Oct. 20, 1931. J. C. WOODFORD 1,828,696

FLUID DISPENSING APPARATUS

Filed Nov. 28, 1930 3 Sheets-Sheet 1

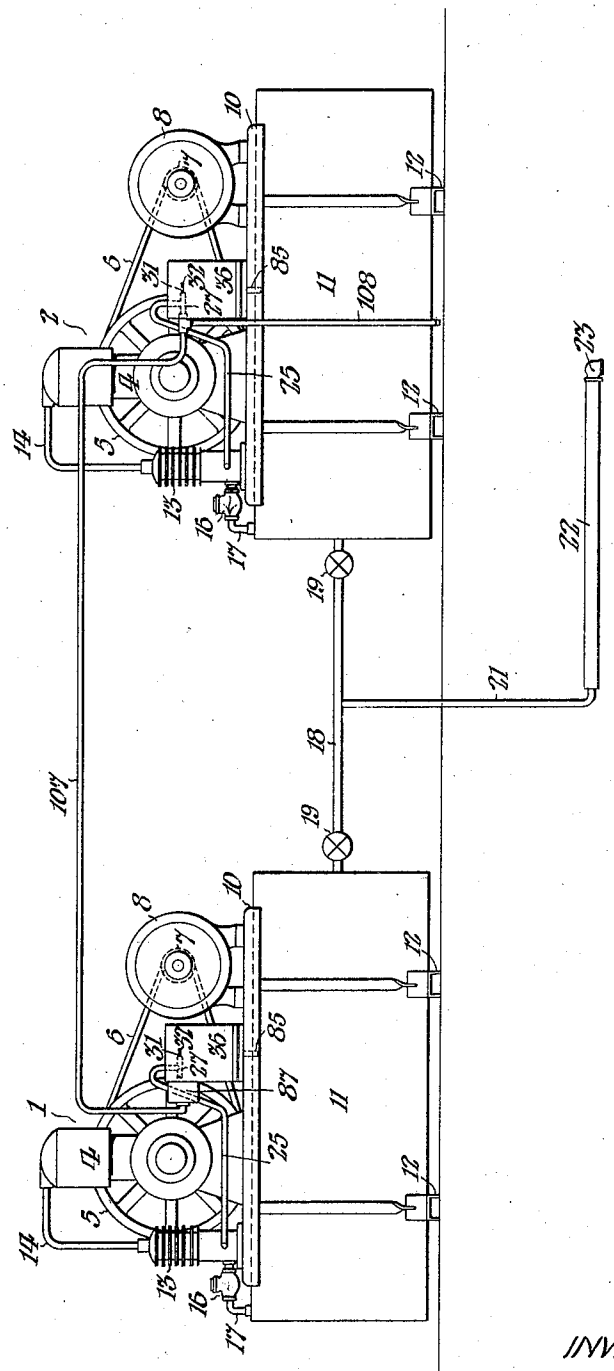

FIG. 1.

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FIG. II.

