June 7, 1955 P. R. FECHHEIMER 2,710,127

RESERVOIR TYPE FILLING MACHINE

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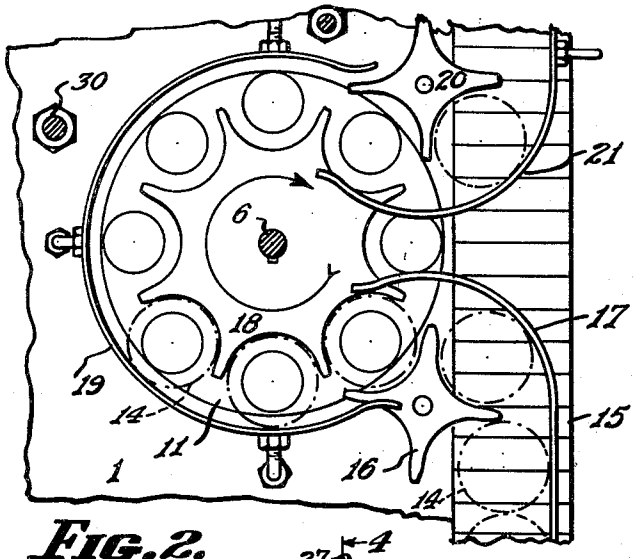

FIG. 2.

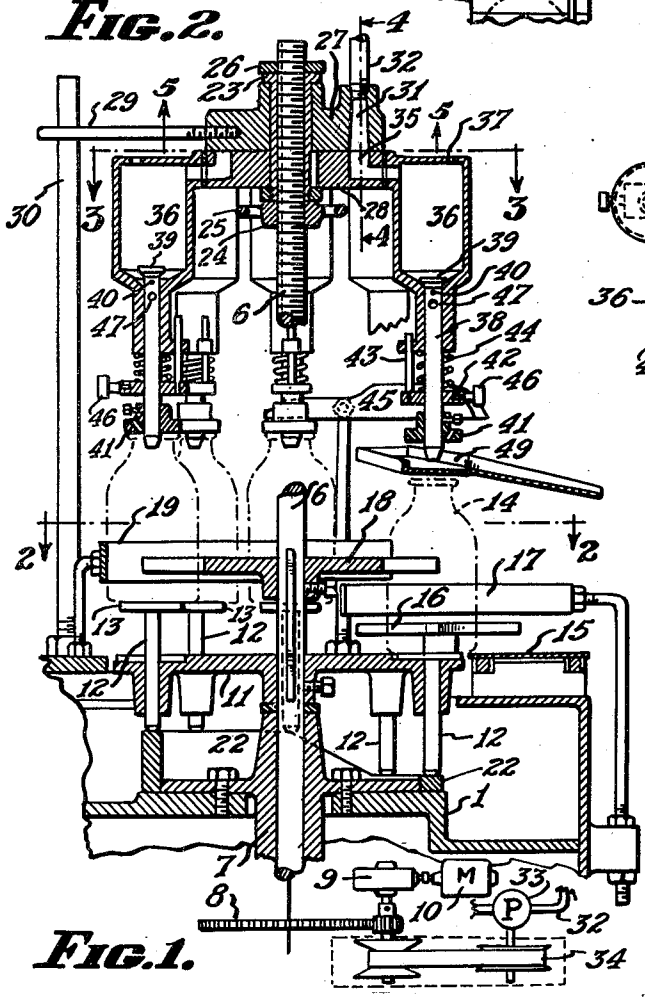

FIG. 1.

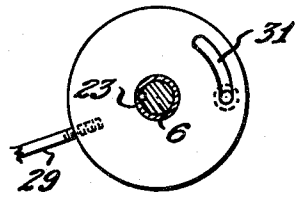

FIG. 5.

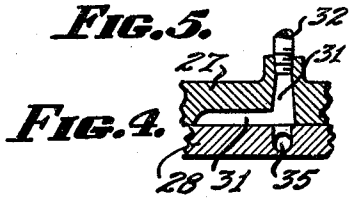

FIG. 4.

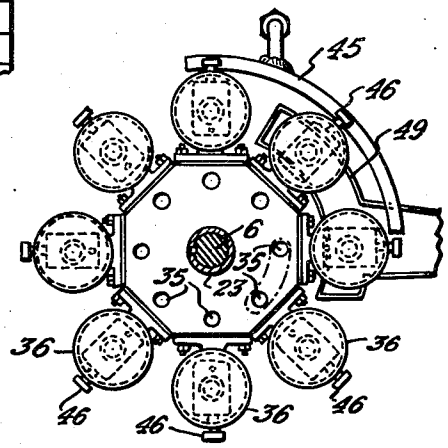

FIG. 3.

