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3,363,571

METERING PUMP AND SYSTEM

Filed Aug. 2, 1965

3 Sheets-Sheet 1

FIG. 1

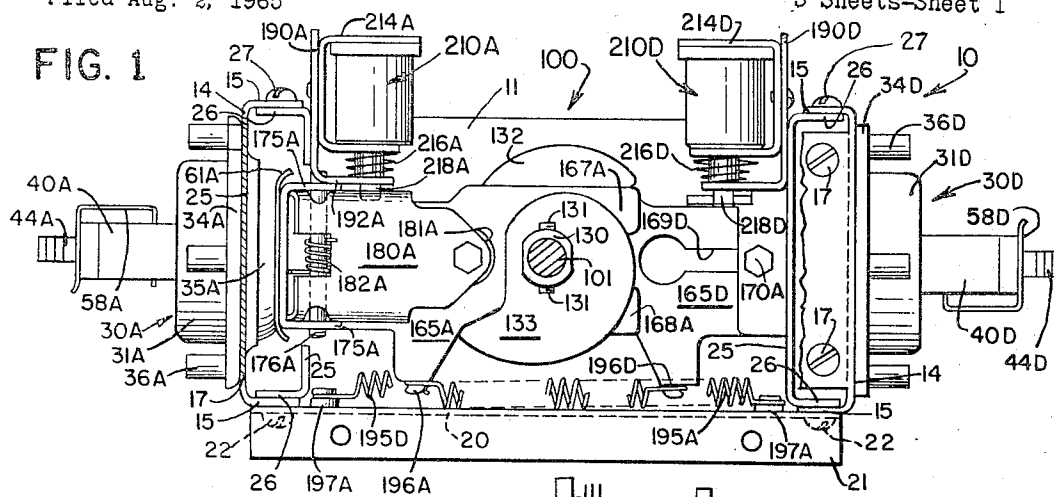
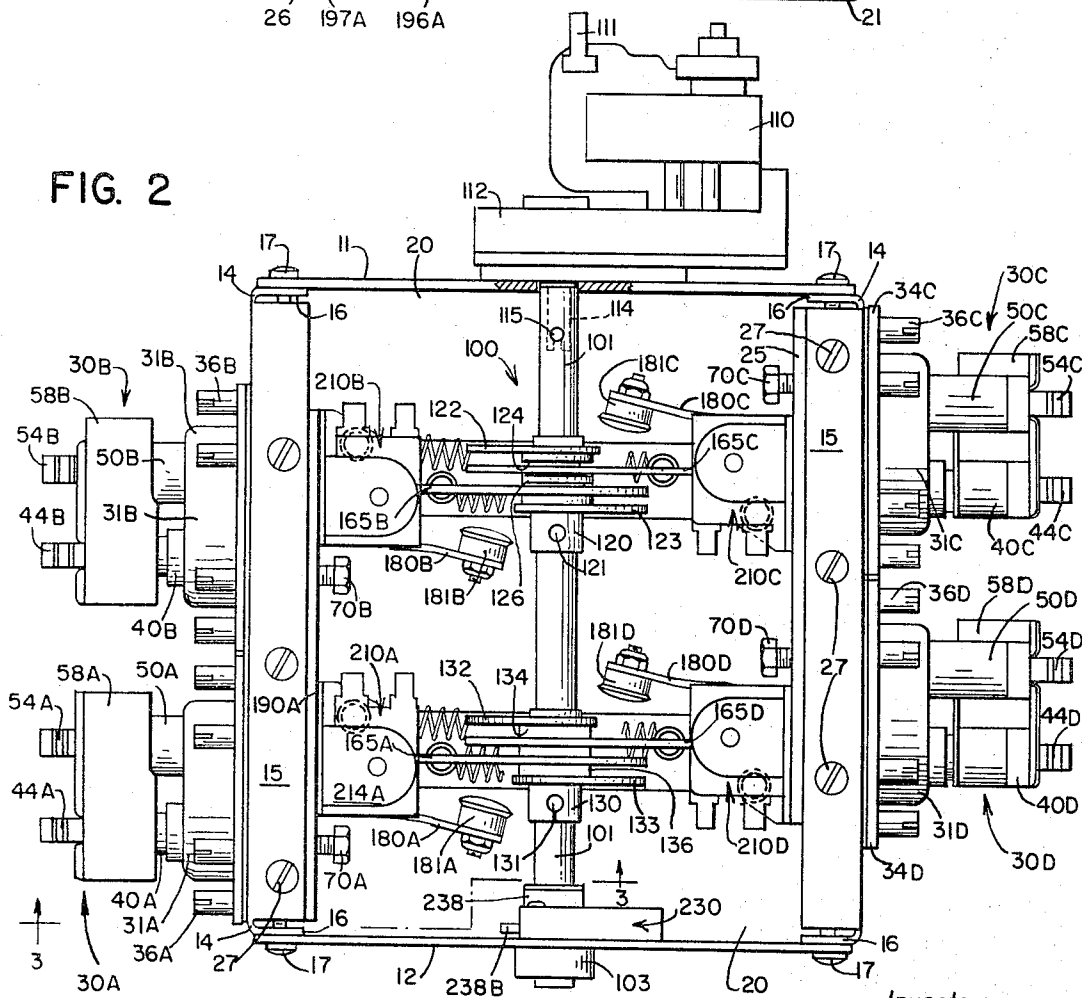


