March 24, 1936. A. R. THOMPSON 2,034,964

FLUID APPORTIONING AND DISPENSING DEVICE

Filed Oct. 12, 1933 5 Sheets-Sheet 1

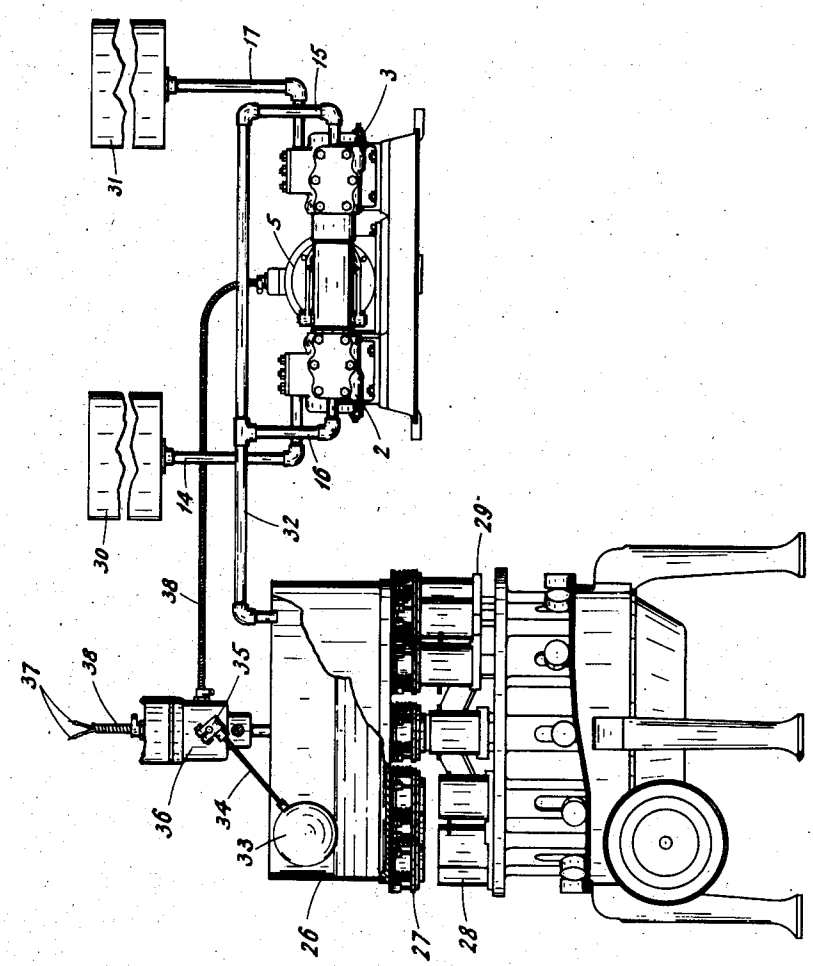


Fig. 1.

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FLUID APPORTIONING AND DISPENSING DEVICE

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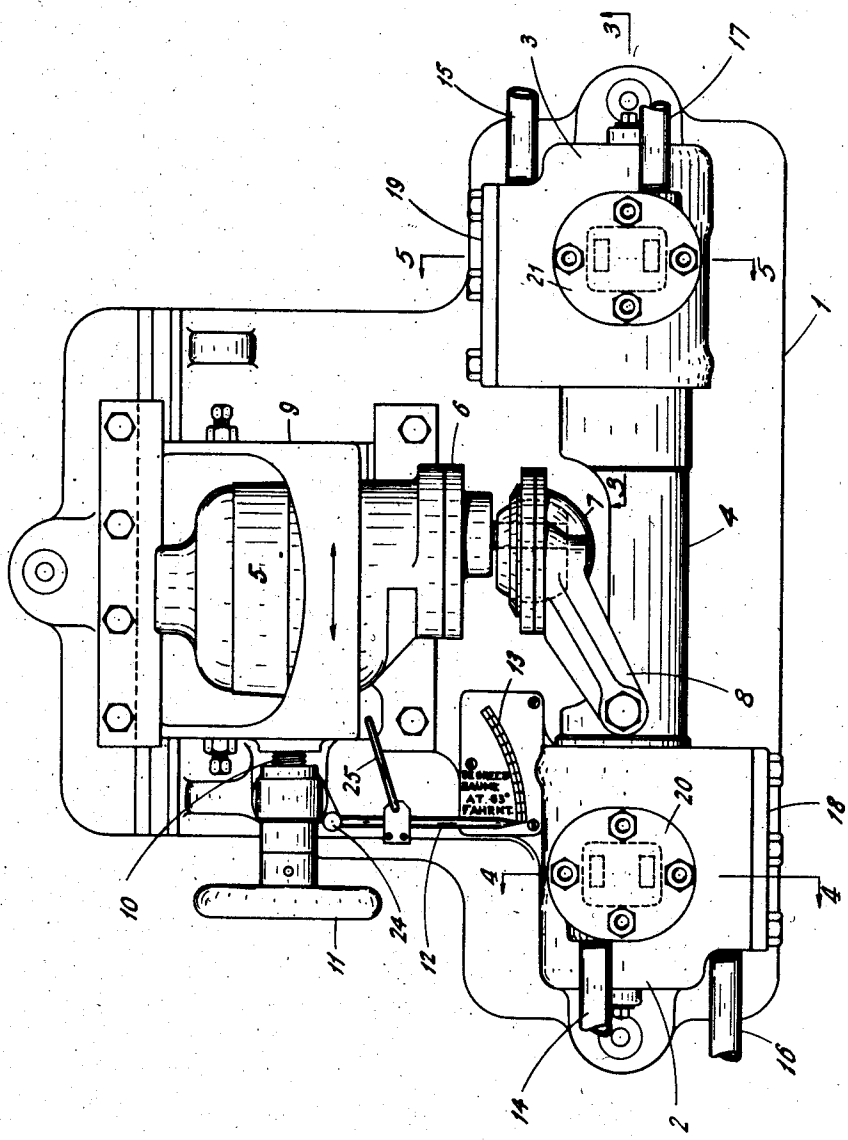


Fig. 2.