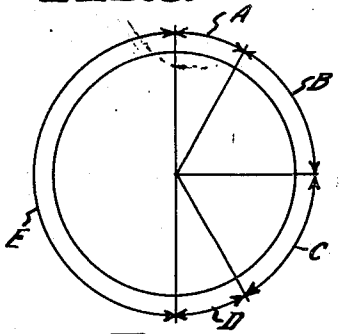

FIG. 6.

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RESERVOIR TYPE FILLING MACHINE

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6 Claims. (Cl. 226—97)

My invention relates to rotary machines for filling containers of various types. Such machines have hitherto been made in which filling spouts for the containers have been mounted on a rotary head element and in which appropriate apparatus is provided for delivering through each of the filling spouts measured increments of the filling material. The containers, such as bottles, jars, cans, and the like, are delivered to platforms on a table rotating beneath the filling head, and the platforms have been arranged to be raised and lowered so as not only to bring the containers into and out of juxtaposition to the pouring spouts, but also in many instances to cause the containers themselves to actuate valving elements in connection with the spouts for various purposes inclusive of the purpose of avoiding discharge of the filling material if no container is present to receive it.

Filling is accomplished in various ways and by various procedures inclusive of the direct pressure introduction of the filling material into the containers accompanied by escape of the contained air to the outer atmosphere, the application of suction to the containers so as to draw the contents into them through an appropriate filling tube, and more elaborate procedures including practices whereby exact fills may be attained either through the initial introduction of exact measured quantities or through overfilling and subsequent removal of the excess; and modes of scavenging the nozzle tubes to prevent drippage have also been developed. These constitute no limitation upon the present invention; and many of such known teachings may be employed in connection with the present invention.

In rotary machines, however, efforts to attain greater speed of operation without sacrificing accuracy encounter a number of important difficulties. Considering a circular path of travel of the containers in the machine, a large portion of the path is taken up by operations other than, although adjunctive to, true filling operations. For example, the containers must in some way be positioned on the several platforms for filling and subsequently removed therefrom after filling; and these operations, whether performed by hand or by automatic machinery, take up a great part of the available path of travel, usually as much as a full quadrant of the circle. Moreover, the containers have to be raised to a position in engagement with the pouring spouts and after filling must be lowered to discharge position; and these operations take further time. Under any given circumstances, a speeding up of the operations of the machine involves a speeding up of the rate of introduction of the filling material into the containers. Another factor which limits the filling time available is the fact that in machines of the type having a head with relatively rotating parts wherein the filling spouts are successively brought into communication with ports in the stationary head member, it is undesirable to elongate these ports unduly since this would involve the connection of more than two filling spouts with a port at one time. Where filling material is delivered to the stationary head part under constant pressure, exactly measured increments are best achieved where only one pouring spout or at most two become connected to the port at any one time. Differences in the resistance of the several nozzles to the flow of filling material will make substantial differences in the quantity of material delivered by each if they are concurrently connected to the same port; and if more than two nozzles are so connected, it becomes very difficult to achieve accurate filling.

To increase the rate of flow of the filling material into the containers is in many instances disadvantageous or impossible because of foaming, splashing, and undue turbulence, so that it is not possible to speed up the operation of the machine beyond the point permitted by an acceptable rate of delivery of the particular filling material being handled.

A principal object of my invention is the provision of useful solutions for the difficulties set forth above.

It is an object of my invention to provide a mechanism in which the rate of formation of the initial measured increments of filling material is rendered to a large degree independent of the rate of introduction of the material into the containers.

It is my object to provide a mechanism in which a greater length of time is provided for the introduction of filling material into containers while the productive capacity of the machine is at the same time increased.

It is an object of my invention to provide a machine in which the formation of measured increments of material can be caused to occur during a time when actual filling is not going on, so that the time for filling may be increased for any given length of time during which the containers are associated with the machine and hence either a greater quantity of filling material introduced into containers in the same time of association or the time of association cut down for the introduction of the same quantity of material with an attendant increase in the productive capacity of the machine.

It is an object of my invention to provide a machine having the advantages set forth above and at the same time having certain safety factors as hereinafter more fully explained.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, I accomplish by that construction and arrangement of parts of which I shall now describe an exemplary embodiment. Reference is made to the accompanying drawings wherein:

Figure 1 is a vertical sectional view through an exemplary machine.

Figure 2 is a horizontal sectional view taken along the line 2—2 of Figure 1.