FIG. 2



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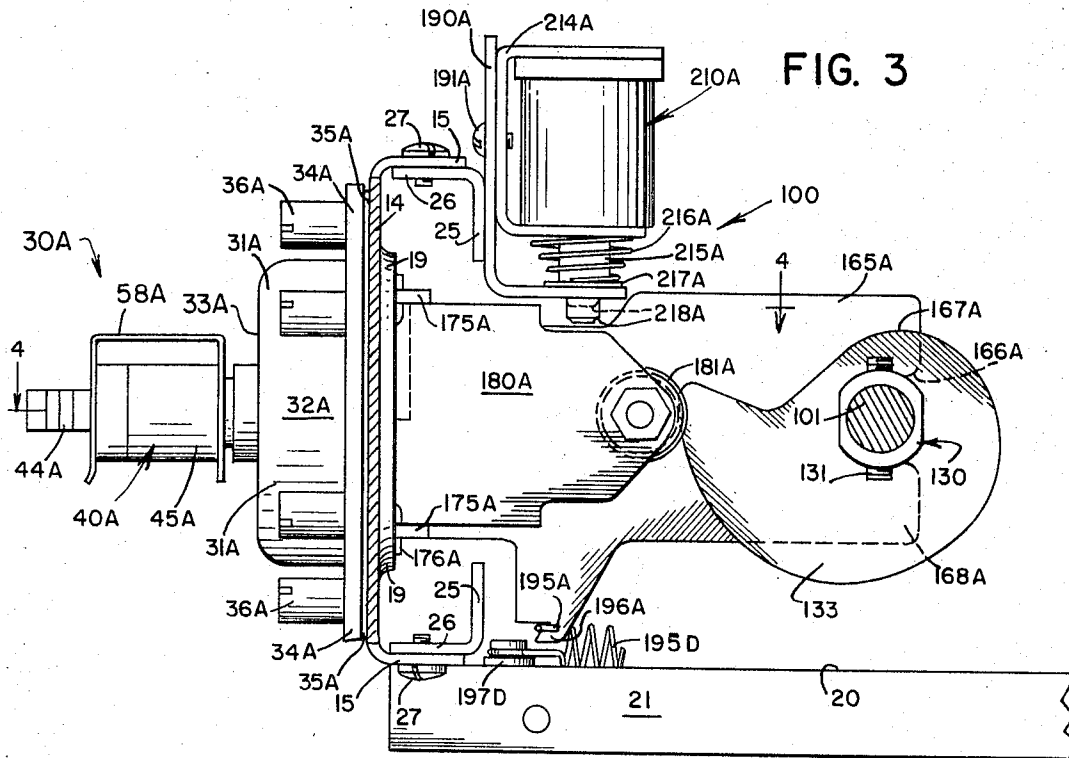
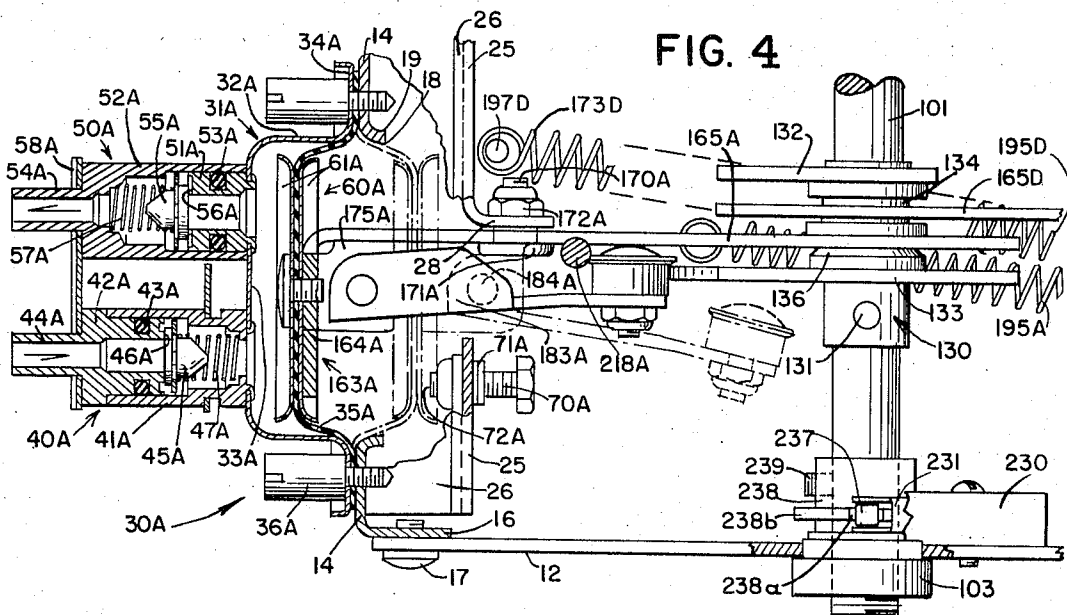
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3 Sheets-Sheet 2



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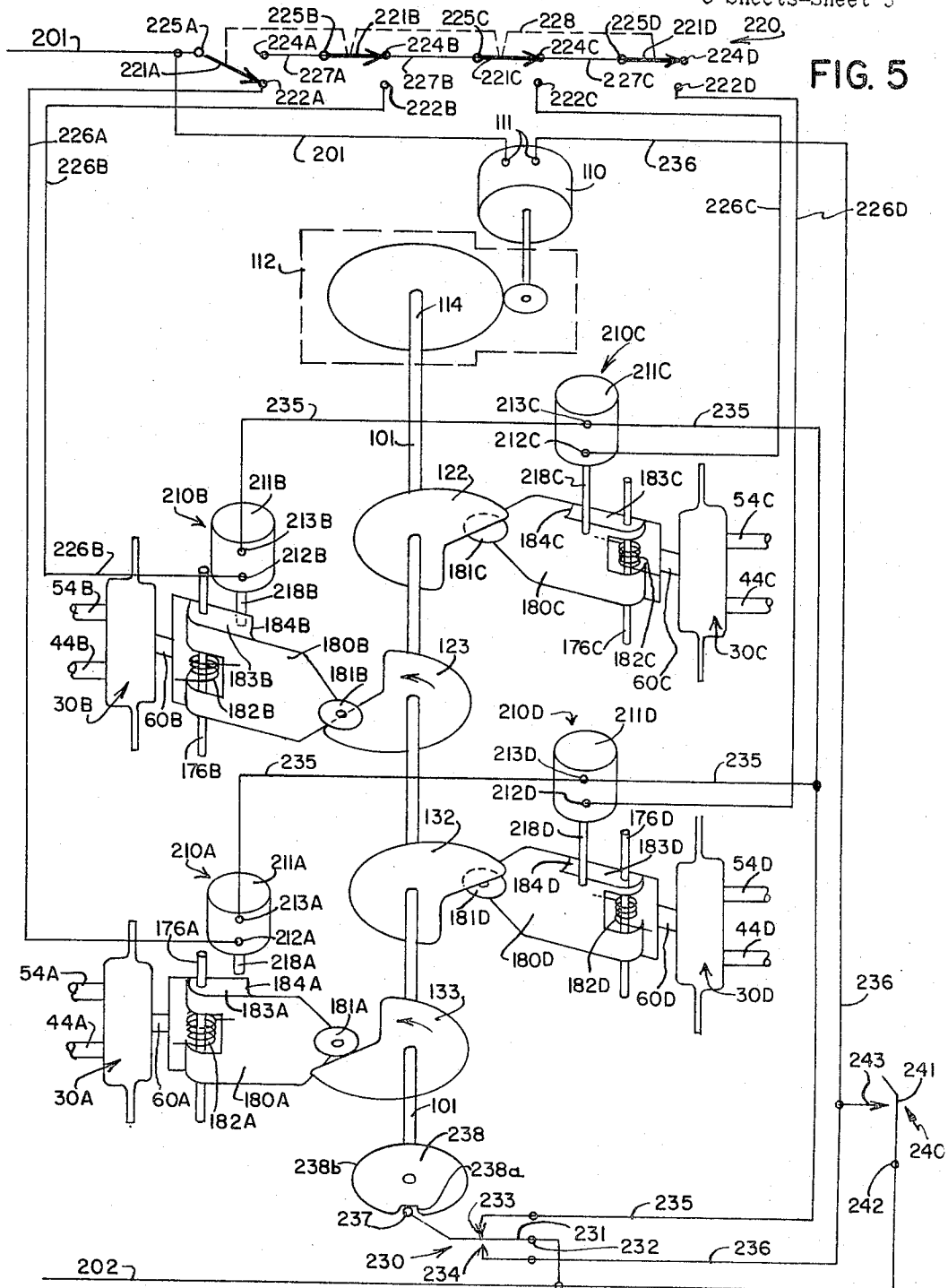
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METERING PUMP AND SYSTEM