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FLUID APPORTIONING AND DISPENSING DEVICE

Filed Oct. 12, 1933 5 Sheets-Sheet 3

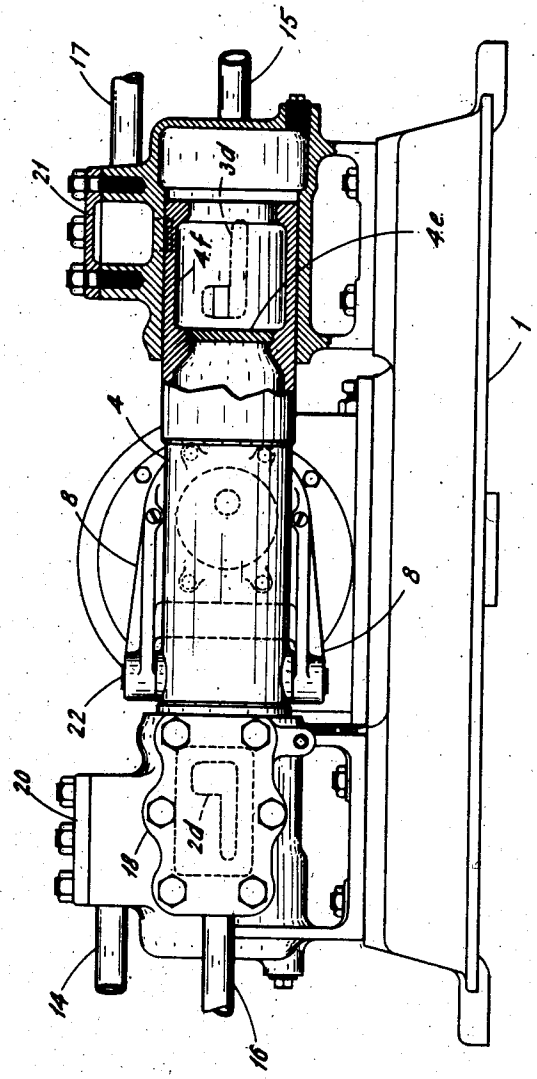


Fig. 3.

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FLUID APPORTIONING AND DISPENSING DEVICE

Filed Oct. 12, 1933 5 Sheets-Sheet 4

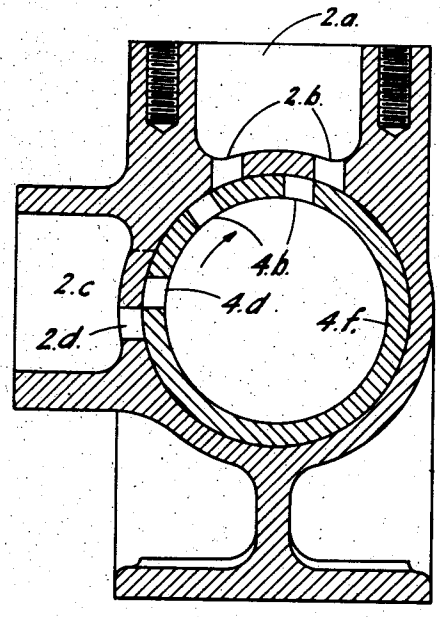


Fig_4.

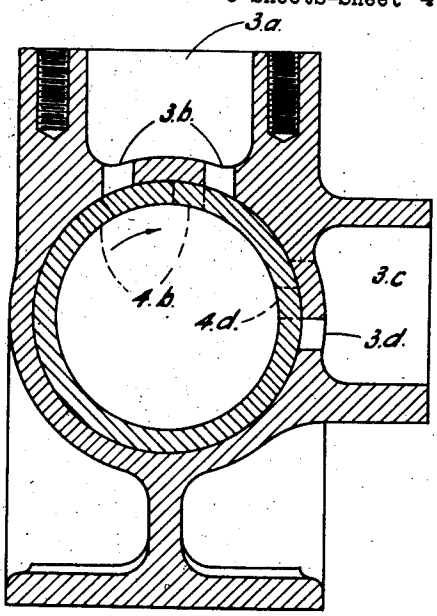


Fig_5.

