open to the groove, a disk-like timer head mounted on the housing and covering the mouth of said chamber, the rotor being of an axial length shorter than said chamber whereby fluid entering said second port urges the rotor in close association with the timer head, means for holding the timer head firm against the housing but providing for the same to be angularly adjustable, a plurality of channels in said timer head, each adapted to register with the passage in said rotor as the same is rotated; for each channel, a control piston movable back and forth therein, fluid actuated means for yieldably biasing each piston toward said rotor, and each piston being adapted to be moved away from the rotor when fluid in said groove is transferred to the piston by the registry of said channels and said passage, a control mechanism including, for each piston, a valve connected thereto and arranged to control fluid flow, and means for releasing the fluid in said groove and in each of said channels as the latter register with the passage in said rotor so that said fluid actuated means is effective to return each of said pistons toward said rotor.

References Cited in the file of this patent

UNITED STATES PATENTS

1,763,154	Holzworth	June 10, 1930
2,079,041	Ryan et al.	May 4, 1937
3,019,777	Candellise	Feb. 6, 1962