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3 Sheets-Sheet 3



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3,363,571

METERING PUMP AND SYSTEM

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17 Claims. (Cl. 103—11)

ABSTRACT OF THE DISCLOSURE

There is disclosed a metering pump and a pumping system incorporating a metering pump for delivering a predetermined quantity of liquid for each operation of the pump, preferably a plurality of the pumps being provided to pump a predetermined quantity of one of a plurality of liquids from a supply thereof for each cycle of operation with the pumping system, the system comprising a frame, a plurality of pumps mounted on the frame and each including a reciprocating piston movable between an intake position and an exhaust position, a drive shaft journaled in the frame for rotation with respect thereto, a drive motor mounted on the frame and operatively connected to the drive shaft for causing rotation thereof, a plurality of first cams mounted on the drive shaft, a plurality of single rectilinearly extending arms each having one end thereof pivotally mounted on one of the pistons and each carrying a cam follower on the other end thereof, a plurality of control members operatively associated with the arms and each movable between a first position holding the associated arm in a retracted position wherein the cam follower is out of engagement with the associated first cam and a second position positioning the associated arm in a driving position wherein the associated cam follower is in driving engagement with the associated first cam, a plurality of electromagnets operatively coupled respectively to the control members for moving the associated control member between the first and second positions thereof, a second cam mounted on the drive shaft, a control switch for the drive motor mounted adjacent to the second cam, and a control circuit interconnecting the drive motor and the control switch and the electromagnets for selectively actuating one of the electromagnets to energize the drive motor to cause rotation of the drive shaft thereby reciprocating the piston associated with the energized electromagnet between the intake and exhaust positions thereof and thereafter operating the control switch to de-energize the drive motor.

The present invention relates to a metering pump for delivering a predetermined quantity of liquid for each cycle of operation of the pump, and to drive structure for such pumps and to pumping systems incorporating such pumps therein.

The metering pump of the present invention is particularly adapted to pump syrups in automatic beverage dispensers wherein a plurality, such as four, sources of viscous flavored syrups are provided, the pump being useful to deliver a precise quantity of flavored syrup to a cup where the syrup is mixed with carbonated water to provide a drink for the customer. In such automatic beverage dispensers, the initiation of the dispensing cycle must be under the control of the customer and the choice of the flavor of syrup utilized must likewise be under the control of the customer, the predetermined precise quantity of syrup being dispensed each time the customer causes an initiation of the dispensing cycle, and regardless of the particular flavor of syrup selected.

Accordingly, it is an important object of the present invention to provide a metering pump of the type set forth

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which is operable to deliver a predetermined precise quantity of liquid, such as a flavor syrup, for each cycle of operation of the pump.

Another object of the invention is to provide for a metering pump of the type set forth including a drive piston, an improved drive structure for the piston wherein a drive shaft having a cam therein is provided, an arm is provided having one end thereof pivotally mounted on the piston and carrying a cam follower on the other end thereof for engagement with the cam, and a control member operative to position the arm in a retracted position wherein the cam follower is out of engagement with the cam or in a driving position wherein the cam follower is in driving engagement with the cam, whereby upon rotation of the drive shaft the piston is reciprocated to cause operation of the pump.

In connection with the foregoing object, it is another object of the invention to provide an improved metering pump of the type set forth wherein a first resilient means such as a spring urges the pump piston to the intake position thereof, and a second resilient means such as a spring urges the arm into the driving position thereof.

Yet another object of the invention is to provide an improved metering pump of the type set forth wherein an electromagnet is provided to move the control member so as to position the arm either in the retracted position thereof or in the driving position thereof.

Still another object of the invention is to provide in an improved metering pump of the type set forth a piston rod connected to the piston and journaled so as to guide the piston in the reciprocating movement thereof.

A further object of the invention is to provide a pumping system incorporating therein a plurality of the metering pumps and the drive shaft having a corresponding plurality of cams, a corresponding plurality of pivoted arms and control members being provided so that any one of the plurality of metering pumps can be selectively operated from the single drive shaft.

A still further object of the invention is to provide in a pumping system of the type set forth an improved electrical control circuit for causing selective operation of one of the metering pumps.

Further features of the invention pertain to the particular arrangement of the parts and elements in the metering pump and pumping system whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which:

FIGURE 1 is an end elevational view with portions of the frame broken away of a pump system incorporating therein an improved metering pump made in accordance with and embodying the principles of the present invention;

FIG. 2 is a plan view of the pumping system of FIG. 1, certain portions being broken away for illustrative purposes;

FIG. 3 is a partial view in vertical section through one of the metering pumps of FIG. 2 along the line 3—3 thereof;

FIG. 4 is a view in horizontal section through the metering pump illustrated in FIG. 3 as viewed along the line 4—4 thereof; and

FIG. 5 is a schematic and electrical diagram illustrating the electrical connections for operation of the pumping system of the present invention.

Referring to FIGS. 1 and 2 of the drawings, there is illustrated a pumping system 10 made in accordance with

and embodying the principles of the present invention. The pumping system 10 includes a frame comprising a pair of end plates 11 and 12 that are generally rectangular in shape and are disposed parallel to each other, and a pair of opposed and spaced apart side plates 14 and a bottom plate 20. Each of the side plates 14 has a pair of longitudinally extending flanges 15 at the top and bottom thereof and a pair of laterally extending end flanges 16 at the ends thereof. The end plates 11 and 12 and the associated end flanges 16 have aligned openings therethrough receiving fasteners such as the screws 17 fixedly to interconnect the end plates 11 and 12 and the side plates 14. The bottom plate 20 has downturned flanges 21 on each end thereof and further has openings therein aligned with corresponding openings in the lower flanges 15 on the side plates 14 to receive fasteners such as screws 22 therethrough. A pair of inner frame plates 25 is also provided, each frame plate 25 being substantially rectangular in shape and having outwardly directed flanges 26 on the top and bottom edges thereof that are disposed within and against the inner surfaces of the flanges 15 on the side plates 14, a plurality of aligned openings being provided in the flanges 15 and 26 and receiving therethrough fasteners such as the screws 27 fixedly to mount the inner plates 25 parallel to and spaced from the adjacent side plate 14.