Figure 3 is a horizontal sectional view taken along the line 3—3 of Figure 1.

Figure 4 is a partial sectional view taken along the line 4—4 of Figure 1.

Figure 5 is a partial sectional view taken along the line 5—5 of Figure 1.

Figure 6 is a diagrammatic chart of an exemplary machine operation.

In the exemplary machine, which has a base 1, a vertical shaft 6 is journaled as at 7, and is arranged to be driven through gearing 8 and a speed reducing gear box 9 by a motor 10. A table 11 is splined to the shaft 6 and, in the exemplary embodiment, has certain rods 12 mounted in it so as to be vertically slidable. These rods bear platform elements 13 to receive the containers 14; and the table is recessed as shown to accept these platforms and to provide a smooth surface when the platforms are in their lowermost position for the acceptance and discharge of the containers.

The containers are brought to the machine by a conveyor 15 mounted on the base 1 and suitably driven by means (not shown) in synchronism with the shaft 6.

A star wheel 16 is provided, coacting with a curved sweep or guide 17 to move the containers from the conveyor 15 to the table 11, these elements acting, as will be readily understood by the skilled worker in this art, to position a container upon each of the platforms 13. A star wheel 18 may be affixed to the shaft 6 to receive the containers, and a curved guide 19 may surround the larger part of the table 11 so as to maintain the containers in the pockets of the star wheel 18. It will be suitably supported as shown.

Another star wheel 20 operating in conjunction with a curved sweep 21 removes the containers from the respective platforms and redelivers them to the conveyor 15.

The lower ends of the rods 12 engage a cam element 22 on the machine base, and this is shaped in such a way as, at the proper point in the rotation of the table 11, to raise the platforms and the containers resting thereon so as to juxtapose them to the pouring spout devices and to operate the pouring spout mechanisms. The cam 22 may be shaped to cause the containers to follow a cycle of raising and lowering operations as may be required for any particular type of pouring spout construction.

In the exemplary machine a sleeve 23 is splined to the shaft 6 and is slidable thereon. The position of this sleeve may be adjusted by means of a nut 24 threaded on the shaft and provided with a hand wheel 25. The adjusted position of the sleeve may be fixed on the shaft by a nut 26. A stationary head 27 and a rotating head 28 are mounted on the sleeve 23 and the rotating head is splined to this sleeve so as to be driven by the shaft. The stationary head 27 is held against rotation by a rod 29 engaging a fixed support 30 on the machine base.

An elongated port 31 is formed in the stationary head element 27, opening through the under face thereof, as shown in Figure 5. This port is connected by a conduit 32 to a source of filling material under constant pressure. The pressure may be provided by gravity or otherwise but I prefer, as shown in Figure 1, to provide a pump 33 in the line 32 and to connect this pump by a suitably adjustable change speed drive 34 with one of the primary driven parts of the machine such as the shaft of the gear box 9. The pump 33 is, in this event, preferably of the positive displacement type, and its operations may, therefore, be positively synchronized with the operations of the filling machine. An arrangement of this type is shown in my Patent No. 2,184,117 issued December 19, 1939.

The rotating head element 28 is provided with passageways 35 extending radially of the head element, opening at intervals about its periphery and also opening upwardly through the upper face of the rotating head element 28 so that during a portion of the travel of the rotating head each such passageway becomes connected with the port 31 and remains connected with it for a length of time depending upon the circumferential length of the port 31 and the speed of rotation of the shaft 6. This arrangement will be clear from Figures 1 and 4, and is common in filling machines in which rotating and fixed head elements exert a valving action on filling material. In such machines a filling spout is ordinarily attached to the rotating head so as to be in communication with each passageway, and it will be understood that the positioning of parts is such that filling spouts are located directly above the containers on the platforms.

In the practice of my invention, however, I interpose between the rotating head and the filling spouts proper, individual reservoir elements indicated in the figures at 36. The filling spouts proper are in turn mounted on these reservoirs as hereinafter described. The filling spouts may take any suitable form, and I shall herein set forth a simple one, it being understood that the form of the filling spout and its attendant control devices do not constitute a limitation on this invention otherwise than as set forth in the appended claims.

In the operation of my machine, measured increments of the filling material are introduced into the several reservoirs in succession through the passageways 35. This introduction can be very rapid. The passageways are large in cross section, making for a large volume of flow without undue velocity. Further, the closed nature of the reservoirs minimizes foaming and renders turbulence inconsequential. The reservoirs may be made to have a very large volumetric capacity, which is further helpful in this regard; and they can be vented to the atmosphere as shown at 37.