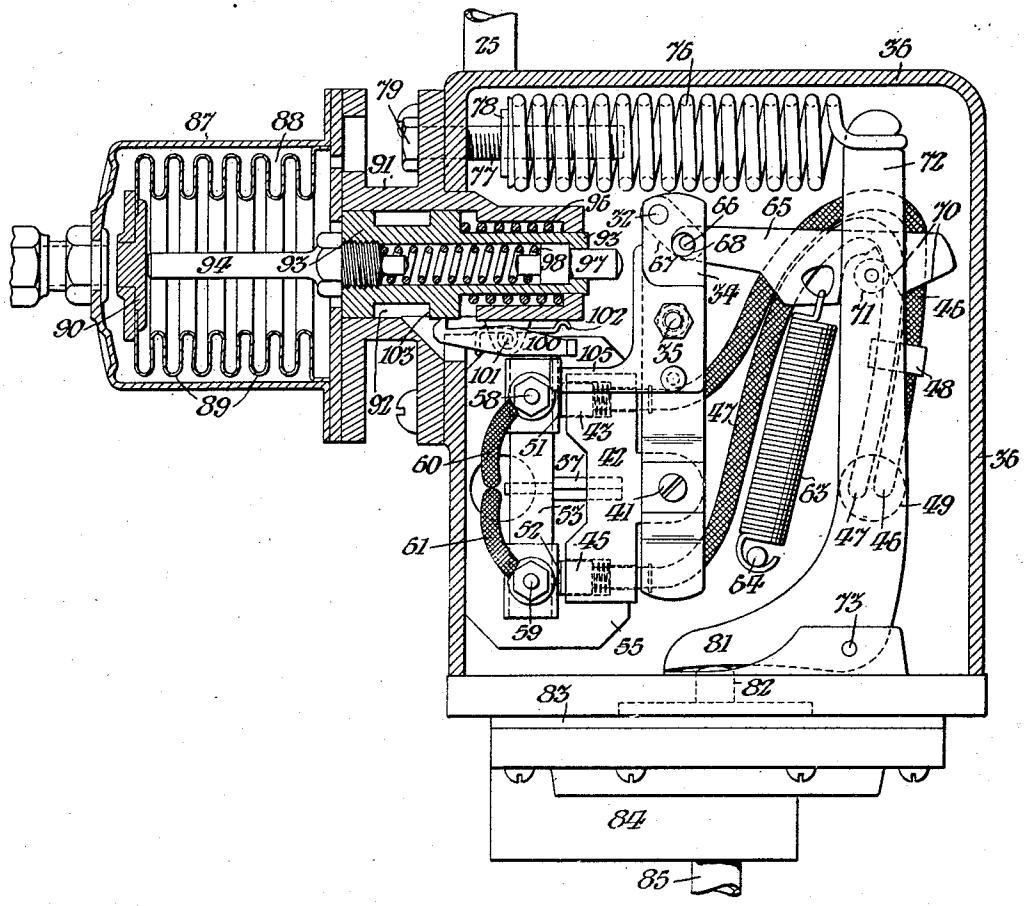

FIG. III.

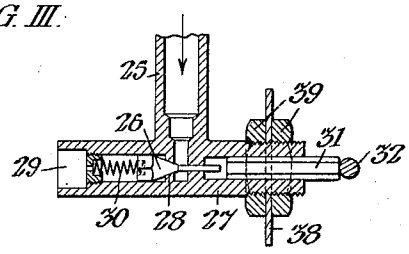

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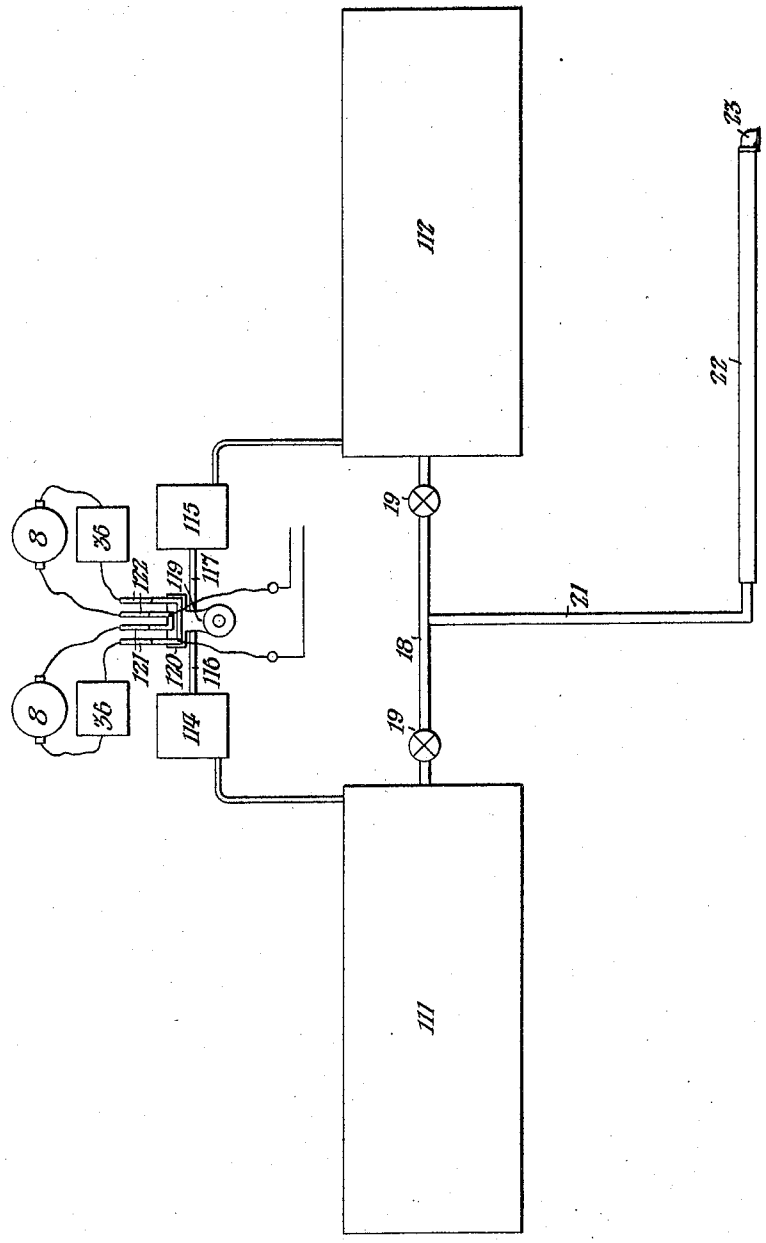
FIG. IV.