As illustrated, four metering pumps have been shown mounted upon the frame, all four metering pumps being substantially identical in construction, whereby like reference numerals have been applied to like parts of the pumps with the addition of the suffixes A, B, C and D, the four metering pumps being designated 30A, 30B, 30C and 30D, respectively. Referring particularly to FIGS. 3 and 4 of the drawings, the details of construction of the metering pump 30A will be described. Mounted on the associated side plate 14 is a pump housing 31A having a generally cylindrical side wall 32A closed at one end by an end wall 33A and having an outturned flange 34A extending completely therearound. A flexible diaphragm 35A formed of synthetic organic plastic resin, such as neoprene, is provided, the diaphragm 35A being generally circular in shape and extending outwardly to underlie the flange 34A. A plurality of aligned openings are formed in the side plate 14, the flange 34A and the periphery of the diaphragm 35A receiving therethrough bolts 36A fixedly to mount the housing 31A upon the side plate 14 and to clamp the periphery of the flexible diaphragm 35A between the outer surface of the side plate 14 and the inner surface of the housing flange 34A. It will be seen that the side plate 14 has a generally circular opening 18 therein surrounded by an inwardly directed flange 19 so as to present a smooth curved surface to the adjacent side of the diaphragm 35A during the operation of the pump 30A, all of which will be explained more fully hereinafter.

An inlet valve 40A is provided for the pump 30A, the valve 40A including a pair of generally cylindrical telescoping housing members 41A and 42A having a sealing O-ring 43A disposed therebetween, the end of the housing 41A disposed to the right in FIG. 4 being firmly secured to the housing 31A and surrounding an opening therein to provide communication between the interior of the housing 31A and the interior of the valve housing 41A. The housing member 42A has an outwardly projecting connection 44A adapted to be connected to a supply line (not shown) connected to a supply of flavored syrup (not shown), the syrup during the pumping operation moving in the direction of the arrow and against a resilient valve member 45A. The valve member 45A is urged against a valve seat 46A on the housing member 42A by means of a spring 47A under compression. It will be understood that the valve 40A readily permits flow of syrup in the direction of the arrows, i.e., from the connection 44A past the valve member 45A and into the housing 31A, but effectively blocks any reverse flow thereof.

An outlet valve 50A is provided for the pump 30A, the valve 50A including a pair of generally cylindrical telescoping housing members 51A and 52A having a sealing O-ring 53A disposed therebetween, the end of the housing 51A disposed to the right in FIG. 4 being firmly secured to the housing 31A and surrounding an opening therein to provide a communication between an interior of the housing 31A and the interior of the housing member 51A. The housing member 52A has an outwardly projecting connection 54A adapted to be connected to an outlet line (not shown) connected to a point of delivery for the syrup (not shown), the syrup during the pumping operation moving in the direction of the arrows and against a resilient valve member 55A. The valve member 55A is urged against a valve seat 56A on the housing member 51A by means of a spring 57A under compression. It will be understood that the valve 50A readily permits flow of syrup in the direction of the arrows, i.e., from the housing 31A past the valve member 55A and into the connection 54A, but effectively blocks any reverse flow therethrough. A clip 58A is provided engaging the housing member 41A and the two outer housing members 42A and 52A to hold the housing members 42A and 52A in the operative positions with respect to the housing members 41A and 51A, respectively, while permitting ready disassembly and reassembly of the valves 40A and 50A for cleaning purposes.

A piston 60A is provided within the housing 31A and including a pair of discs 61A disposed on opposite sides of the diaphragm 35A, aligned openings being provided through the centers of the diaphragm 35A and the discs 61A for receiving a fastener 62A connecting all of the members to a piston rod 163A and specifically to a flange 164A thereon disposed parallel to the discs 61A. The piston rod 163A also includes a shank 165A disposed normal to the flange 164A and to the discs 61A and extending inwardly into the associated housing. The associated inner plate 25 has suitable openings therethrough to accommodate the shank 165A and also has mounted thereon an adjustable positive stop 70A in the form of a screw threadedly mounted upon the inner plate 25 and fixedly locked in the adjustable position by means of lock nuts 71A, the outer end 72A of the screw 70A abutting against the piston rod flange 163A positively to position the innermost or righthand extremity of travel of the piston rod 60A, all as viewed in FIG. 4. In the operation of the pump 30A, the piston 60A moves between an exhaust position illustrated by full lines in FIG. 4 and an intake position illustrated by the dashed lines in FIG. 4, the flange 164A being against the outer end 72A of the positive stop 70A in the intake position thereof. It will be understood that during movement from the exhaust position to the intake position of the piston 60A, syrup is drawn through the connection 44A and the inlet valve 40A into the space between the housing 31A and the diaphragm 35A, the valve member 55A and the outlet valve 50A being closed at this time, and when the piston 60A moves from the intake position to the discharge position thereof, the syrup within the pump 30A is discharged through the outlet valve 50A past the valve member 55A and into the connection 54A, the valve member 55A being closed during this portion of the cycle of operation.

A pump drive mechanism 100 is also mounted upon the frame of the pumping system 10, and includes a shaft 101 having the axis thereof disposed substantially parallel to the side plates 14 and normal to the end plates 11 and 12 and disposed in the same plane as the axes of the various pump pistons 60A, 60B, 60C and 60D. The lower end of the shaft 101 as viewed in FIG. 2 is journaled in a bearing 103 mounted upon the end plate 12, and the other end of the shaft 101 passes through an opening in the end plate 11, that end of the shaft 101 having a longitudinal opening therein to receive another shaft that serves to drive the shaft 101. Also mounted upon the end plate 11 is an electric drive motor 110 having a pair of terminals 111 for attachment to an electrical control circuit (to be de-

scribed later), and an output shaft connected to a gear reducing mechanism 112 which in turn has an output shaft 114 that is received in the bore in the end of the shaft 101 and is operatively connected thereto as by a set screw 115. As a result of the connection described above, energization of the electric motor 110 serves to drive the shaft 101 through the action of the gear reducing mechanism 112 and the output shaft 114 therefor.