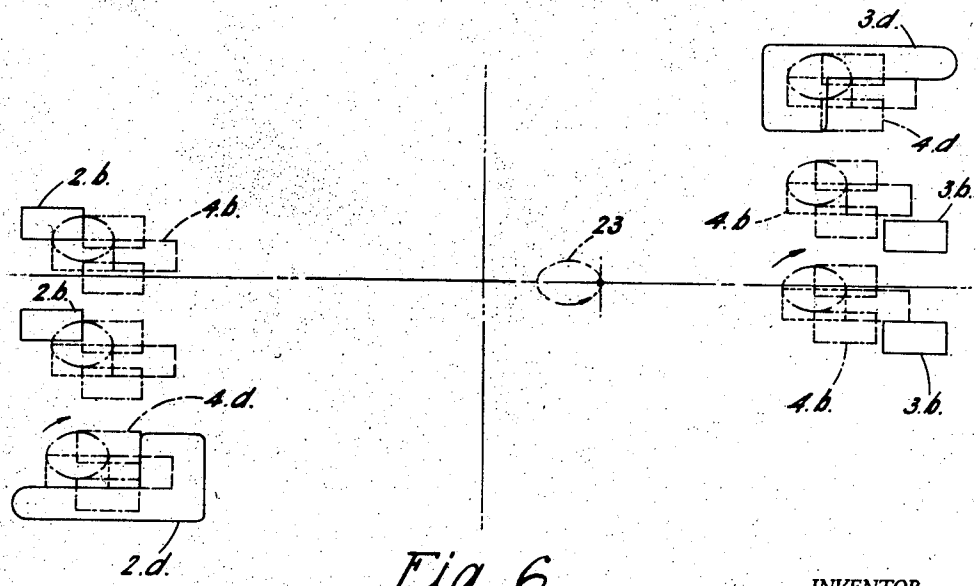


Fig_6.

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FLUID APPORTIONING AND DISPENSING DEVICE

Filed Oct. 12, 1933 5 Sheets-Sheet 5

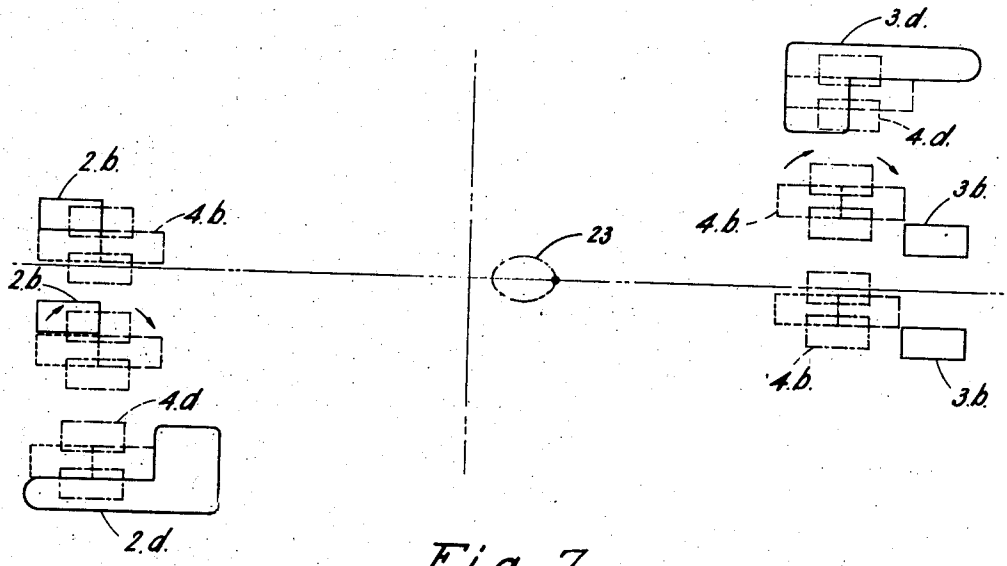


Fig. 7.

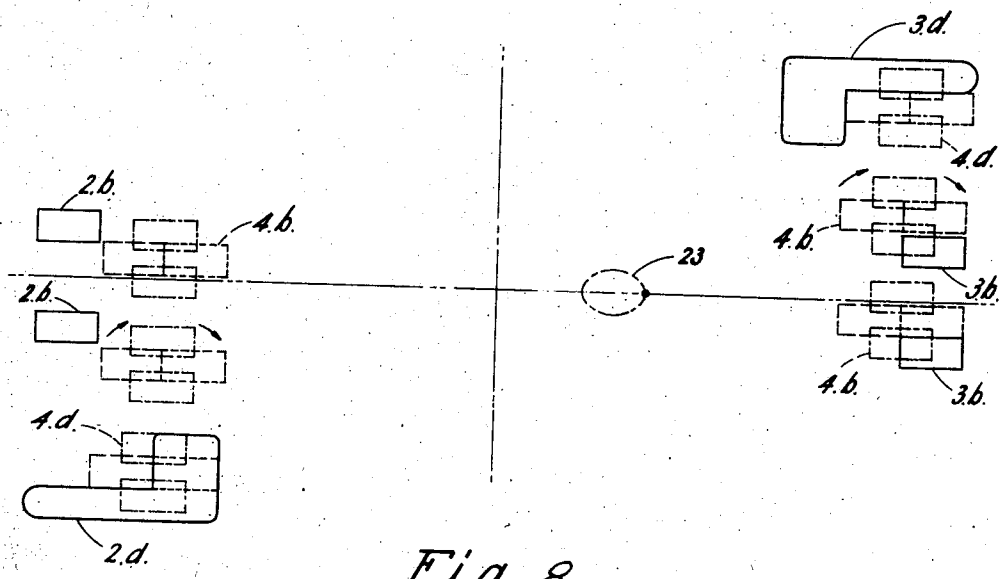


Fig. 8.

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Patented Mar. 24, 1936

2,034,964

UNITED STATES PATENT OFFICE

2,034,964

FLUID APPORTIONING AND DISPENSING DEVICE

Albert R. Thompson, San Jose, Calif., assignor to Food Machinery Corporation, San Jose, Calif., a corporation of Delaware

Application October 12, 1933, Serial No. 693,360

14 Claims. (Cl. 221—96)

This invention relates in part to fluid apportioning and dispensing devices and in part to an improved syrup supply and control system—an adjunct to the syruping machines used in canneries.

Commercial canned fruit of the better grades is packed in syrup consisting of sugar and water, several grades of syrup being used according to the quality of the product being packed—the grades (referred to in canning parlance as degrees) of syrup differing in sugar content.

Inasmuch as the syruping operation (putting syrup into the cans) is performed on the same machines regardless of the grade of fruit being packed, and inasmuch as the pack is apt to vary from day to day or even from hour to hour, it is necessary to be able to shift quickly from one grade (degree) of syrup to another. Heretofore this has been accomplished through the provision of several syrup supply tanks (located usually on the floor above the syruping machines) and a net-work of pipes interconnecting the syrup supply tanks with the syruping machines.

Such an arrangement, in addition to entailing a costly installation, is deficient in that it fails to take into account differences in sugar content of the fruit. For a given quality of product it is often practicable to use syrup of a lesser sugar content if the fruit is quite ripe than in the case of under-ripe fruit; and although the differences in the percentage of sugar necessary in the syrup may be small it is, nevertheless, possible to effect very substantial aggregate savings on, say, a season's pack, amounting to many thousands of cases of fruit and involving hundreds of tons of sugar. With the old syrup supply system to which reference has been made, it was not practicable to effect small variations from time to time in the sugar content of the syrup conformably to momentary differences in the ripeness of the fruit and, for that reason, the savings possible of being effected in that way were not susceptible of realization in practice.

A further deficiency in the old system of syrup supply and distribution resides in the fact that it is necessary to mix and maintain supplies of syrup of some five or six different degrees, and it has usually required the entire time of one competent man throughout the packing season to maintain the syrup supplies in the several supply tanks.

Still another defect in the old system is that it lends itself very readily to the mistake of turning on syrup of the wrong degree at the syruping machines. While this is not apt to happen if the machine operator is on the alert, nevertheless it does happen only too frequently in actual practice.

The primary object of the present invention is to provide a more simple and less expensive arrangement for supplying syrup to the syruping machines and, at the same time, one which will facilitate the making of small variations in the sugar content of the syrup to compensate for variations in the sugar content of the fruit. This has been accomplished by substituting for the several syrup supply tanks of the prior practice a single supply tank containing syrup of the maximum sugar content ever required and providing a novel device (usually one for each syruping machine) which will be referred to hereinafter as an apportioning and dispensing device—the function of which is to receive syrup from the supply tank and dispense it to the syruping machine or machines, as the case may be, together with whatever proportion of water may be needed to reduce the syrup to the prescribed degree of saturation.

Another object is to reduce the risk of error with respect to the matter of supplying the correct degree of syrup in each instance.

A further object is to devise a reliable and accurate apportioning and dispensing device capable of delivering syrup and water in the required proportions to the syruping machines and capable of quick readjustment by the operator to change from time to time the proportions of the syrup and water.

A novel apportioning and dispensing device which is regarded as being best adapted to the purpose is illustrated in the accompanying drawings and will be described in detail hereinafter; but it will be apparent to those skilled in the art, and will be made further evident as the detailed description progresses, that there are numerous alternatives and modifications within the scope and purview of the broad inventive concept.

Neither the device to be described nor the numerous alternative devices and modifications embraced within the scope of this invention are limited in their utility to the apportioning and dispensing of syrup and water. They are equally useful, as will be evident, wherever there is occasion to apportion and dispense two or more fluid constituents, which in their nature are susceptible of being handled by a device of this character.

Referring to the drawings:

Figure 1 is a front elevation of a can syruping machine illustrating the application thereto

of the apportioning and dispensing device in accordance with the present invention.

Fig. 2 is a plan view of the apportioning and dispensing device.

Fig. 3 is a front elevational view of the apportioning and dispensing device, partially in cross section—the sectional portion being taken along the line 3—3 of Fig. 2.

Fig. 4 is an enlarged cross sectional view through one of the cylinder blocks, taken along the line 4—4 of Fig. 2.

Fig. 5 is a similar enlarged cross sectional view through the other cylinder block, taken along the line 5—5 of Fig. 2.

Fig. 6 is a development diagram of the valve ports in the cylinder blocks and piston sleeves, with the device adjusted to deliver equal quantities of water and syrup to the syruping machines.

Fig. 7 is a development diagram similar in every respect to that of Fig. 6, except that it illustrates the various relative positions of the valve ports with the device adjusted to deliver either water alone or syrup alone to the syruping machines, depending upon which of the two cylinders of the device is considered to be handling syrup. For purposes of description it will be assumed that with the valves adjusted as shown in Fig. 7 the device is delivering undiluted syrup alone, and no water.

Fig. 8 is a development diagram like those of Figs. 6 and 7, but with the valves adjusted to the extreme opposite position as compared with the valve setting of Fig. 7.

The device comprises a base plate 1 on which are mounted two opposed cylinder blocks 2 and 3 respectively, a double ended plunger 4 the opposite ends of which are disposed in the bores of cylinder blocks 2 and 3, respectively, an electric motor 5 having an integral speed reduction gear head 6, a spherical eccentric 7 mounted on the drive shaft of the motor, a bifurcated pitman 8 interconnecting the plunger 4 with the spherical eccentric 7, a slidable carriage 9 upon which the motor 5 is mounted, an adjusting screw 10 with a hand wheel 11, an indicator 12, a calibrated scale 13, intake pipes 14 and 17, discharge pipes 15 and 16, and cover plates 18, 19, 20 and 21.

For purposes of description the intake pipe 14 connecting with cylinder block 2 will be assumed to be connected to a syrup supply tank from which syrup flows by gravity through pipe 14 to the apportioning and dispensing device. It will further be assumed that the intake pipe 17 to cylinder block 3 is connected to a source of water supply under suitable pressure, and that the discharge pipes 15 and 16 are connected to the tank of a syruping machine, pipe 16 delivering syrup thereto and pipe 15 delivering water.

The two cylinder blocks 2 and 3 are identical, and their internal construction is clearly illustrated in the cross sectional portion of Fig. 3 together with sectional views 4 and 5. The cylinder blocks are cast with intake chambers 2*a*, 3*a*, to which the intake pipes are connected, and which are in communication with the interior through the rectangular intake ports 2*b*, 3*b*. Similarly, each cylinder block is cast with a discharge chamber 2*c*, 3*c* to which the discharge pipes are connected and which are in communication with the interior of the block through L-shaped discharge ports 2*d*, 3*d*.

The cylinder blocks are bored to receive the end portions, respectively, of the plunger 4, which end portions function as pistons, the ends of which are defined by the surfaces 4*e*. Each end of the plunger is cored cylindrically, as a consequence of which the extreme end portions of the plunger beyond the surfaces 4*e* form, respectively, annular skirts or sleeves 4*f*. The plungers are, of course, ground cylindrically to a close running fit in the bores of the cylinder blocks. In each of the sleeves 4*f* there are two rectangular intake ports 4*b* and rectangular discharge ports 4*d*. The intake and discharge ports are shown in all figures of the drawings but are illustrated to best advantage in the valve development diagrams of Figs. 6, 7, and 8, wherein the cylindrical surfaces of the cylinder bores and sleeves are shown superimposed and projected onto a flat surface. These development diagrams will be dealt with following completion of the detailed description with respect to the structural design of the device.

To enable the required operation of the valve ports it is necessary to provide means operable not only to reciprocate the plunger 4 longitudinally, but also arcuately about its longitudinal axis. The means here provided for reciprocating the plunger both longitudinally and arcuately comprises the driving motor 5, the spherical eccentric 7 which is driven by the motor 5 through the reduction gear 6, and the bifurcated pitman 8 which is bored spherically at one end to engage the spherical eccentric 7 and which is pivotally connected to the plunger 4 by means of a pin 22. The motion transmitted to the cylindrical surface of plunger 4 may be compared with the movement of a point traversing an elliptical path projected upon a cylindrical surface. Such a path projected in turn upon a flat surface is illustrated in each of the development diagrams of Figs. 6, 7 and 8 and designated by reference numeral 23.

If it were desired to use the device solely for dispensing fluids in an invariable fixed proportion, the motor 5 could be attached stationarily to the base plate, but inasmuch as one of the functions of the device, when used as an auxiliary to a syruping machine, is to enable quick changes in the proportions of syrup and water, it is necessary to make some provision for effecting such adjustments and this has been accomplished by mounting the motor on carriage 9 which, in turn, is mounted slideably on the base plate 1,—the directions of movement of the carriage 9 being indicated by the double headed arrow, Fig. 2. The adjustment is in a plane parallel to the direction of longitudinal reciprocation of the plunger. The carriage 9, while slideably secured to the base plate, is adjustably movable by means of the adjusting screw 10 to which is attached the hand wheel 11, upon operation of which the entire motor assembly, together with the pitman and plunger, are moved in a direction depending upon the direction of rotation of the hand wheel. The manner in which these adjustments bring about variations in the apportionment of fluids dispensed will be explained presently, in connection with the development diagrams of Figs. 6, 7 and 8. Suffice it to say for the moment, that the operator of the syruping machine adjusts the device to deliver syrup and water in the proper proportions by rotating the hand wheel 11 in one direction or the other until the pointed end of the indicator 12 is brought into registration with the proper graduation on the calibrated scale 13, the scale readings of which indicate directly the resulting degree of syrup. It is to be understood that "degree" is the term used

in the fruit canning industry to designate the grade of syrup according to sugar content. The indicator 12 is pivoted at a fixed point 24 and is connected through a link 25 to the motor carriage 9, and, as will be evident, the point of the indicator moves backward and forward over the scale in conformity with the movements of the motor assembly.

In each of the development diagrams, Figs. 6, 7 and 8, the intake and discharge ports in the cylinder blocks are shown in full lines, while the complementary intake and discharge ports in the sleeves 4*f* are shown in dot and dash lines. In each of the three diagrams the moving ports, which is to say the ports in the sleeves 4*f*, are shown in four of the positions which they occupy during a complete cycle of the plunger. It will be remembered that the moving ports traverse, as previously stated, an eliptical path projected on a cylindrical surface,—which path corresponds to that designated by reference numeral 23 on each of the development diagrams. While the moving ports are illustrated each in four cyclical positions, it is to be understood that each of them passes consequently through an infinite number of positions in traversing its eliptical path during the course of each cycle.

The diagram of Fig. 6 illustrates the relative positions and movements of the ports at which may be termed the mid-position adjustment, by which is meant the position of the motor assembly wherein the opposite ends of the plunger project equally into the cylinders at mid-stroke. In this position the discharges from the two cylinders are equal, which is to say that equal quantities of syrup and water are delivered to the syruping machine by the apportioning and dispensing device. The direction of travel of the moving ports is indicated by appropriate arrows on the diagrams.

With respect to cylinder block 2, it is apparent that the intake occurs when the plunger is moving to the right, and from Fig. 6 it will be evident that the intake ports are in registration only during a portion of the intake stroke and are not in registration at all during any part of the discharge stroke. The discharge ports come into registration during the latter part of the intake stroke, but only after the intake ports have closed and the cylinder is completely filled. The discharge ports remain in registration during the entire discharge stroke, but close before the opening of the intake ports. Obviously, there can be no flow-back to the cylinder through the discharge ports since at no time while the discharge ports are in registration is there any unoccupied space in the cylinder into which fluid could flow. In the mid-position setting according to Fig. 6 the cycle of operations of the valves in the right hand cylinder are exactly the same as in the left hand cylinder, except that they are 180 degrees out of phase,—the intake stroke occurring in one cylinder during the discharge stroke in the other, and vice versa.

Fig. 7 illustrates the valve action in the two cylinders when the motor assembly is adjusted to its extreme left hand position from the point of view of the observer,—the relative positions of the motor assembly with respect to the cylinders being indicated on the development diagrams by the positions of the elliptic path 23 with respect to the vertical center line.

Having assumed that cylinder 2 is connected to the syrup supply tank and cylinder 3 to a source of water supply, the valve adjustment of Fig. 7 will result in delivering syrup but no water, because the intake ports and discharge ports at the left both come into registration during each cycle but the intake ports at the right do not come into registration at all during the cycle, although the discharge ports do come into registration. That being the case, no water enters cylinder 3 and, of course, none can be discharged; and it follows that syrup of maximum sugar content will be delivered to the syruping machine.

In Fig. 8 the extreme opposite adjustment of the valves is illustrated, and in this case water alone is delivered to the syruping machine, since the intake ports at the left do not come into registration during any part of the cycle.

There are, of course, an infinite number of possible intermediate valve settings between the extremes illustrated by Fig. 7 and 8, of which Fig. 6 is but one, and for every such setting a different ratio of syrup to water is dispensed. In all of the other intermediate settings,—that is, settings lying between those of Figs. 6 and 7 and settings lying between those of Figs. 6 and 8, the valve port layout is such that both intake and discharge ports are open during the suction stroke—but not at the same time. In those settings syrup or water, as the case may be, is drawn into the cylinder partly from the intake pipe and partly from the discharge pipe. Hence the quantity of fluid delivered by each cylinder per cycle is equal to the displacement volume per cylinder less the amount drawn back into the cylinder from the discharge pipe during the suction stroke, which, manifestly is the quantity flowing into the cylinder from the intake pipe during the suction stroke. Another way of describing this action is to compare it with that of a force pump having two intake valves which open consecutively during each intake stroke of the piston, but which are never open at the same time during an intake stroke. Obviously the quantitative ratio of fluids taken into the cylinder through the respective intake valves per cycle of operation would depend upon the relative piston displacements during the open periods. That is precisely what occurs in the present case, but the operation may be a little obscured by the fact that one of the intake valves functions also as a discharge valve.

It so happens that two identical intake ports have been provided in this particular case but this is mere duplication, resulting from the fact that the desired area was better obtainable with two duplicate intake ports than with one of twice the area. This is due in the instant case to the shortness of the stroke.

No rule or formula for determining the valve layout, applicable to all cases where the bore and stroke is known, has been developed. In designing the apportioning and dispensing device herein described the positions of the valve parts and their movements were determined by trial and error, so to speak. The method of procedure is arbitrarily to select a bore and stroke which is thought convenient together with an angle of arcuate reciprocation—which three factors determine the elliptical path (which, let it be noted, is not necessarily geometrically elliptical). The path being tentatively determined, proposed cylinder parts are laid out on the drafting board and prospective moving parts are laid out on tracing paper. The latter being superimposed upon the cylinder part layout on the drafting board and moved through the tentative path, the action for all positions of adjustment is

rendered visible and necessary modifications and connections can be noted. Within obvious limits the bore and stroke, as well as the angle of arcuate reciprocation and the area, from and location of parts, are all factors amenable to variation and it is certain that any competent machine designer can follow the foregoing method of procedure and arrive at a correct layout without exercising anything more than common engineering intelligence.

So far as the application of the present device to syrup machine service is concerned there will probably never be any occasion to utilize either more or less than two cylinders per device, since there are only two constituent fluids, namely, syrup and water, to be dispensed; but it will be apparent that the utility of this device is not limited to syruping machine service, and that any number of cylinders could be employed conformably to the number of different fluids to be apportioned and dispensed. Of course that would require appropriate changes in the design, but the underlying principles would still remain. Again it will be apparent that each cylinder dispenses a uniform quantity of fluid per cycle of operation, which quantity is readily variable by shifting the plunger path within the cylinder. A device of this character with but one cylinder would, obviously, have utility as a fluid dispensing and necessary device.

While the particular design of apportioning and dispensing device illustrated and described, having a single plunger and opposed cylinders together with valves of the sliding sleeve type, is considered ideal, none of those features are inherently vital and indispensable. There are many practicable alternative arrangements within the scope and purview of the invention which it would serve no useful purpose to illustrate, but which are intended to be embraced within the terms of the appended claims.

In applying the herein-described device or other apportioning and dispensing device within the scope of this invention to syruping machine service or like situations wherein the locus of delivery of the constituent fluids includes a tank, such as the tank of a syruping machine which, in the absence of preventive measures, may be overflowed, it is desirable to provide some automatic means for starting and stopping the device responsively to the level of the delivered fluid. This can be accomplished most advantageously by including in the motor circuit a switch, preferably float-operated, which will open its circuit when the delivered fluid has risen to a predetermined level and close the circuit when the level has receded to another predetermined elevation.

Such an arrangement is illustrated in Figure 1 wherein the application of the dispensing device to a can syruping machine is shown. The syruping machine may be of conventional construction including the usual rotary tank or reservoir 26 provided with valves 27 in its bottom through which the syrup is admitted to cans 28 therebeneath as the latter are pressed against the undersides of the valves by the travelling can carriers 29.

The dispensing device is illustrated as having its intake pipes 14 and 17 connected with separate sources of liquid supply 30 and 31, the former of which may be concentrated syrup and the latter water. The discharge pipes 15 and 16 are connected to a common delivery pipe 32 which discharges into the tank 26 of the syruper. A float 33 is disposed within the tank 26 and has a lever arm 34 secured to the operating arm 35 of an electric switch 36 interposed in the supply wires 37 leading to the motor 5 through flexible conduits 38, the arrangement being such that the rise of syrup in the tank 26 to a predetermined level actuates the float to open the switch 36, and lowering of the liquid level below a predetermined point causes the float to close the switch. The operation of the dispensing device is thus controlled to maintain a constant level of syrup in the syruper tank 26.

In the subjoined claims there are a few instances of terminology not appearing hereinbefore in this specification and which for the sake of greater clarity it is thought desirable to apply to the disclosure at this point. One of these instances is the use of the term "crank member" which applies to the spherical eccentric 7. This eccentric performs the function of a crank and the term "crank member" has been selected for use in some of the broader claims because it seems inherently better adapted to signify generically the several mechanical equivalents of an eccentric or crank. The term "displacement member" refers to the piston. It is not intended by the use of this term in certain claims to restrict the range of equivalents of the term "piston". The term "cylinder chamber" obviously refers to the cylindrical cavity in each of the cylinder blocks in which the pistons and sleeves are slidably disposed. It is thought to make for greater clarity to define these chambers as "cylinders"—which, obviously, is the most convenient geometrical form—but it should be borne in mind that there is no inherent necessity that these chambers be geometrically cylindrical and the term should therefore be interpreted in its secondary sense.

What is claimed is:

1. A fluid dispensing device comprising a cylinder block having a cylinder chamber and intake and discharge ports communicating with said chamber, a piston arranged to reciprocate in said chamber, means for imparting to said piston a reciprocating motion consisting of intake and discharge strokes, a movable valve member operable to open and close said ports in timed relation to the reciprocating motion of said piston, means for actuating said member in timed relation to the reciprocating motion of said piston, and means for adjusting said member with respect to said ports for enabling alteration at will of the timing of the opening and closing of said ports to the end that the quantity of discharge of said device per cycle of operation of said piston is rendered variable.

2. A fluid dispensing device comprising a cylinder block having a cylinder chamber together with an intake port and a discharge port communicating with said chamber, a piston disposed within said chamber, means for imparting a reciprocatory motion to said piston, a valve member operable to open and close said ports in timed relation to the reciprocatory movements of said piston, means for actuating said valve member, and means operable to alter at will the timed relation between the movements of said piston and the opening and closing of said ports whereby to vary the quantity of fluid discharged per cycle of operation of said piston.

3. A fluid dispensing device comprising a cylinder block having a cylinder chamber together with an intake port and a discharge port communicating with said chamber, a piston disposed within said chamber, means for imparting a re-

ciprocating motion to said piston, a valve sleeve within said chamber operable to open and close said ports in timed relation to the reciprocatory movements of said piston, means for actuating said valve sleeve, and means operable to alter at will the timed relation between the movements of said piston and the opening and closing of said ports whereby to vary the quantity of fluid discharged per cycle of operation of said piston.

4. A fluid dispensing device comprising a cylinder block having a cylinder chamber together with an intake port and a discharge port communicating with said chamber, a piston disposed within said chamber, means for reciprocating said piston cyclically, a slideable valve member disposed within said chamber, said valve member being connected to and movable with said piston and operable to cover and uncover said intake and discharge ports cyclically in proper sequence and in timed relation with the reciprocating movement of said piston, and means operable to adjustably move said sleeve and thereby alter at will the timed relation between the movements of said piston and the opening and closing of said ports whereby to vary the quantity of fluid discharged per cycle of operation of said piston.

5. A fluid apportioning and dispensing device comprising means defining a pair of opposed cylinder chambers together with an intake port and a discharge port communicating with each of said cylinders, pistons disposed, one each, within said chambers, means mechanically interconnecting said pistons, valve sleeves, each integral with one of said pistons and disposed each within one of said chambers, and driving means for reciprocating and arcuately rotating said pistons and sleeves simultaneously.

6. A fluid dispensing device comprising a cylinder block having a cylinder chamber together with an intake port and a discharge port communicating with said chamber, a plunger member projecting into said chamber and slideable therein with a reciprocatory motion, said plunger member functioning as a piston in said chamber, said plunger member including as an integral part an end portion disposed within said chamber forming an annular sleeve having an intake port opening and a discharge port opening, the last mentioned intake port opening and discharge port opening being adapted to be moved into and out of registration with the intake and discharge ports, respectively, in said cylinder block in timed relation with the reciprocatory motion of said plunger member, driving means for imparting both longitudinal and rotary reciprocating motion to said plunger member including said sleeve, and adjusting means for moving said plunger member in the direction of its longitudinal reciprocation so as to alter its mid-stroke position in said chamber, the arrangement being such that said sleeve functions to open and close the intake and discharge ports in proper sequence and, further, that the timing of the opening and closing of said ports is adjustable through operation of said adjusting means to vary the quantity of fluid discharge per cycle of operation of said plunger member.

7. A fluid apportioning and dispensing device comprising a pair of opposed cylinder blocks each having cylinder chambers together with intake and discharge ports communicating with said chambers, a plunger member having its opposite ends projecting, respectively, into said chambers and adapted to function as pistons therein, a pitman pivotally connected to said plunger member, a crank member laterally off-set from said plunger member, said pitman being connected with said crank and adapted to transmit motion from said crank member to said plunger member, a motor for driving said crank member, said motor together with said crank member being slideably mounted relatively to said cylinder blocks and in a plane parallel to the directions of longitudinal reciprocation of said plunger member, and means for adjustably moving said motor together with said crank member, the arrangement being such that the mid-stroke position of said plunger member with respect to said chambers is altered in response to positional adjustments of said motor and crank member.

8. A fluid apportioning and dispensing device comprising a pair of opposed cylinder blocks each having cylinder chambers together with intake and discharge ports communicating with said chambers, a plunger member having its opposite ends projecting, respectively, into said chambers and adapted to function as pistons therein, the extreme end portions of said plunger member forming annular valve sleeves which are disposed within said chambers, respectively, and adapted to open and close said intake and discharge ports in timed relation with the reciprocatory motion of said plunger member, a pitman pivotally connected to said plunger member, a spherical eccentric in a position laterally off-set from the pivotal connection of said pitman to said plunger member, said pitman being drivingly connected with said eccentric and adapted to transmit motion from said eccentric to said plunger member, the motion thus transmitted to said plunger member being both longitudinally and arcuately reciprocatory, a motor for driving said eccentric, a carriage mounted slideably relatively to said cylinder blocks and in a plane parallel to the directions of longitudinal reciprocation of said plunger member, said motor together with said eccentric being mounted upon and movable with said carriage, and an adjusting screw for adjustably moving said carriage together with said motor and eccentric, the arrangement being such that the mid-stroke position of said plunger member with respect to said chambers is altered in response to positional adjustments of said carriage.

9. In a liquid dispensing device, a pair of pumps connected with separate sources of liquid supply, each of said pumps including a cylinder and a piston, valve means associated with each of said pumps for controlling the discharge therefrom, means for actuating said pistons and valve means, and means for simultaneously varying the timing of the valve means of both pumps to vary the ratio of discharge from said pumps.

10. In a liquid dispensing device, a pair of pump cylinders each having an intake port and a discharge port, said intake ports communicating with separate sources of liquid supply, a pair of pistons in said cylinders, means for reciprocating said pistons, means controlling said intake and discharge ports, and means for simultaneously and proportionately adjusting said control means to vary the ratio of discharge from said pumps.

11. In a liquid dispensing device, a pair of pump connected with separate sources of liquid supply, each of said pumps including a cylinder and a piston, valve means associated with each of said pumps for controlling the discharge therefrom, means for actuating said pistons and valve means in timed relation, and means for simul-

taneously and proportionately adjusting the timing of the valve means of both pumps and the position of the stroke of both pistons relative to their respective cylinders to vary the ratio of discharge from said pumps.

12. In a liquid dispensing device, a pair of pumps connected with separate sources of liquid supply, each of said pumps including a cylinder and a piston, said cylinders being arranged in tandem, and the pistons being interconnected for simultaneous reciprocation, and means for varying the position of the stroke of said interconnected pistons to equally and reversely vary the operative relations of said pistons with respect to their respective cylinders.

13. In a liquid dispensing device, a pair of pump cylinders arranged in tandem and respectively provided with intake and discharge ports, said intake ports communicating with separate sources of liquid supply, a pair of pistons in said cylinders interconnected for simultaneous actuation, means for reciprocating said pistons, slide valves carried by said pistons for actuation thereby to cover and uncover said intake and discharge ports in timed relation to the operation of said pistons, and means for simultaneously adjusting said pistons to alter the timing of said valves so as to vary the discharge of the pumps in reversely proportional relation.

14. In a liquid dispensing device, a pair of pump cylinders arranged in tandem and respectively provided with intake and discharge ports, said intake ports communicating with separate sources of liquid supply, a pair of pistons in said cylinders interconnected for simultaneous actuation, drive means for imparting compound reciprocation and rotative oscillation to said pistons, slide valves carried by said pistons for actuation thereby to cover and uncover said intake and discharge ports in timed relation to the operation of said pistons, and means for varying the position of the stroke of said interconnected pistons with respect to their respective cylinders to alter the timed relation between the piston movements and the opening and closing of said intake and discharge ports, whereby to vary the ratio of discharge from said pumps.

ALBERT R. THOMPSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,034,964. March 24, 1936.

ALBERT R. THOMPSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 25, for "consequently" read consecutively; page 5, second column, line 70, claim 11, for "pump" read pumps; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day May, A. D. 1936.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.