In the simplified form of my invention I shape the reservoirs so that they will drain readily, and I provide each of them with a filling tube or nozzle 38 closed at the upper end and provided with a valve element 39 operating against a seat in the bottom of the reservoir. The arrangement is such that when the filling spout is in its lowermost position, the filling tube 38 is out of communication with the reservoir. When, however, the filling tube is raised, the valve element 39 is lifted from its seat and the filling tube is brought into communication with the reservoir by reason of an opening 40 formed near the upper end of the tube. Irrespective of the size of the tube, the opening 40 may be made of a suitable size to produce the desired rate of flow of the filling material through the filling tube into the containers 6 to avoid splashing, foaming and undue turbulence.

A suitable abutment element 41 is arranged on each of the filling tubes in such position as to be contacted between the containers so that the containers can raise the filling tube to filling position as shown at the left hand side of Figure 1. The abutment element 41 may be made adjustable on the filling tube to accommodate containers of different dimensions. Another abutment element 42 may be fixed to the filling tube so as to move with it, and guided by a rod 43 operating, as shown, in a perforation in an ear formed on the lower part of each reservoir. A compression spring 44 may be placed around each filling tube, engaging between the lower end of the reservoir and the abutment 42 to insure rapid and positive downward motion of the filling tube and consequent closure of the valve arrangement as soon as a container is removed from contact with the abutment 41.

The filling tube 38 may be slidably journaled for smooth operation in an elongated lower portion of the reservoir, as will be clear from the drawing.

It will now be evident that if a container fails to contact the abutment 41 and move the filling tube 38 upwardly, there will be no discharge of filling material from the reservoir. This prevents fouling of the filling machine if the mechanism hereinabove described fails to place a container properly on each of the platforms 13. But when a reservoir fails to be emptied by a container, it must be emptied prior to filling, since otherwise an overfill would result. This is accomplished by providing means for automatically draining each reservoir at a given position on the machine. I accomplish the function by supporting a cam 45 on the machine and by providing the abutments 42 with cam followers 46 coacting therewith. If the cam is shaped to raise the filling tubes 38 higher than they would be raised by the containers, it then becomes possible to provide a second and larger opening 47 near the upper ends of the filling tubes, which opening will be uncovered by the greater upward movement of the filling tubes produced by the cam. If the contents of a reservoir were not emptied from it into a container, they will drain very rapidly from it through the openings 40 and 47 when the reservoir is opened up by the cam 45. A trough 49 is arranged to catch the contents of an unemptied reservoir and any drippage from the other reservoirs after they have be-

come disassociated with respective containers, and to carry away the discharged filling material. The shape and positioning of this trough will be evident from Figure 3, and it may be pointed out that the arcuate portion of the trough may be extended so as to underlie the various reservoirs during the whole of the period when they are not in association with containers.

It will be evident from the above that the operations of draining any undrained reservoirs and of filling all reservoirs are operations which can be carried on concurrently with such operations as the placing of containers on the platforms, the raising of the containers toward filling position, the lowering of containers from filling position and the withdrawal of containers from the platforms. Furthermore, since the operations of draining and filling reservoirs occur very rapidly, they can be made to occupy a very small portion of the length of time individual containers are associated with the machine. The entire remaining portion of the cycle can be employed for the introduction of the filling material into the containers themselves so that the container filling operation can be very greatly prolonged at any given speed of operation. Further, whereas in former machines the filling of the containers had to coincide exactly with the duration of the formation of the measured increments, and whereas the duration of increment measuring could not occupy any great portion of the circular travel of the containers and could not be prolonged because of mechanical difficulties set forth above, the actual filling of the containers was of necessity confined to a comparatively very small portion of the circular path of travel. In my machine the formation of the measured increments for introduction into the individual containers not only occurs with great rapidity, but is rendered independent of the rate of introduction of the increments into the containers. Thus without speeding up the rate of fill for an individual container, the rate at which the machine accepts empty containers and discharges full ones can be very greatly increased.

My mechanism is capable of being operated in various ways and Figure 6 is intended only to illustrate an exemplary operation. Here, however, I have indicated in chart form that the filled containers are lowered to discharge position in that radial portion of the rotation of the machine indicated at A. The reservoirs are drained as at B if their contents were not discharged into containers and the reservoirs are refilled as at C. The steps of loading the containers onto the table and discharging them therefrom can be confined to those portions of the cycle represented at C and B. The containers are lifted into filling position as at D. In the operation exemplified by the chart, this leaves a full half of the rotative cycle for the container filling operation as indicated at E. In many operations more than one-half of the rotative travel of the table can be employed for filling operations. Considering that for most perfect operation a given measured increment of a given material should be introduced into a container within a given length of time, and since the path of travel represented by this length of time can now be increased to equal or exceed half of the rotative cycle of the machine as compared with a small fraction of the rotative cycle in the hitherto known machines, say a sixth of the cycle or less, it will now be evident that the speed of the machine may be increased to the point where the time required to execute a half cycle of rotation is equal to that hitherto required to execute a sixth of a cycle or less. Hence the output of the machine may be increased proportionately.