Mounted upon the shaft 101 intermediate the ends thereof is a pair of identical cam carrying sleeves 120 and 130. Referring first to the cam sleeve 120, it is held in position by set screws 121 and carries thereon a pair of oppositely directed drive cams 122 and 123 having cam surfaces shaped as illustrated best in FIGS. 1 and 3 of the drawings, the cams 122 and 123 being identical in shape but rotationally displaced 180° with respect to each other about the sleeve 120. Also formed on the cam sleeve 120 is a pair of guide grooves 124 and 126 which guide the piston rods 163C and 163B, respectively. The cam sleeve 130 is held in position by set screws 131 and carries thereon a pair of oppositely directed drive cams 132 and 133 having cam surfaces shaped as illustrated best in FIGS. 1 and 3 of the drawings, the cams 132 and 133 being identical in shape but rotationally displaced 180° with respect to each other about the sleeve 130. Also formed on the cam sleeve 130 is a pair of guide grooves 134 and 136 which guide the piston rods 163D and 163A, respectively. It further will be noted that the cams 122 and 133 are in the same rotational position with respect to the shaft 101 and serves to drive the pumps 30C and 30D, respectively, and the cams 132 and 133 are likewise in the same rotational position with respect to the shaft 101 and drive the pumps 30B and 30A, respectively.

The mechanism for forming a driving connection between one of the drive cams on the shaft 101 and the associated pump will now be described in detail with particular reference to FIGS. 3 and 4 of the drawings wherein the mechanism for the driving of pump 30A from the drive cam 133 will be described. The piston rod 163A is guided during the reciprocating motion thereof with the piston 60A by two guide mechanisms cooperating with the shank 165A thereof. First of all, the outer end of the shank 165A has a slot 166A therein providing a pair of spaced apart arms 167A and 168A that are disposed in the guide groove 136 on the cam sleeve 130, the sides of the sleeve 130 defining the guide slot 136 guiding the sides of the shank 165A during the reciprocating motion thereof. There further is provided in the shank 165A a keyhole shaped slot 169A (not shown) like the keyhole shaped slot 169D illustrated to the right in FIG. 1. Passing through the slot 169A is a shank 170A having an enlarged head 171A on one side of the shank 165A. The shank 170A also passes through a flange 28 formed integral with the inner plate 25 and disposed substantially normal thereto and extending inwardly, the flange 28 having an opening therethrough for receiving the shank 170A. A nut 172A threadedly engages the outer end of the shank 170A to mount it upon the flange 28. An enlargement 173A on the shank 170A is disposed within the slot 169A of the arm 165A during the reciprocating movement thereof and the opposed adjacent faces of the flange 28 and the head 171A engage the opposite sides of the shank 165A to impart the guiding action thereto. Accordingly, the cooperation of the shank 170A and the guide groove 133 with the shank 165A serves to guide the piston rod 163A and the associated piston 60A during the reciprocating movement thereof during the operation of the pump 30A.

The flange 164A on the piston rod 163A has a pair of inwardly directed substantially parallel flanges 175A thereon which carry a shaft 176A extending therebetween and suitably secured thereto by lock rings 177A at the opposite ends thereof. Mounted upon the shaft 176A for pivotal movement therewith is an arm 180A extending inwardly therefrom toward the drive shaft 101 and carrying on the outer end thereof a cam follower 181A in the form of a

roller mounted upon the arm 180A. There further is provided a spring 182A under tension which continually urges the arm 180A in a counterclockwise direction as viewed in FIGS. 2 and 4 whereby to move the cam follower 181A into driving engagement with the drive cam 133.

In order to control the position of the arm 180A and the associated cam follower 181A, a control circuit 200 is provided including a control solenoid 210A. In order operatively to mount the solenoid 210A upon the frame, a bracket 190A is suitably secured to the inner surface of the inner plate 25 such as by welding and in turn has connected thereto by means of a screw 191A a U-shaped frame 214A for the solenoid 210A. The solenoid 210A is thus mounted above the associated arm 180A and has the vertical axis thereof disposed generally between the plane defined by the inner surface of the cam 133 and the adjacent surface of the shank 165A. Extending downwardly from the underside of the solenoid 210A is the movable core 215A therefor which carries an outwardly extending lock ring 217A thereon, a spring 216A being disposed between the underside of the U-shaped frame 214A and the lock ring 217A, whereby to urge the core 215A downwardly as viewed in FIG. 3. Formed on the bracket 190A is a laterally extending flange 192A having an opening therethrough that receives a reduced portion providing a control member 218A extending downwardly through an opening in the flange 192A, the lock ring 217A resting upon the upper surface of the flange 192A in the de-energized position of the solenoid 210A. When the solenoid 210A is in the de-energized condition so that the control member 218A extends downwardly to the solid line position illustrated in FIG. 3, it is in position to engage a cam surface 184A on a flange 183A carried by the arm 180A, thereby to hold the cam follower 181A in the retracted position illustrated by dashed lines in FIG. 4 wherein it is out of engagement with the associated drive cam 133. Upon energization of the solenoid 210A, the movable armature 215A thereof is drawn upwardly against the action of the spring 216A thereby to move the control member 218A to the upper dashed line position illustrated in FIG. 3 and out of engagement with the cam surface 184A. This permits the spring 182A to pivot the arm 180A in a counterclockwise direction as viewed in FIG. 4 so as to place the cam follower 181A thereon in alignment with the associated drive cam 133A. Rotation of the drive shaft 101 will now cause engagement between the cam 133 and the cam follower 181A, and due to the shape of the cam surface on the cam 133, the piston 60A will be moved from the dashed line position illustrated in FIG. 4 (the intake position thereof) to the solid line position in FIG. 4 (the exhaust position thereof), thereby to move a predetermined charge or quantity of syrup past the valve member 55A and outwardly through the connection 54A. Continued rotation of the shaft 101 will cause the piston 60A to move from the solid line position illustrated in FIG. 4 to the dashed line position illustrated therein, thereby to draw a new charge of syrup from the connection 44A past the valve member 45A and into the housing 31A.

In order to insure that the cam follower 181A is held in firm contact with the surface of the associated driving cam 133, a spring 195A is connected between a hook 196A on the shank 165A and a stud 197A on the bottom plate 20, the spring 195A being under tension and continually urging the shank 165A and the connected piston 60A toward the right as illustrated in FIG. 4 and into the intake position thereof, and more specifically into the extreme righthand position thereof wherein the flange 164A is in abutting engagement with the positive stop 70A.

It will be understood that the pumps 30B, 30C and 30D are all constructed and all operate in a manner like that described above for the pump 30A. Accordingly, like reference numerals in B, C and D series have been applied to like parts throughout the several figures of the drawings, and in the interest of brevity the description thereof will not be here repeated.

The details of the electrical portion of the control system are best seen in FIG. 5 of the drawings wherein it will be seen that there is provided a pair of input conductors 201 and 202 that are adapted to be connected through suitable switches and fuses to a 115 volt 60 cycle commercial electrical source. The conductors 201 and 202 supply operating potentials for the drive motor 110 and the various control solenoids 210A, 210B, 210C and 210D. As illustrated, the control solenoid 210A includes a coil 211A which in cooperation with the movable core 215A carrying the control member 218A provides an electromagnet, the coil 211A having a pair of connections 212A and 213A therefor. Each of the solenoids 210B, 210C and 210D is constructed and arranged in a like manner, whereby like reference numerals in B, C and D series, respectively, have been applied to like parts.

