

Nov. 18, 1947.

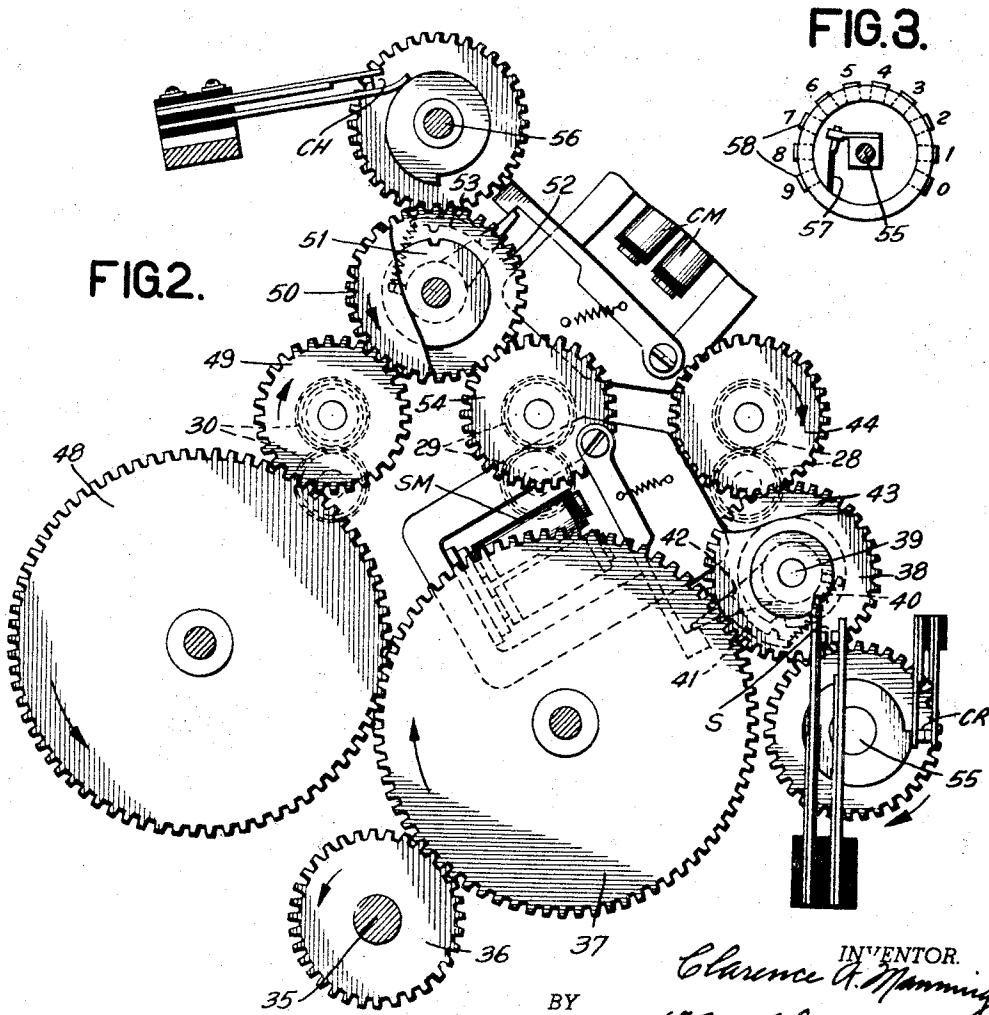
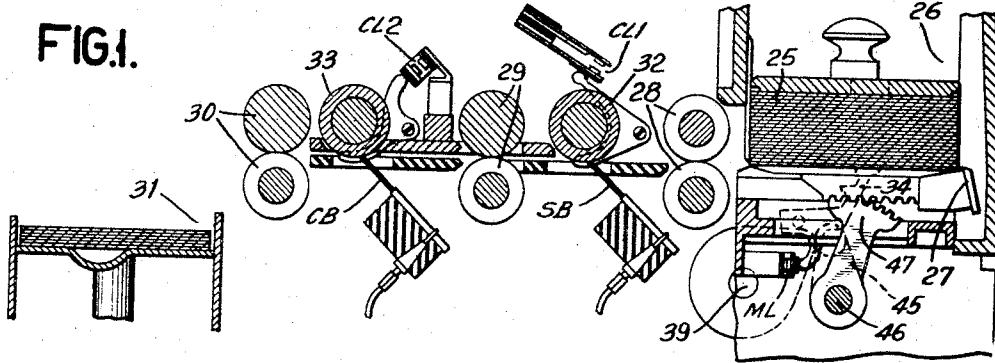
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2,431,058

CONTROL MECHANISM FOR DISPENSING APPARATUS

Filed Aug. 22, 1942

8 Sheets-Sheet 1



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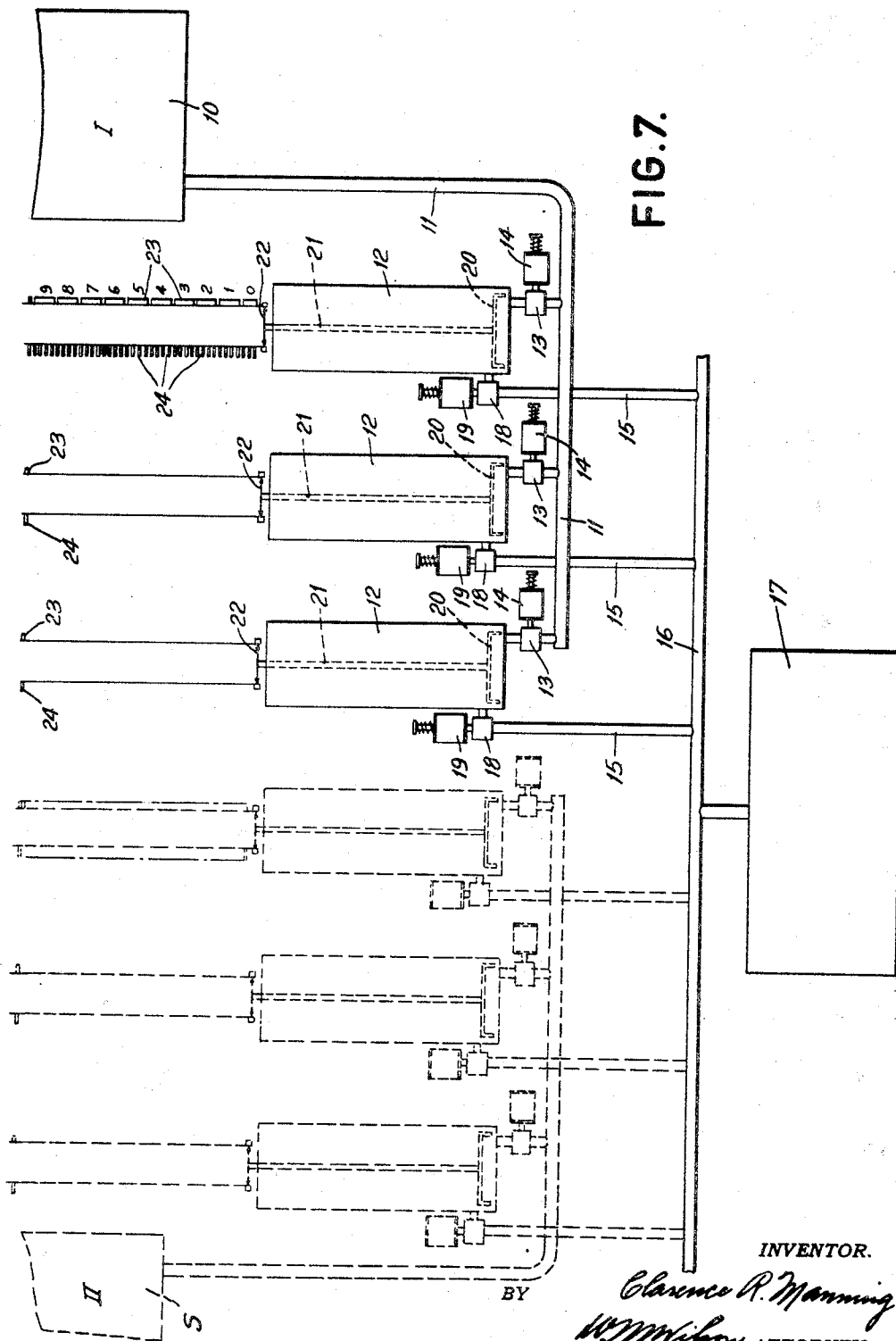
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CONTROL MECHANISM FOR DISPENSING APPARATUS