Modifications may be made in my invention without departing from the spirit of it. Having thus described my invention in an exemplary embodiment, what I claim as new and desire to secure by Letters Patent is:

1. A rotary filling machine having a cycle of operation wherein predetermined measured increments of filling material are introduced into storage reservoirs during a minor portion of the operating cycle and the measured increments drained from the reservoirs into containers to be filled during a major portion of the operating cycle, said filling machine comprising a fixed head having a port connected to a source of filling material under pressure, a rotatable head having a plurality of passageways adapted to be serially brought into communication with said port, reservoirs in communication with said passageways to receive predetermined measured increments of filling material during the intervals the passageways are in communication with said port, filling spouts mounted beneath said reservoirs, said filling spouts opening into the bottoms of said reservoirs, whereby the filling material in said reservoirs will flow by gravity through said filling spouts to the containers to be filled, valve means normally closing the openings between said reservoirs and said filling spouts, and valve actuating means effective subsequent to the introduction of filling material into said reservoirs to open said spouts to the flow of filling material from said reservoirs during a major portion of the operating cycle of said machine, whereby the filling material may be rapidly metered into the reservoirs in predetermined measured quantities and thereafter drained into the containers to be filled at a slower rate without decreasing the operating speed of the machine.

2. A rotary filling machine having a cycle of operation wherein predetermined measured increments of filling material are introduced into storage reservoirs during a minor portion of the operating cycle and the measured increments drained from the reservoirs into containers to be filled during a major portion of the operating cycle, said filling machine comprising a fixed head having a port connected to a source of filling material under pressure, a rotatable head having a plurality of passageways adapted to be serially brought into communication with said port, reservoirs in communication with said passageways to receive predetermined measured increments of filling material during the intervals the passageways are in communication with the said port, filling spouts mounted beneath and opening into the bottoms of said reservoirs, whereby the filling material introduced into said reservoirs through said passageways will readily drain by gravity into said filling spouts, said filling spouts comprising filling tubes provided with valve elements operating against valve seats in the bottoms of said reservoirs, said filling tubes being movable axially to unseat said valve elements, means for bringing containers individually into association with said filling tubes, and valve operating means actuated by the containers and effective subsequent to the introduction of filling material into the reservoirs for unseating said valve elements during a major portion of the operating cycle of said machine, whereby filling material may be rapidly metered into the reservoirs in predetermined measured quantities and thereafter drained into the containers to be filled at a slower rate without decreasing the operating speed of the machine.

3. A rotary filling machine having a cycle of operation wherein predetermined measured increments of filling material are introduced into storage reservoirs during a minor portion of the operating cycle and the measured increments drained from the reservoir into containers to be filled during a major portion of the operating cycle, said filling machine comprising a fixed head having a port connected to a source of filling material under pressure, a rotatable head having a plurality of passageways adapted to be serially brought into communication with the said port, reservoirs in communication with said passageways to receive predetermined measured increments of filling material during the intervals the passageways are in communication with the ports, filling spouts mounted beneath and opening into said reservoirs, whereby filling material will drain by gravity through said filling spouts, valve means in the openings between said reservoirs and said filling spouts, said valve means having a filling position and a reservoir drain position, valve moving means

operable by containers brought into association with said filling spouts for moving said valve means to the filling position subsequent to the introduction of filling material into said reservoirs and for maintaining said valve means in the filling position during a major portion of the operating cycle of said machine, and additional valve moving means independent of said first mentioned valve moving means for moving said valve means to said drain position during each cycle of operation irrespective of movement of said valve means to the filling position.

4. The structure claimed in claim 3 including a trough positioned beneath the filling spout during that portion of the machine cycle during which said valve means are in the reservoir drain position.

5. The structure claimed in claim 4 wherein the means for moving the containers comprises a table, vertically movable container platforms mounted on said table and unloading and loading means for said platforms, and in which the operations of draining and refilling the reservoirs occurs during the loading and unloading operations for the containers.

6. The structure claimed in claim 5 in which the extent of filling association of the containers with the filling spout occupies at least substantially half of the rotative cycle of the filling machine.

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