The operation of the solenoids is controlled by a selector switch 220, the selector switch 220 having four switch arms 221A, 221B, 221C and 221D which are suitably interconnected by a push button mechanism diagrammatically illustrated as at 228 which is of the type wherein one of the push buttons and the associated switch is actuated at all times, the actuation of a non-actuated push button serving to move the actuated switch to the non-actuated position thereof and thereafter to move the associated switch to the actuated position. As illustrated, the switch arm 221A has associated therewith a pair of contacts 222A and 224A between which it is movable and a terminal 225A in electrical connection therewith. The contact 222A is connected by a conductor 226A to the solenoid terminal 212A. The contact 224A is connected by a conductor 227A to the contact 225B associated with the switch arm 221B; and the terminal 225A is connected to the conductor 201. All of the other switch arms 221B, 221C and 221D are constructed and connected in a like manner, whereby like reference numerals in the B, C and D series respectively, have been applied thereto. Finally, the terminal 224D is not connected.

A cycle switch 230 is provided including a movable switch arm 231 having a terminal 232 connected thereto and movable between a pair of switch contacts 233 and 234. The terminal 232 is connected to the input conductor 202; the switch contact 233 is connected to a conductor 235 which also connects with the other output terminals of the various solenoids, such as the output terminal 213A of the solenoid 210A; and the switch contact 234 is connected by a conductor 236 to one terminal of the drive motor 110. The other terminal 111 of the drive motor 110 is connected to the input conductor 201. There further is provided a mechanical connection between the drive motor 110 and the cycle switch 230 (see FIGS. 2 and 4); more specifically, the switch 230 is mounted upon the end plate 12 with the switch arm 231 thereof extending downwardly toward the drive shaft 101 and carrying thereon a roller 237. The roller 237 in turn engages a cam 238 fixedly secured to the drive shaft 101 by means of a set screw 239, the cam 238 serving through contact with the roller 237 to move the switch arm 231 between the switch contacts 233 and 234, the roller 237 being in contact with a recessed portion 238a in the cam 238 at the beginning of a cycle of operation, thereby to place the switch arm 231 against the switch contact 233. After only a small amount of rotation of the shaft 101, the roller 237 moves onto a raised portion 238b of the cam 238, thereby to move the switch arm 231 from the switch contact 233 to the switch contact 234, and to hold the switch arm 231 against the switch contact 234 until the drive shaft 101 has made a complete revolution to bring the recessed portion 238a under the roller 237, it being understood that a spring (not shown) within the switch 230 continually serves the roller 237 against the cam 238.

Finally, there is provided a start switch 240 including a switch arm 241 having a terminal 242 connected thereto and a terminal 243 with which the switch arm

242 can be moved into contact. The terminal 242 is connected to the input conductor 202, and the terminal 243 is connected to the conductor 236.

A typical cycle of operation of the pumping system 10 will now be described with special reference to FIG. 5 of the drawings. Before the application of operating potential to the input conductors 201 and 202, the drive motor 110 is de-energized and the drive shaft 101 is positioned such that the cam portion 238a is disposed beneath the roller 237, thereby to place the cycle switch 230 in a condition such that the switch arm 231 is against the switch contact 233; the selector switch 220 has the push button thereof associated with the switch arm 221A in the depressed or actuated position thereof so that the switch arm 221A is against the contact 222A; and the start switch 240 is open. As a result, all of the solenoids including the solenoids 210A are de-energized, whereby the control member 218A is in the lowermost position thereof and in engagement with the cam surface 184A and holding the arm 180A in a position such that the cam follower 181A is out of contact with the drive cam 133.

Upon the application of operating potential to the input conductors 201 and 202, the solenoid 210A has the coil 211A thereof energized by a circuit including the input conductor 201, the switch arm 221A and the conductor 226C to one terminal 212A of the coil 211A; and from the 213A via the conductor 235, and the switch arm 231 to the other input conductor 202. As a result of energizing the solenoid 210A, the armature 215A thereof moves upwardly carrying the control member 218A therewith so as to move the control member 218A out of engagement with the cam surface 184A on the arm 180A. The arm 180A is now free to pivot under the urging of the spring 182A into the operative or driving position thereof wherein the cam follower 181A is in position to be engaged by the cam 133.

The user next momentarily closes the start switch 240 which serves to energize the motor 110 through a circuit from the input conductor 201 through the motor 110, the conductor 236 and the closed start switch 240 to the other input conductor 202. Shortly after initiation of the operation of the drive motor 110, the drive shaft 102 driven thereby rotates the cam 238 so that the roller 237 of the cycle switch 230 is in engagement with the cam portion 238b, thereby to move the switch arm 231 from the switch contact 233 to the switch contact 234, this serving to de-energize the solenoid 210A and to create a holding circuit for the drive motor 110 after the start switch 240 has been opened, the holding circuit being from the input conductor 201 through the motor 110 the conductor 236 and the switch arm 231 to the input conductor 202. After one revolution of the drive shaft 101, the roller 237 on the cycle switch 230 will come into contact with the cam portion 238a, thereby to move the switch arm 231 from the switch contact 234 to the switch contact 233; this results in de-energization of the drive motor 110 since the start switch 240 is now open.

The pumping system 10 now in condition for the next cycle of operation thereof, the user first punching one of the punch buttons on the selector switch 220 to select the desired flavor of drink, and consequently selecting which of the switch arms 221A, 221B, 221C and 221D is to be moved into the associated lower contact to energize the associated solenoid 210A, 210B, 210C and 210D, respectively. Subsequent application of operating potential to the input conductors 201-202 followed by a closure of the start switch 240 will cause another operation of the pumping system as described above.