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UNITED STATES PATENT OFFICE

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FLUID DISPENSING APPARATUS

Application filed November 28, 1930. Serial No. 498,697.

Although not limited to any particular embodiment, my invention may be advantageously embodied in apparatus for compressing and dispensing air at an automobile service station. At such station, compressed air is principally used for operation of elevators to lift vehicles to permit them to be greased with facility; to dispense grease under pressure to the bearings of such vehicles, and to inflate the vehicle tires. The demand for such service varies, the maximum being usually more than double the minimum. If the air is compressed by a pump operated by an electric motor, two small compressing and dispensing units of the aggregate capacity required may be operated more economically than a single unit of such aggregate capacity, and it is an object and effect of my invention to so cooperatively connect two such units that they may be operated most economically and efficiently from the minimum capacity of one to the maximum capacity of both.

In accordance with my invention as hereinafter described, two fluid compressing and dispensing units, which may be alike, are connected to a common manifold, from which the compressed fluid is dispensed, and said units are so cooperatively cross-connected that if the demand for fluid exceeds the capacity of one they operate contemporaneously, otherwise they operate alternately, to thus insure that they shall be worn equally, and that both shall not be operative except when the demand exceeds the capacity of one of them. Such cooperative connecting means includes an electric switch in the energizing circuit of the motor in one unit, which switch is adapted to be controlled by a bellows subjected to fluid pressure from the other of said units; the arrangement being such that when the operation of one unit is stopped by the breaking of its energizing circuit; a surge of air from that unit is caused to position the control mechanism of the other unit so that upon demand, said other unit automatically starts in operation and, at the expiration of that operation, permits the first unit aforesaid to next operate, and so on with said units in alternation.

My invention includes not only the general arrangement aforesaid but the specific construction and arrangement of the pneumatically controlled switch mechanism and the various novel features of construction and arrangement hereinafter more definitely specified.

In said drawings; Fig. I is a diagrammatic representation of apparatus embodying my invention, including two similar air compressing and dispensing units connected to a common manifold and provided with respective electric controlling switches.

Fig. II shows one of the electric switch controlling devices indicated in Fig. I, but on a larger scale, and partly in section.

Fig. III is a longitudinal sectional view of a fluid controlling valve on the back of the structure shown in Fig. II but in operative relation with a pin projecting rearwardly from the switch lever in Fig. II.

Fig. IV is a diagrammatic representation of a modified form of apparatus embodying my invention.

Referring to the form of my invention shown in Figs. I to III inclusive, the two fluid compressing and dispensing units are respectively indicated at 1 and 2. Each of said units includes a fluid compressing pump 4 the operating mechanism of which includes a fly wheel 5 which is connected by a belt 6 with a pulley 7 on the armature shaft of an electric motor 8; said pump and motor being both rigidly connected with the same base plate 10, in the respective units. Said base plates 10 are conveniently mounted upon the tops of cylindrical tanks 11 which serve as respective containers for the compressed fluid in each unit and have foot members 12 by which they are supported.

Each of said units includes a condenser 13 including a fluid chamber to which the compressed fluid is discharged thru the conduit 14 from the respective compressor 4. Each of said condensers 13 is connected through a check valve 16 and conduit 17 with its respective tank 11; said check valves being operative to open toward the tanks and close in the opposite direction so as to trap the compressed fluid in the tanks.

Said tanks 11 are connected with the common manifold 18 through respective valves 19 which may be manually operated to prevent the escape of compressed fluid from respective tanks when desired and said manifold 18 has the branch 21 to which one or more flexible dispensing conduits 22 may be connected, each provided with a valve coupling 23 at its discharge end for detachable connection with a vehicle tire valve.

In order to facilitate the starting of said units in operation after they have been used to compress fluid; each of said condensers is conveniently provided with a conduit 25 through which the compressed air which otherwise would resist the starting movement of the pump may be vented under control of the respective valves 26 each of which is mounted to reciprocate in respective casings 27, as indicated in Fig. III. As indicated in Fig. III, each valve 26 controls a port 28 leading to the outer atmosphere through its vent tube 29 but is continually thrust by a spring 30 to close such port. However, each of said valves is adapted to be opened by a plunger 31 which is mounted to reciprocate in the valve casing 27 and adapted to be thrust toward the valve by a pin 32 which projects rearwardly from the switch lever 34 which is fulcrumed at 35 in the respective control casing 36. Each valve casing 27 is conveniently rigidly supported by a bracket 38 projecting from the back of the respective casing 36 and through which the screw threaded end of the casing 27 extends in engagement with a pair of nuts 39 between which said bracket is clamped.

Said switch lever 34 is pivotally connected by the screw 41 with the movable contact block 42 of insulating material, so as to close the energizing circuit of the local motor 8 when in the position shown in Fig. II and to break such circuit when said lever 34 is turned counterclockwise in Fig. II. Said block 42 carries the spring pressed terminals 43 and 45 of the respective flexible electrical conductors 46 and 47 which extend in said casing 36 in a loop, from the clamp 48, and thru an opening 49 in the back of said casing. Said terminals 43 and 45 are adapted to register in contact with respective stationary terminals 51 and 52 which are supported by the bar 53, of insulating material, which is rigidly connected with said casing 36 thru the insulating pad 55. Said block 42 is maintained in proper cooperative relation with said bar 53 by the stud 57 which projects rigidly from said block 42 and is slip fitted in a hole in said bar 53. Said stationary terminals 51 and 52 are respectively electrically connected by binding posts 58 and 59 with respective electric conductors 60 and 61 of said motor energizing circuit.

Said switch shown in Fig. II is normally maintained closed by the spring 63, one end of which is connected with the stud 64 in said casing 6 and the other end of which is engaged with the cam latch 65. Each such latch 65 is pivotally connected by a pin 66 with a pair of links 67 which are suspended at their other ends upon said pin 32; said pin 66 projecting thru opposite openings 68 in said lever 34 to limit the freedom of movement of said links 67. Each of said latches 65 has a double inclined cam end 70 which normally depends over the right side of a roller 71 carried by a lever 72 fulcrumed at 73 in said casing 36, as shown in Fig. II, with the effect of then stressing said lever to turn clockwise and thus normally maintaining said circuit closed. However, each lever 72 is adapted to be tilted clockwise to move its roller 71 past the crest of its latch cam 70; whereupon, the latch and switch lever 34 are snapped counterclockwise by their spring 63 to open the circuit and thus stop the electric motor energized thereby, if and when said lever 72 is subjected to a predetermined pressure of the fluid to be dispensed.

Such pressure is variable by axial adjustment of the spring 76 which is engaged at one end with the upper end of said lever 72 and adjustably connected at its other end with the casing 36, by means of the screw 77 which extends through said casing in engagement with the nut 78 fixed in said spring and has the head 79 exterior to said casing adapted to be turned by any suitable wrench. The arrangement is such that the stress of said spring 76 may be increased or diminished in accordance with the direction of turning movement of said screw 77.

Said lever 72 has the short arm 81 in cooperative relation with the stud 82 which has a broad head resting on the flexible diaphragm 83 and subjected to the pressure of fluid in the casing 84 below said diaphragm, through the inlet 85 which is in communication with the interior of the subjacent respective storage tank 11.

The normal effect of the construction and arrangement last above described is that when the fluid in the respective tank 11 reaches the degree of compression for which the respective spring 76 has been adjusted; the diaphragm 83 is uplifted to turn the lever 72 clockwise so as to cause its roller 71 bearing upon the latch cam 70 to thrust the respective latch 65 upwardly against the stress of its spring 63 and thereby permit said spring 63 to snap the local switch lever 34 counterclockwise and break the circuit of the motor energizing pump supplying compressed fluid to that tank and thus stop the compressing operation whenever the fluid in said tank 11 reaches that predetermined pressure.

However, when the fluid pressure in the diaphrgm casing 84 diminishes far enough to let said roller 71 pass to the left of the crest of its latch cam 70 in Fig. II, the latch

spring 63 then snaps the switch closed, as shown in Fig. II.

Each lever 72 being thus rocked back and forth by the opposed stresses of its spring 76 and upon its diaphragm 83; each of such controlling mechanisms in the respective casings 36 is normally adapted to independently automatically operate to open and close the energizing circuit of its respective pump motor 8 in accordance with the pressure of fluid in its diaphragm chamber 84.

However, an essential feature of my invention is the provision of means in cooperative relation with at least one such switch controlling mechanism as last above described which shall be operative by the pressure of fluid elsewhere in the apparatus to cause the switch mechanism to function to close the circuit under conditions when it would not be normally closed by the fall of pressure in its chamber 84. Specifically, such fluid pressure from a source remote from the switch controlling mechanism which it affects is preferably derived from a container in which it has been compressed by the other pump which is not controlled by the switch mechanism thus affected.

In the form of my invention shown in Fig. II, means are provided to impose with such extraneous fluid pressure an abnormal stress upon the switch lever 34 tending to close it, with the effect of closing the circuit through the local pump motor before the pressure of the fluid in the chamber 84 beneath the diaphragm 83 is diminished to the point where said switch lever would normally be permitted to close under control solely of said lever 72 and spring 76.

The means for applying such extraneous fluid pressure to the switch lever 34 shown in Fig. II, include the casing 87 in which such extraneous fluid pressure is received in the chamber 88, surrounding the corrugated metal bellows 89 with the effect of more or less collapsing the latter so that its head 90 moves to the right in Fig. II. Said casing 88 and its appurtenances are rigidly connected with the casing 36, conveniently by the housing 91. Said housing 91 incloses the cylindrical chamber 92 in which the tubular plunger 93, provided with the stem 94, is mounted to reciprocate, with said stem in cooperative relation with the head 90 of said bellows. Said plunger and stem are continually stressed to the left in Fig. II by the spring 96 in said housing, to insure that said bellows 89 shall be restored to its normal distended shape shown in Fig. II, whenever it is relieved of said extraneous fluid pressure. Said plunger 93 is preferably provided with the relatively reciprocatory tip 97 which is continually stressed relatively to said housing 93, toward its position in the latter shown in Fig. II, by the spring 98 which yieldingly limits the stress applied to said switch lever 34 by the movement of said plunger 93 to the right in Fig. II under the foreign fluid pressure in said chamber 88, to merely enough to cause said switch to close against the local fluid pressure, in the diaphragm casing 84, slightly higher than that for which said spring 76 has been adjusted.

When the fluid pressure in said chamber 88 is effective to shift said plunger 93 to the right in Fig. II and impose abnormal stress upon said switch lever 34 as above contemplated, and said switch lever 34 is in the open position with the circuit broken; the latch lever 100, which is fulcrumed at 101 on said housing 91 and provided with the spring 102 tending to snap the hooked end of said latch over the shoulder 103 on said plunger 93, is then permitted to automatically engage said shoulder and temporarily prevent reverse movement of said plunger, to the left in Fig. II, when the bellows 89 is relieved of the pressure in its chamber 88; so that the abnormal stress upon the switch lever 34 is then continued, by the spring 98, until said switch lever 34 is restored to the closed position shown in Fig. II. When said lever 34 moves to the closed position shown in Fig. II; the latch tripping bracket 105, which is rigidly connected with said lever 34, then uplifts the right hand end of said latch 100 and thus releases the latter from said plunger 93 and permits it to be restored to the position shown.