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8 Sheets-Sheet 3



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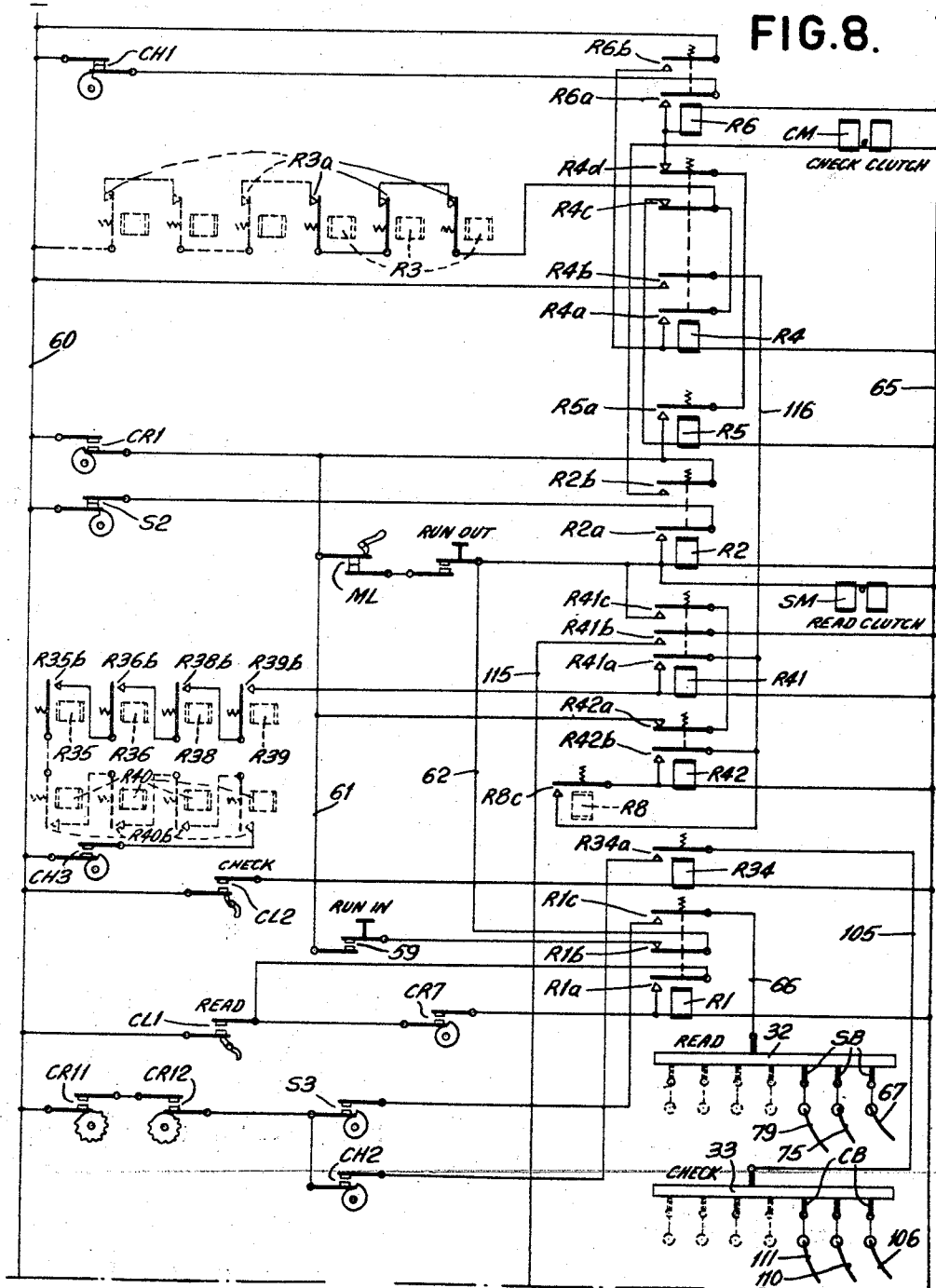
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CONTROL MECHANISM FOR DISPENSING APPARATUS

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8 Sheets-Sheet 4

FIG. 8.



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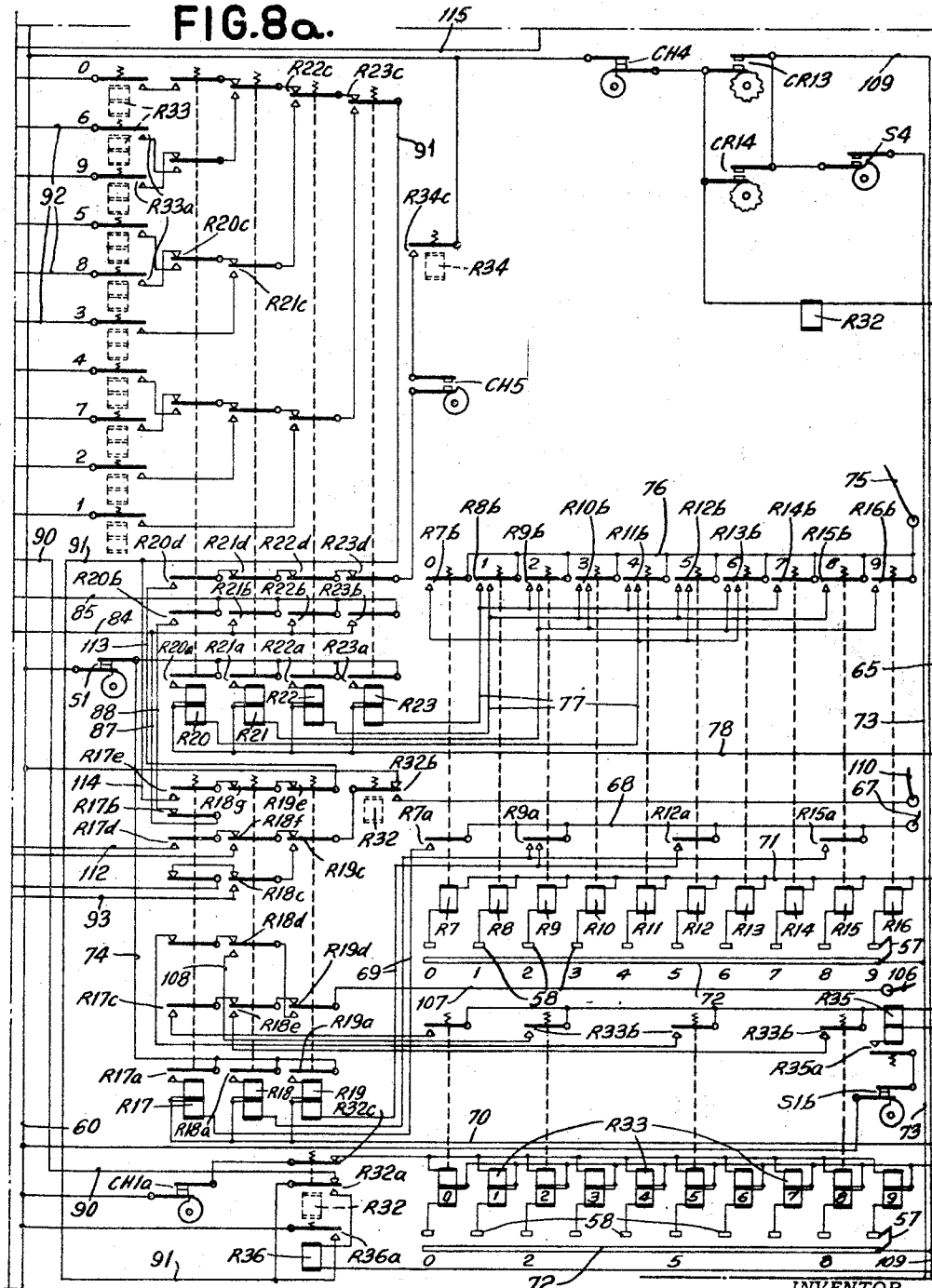
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CONTROL MECHANISM FOR DISPENSING APPARATUS

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8 Sheets-Sheet 5

FIG. 8a.



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CONTROL MECHANISM FOR DISPENSING APPARATUS

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8 Sheets-Sheet 6

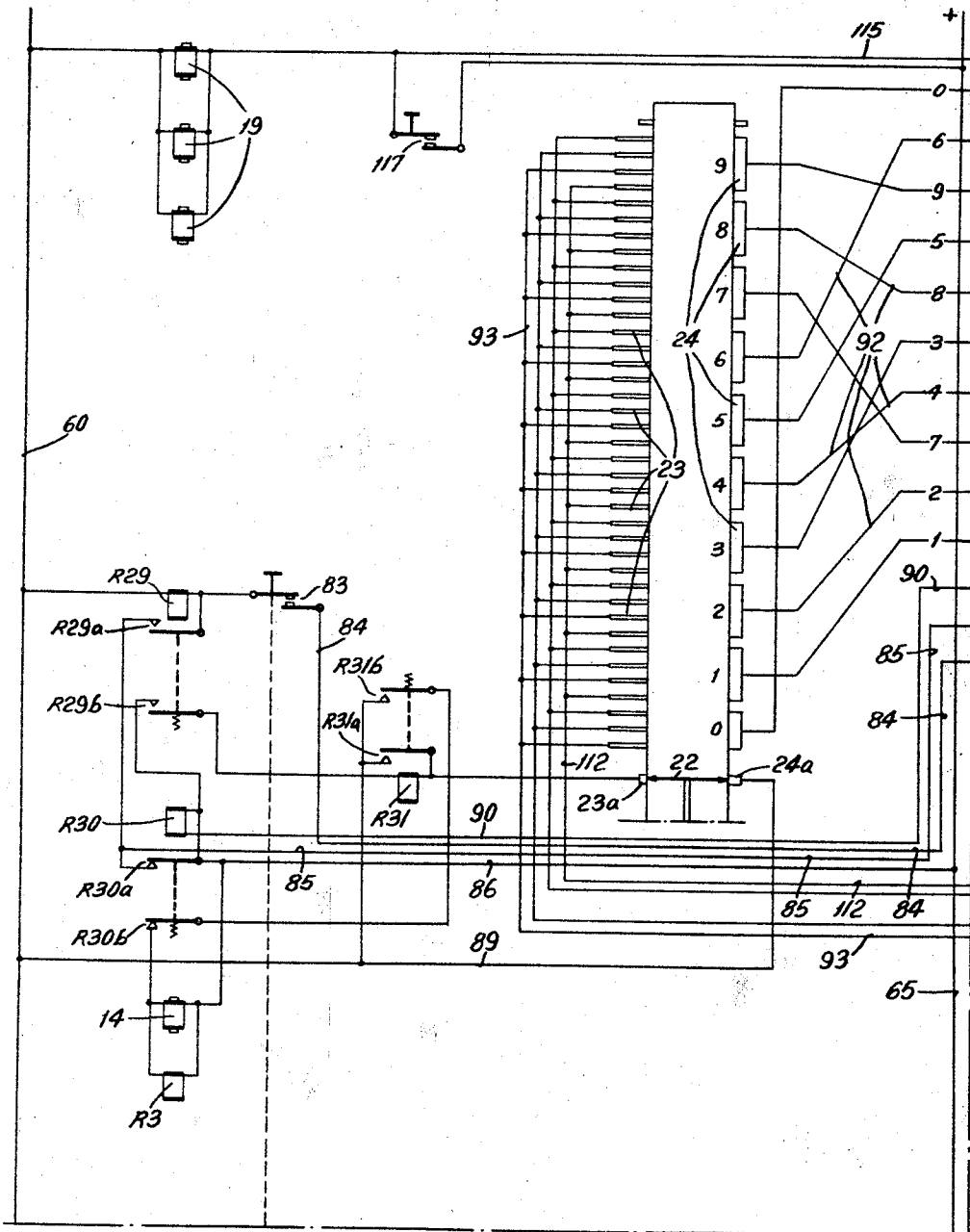


FIG. 8b.

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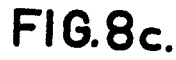
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CONTROL MECHANISM FOR DISPENSING APPARATUS

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8 Sheets-Sheet 7



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CONTROL MECHANISM FOR DISPENSING APPARATUS

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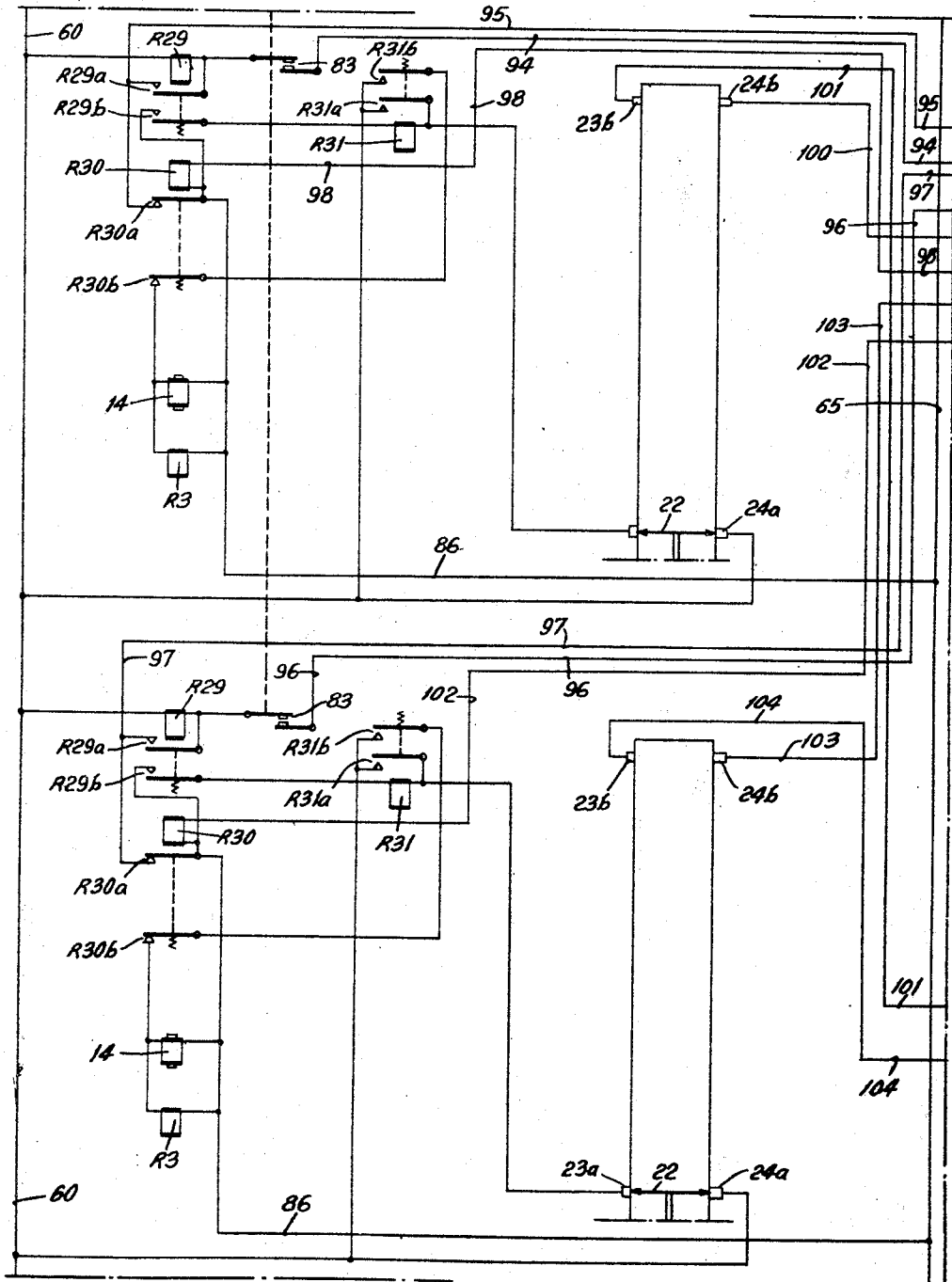


FIG. 8d.

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UNITED STATES PATENT OFFICE

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CONTROL MECHANISM FOR DISPENSING APPARATUS

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15 Claims. (Cl. 222-2)

1

This invention relates to record controlled mechanism for selectively operating dispensing apparatus and in particular apparatus for dispensing liquids to combine various ingredients in the preparation of formulae.

In carrying out the broad object of the invention, a record card is provided for each formula that it is desired to prepare, and the record card is provided with designations in the form of perforations that by their number and location indicate the ingredients and their quantities required for the related formula. These record cards are sensed singly, and the data contained therein is set up on a relay system which, operating in conjunction with inlet valves and dispensing apparatus, permit the required ingredients in the classified amounts to be withdrawn from supply reservoirs and measured in separate receptacles, where they are separately retained. When all the required ingredients have been drawn off from the reservoirs, the record card is sensed a second time and a comparison is made between the data on the card and the measured quantities of the selected ingredients. This constitutes a checking or verifying to insure that the proper ingredients in the proper quantities have been drawn off. If the comparison is satisfactory, valve mechanism on the various receptacles are controlled to permit the selected ingredients to flow together or discharge into a common receptacle.

It is accordingly among the more particular objects of the invention to provide the mechanism for carrying out the several steps of record card sensing, control of the dispensing apparatus or selection of ingredients and quantities thereof, the checking of the selected ingredients, and the ultimate discharge thereof into a common receptacle.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a sectional view of the essential elements of the record card feeding and sensing devices.

Fig. 2 is a view looking in the same direction as Fig. 1 showing the drive gearing and clutch controls for the card feeding and sensing mechanism.

Fig. 3 is a detail of a timing commutator.

Fig. 4 is a fragment of a record card showing

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the manner in which the ingredients and their quantities are designated.

Fig. 5 is a timing chart of certain of the electrical circuit closing devices.

Fig. 6 is a chart showing the arrangement of the circuit diagram figures to indicate the order in which they are to be placed.

Fig. 7 is a diagrammatic representation of a section of the dispenser apparatus.

Figs. 8, 8a, 8b, 8c and 8d taken together and arranged in the order indicated in Fig. 6 constitute a wiring diagram of the dispensing apparatus and the control mechanism sufficient to illustrate and explain the operation of the device.

By duplicating Figs. 8a, 8b, 8c and 8d and adding them to the existing figures as indicated in Fig. 6, the circuit will be suitable for a device of greater capacity.

The record card

Referring to Fig. 4, there is shown a form of well known record card 25 as used for statistical purposes which is provided with a number of vertical columns and a number of horizontal rows, the latter of which are numbered in accordance with the digits. A perforation in the vertical column represents a value corresponding to the digit related to the horizontal line. Thus, the perforation in column 1 represents 2 and the perforation in column 2 represents a 5. For recording fractions, a form of coding is employed wherein for the fraction $\frac{1}{4}$ a 2 perforation is employed, for $\frac{1}{2}$ a 5 perforation, and for $\frac{3}{4}$ an 8 perforation, so that with the card as arranged in Fig. 4 the seven different ingredients indicated are indicated by the perforations whose interpretation is given at the bottom of the figure.

In accordance with the arrangement of the present device, it is required that a zero representing perforation be made in those columns of the various ingredient fields in which there is no significant digit or fraction representing the perforation. Thus, for the card shown in Fig. 4, the formula X requires neither of the ingredients IV or V, so that the two columns of each of these two fields are perforated in the zero position. Also, in the fields designated 2 and 7, the zeros are punched as shown.

The dispensing apparatus

In Fig. 7 is shown the dispensing apparatus which the record card in Fig. 4 is designed to control. In general, it comprises a reservoir or supply hopper generally designated 10, of which

there is one for each possible ingredient. From the reservoir 10 the feed line 11 extends to and has connection with a plurality of what may be termed "measuring tubes" designated 12 in which the ingredients are segregated and momentarily retained. The connection is through valves 13 which are operated by solenoids designated 14. Energization of solenoid 14 will open valve 13 and permit liquid to flow into the tube 12 until the solenoid is deenergized. Each tube 12 has a connection 15 in a common line 16 extending to a receptacle 17. In each line 15 there is a valve 18 operated by a solenoid 19. The valve 13 may be termed an "intake valve" and the valve 18 may be termed a "discharge valve," which is open as long as solenoid 19 is energized and closed at all other times. Within each tube 12 is a float 20 to which is secured a stem 21 which carries a contact slider 22 at its upper extremity. This slider makes contact between a group of contact segments 23 on one side and a group of contact segments 24 on the opposite side. The arrangement of these contacts is such that for any quantity of liquid in the tube, the slider 22 will be in the position to indicate the amount on the contact segments 23 and 24 of which the former indicate whole ounces and the latter quarter ounces.

In the apparatus in which the present invention is used, the tubes 12 are all alike and each has a capacity of 10 ounces so that, where more than 10 ounces are required, a number of tubes 12 is required. Thus, for the ingredient I (Fig. 4) where $25\frac{1}{4}$ ounces are required, $5\frac{1}{4}$ ounces will be measured in the right hand tube 12, 10 ounces in the next tube and the other 10 ounces in the third tube. The second and third tubes, when utilized, measure only the full 10 ounces and their sliders 22 cooperate with contact segments 23 and 24 located in only the highest or full position of the tube.

As indicated in dotted outline in Fig. 7, a second receptacle S may contain ingredient II which, through similar connections, will flow into another set of tubes 12 which in turn also have connection to the common line 16 for discharge into the common receptacle 17, and thus for each of the other ingredients indicated in Fig. 4 there is a reservoir 10 and one, two or three tubes 12 depending on the highest possible quantity of any ingredient required. For example, for ingredient III (Fig. 4), only two columns are set aside which indicates that the greatest possible amount of this ingredient called for would be $9\frac{3}{4}$ ounces, in which case a single tube 12 with the graduated segments 23 and 24 would be sufficient, and for this ingredient the second and third 10 ounce measuring tubes would not be required.

Card feeding and sensing mechanism

Referring to Fig. 1, the record cards 25 are placed in a hopper 26 from the bottom of which they are fed singly by a picker 27 to a pair of feed rolls 28 which advance it to a second pair of feed rolls 29, and then to a third pair of rolls 30 from which the card drops into a pocket 31. Between the rolls 28 and 29 is a row of sensing brushes designated SB which sense the rows of perforated positions in the order 9, 8, 7, etc. as the card passes the brushes, with the brush SB making contact through the hole in the card with a common contact roller 32. Similarly, as the card later passes a second set of so-called "checking brushes" CB, contact is made by these brushes

through the perforations with a contact roller 33.

At each brush station is provided the usual card levers which close their respective card lever contacts designated CL1 and CL2. At the hopper 26 there is also a so-called "magazine card lever" designated 34 which maintains a pair of contacts ML closed as long as there are cards in the supply hopper. In the operation of the machine there is what may be termed the "starting position." During a cycle of operations now to follow, the card is advanced past the brushes SB to the corresponding position with respect to the brushes CB, and during such transmit the perforated data is sensed by the brushes SB. The cards wait in this position while the several tubes 12 receive the proper quantities as will be explained and, when all have done so, the first card is advanced past the brushes CB into the hopper 31. During the passage of the card, its perforations are again read and a comparison is made with the tubes 12 to determine whether the proper amounts are in fact in the tubes.

While the first card is passing the brushes SB, the second card is brought from the magazine up to the brushes SB and waits in this position until the first card has passed the brushes CB. If the comparing is correct, the metering tubes used for that particular formula are allowed to empty. While they are emptied the second card passes the brushes SB and the storage relays are set up for that card. In this way no time is lost for the setup of each card. As a second card passes the brushes SB, the third card moves from the magazine up to these brushes, so that after the first card has been sensed by the brushes CB, following which the tubes 12 are evacuated, the device is in readiness to repeat the operations sensing the next following card.

In Fig. 2 is shown the driving mechanism for the card feed rollers and picker mechanism, wherein a shaft 35 is in constant rotation, being driven from any suitable source of power, such as an electric motor. Shaft 35 carries a gear 36 driving a gear 37 which in turn drives a gear 38 loosely mounted on a shaft 39. Integral with gear 38 is a clutch driving element 40 in whose plane lies a clutch dog 41 secured to a clutch arm 42 fixed on shaft 39. Energization of magnet SM will release dog 41 for engagement with driving element 40, so that shaft 39 will rotate and the gear 43 thereon will drive the gear 44 which is secured to the upper roller 28 which in turn has pinion connection with the lower gear, so that the two rollers 28 rotate together. The shaft 39 (Fig. 1) has an eccentric cam operating an eccentric strap 45 which rocks a rod 46 upon which is the arm 47 which through teeth on its upper extremity reciprocates the picker knife 27. Through the connections traced, it will be seen that, when magnet SM is energized, shaft 39 makes a revolution during which the picker 27 and pair of feed rolls 28 are operated. The gear 37 through the gear 48 drives a gear 49 on the end of the upper roller 30 which also has pinion connection with the lower roller 30, so that these two rollers are in constant motion. The gear 49 drives the gear 50 and a clutch driving element 51 to which a gear 52 may be coupled for rotation through a clutch dog 53 upon energization of a magnet CM.

When coupling is so effected, the gear 52 drives a gear 54 on the shaft of the intermediate roller 39 so that, when magnet CM is energized, the rollers 29 rotate. As will be explained in connection with the circuit diagram, the magnet CM is energized whenever the magnet SM is energized. As

seen from Fig. 1, it is necessary to rotate both rollers 28 and 29 to advance the card past brushes SB. To advance the card past the brushes CB, it is only necessary to rotate the rollers 29 by energizing magnet CM, rollers 30 being in constant motion.

On a shaft 55 driven from the constantly running gear 38 are a number of the contact operating cams controlling contacts which in the circuit diagram are prefixed CR. Also on shaft 39 are contact operating cams which control contacts prefixed S, and these operate only when the clutch magnet SM is operated and a card is passing the brushes SB. Likewise, a shaft 56 is provided and driven from the gear 52, upon which shaft are cams for operating contacts prefixed CH which accordingly operate only when magnet CM has been energized and while the card is passing the brushes CB. On the constantly running shaft 55 there is a number of commutator devices termed "emitters," of which one is shown in Fig. 3 comprising a brush 57 which has connection with a ring as shown, and which also makes contact in succession with segments designated 58 which are numbered 9 to zero and which are contacted by the brush 57 at the time the correspondingly numbered positions on the record cards are sensed by the brushes SB or CB. The timing of the various contact devices is shown in Fig. 5 wherein one cycle or revolution of the shafts 39, 55 and 56 is indicated.