From the above it will be seen that there has been provided an improved metering pump which is operable to deliver a predetermined precise quantity of a liquid, such as a flavored syrup, for each cycle of operation of the pump. More specifically, an improved metering pump has been provided having an arm with one end thereof pivotally mounted on the piston of the pump and carrying

a cam follower on the other end thereof for engagement with a drive cam, and a control member operative to position the arm in a retracted position wherein the cam follower is out of engagement with the drive cam or in a driving position wherein the cam follower is in a driving engagement with the cam, whereby upon operation the drive shaft carrying the cam, the pump piston is reciprocated to cause operation of the pump. The pump further includes first resilient means such as a spring to urge the pump piston to the intake position thereof, and a second resilient means such as the spring to urge the arm into the driving position thereof. Preferably an electromagnet is provided to position the control member. Furthermore, a pumping system has been shown incorporating a plurality of the metering pumps therein, a single drive shaft being provided having a plurality of cams and a corresponding plurality of pivoted arms and control members, whereby any one of the plurality of metering pumps can be selectively operated from the single drive shaft. Finally, there has been provided an improved electrical control circuit for the pumping system to cause selective operation of one of the metering pumps.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A metering pump for delivering a predetermined quantity of liquid for each cycle of operation of said pump comprising a frame, a pump housing mounted on said frame and having a reciprocating piston movable between an intake position and an exhaust position, a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly extending arm having one end thereof pivotally mounted on said piston and carrying a cam follower on the other end thereof, and a control member operative to position said arm in a retracted position wherein said cam follower is out of engagement with said cam and in a driving position wherein said cam follower is in driving engagement with said cam, said drive shaft upon rotation thereof reciprocating said piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

2. A metering pump for delivering a predetermined quantity of liquid for each cycle of operation of said pump comprising a frame, a pump housing mounted on said frame and having a reciprocating piston movable between an intake position and an exhaust position, first means resiliently urging said piston toward the intake position thereof, a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly extending arm having one end thereof pivotally mounted on said piston and carrying a cam follower on the other end thereof, second means resiliently urging said arm from a retracted position wherein said cam follower is out of engagement with said cam toward a driving position wherein said cam follower is in driving engagement with said cam, and a control member movable between a first position holding said arm in the retracted position thereof and a second position permitting said second resilient means to move said arm into the driving position thereof, said drive shaft upon rotation thereof reciprocating said piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

3. The metering pump set forth in claim 2, wherein said first means resiliently urging said piston toward the intake position thereof is a first spring interconnecting said piston and said frame, and said second means resiliently urging said arm into the driving position thereof

is a second spring interconnecting said arm and said frame.

4. A metering pump for delivering a predetermined quantity of liquid for each cycle of operation of said pump comprising a frame, a pump housing mounted on said frame and having a reciprocating piston movable between an intake position and an exhaust position, first means resiliently urging said position toward the intake position thereof, a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly extending arm having one end thereof pivotally mounted on said piston and carrying a cam follower on the other end thereof, second means resiliently urging said arm from a retracted position wherein said cam follower is out of engagement with said cam toward a driving position wherein said cam follower is in driving engagement with said cam, a control member movable between a first position holding said arm in the retracted position thereof and a second position permitting said second resilient means to move said arm into the driving position thereof, and an electromagnet coupled to said control member for moving said control member between the first and second positions thereof, said drive shaft upon rotation thereof reciprocating said piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

5. A metering pump for delivering a predetermined quantity of liquid for each cycle of operation of said pump comprising a frame, a pump housing mounted on said frame and having a reciprocating piston movable between an intake position and an exhaust position, a piston rod fixedly connected to said piston and journaled in said frame for driving and guiding said piston, a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly extending arm having one end thereof pivotally mounted on said piston rod and carrying a cam follower on the other end thereof, and a control member operative to position said arm in a retracted position wherein said cam follower is out of engagement with said cam and in a driving position wherein said cam follower is in driving engagement with said cam, said drive shaft upon rotation thereof reciprocating said piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

6. Drive structure for a reciprocating pump including a cylinder and a reciprocating piston therefor movable between an intake position and an exhaust position to deliver a predetermined quantity of liquid from the pump for each cycle of operation thereof, said drive structure comprising a frame fixedly mounted with respect to the pump cylinder, a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly extending arm having one end thereof pivotally mounted on the piston and carrying a cam follower on the other end thereof, and a control member operative to position said arm in a retracted position wherein said cam follower is out of engagement with said cam and in a driving position wherein said cam follower is in driving engagement with said cam, said drive shaft upon rotation thereof reciprocating the piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

7. Drive structure for a reciprocating pump including a cylinder and a reciprocating piston therefor movable between an intake position and an exhaust position to deliver a predetermined quantity of liquid from the pump for each cycle of operation thereof, said drive structure comprising a frame fixedly mounted with respect to the pump cylinder, first means resiliently urging the piston toward the intake position thereof, a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly

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extending arm having one end thereof pivotally mounted on the piston and carrying a cam follower on the other end thereof, second means resiliently urging said arm from a retracted position wherein said cam follower is out of engagement with said cam toward a driving position wherein said cam follower is in driving engagement with said cam, and a control member movable between a first position holding said arm in the retracted position thereof and a second position permitting said second resilient means to move said arm into the driving position thereof, said drive shaft upon rotation thereof reciprocating the piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

8. The drive structure set forth in claim 7, wherein said first means resiliently urging the piston toward the intake position thereof is a first spring interconnecting the piston and said frame, and said second means resiliently urging said arm into the driving position thereof is a second spring interconnecting said arm and said frame.

9. Drive structure for a reciprocating pump including a cylinder and a reciprocating piston therefor movable between an intake position and an exhaust position to deliver a predetermined quantity of liquid from the pump for each cycle of operation thereof, said drive structure comprising a frame fixedly mounted with respect to the pump cylinder, first means resiliently urging the piston toward the intake position thereof, a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly extending arm having one end thereof pivotally mounted on the piston and carrying a cam follower on the other end thereof, second means resiliently urging said arm from a retracted position wherein said cam follower is out of engagement with said cam toward a driving position wherein said cam follower is in driving engagement with said cam, a control member movable between a first position holding said arm in the retracted position thereof and a second position permitting said second resilient means to move said arm into the driving position thereof, and an electromagnet coupled to said control member for moving said control member between the first and second positions thereof, said drive shaft upon rotation thereof reciprocating the piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

10. Drive structure for a reciprocating pump including a cylinder and a reciprocating piston therefor movable between an intake position and an exhaust position to deliver a predetermined quantity of liquid from the pump for each cycle of operation thereof, said drive structure comprising a frame fixedly mounted with respect to the pump cylinder, a piston rod fixedly connected to the piston and journaled in said frame for driving and guiding said piston a drive shaft journaled in said frame for rotation with respect thereto, a cam mounted on said drive shaft, a single rectilinearly extending arm having one end thereof pivotally mounted on said piston rod and carrying a cam follower on the other end thereof, and a control member operative to position said arm in a retracted position wherein said cam follower is out of engagement with said cam and in a driving position wherein said cam follower is in driving engagement with said cam, said drive shaft upon rotation thereof reciprocating the piston between the intake and exhaust positions thereof when said arm is in the driving position thereof.