As shown in Fig. I, said casing 87 is appurtenant to the control casing 36 of the unit 1 in Fig. I, and is connected by the fluid pressure conduit 107 with the fluid vent conduit 108, leading from the vent conduit 29 at the back of the control casing 36 of the unit 2 in said figure. The effect of that arrangement is that when the switch mechanism in the casing 36 controlling said unit 2 shifts the switch lever 34 therein to open position and thus stops the pump 4 of said unit 2, the pin 32, indicated in Figs. II and III, which projects rearwardly thru said casing 36 into operative relation with the plunger 31 shown in Fig. III, opens the valve 26 to release the compressed air from the condenser 13 into said conduits 107 and 108; the latter being so restricted at its end, or affording by its length such resistance to the outlet of such pressure therethru, as to momentarily impose a surge of fluid pressure upon said bellows 89 thru said conduit 107 with the effect of thrusting said plunger 93 to the right and imposing abnormal stress upon the switch lever 34 local thereto, as above contemplated; so that it closes when the pressure in the chamber 84 falls to, say, one hundred and five pounds.

If the springs 76 in the respective control casings 36 of the two units 1 and 2 are slightly differently set for normal operation, for instance, to close the circuit of the unit 2

and energize its pump motor 8 when the pressure falls to, say, one hundred and two pounds in its diaphragm chamber 84, and to close the circuit of the unit 1 when the pressure falls to, say, one hundred pounds; and to open both circuits and stop the pumping operation when the fluid thus compressed reaches the pressure of, say, one hundred and fifty pounds in the respective containers 11 and diaphragm chambers 84 which are connected in common with the manifold 18 as above described; the effect of the connection of the two units by the fluid pressure conduit 107 and its appurtenances as above described is to cause the unit 1, at the left in Fig. I, to automatically close its circuit and begin to compress fluid into the dispensing system when the pressure therein falls to, say, one hundred and five pounds; thus before either of said units would normally start compression. Thereupon, the compressing operation of the unit 1, by raising the fluid pressure in the dispensing system common to both units, prevents the initiation of the compressing operation of unit 2 unless and until the demand upon the system for dispensation of fluid becomes greater than can be supplied by the operation of unit 1, and the pressure in the system falls to the assumed low point of one hundred and two pounds aforesaid; whereupon, the unit 2 comes into operation automatically to supplement the effect of the unit 1, until the maximum pressure aforesaid is attained and both stop the final surge from unit 2, resetting the plunger 93 of unit 1 as aforesaid, to close its circuit and start it pumping when the pressure falls to one hundred and five pounds.

Whenever the unit 1 operates and stops without the unit 2 being operated conjointly therewith, of course, its plunger 93 is not set to initiate the operation of the unit 1 when the pressure falls to one hundred and five pounds and, consequently, when the pressure thereafter falls to one hundred and two pounds, the unit 2 starts to operate, and whether or not the unit 1 is caused to operate conjointly with the unit 2 by the fall of pressure to one hundred pounds; the stoppage of the unit 2 resets the plunger 93 of the unit 1 so that upon resumption of demand, the unit 1 will restart at one hundred and five pounds. Both units are thus alternately operative to supply the containers 11 with fluid under pressure at from one hundred to one hundred and fifty pounds per square inch, if the adjustment is as above indicated.

Therefore, the effect of cross connecting two units in accordance with my invention, as aforesaid, is to economize the cost of operation thereof by insuring that neither shall be operative unless its capacity is required to supply the demand upon the system, and that they shall operate alternately when the capacity of but one is required.

Altho I find it convenient to connect said conduit 107 as above described to take the fluid pressure from the unit 2 from the vent side of the valve 26 in that unit, it may be taken from the other side, or from any other part of the unit 2 containing fluid compressed by its operation.

Moreover, it is to be understood that my invention is not limited to the specific construction of the means for coordinately connecting two fluid compressing units as above described, for my invention includes any suitable means whereby a plurality of such units connected to a common manifold from which the compressed fluid is dispensed may be so coordinately connected that but one of said units is operative when its capacity is sufficient to meet the demand upon said manifold and the operation of another unit in the system is automatically initiated only if and when its capacity is required to supplement that of the first operative unit. For instance, in Fig. IV, I have indicated two units 111 and 112 connected in common to a single manifold and dispensing conduit as above contemplated with reference to Fig. I, but wherein respective bellows 114 and 115 are independently subjected to fluid pressure from the respective units and adapted by connections 116 and 117 to operate the lever 119 of the switch 120 with respect to the terminals 121 and 122 of the respective unit motor circuits and thereby effect the alternate and contemporaneous operation of said units when required.

Therefore, I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention, as defined in the appended claims.

I claim:

1. In fluid dispensing apparatus; the combination with a plurality of unit fluid compressors; of individual electric motors connected to respectively operate said compressors; a manifold connected in common to the discharge outlets of said compressors; electric switch means adapted to selectively energize one or more of said compressors simultaneously; automatically operative means controlling said switches, including parts adapted to be stressed in one direction by spring means and to be stressed in the opposite direction by the fluid compressed; and fluid conducting means coordinately connecting said units, adapted to energize the motor of one unit in accordance with the fluid pressure at another unit.

2. In fluid dispensing apparatus, the combination with a plurality of unit fluid compressors; of a fluid dispensing manifold connected in common to said compressors; individual electric motors connected to respectively operate said compressors; motor controlling means including at each unit an elec-

tric switch, a spring adapted to stress said controlling means to effect the closure of said switch; and means opposing the stress of said spring and operative by the fluid compressed, adapted to open said switch when a predetermined pressure of said fluid is attained.

3. Apparatus as in claim 2, including means adapted to vary the pressure at which said switch shall open, including means operated by the pressure of said fluid to stress said switch and cause it to close when the fluid pressure in the apparatus is higher than that for which said spring is set.

4. Apparatus as in claim 2, including means adapted to vary the pressure at which said switch shall open, including means operated by the pressure of said fluid to stress said switch and cause it to close when the fluid pressure in the apparatus is higher than that for which said spring is set; including a plunger adapted to be pressed toward said switch by said fluid, and a catch adapted to detain said plunger in cooperative relation with said switch, until the latter is closed, and means operative by the closing movement of said switch to trip said catch and release said plunger.

5. In fluid dispensing apparatus, the combination with a plurality of fluid compressors; of a manifold connected in common to said compressors; and controlling means operatively connecting said units, whereby one or more of said units may be selectively operated contemporaneously in accordance with the rate of dispensation of fluid through said manifold.

6. Apparatus as in claim 5; wherein each unit includes an electric motor adapted to operate its compressor, and electrical controlling means for said motor including a switch; a lever adapted to be stressed in one direction by the fluid compressed and adapted to be stressed in the opposite direction by a spring; said spring tending to cause said switch to be closed automatically at a predetermined pressure of the fluid upon said lever; and auxiliary fluid operated means adapted to stress said switch to close it at a pressure of the fluid upon said lever higher than that for which said spring is calibrated; and a fluid conduit connecting said auxiliary controlling means of one unit with a compressed fluid container local to another of said units; whereby one of said units is automatically controlled in accordance with the conditions local to another of said units and with the effect of limiting the operation of said units in accordance with the rate of dispensation of fluid in said manifold.

7. In fluid dispensing apparatus, the combination with a manifold through which the fluid is dispensed; of a plurality of distinct unit fluid compressors connected in common to said manifold; and fluid conducting means connecting said units, whereby the initiation of the operation of one unit is predetermined by the pressure of fluid at another unit, and the number of units operating at any time determined by the rate of dispensation of fluid from said manifold.

In testimony whereof, I have hereunto signed my name at Philadelphia, Pennsylvania, this twenty-sixth day of November, 1930.

JOSEPH C. WOODFORD.