Circuit diagram

The complete operation of the machine will now be described in connection with the circuit diagram and the various operations will be explained in the order in which they take place. To facilitate the understanding of the various electrical devices, the relay magnets, of which a number are employed, have been designated with the letter R followed by a numeral. The contacts controlled by the relay magnets are designated with the same reference followed by a lower case letter. Thus, R1 may designate a magnet, and R1a, R1b designate contacts controlled thereby. In most instances, the contacts controlled by the magnets are shown adjacent thereto. In several cases, where for the sake of simplicity of the wiring connections the contacts have not been drawn adjacent the controlling magnets, the magnets are shown in dotted outline adjacent the contacts which together with the manner of designating the same will serve to make the relationship clear.

Preliminary operations.—With cards placed in the feed magazine, the "run-in" key is depressed to close contacts 59 (Fig. 8). This completes a circuit at the time constantly running contacts CR1 close, which is traceable from negative side of line 60, through contacts CR1, wire 61, contacts 59, relay contacts R1b, wire 62, relay magnet R2, and card reading clutch magnet SM parallel therewith to positive side of line 65. Relay magnet R2 closes its contacts R2a to provide a holding circuit from line 60 to normally closed contacts S2, contacts R2a, magnets R2 and SM to line 65. The contacts S2 open during the cycle of operations initiated by magnet SM to break the holding circuit and enable declutching of the card feeding mechanism at the end of the revolution, during which a card was advanced from the hopper up to the sensing brushes SB.

It is pointed out that at the very start the clutch magnet CM is also energized and the intermediate feed rollers 29 rotated, but such op-

eration at this time has no effect. The circuit for energizing magnet CM at this time is traceable from negative side of line 60, in series through a chain of normally closed contacts R3a, contacts R4c, a relay magnet R5, to line 65. As soon as current is put on the lines 60 and 65, the magnet R5 becomes energized and closes its contacts R5a. Thus, a circuit is completed from line 60, contacts CR1, contacts R5a, normally closed contacts R4d, magnet CM to line 65. Parallel with magnet CM is a relay magnet R6 which closes its contacts R6a to provide a holding circuit for itself and magnet CM through contacts CH1. The magnet R6 also closes a pair of contacts R6b to set up a circuit from line 60, through contacts R6b, relay magnet R4, to line 65. Magnet R4 in turn opens its contacts R4c so that magnet R5 becomes deenergized and at the same time closes its contacts R4a to establish a holding circuit from line 65, magnet R4, contacts R4a, and the chain of contacts R3a to line 60.

Reading the first card by brushes SB.—The run-in key is now operated a second time, closing contacts 59 as before, the clutch magnet SM is energized to advance the card past the brushes SB. As explained above, it is also necessary to operate the clutch magnet CM in order to advance a card up to the brushes CB, so that with the closure of contacts R2b a circuit is also completed to energize the magnet CM. It may be noted from the circuits traced that, whenever the magnet SM is energized together with its parallel relay R2, the magnets CM and R6 are also necessarily energized through parallel circuits controlled by the contacts R2b.

Entering the card reading.—As the card passes the brushes SB, it closes the card lever contacts CL1 to complete a circuit from line 60, contacts CL, CR7, relay magnet R1 to line 65. The magnet R1 closes its contacts R1a to provide a holding circuit for the relay magnet which is maintained energized as long as the card continues to pass the brushes SB. Magnet R1 closes a pair of contacts R1c which supply current to the contact roll of the brushes SB through the following circuit: line 60, circuit breaker contacts CR11, CR12, which make and break the circuit for each hole position in the card, contacts S3, R1c, wire 66, to the contact roller 32. From the contact roll 32 the circuit proceeds through the perforations in the record card, the time of completion of the circuit depending upon the differential location of the perforation.

Entering the fractional amount.—Considering the circuits completed through the column of the card containing a fractional designation which would be either zero, 2, 5, or 8, the circuit continues from contact roller 32, brush SB sensing the fractional column, a connection indicated at 67 (Fig. 8) which extends to Fig. 8a, to a wire 68, thence through one of the contacts R7a, R9a, R12a, or R15a, depending upon the value of the perforation, thence through one of the wires 69, through a winding of one of three magnets R17, R18 or R19, wire 70, to positive side of line 65. The contacts R7a, R9a, R12a, R15a are closed by their respective magnets, shown below them in Fig. 8a, at the times in the cycle corresponding to the value of the perforations 0, 2, 5, and 8. These magnets are connected to contact segments 58 which are traversed by the brush 57 (see Fig. 3) in such manner that the row of magnets R16, R15, etc. to R7 are energized in succession as the perforation receiving positions 9, 8, 7, etc. are sensed.

The energizing circuit is traceable from positive side of line 65, wire 71, in parallel through the magnets R17, R16, segments 58, brush 57, common conductor 72, wire 73, cam contacts S4, circuit breaker contacts CR13, CR14 in parallel, cam contacts CH4 to negative side of line 60. It is to be recalled that during this cycle both the sensing and checking clutch magnets have been energized, so that both the CH, S and CR cam contacts are in operation, so that during the period the card is passing the brushes SB, both contacts S4 and C4 are closed. Each of the magnets R17, R18 and R19 close a pair of contacts suffixed *a* to provide a holding circuit for the magnets traceable from line 65, wire 70, the upper winding of the magnets, its *a* contacts, wire 74, and cam contacts S1 to line 60.

From examination of the coding for the fractional $\frac{1}{4}$ ounce representation in Fig. 4 and from the connections through the relay magnet contacts R7a, R9a, R12a and R15a, when a 2 perforation representing $\frac{1}{4}$ ounce is sensed, magnets R18 and R19 are energized. When a 5 perforation representing a $\frac{1}{2}$ ounce is sensed, the magnet R19 alone is energized; when an 8 hole representing $\frac{3}{4}$ ounce is sensed, magnet R18 alone is energized, and when a zero perforation indicating no ounce is sensed, the magnet R17 is energized, and the setting thereof will be retained until contacts S1 open just prior to the sensing of the next card by the brushes SB.

Entering the units order digit amount.—Considering now the sensing of the units order column, the circuit from the contact roller 32 extends through the perforations in the related column to the brush SB and thence through the wire 75 (Fig. 8), to the common wire 76, as indicated in Fig. 8a. The wire 76 is connected to contacts R7b to R16b which, as already explained, flows in succession under control of the emitter brush 57. These contacts R7b to R16b are connected through wires generally designated 77 to the 4 relay magnets R20, R21, R22, and R23 to energize them in combination for the ten digits sensed. For example, assuming a perforation in the 1 position of the card column, then at the 1 time in the cycle the contacts R8b are closed. The circuit from the sensing brush extends through connection 75, wire 76, the 2 contacts R8b, to relay magnets R22 and R23 in parallel, and thence through wire 78 to line 65. These contacts close their *a* contacts to provide a holding circuit through the cam contacts S1 in the same manner as the fraction receiving magnets R17 to R19.

Tracing of the circuits for the various digits would show that sensing of a zero in the units order column will energize magnet R20, a 1 will energize magnets R22 and R23, a 2 will energize magnets 21 and R23, a 3 will energize magnets R21 and R22, 4 will energize magnets R20 and R23, 5 will energize magnets R20 and R22, 6 will energize magnets R20 and R21, 7 will energize magnet 23, and 8 will energize magnet R22 and 9 will energize magnet R21.

Entering the tens order digit amount.—From the brush SB sensing the tens order column, a connection 79 (Fig. 8a) extends (Fig. 8c) to a wire 80, contacts R24a, R25a and R26a, wire 81, to relay magnets R27, R28, wire 82, to line 65. The magnets R24, R25 and R26 are energized in succession through an emitter having segments 58 and brush 57, and common conductor 72 in the same manner as the magnets R7 to R16, the timing being such that the magnets are energized at

the zero, 1 and 2 times. Only three magnets are provided as in the present machine, the tens column is only utilized in the zero, 1 and 2 hole positions. Again, as for the fractions and the units digits, a combination setting is effected on the relay magnets R27 and R28 such that, when a zero hole is sensed, magnet R28 alone is energized; when a 1 hole is sensed, magnet R27 is energized, and when a 2 hole is sensed, both magnets R27 and R28 are energized. Each will close its *a* contacts to set up a holding circuit through cam contacts S1a whose timing is the same as the contacts S1. Thus, after the card has passed the brushes SB, a relay setting will have been made in accordance with the values sensed.

For example, for ingredient I of Fig. 4, the value $25\frac{1}{4}$ ounces will have resulted in energization of the following relay magnets: R27 and R28 for the tens digit 2, R20 and R22 for the units digit 5, and R18 and R19 for the fraction $\frac{1}{4}$. At the end of a cycle, the machine comes to rest, the card in readiness to pass the checking brushes CB.

Measuring the liquid quantities

The operator now presses the start key, concurrently closing a plurality of contacts (Figs. 8b and 8d), of which there is one for each tube 12. This will initiate the feeding of the ingredient to the tubes which are to receive the same and feeding will continue until the amount therein reaches the proper level, at which time certain connections will be established under control of the contact slider 22, the contact segments 23 and 24 of the tube, and circuit connections partially set up by the aforescribed amount representing relays to terminate the measuring operation. Specifically, for the tube shown in Fig. 8b, when this tube has received $5\frac{1}{4}$ ounces in accordance with the example shown in Fig. 4, the required quantity will have been measured. Upon closure of contacts 83 (Fig. 8b), a circuit is completed from negative side of line 60, a start relay magnet R29, contacts 83, wire 84 (Fig. 8a), contacts R21b, R22b, or R23b, if one of these is closed, wire 85 (Fig. 8b), contacts R30a of a stop relay magnet R30, wire 86, to positive side of line 65.

A circuit may also be completed upon closure of contacts 83 traceable from line 60 (Fig. 8b), magnet R29, contacts 83, wire 84 (Fig. 8a), downwardly through a wire 87, contacts R17b, a wire 88, contacts R20b, if these are closed, wire 88 (Fig. 8b), contacts R30a and wire 86 to line 65. Analysis of the circuits just traced will show that relay magnet R29 is energized, if a significant digit is set up for the units order or if a zero is set up for the units order, and the zero is not set up in the fractional order. If a zero is set up in both the units digit and the fraction order, the relay magnet R29 is not energized and the related tube remains inactive.

Magnet R29 closes its contacts R29a to provide a holding circuit from line 60, magnet R29, contacts R29a, stop relay contacts R30a, wire 86, to line 65. It also closes contacts R29b to complete a circuit from line 65, wire 86, contacts R29b, relay magnet R31, a contact segment 23a, slider 22, contact segment 24a, wire 89, to line 60. The slider 22 makes electrical connection between contact segments 23a and 24a only when the float in the tube is in its empty indicating position, so that unless the tube is empty, the circuit just traced cannot be completed. Magnet R31 closes its contacts R31a to provide a holding circuit from line 60, contacts R31a, magnet R31, contact

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R29b, which are held closed, wire 86, to line 65. The magnet also closes its contacts R31b, completing a circuit from line 65, wire 86, intake valve solenoid 14, stop relay contacts R30b, contacts R31b, to line 60.

As a result, the intake valve 13 (Fig. 7) is open and ingredient I commences to flow into the tube 12. This flow will continue until magnet R30 is energized to break the contact R30b. The manner in which this is done will now be explained.

When the float has raised contact slider 22 to the 5¼ ounce level for the example chosen, it makes electrical contact between the 5 segment 24 and the ¼ segment 23 opposite and at such time a circuit is completed which is traceable as follows: from line 65 (Fig. 8b), wire 86, stop relay magnet R30, wire 90 (Fig. 8a), normally closed contacts R32a, wire 91, upper contacts R23c, lower contacts R22c now closed, upper contacts R21c, lower contacts R20c, now closed, a pair of contacts R33a, to the 5 wire of a group of wires designated 92 (Fig. 8b), the 5 segment 24, slider 22, the ¼ ounce segment 23 to wire 93 (Fig. 8a), lower contact R18c now closed (due to ¼ ounce entry), lower contacts R19c also closed, upper normally closed contacts R32b, to line 60. Thus, when the slider reaches the level corresponding to the setting of the combined units and fraction value, a circuit is completed through stop relay magnet R30 which opens its contacts R30b to deenergize the intake solenoid 14, so that the intake valve automatically closes. It will, of course, be understood that similar circuits are completed through other like settings and valves at times depending on when the slider reaches the desired slide.

In tracing the circuit, it was mentioned that it extended through contacts R33a (Fig. 8a). A number of contacts R33a is shown, and during the period that the intake valve functions, these contacts are all closed. Their closure is effected in the following manner: The controlling magnets R33 are shown in the lower part of Fig. 8a, and each constitute a magnet core with two separate windings thereon wound so that energization of either winding will operate the related contacts. Normally, the upper winding of each magnet R33 is energized so that the contacts R33c are closed. This circuit can be traced from line 60, contacts CH1a, R32c, all of the upper windings of the magnets R33 in parallel to line 65.

For the two so-called "10" ounce tubes, which together are to measure the 20 ounces to be measured for the example chosen, start circuit for the intake valve solenoid is completed in a similar manner to that already explained. These circuits will be briefly traced in connection with Figs. 8c and 8d, where similar parts will be identified by the same reference characters. In Fig. 8d closure of the upper contacts will complete a circuit through the start relay magnet R29, from line 60, the magnet R29, contacts 83, wire 94 (Fig. 8c), contacts R27b (now closed), wire 95 (Fig. 8d), stop relay contacts R30a, to line 65. Concurrently, the lower start relay magnet R29 is energized through a circuit traceable from line 60, magnet R29, contacts 83, wire 96 (Fig. 8c), contacts R27c, R28b (both closed), wire 97 (Fig. 8d), contacts R30a to line 65 as before.

Inspection will show that, if the tens digit setting is 1, only the upper relay magnet R29 (Fig. 8a) is energized and, if the setting is 2, then both relay magnets R29 are energized, while if the segment is zero, neither is energized. As before, contacts R29a close to provide a holding circuit and

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contacts R29b close to energize relay magnet R31, provided the contact slider is in "empty indicating position," bridging the contact segments 23a, 24a. The circuits involved in energizing relay magnets R31 are the same as traced for Fig. 8b, so the same need not be repeated. Each magnet R31 again in the same manner causes energization of its related intake valve solenoid 14 which, when energized, is held through the stop relay contacts R30b and the liquid will flow into the tube until the stop relay R30 is energized.

The stop circuit is traceable as follows for the upper tube of Fig. 8d: from line 65, wire 86, magnet R30, wire 98 (Fig. 8c), normally closed upper contacts R32c, wire 99, closed contacts R27d, wire 100 (Fig. 8d), contact segment 24b, slider 22 in the 10 ounce registering position, contact 23b, wire 101 (Fig. 8c), upper normally closed contacts R32e, to line 60. Thus, when the slider reaches the full capacity indicating position, relay magnet R30 is energized and the intake valve solenoid R14 is deenergized. In a somewhat similar manner the stop relay magnet circuit for the lower tube in Fig. 8d is traceable from line 65, wire 86, relay magnet R30, wire 102 (Fig. 8c), normally closed upper relay contacts R32d, wire 103, contacts R27e, R28c, wire 103 (Fig. 8d), contacts 24b, slider 22, segment 23b, wire 104 (Fig. 8c), upper normally closed contacts R32f, to line 60. Thus, also for the two tubes which receive 10 ounce portions of the total quantity, the intake valve cannot be operated unless the tube is initially empty and the intake valve is closed when the position of the tube slider corresponds to the setting on the relay system.

In parallel with each of the intake valve solenoids 14 (Figs. 8d and 8e) is a relay magnet R3, each of which, when energized, opens a pair of contacts R3a (Fig. 8).

As explained at the outset, the contacts R3a normally establish a circuit through relay magnet R4 and its contacts R4a, this circuit being set up through the initial operation of the check clutch CM. When any solenoid is energized, it opens its contacts R3a, so that the holding circuit for relay magnet R4 is broken, permitting its contacts R4d and R4c to again close, while the liquid is entering the tubes. As each tube receives its required amount, its related contacts R3a close and, when all are closed indicating all the intake valves have shut, a circuit is completed from line 60 (Fig. 8) to the contacts R3a in series, contacts R4c, relay magnet R5 to line 65. Magnet R4 closes its contacts R4a, so that at the appropriate time in the cycle when cam contacts CR1 close, a circuit is completed from line 60, contacts CR1, contacts R5a, R4d, magnets R6 and CM in parallel to line 65. Magnet R6 as before closes its contacts R6b to energize relay magnet R4 and the latter is then held energized through its contacts R4a and the series contacts R3a. Energization of the clutch magnet CM will now cause the card to traverse the checking brushes CB and, as the card passes these brushes, a verification or checking is effected to determine whether the amounts of liquid contained in the separate tubes is in accordance with the perforations on the card.

At the beginning of this cycle, relay magnet R32 (Fig. 8a) is energized so that the several related contacts are shifted from the positions shown in the circuit diagram. Also, as the card is passing the brushes, the card lever contacts CL2 (Fig. 8) close to energize the relay magnet R34 which closes its contacts R34a, through which

current is supplied to the checking brush contact roller, through a circuit traceable from line 60 (Fig. 8), contacts CR11, CH12, contacts CH2, contacts 34a, wire 105 to the contact roller 33.

As the fractional order of the card traverses the brush CB, the circuit continues through the brush CD, the connection 106 (Fig. 8a), wire 107, lower contacts R19d (now closed), lower contacts R18d now closed, wire 108, a pair of contacts R33b related to the 2 magnet R33, thence through relay magnet R35, to line 65. Magnet R35 closes its contacts R35a to provide a holding circuit from line 65, lower winding of magnet R35, contacts R35a, contacts S1b, to line 60.

The completion of this circuit is an indication that the perforations sensed by the checking brushes CB correspond to a relay setting obtained from the first set of brushes SB. Closure of the contacts R33b in the circuit just traced is brought about through emitter comprising segments 58 wired to the second winding of each of the magnets R33, a brush 57 in the common conductor 72. The brush contacts the segments 58 in succession as the correspondingly numbered card positions are at the sensing brush CB, so that at the time the 2 position is sensed, the 2 magnet R33 is energized and its contacts R33b are closed. The circuit through the magnet R33 is traceable from line 60 (Fig. 8a), contacts CH4, CR13, CR14, a wire 109, common strip 72, brush 57, segment 58 in the 2 position, lower winding of magnet R33 to line 65.

Checking for the units order.—As the column of the card containing the units digit of the amount traverses the brushes CB, a circuit is traceable through the perforation representing the digit 5 (for the example chosen) as follows: line 60 (Fig. 8), contacts CR11, CR12, CH2, R34a, wire 105, checking contact roller 33, brush CB, connecting wire 110 (Fig. 8a), lower contacts R32b now closed, lower contacts R19c now closed, lower contacts R18c now closed, wire 93 (Fig. 8b), segment 23, slider 22, and segment 24 set at "5 1/4," the 5 wire 92 (Fig. 8a), the 5 contacts R33a which are closed at the time the 5 perforation in the card column is closed, lower contacts R20c, upper contacts R21c, lower contacts R22c, upper contacts R23c, wire 91, lower contacts R32a, relay magnet R36, to line 65. Magnet R36 closes its contacts R36a which provide a holding circuit traceable from line 60, contacts R36a, wire 91, lower contacts R32a, magnet R36, to line 65.

It is to be noted that the checking circuit traced through the 5 perforation required the measuring slider 22 of the tube to be at the proper fractional position in addition to being at the proper digital position, and that the checking of the proper fractional position was indirectly checked through the previously traced checking circuit in which the fractional perforation was compared with the fractional relay setting. Thus, the 2 checking relays R35 and R36 together ascertain whether the quantity of liquid called for by the perforations is present in the related tube.

Checking the amount in the tens digit.—As the tens digit column passes the brushes CB, a circuit is traceable as before to the common contact roller 33 (Fig. 8) from which it passes to the 2 perforation (for the example in Fig. 4), thence through connection 111 (Fig. 8c), contacts R37a in the 2 position which are closed at the 2 time in the cycle by magnet R37 which is energized in parallel with the 2 magnet R33, through a similar commutator and brush structure 57, 58, 72. From contacts R37a the circuit branches to lower

contact R32e and lower contacts R32f both closed at this time, wires 101, 104 in parallel (Fig. 8d), thence in parallel through the contactors 23b, 22b and 24b in both of the 10 ounce tubes, wires 100, 103 in parallel (Fig. 8c), contact R27d, wire 99, lower contacts R32c, relay magnet R38, to line 65. The circuit from wire 103 follows a parallel path to contacts R28c, R27e, wire 103, lower contact R32d, relay magnet R39, to line 65. Contacts R38a, R39a close to provide a holding circuit through the lower contacts R32c and R32d.

Thus, if both 10 ounce tubes contained the proper quantity when the 2 hole is sensed, both relay magnets R38 and R39 will be energized. Accordingly, for ingredient I employing three tubes, four checking relays R35, R36, R38 and R39 associated therewith are energized to indicate that the quantity called for by the perforations is contained in the tubes. As will be explained later, it is necessary for these four magnets to be energized in order that the machine may continue its operation, and provision is made so that, where any tube contained no measured quantity, its related checking relay must nevertheless be energized. This can be explained by assuming, for example, that no amount of ingredient I is called for, in which case the three related columns in Fig. 4 will be perforated in their zero positions.

Checking the fractional column for zero quantity.—Tracing the circuit at the zero checking time, a circuit is traceable from the wire 106 (Fig. 8a), wire 107, upper contacts R19d, upper contacts R18e, contacts R17c, zero contacts R33b closed at the zero time, relay magnet R35 to line 65.

Checking the units digit column for zero quantity.—At the same time upon closure of cam contacts CH5 (Fig. 8a) (timed to close at zero), a circuit is traceable from line 60, card lever relay contacts R34c now closed, contacts CH5, contacts R23d, R22d, R21d, R20d closed for a zero setting of the units and digit relays, wire 113, contacts R19e, R18g, R17e, wire 114, wire 91, lower contacts R32a, magnet R36, to line 65. In this manner at zero time a test is made to determine that the relays are set at zero and, since as previously explained the intake valve of the tube cannot be operated unless the relays are set at a significant value, the checking of the relays at this time for zero setting is an indication that the related tube has not been operated and does not contain a significant quantity.

Checking the tens digit column for zero quantity.—In the same manner a circuit is traceable from line 60 (Fig. 8c), through checking card lever contacts R34d, contacts CH5a timed the same as contacts CH5, upper contacts R27f, lower contacts R28d (closed for zero setting), wire 99, lower contacts R32c, relay R38 to line 65. A parallel circuit is also traceable from the contacts R27f, to contacts R27g, lower contacts R28e, wire 103, lower contacts R32d, relay magnet R39, wire 82, to line 65. Thus, with several relays set to represent a zero quantity for the ingredient, the four checking relays are energized as explained.

Discharging the measured quantities

Contacts R35b, R36b, R38b, R39b are closed when their respective checking relay magnets are energized. In series with these four contacts are shown four others generally designated R40b which are controlled by relay magnets generally designated R40 which in turn are controlled by circuit connections for a set of tubes handling

another ingredient, for example, ingredient II. Where more ingredients are involved, additional checking contacts are included in series so that, when all ingredients or quantities have been checked, a circuit is completed through the series contacts when cam contacts CH3 close at the time indicated in Fig. 5, which is traceable from line 60, through contacts CH3 (Fig. 8) in series through the checking relay contacts, relay magnet R41, to line 65.

Magnet R41 closes its contacts R41b completing a circuit from line 65, contacts R41b, wire 115 (Figs. 8a, 8b), thence in parallel through all discharge valve solenoids 19 to line 60. This causes all the valves to open and the measured quantities in the various tubes 12 (see Fig. 7) pass through the lines 15, 16 to the common receptacle 17, where the ingredients are combined. Contacts R41a (Fig. 8) are closed to provide a holding circuit from line 65, magnet R41, contacts R41a, contacts R4b, which are closed at this time, to line 60. Closure of contacts R4b is due to the energization of relay magnet R4 which, as previously explained, is held energized through the contacts R3a which are closed as long as intake valve solenoids 14 (Fig. 8) are not energized.

Reading the next following card

The first card sensed continues through the last pair of feed rollers into the discharge hopper and, near the end of the cycle, the cam contacts CR1 (Fig. 8) close, completing a circuit from line 60, contacts CR1, contacts R48a, contacts R41c, magnet R2, and the read clutch magnet SM in parallel to line 65. This initiates a cycle of operations during which the second card passes the reading brushes SB, and the S contacts operate, all of which contacts S1, S1a (Figs. 8a and 8c) open to drop the holding circuits for the quantity relay magnets, so that a new setting may be made thereon as the card passes the sensing brushes. Contacts S1b (Fig. 8a) open to drop the holding circuit for the relay R35. Near the end of the passage of the first card past the sensing brushes, the contacts CH4 open to de-energize the relay magnet R32, and its several contacts shift to break the holding circuits for the checking relay magnets R38, R39, and R36.

At the end of the cycle during which the second card passes the brushes SB, the card feed mechanism comes to rest, and at this time the receptacle 17 (Fig. 7) may be removed and replaced by another. Also, during this reading cycle at the 2 time relay magnet R8 becomes energized at the 1 time (Fig. 8a) and closes its contacts R8c (Fig. 8), thereby momentarily energizing relay magnet R42, through a circuit from line 65, relay magnet R42, contacts R8c, wire 116 contacts R42b, establishing a holding circuit for the magnet. After the card feeding mechanism has come to rest, the operator repeats the operation of closing the start contacts 83 (Figs. 8b, 8d) so that one or more of the contacts R3a (Fig. 8) open, which breaks the holding circuit to the discharge valve solenoids and also for the magnet R42. The purpose of the latter is to prevent repeat operation of the reading clutch after the first.

It will be apparent that, if the several checking relay magnets are not energized, the circuit to the discharge valve solenoid is not completed and operations are suspended, serving as an indication that there has been a disagreement which may be due to a number of mechanical

causes in the machine and as a warning to the operator to inspect the apparatus. In Fig. 8b there is provided a pair of reset key contacts 117 which the operator may depress to directly energize the discharge valve solenoids 19 to clear the tubes and the card may then be again run through the machine with the operations repeated. There is thus provided an automatic operating record controlled dispensing apparatus, in which the selected quantities are separately measured and checked before being combined in a common receptacle and, if for any reason the quantities called for and the quantities selected are not in accord, operations are suspended before the ingredients are combined, so that where they are ultimately combined, there is an assurance they are combined in proper selected proportion.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a dispensing apparatus having a plurality of supply hoppers containing different substances, a plurality of intermediate stations, each for receiving one of said substances from the supply hoppers, a discharge station for receiving the substances from the intermediate stations, means for controlling the movement of the substances between the supply hoppers and the intermediate stations and means for controlling the movement of the substances between the intermediate stations and the discharge station, in combination with means for sensing a record card for designations representing quantities of a plurality of substances, means controlled by said sensing means for causing the first named controlling means to effect movement of the designated quantities of said designated plurality of substances into the related intermediate stations, a second means for sensing said record, means controlled thereby for checking the selected quantities of substances for conformity with the record designations, and means controlled thereby when conformity is found for causing operation of said second named controlling means to cause movement of the selected substances to said discharge station.

2. In an apparatus of the class described, a dispensing system having a plurality of compartments, a stack of record cards each bearing designations representing commodities to be dispensed, a pair of record sensing stations past which the cards are fed in turn, means for feeding a card past the first sensing station, means controlled by said first sensing station for controlling the operation of the dispensing apparatus to dispense commodities into the compartments in accordance with the designations on the card, means effective when all selected commodities have been dispensed for causing the card to feed past the second sensing station, means controlled by said second sensing station for checking the commodities in the compartments for agreement with the designations on the card, and means controlled by said checking means for discharging

the commodities from said compartments only when they are correct.

3. In a dispensing apparatus having a supply hopper containing a substance, an intermediate station for receiving said substance from the supply hopper, a discharge station for receiving the substance from the intermediate station, means for controlling the movement of the substance between the supply hopper and the intermediate station and means for controlling the movement of the substance between the intermediate station and the discharge station, in combination with means for sensing a record card for designations representing quantities of substance, means controlled by said sensing means for causing the first named controlling means to effect movement of the designated quantity of said substance into the intermediate station, a second means for sensing said record card, means controlled by said second sensing means for checking the selected quantity of substance for conformity with the record designations, and means controlled by said checking means when conformity is found for causing operation of said second named controlling means to cause movement of the selected substance to said discharge station.

4. In a dispensing apparatus, a supply hopper, a measuring hopper, a discharge hopper, means settable in accordance with any one of a plurality of amounts, devices controlled by said settable means for selecting and feeding the set amount from the supply hopper to the measuring hopper, said measuring hopper being arranged to retain the amount fed thereto for a time interval, further devices controlled by said settable means and operative during the retention of the measured amount for verifying the selected amount, means controlled by said measuring means for initiating and effecting an operation of said further devices, and means controlled by said verifying means, only when the amount selected is correct, for causing the selected amount to be discharged to the discharge hopper.

5. In a dispensing apparatus, a fluid reservoir, a measuring tube, a device settable in accordance with an amount of fluid, mechanism controlled thereby for causing the represented amount of fluid to flow from the reservoir to said measuring tube, said tube being arranged to retain the fluid therein, separate automatically operating mechanism operative after entry of the selected amount into said tube and during retention thereof for verifying the correctness thereof, means controlled by said first named mechanism for initiating and effecting an operation of said verifying mechanism, a discharge container, and means controlled by said verifying mechanism for causing the fluid in the tube to be discharged into said container only when the quantity thereof is correct.

6. In a dispensing apparatus, a fluid reservoir, a measuring tube, a device settable to correspond to any one of a number of selected levels of the tube, means for causing fluid to flow from the reservoir into the tube, means controlled by said device when the fluid in the tube reaches said selected level for terminating said flow, separate mechanism operative after termination of said flow for thereafter checking the level of the fluid in the tube with the settable device, means controlled by said terminating means for initiating and effecting an operation of said checking mechanism, and means controlled thereby when in agreement for causing discharge of the fluid from the tube.

7. In an apparatus of the class described, selectively operable dispensing mechanism, devices settable in accordance with commodities and quantities to be dispensed, mechanism controlled thereby for actuating said dispensing mechanism to separately and concurrently convey each represented commodity in the required quantity to a checking station, separate means for each commodity for ascertaining when the conveying operation for the related commodity is terminated, devices controlled jointly by all the ascertaining means and automatically operative upon termination of conveying of all commodities for checking the commodities and their quantity at said station with said settable devices, means for conveying the selected commodities to a delivery point, and means controlled by said checking devices for rendering said conveying means effective only upon ascertaining that all of the selected commodities and their quantities are correct.

8. In an apparatus of the class described, selectively operable dispensing mechanism, a record containing designations representing commodities and variable quantities thereof, mechanism controlled by said record for actuating said dispensing mechanism to separately and concurrently convey each represented commodity in the required quantity to a checking station, separate means for each commodity for ascertaining when the conveying operation for the related commodity is terminated, devices controlled jointly by all the ascertaining means and automatically operative upon termination of conveying for checking the conveyed commodities and their quantity with the record, means for conveying the selected commodities to a delivery point, and means controlled by said checking devices for rendering said conveying means effective only upon ascertaining that all of the selected commodities and their quantities are correct.

9. In a mechanical dispensing system provided with selective control apparatus for selectively operating the dispensing system to concurrently deliver different wanted commodities to a checking station, said quantities being retained thereat, preset devices adjusted to represent the wanted commodities, means for ascertaining when delivery of all commodities is completed, mechanism controlled by said preset devices and said ascertaining means when all commodities are delivered for automatically checking the commodities at said checking station, and delivery means controlled thereby and operative to delivery the commodities from the checking station to a destination point only when all the commodities dispensed are correct.

10. In an apparatus of the class described, a commodity supply source, a device settable in accordance with selected commodities in variable quantities, a checking station, mechanism controlled by said settable device for conveying the selected commodities in the selected quantities to the checking station, devices at the station for maintaining the different commodities separate from one another, means for ascertaining when delivery of all commodities is completed, means controlled by the settable devices and said ascertaining means when all commodities are delivered for checking the commodities at the checking station for correctness of selection and correctness of quantity, and means controlled by the checking means for discharging the commodities to a common receiver only when all the commodities are correct.

11. In an apparatus of the class described, a

plurality of commodity supply sources, a checking station having a separate compartment for each possible commodity, control mechanism for dispensing selected commodities and conveying the same to the related compartments, means for discharging the commodities from said compartments to a common container, means settable in accordance with which compartments are to receive commodities and which are not, mechanism at said checking station cooperating with said settable means for ascertaining the presence of selected commodities in their respective compartments and the absence of commodities in the remaining compartments, and means controlled thereby for rendering said discharging means effective only when the relation is in accordance with the setting.

12. In a fluid dispensing system, a fluid reservoir, a receiving compartment, a fluid level indicator associated with said compartment, a device settable in accordance with a selected quantity of fluid, means controlled by said settable device only when it is set to represent a significant quantity for initiating the flow of fluid into the compartment, means controlled by said indicator when the quantity of fluid equals the set quantity for terminating the flow, further means effective a predetermined period after termination of the flow for checking the quantity of fluid in the compartment with the settable quantity through said indicator, means controlled by said terminating means for initiating and effecting an operation of said checking means, and means controlled by said checking means for discharging the fluid from the compartment.

13. In a dispensing system, a supply source, a receiving compartment, a quantity indicator associated with said compartment to indicate the quantity of a commodity therein, a device settable in accordance with a selected quantity of a commodity, means controlled jointly by said settable device when it is set to represent a significant quantity and by said indicator when it is set to represent a predetermined quantity, for initiating the transfer of the commodity into the compartment, means controlled by said indicator when the quantity entered equals the set quantity for terminating the transfer, further means effective after termination of said transfer for checking the quantity of the commodity in the compartment with the settable quantity through said indicator, and means controlled by said checking means for discharging the commodity from the compartment.

14. In a dispensing system, a supply source, an intermediate destination, a final destination, a first conveying means between the supply source and said intermediate destination, a second conveying means between the intermediate

and final destinations, a control device for each conveying means, devices settable in accordance with a desired quantity of the commodity, means for operating the control device of the first conveying means to cause conveyance of a quantity of commodity to the intermediate destination, means at said intermediate destination responsive to the presence of commodity thereat, stopping means jointly controlled by said responsive means and said settable devices for operating the control device of the first conveying means to interrupt conveyance of commodity, checking means jointly controlled by said responsive means and said settable devices for operating the control device of the second conveying means only when the quantity of commodity at said intermediate destination agrees with the quantity set up, and means controlled by said stopping means for initiating and effecting an operation of said checking means.

15. In a dispensing apparatus having a supply hopper containing a substance, an intermediate station for receiving said substance from the supply hopper, and means for controlling the movement of the substance between the supply hopper and the intermediate station in combination with means settable to represent a quantity of substance to be moved from the supply hopper to said intermediate station, means at the station to indicate the quantity of substance at the station, means for testing said settable means to ascertain whether it is set to represent a significant quantity, further means for testing said indicating means at the station, means jointly controlled by both said testing means for rendering the said controlling means effective to initiate movement of substance to the station only when the settable means represents a significant quantity and the station contains no substance, and means controlled by the settable means for subsequently disabling said controlling means when the quantity set up has been moved to said station.

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