11. A pumping system for delivering a predetermined quantity of one of a plurality of liquids from a supply thereof for each cycle of operation of said system comprising a frame, a plurality of pumps mounted on said frame and each including a reciprocating piston movable between an intake position and an exhaust position, a drive shaft journaled in said frame for rotation with respect thereto, a plurality of cams mounted on said drive shaft, a plurality of single rectilinearly extending arms

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each having one end thereof pivotally mounted on one of said pistons and each carrying a cam follower on the outer end thereof, and a plurality of control members operatively associated respectively with said arms and each operative to position the associated arm in a retracted position wherein the associated cam follower is out of engagement with the associated cam and in a driving position wherein the associated cam follower is in driving engagement with the associated cam, said driving shaft upon rotation thereof reciprocating the one of said pistons between the intake and exhaust positions thereof which has the associated arm in the driving position thereof.

12. A pumping system for delivering a predetermined quantity of one of a plurality of liquids from a supply thereof for each cycle of operation of said system comprising a frame, a plurality of pumps mounted on said frame and each including a reciprocating piston movable between an intake position and an exhaust position, first means resiliently urging each of said pistons toward the intake position thereof, a drive shaft journaled in said frame for rotation with respect thereto, a plurality of cams mounted on said drive shaft, a plurality of single rectilinearly extending arms each having one end thereof pivotally mounted on one of said pistons and each carrying a cam follower on the other end thereof, second means resiliently urging each of said arms from a retracted position wherein the associated cam follower is out of engagement with the associated cam toward a driving position wherein the associated cam follower is in driving engagement with the associated cam, and a plurality of control members each movable between a first position holding one of said arms in the retracted position thereof and a second position permitting said second resilient means to move said one associated arm into the driving position thereof, said driving shaft upon rotation thereof reciprocating the one of said pistons between the intake and exhaust positions thereof which has the associated arm in the driving position thereof.

13. The pumping system set forth in claim 12, wherein said first means resiliently urging said pistons toward the intake position thereof is a corresponding plurality of first springs respectively interconnecting said pistons and said frame, and said second means resiliently urging said arms into the driving position thereof is a plurality of second springs respectively interconnecting said arms and said frame.

14. A pumping system for delivering a predetermined quantity of one of a plurality of liquids from a supply thereof for each cycle of operation of said system comprising a frame, a plurality of pumps mounted on said frame and each including a reciprocating piston movable between an intake position and an exhaust position, first means resiliently urging each of said pistons toward the intake position thereof, a drive shaft journaled in said frame for rotation with respect thereto, a plurality of cams mounted on said drive shaft, a plurality of single rectilinearly extending arms each having one end thereof pivotally mounted on one of said pistons and each carrying a cam follower on the other end thereof, second means resiliently urging each of said arms from a retracted position wherein the associated cam follower is out of engagement with the associated cam toward a driving position wherein the associated cam follower is in driving engagement with the associated cam, a plurality of control members each movable between a first position holding one of said arms in the retracted position thereof and a second position permitting said second resilient means to move said one associated arm into the driving position thereof, and a plurality of electromagnets respectively coupled to said control means for moving the associated control member between the first and second positions thereof, said driving shaft upon rotation thereof reciprocating the one of said pistons between the intake and exhaust positions thereof which has the associated arm in the driving position thereof.

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15. A pumping system for delivering a predetermined quantity of one of a plurality of liquids from a supply thereof for each cycle of operation of said system comprising a frame, a plurality of pumps mounted on said frame and each including a reciprocating piston movable between an intake position and an exhaust position, a plurality of piston rods respectively fixedly connected to an associated one of said pistons and each journaled in said frame for driving and guiding the associated piston, a drive shaft journaled in said frame for rotation with respect thereto, a plurality of cams mounted on said drive shaft, a plurality of single rectilinearly extending arms each having one end thereof pivotally mounted on one of said piston rods and each carrying a cam follower on the other end thereof, and a plurality of control members operatively associated respectively with said arms and each operative to position the associated arm in a retracted position wherein the associated cam follower is out of engagement with the associated cam and in a driving position wherein the associated cam follower is in driving engagement with the associated cam, said driving shaft upon rotation thereof reciprocating the one of said pistons between the intake and exhaust positions thereof which has the associated arm in the driving position thereof.

16. A pumping system for delivering a predetermined quantity of one of a plurality of liquids from a supply thereof for each cycle of operation of said system comprising a frame, a plurality of pumps mounted on said frame and each including a reciprocating piston movable between an intake position and an exhaust position, a drive shaft journaled in said frame for rotation with respect thereto, a drive motor mounted on said frame and operatively connected to said drive shaft for causing rotation thereof, a plurality of cams mounted on said drive shaft, a plurality of single rectilinearly extending arms each having one end thereof pivotally mounted on one of said pistons and each carrying a cam follower on the other end thereof, a plurality of control members operatively associated with said arms and each movable between a first position holding the associated arm in a retracted position wherein said cam follower is out of engagement with the associated cam and a second position positioning the associated arm in a driving position wherein the associated cam follower is in driving engagement with the associated cam, a plurality of electromagnets operatively coupled respectively to said control members for moving the associated control member between the first and second positions thereof, and a control circuit interconnecting said drive motor and said electromagnets for selectively actuating one of said electromagnets and

operating said drive motor to cause rotation of said drive shaft thereby reciprocating the piston associated with the energized electromagnet between the intake and exhaust positions thereof.

17. A pumping system for delivering a predetermined quantity of one of a plurality of liquids from a supply thereof for each cycle of operation of said system comprising a frame, a plurality of pumps mounted on said frame and each including a reciprocating piston movable between an intake position and an exhaust position, a drive shaft journaled in said frame for rotation with respect thereto, a drive motor mounted on said frame and operatively connected to said drive shaft for causing rotation thereof, a plurality of first cams mounted on said drive shaft, a plurality of single rectilinearly extending arms each having one end thereof pivotally mounted on one of said pistons and each carrying a cam follower on the other end thereof, a plurality of control members operatively associated with said arms and each movable between a first position holding the associated arm in a retracted position wherein said cam follower is out of engagement with the associated first cam and a second position positioning the associated arm in a driving position wherein the associated cam follower is in driving engagement with the associated first cam, a plurality of electromagnets operatively coupled respectively to said control members for moving the associated control member between the first and second positions thereof, a second cam mounted on said drive shaft, a control switch for said drive motor mounted adjacent to said second cam, and a control circuit interconnecting said drive motor and said control switch and said electromagnets for selectively actuating one of said electromagnets and to energize said drive motor to cause rotation of said drive shaft thereby reciprocating the piston associated with the energized electromagnet between the intake and exhaust positions thereof and thereafter operating said control switch to de-energize said drive motor.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,363,571

January 16, 1968

Donald S. Reynolds et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 48, for "poistive" read -- positive --;
column 10, line 8, for "position" read -- piston --.

Signed and sealed this 11th day of March 1969.

SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents