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Faessler et al.

[11] **3,797,537**
[45] **Mar. 19, 1974**

[54] **NO-CAN NO-FILL FEEDING STAR WHEEL**

[75] Inventors: **Adelmar Faessler**, Rochester; **Stewart E. Engle**, Fairport, both of N.Y.

[73] Assignee: **Sybron Corporation**, Rochester, N.Y.

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[52] **U.S. Cl.** **141/142,** 137/804
[51] **Int. Cl.** **B65b 57/02**
[58] **Field of Search** 141/140, 141, 142, 143; 137/804, 805

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Primary Examiner—Houston S. Bell, Jr.
Attorney, Agent, or Firm—Theodore B. Roessel

[57] **ABSTRACT**

A no-can no-fill mechanism is incorporated in a star wheel which feeds containers to a rotating filling wheel. A fluidic sensor, a cam, and control means for moving the cam are positioned at each pocket on the star wheel. The cams are normally in position to open filling valves on the filling wheel. When one of the pockets does not pick up a container at the normal point, the sensor and control means at that pocket move the corresponding cam to an inoperative position, so that a filling valve will not be opened at an empty filling station on the filling wheel.

17 Claims, 6 Drawing Figures

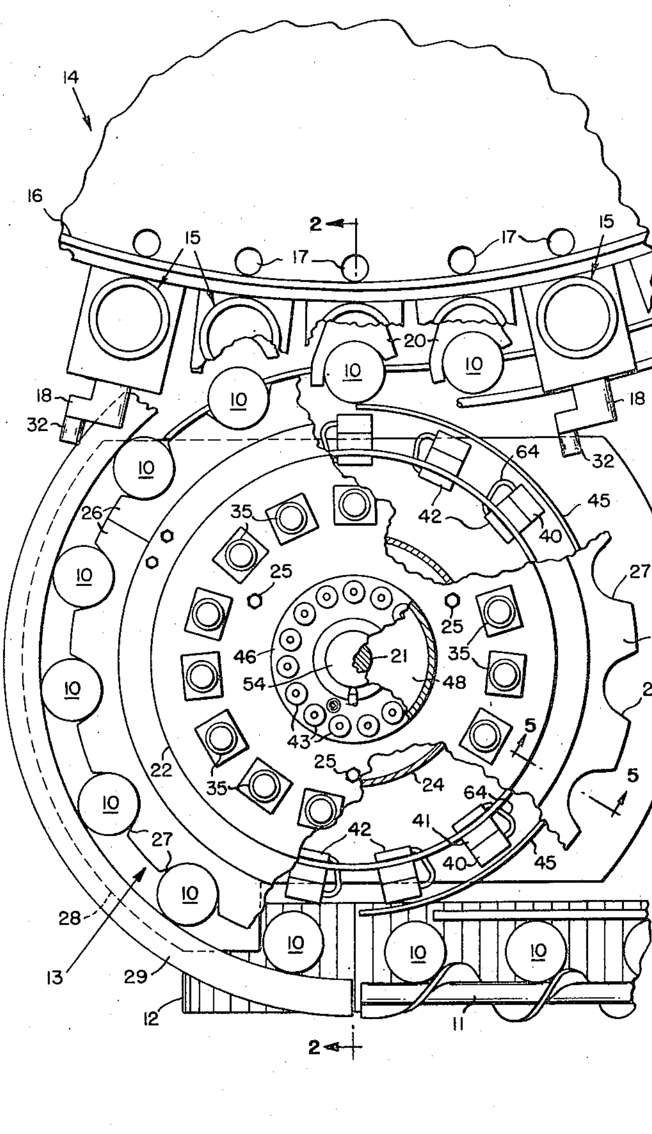
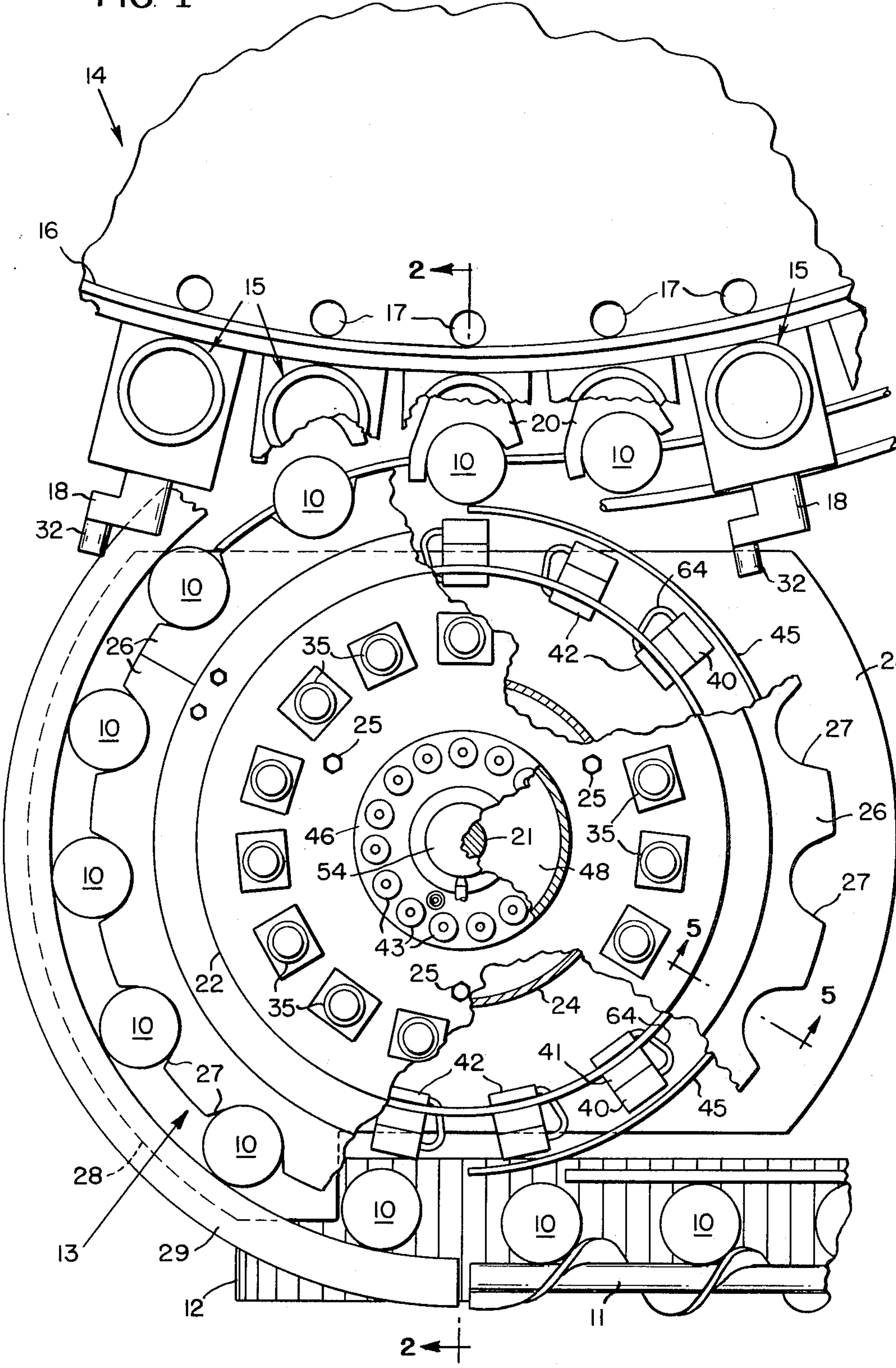


FIG. 1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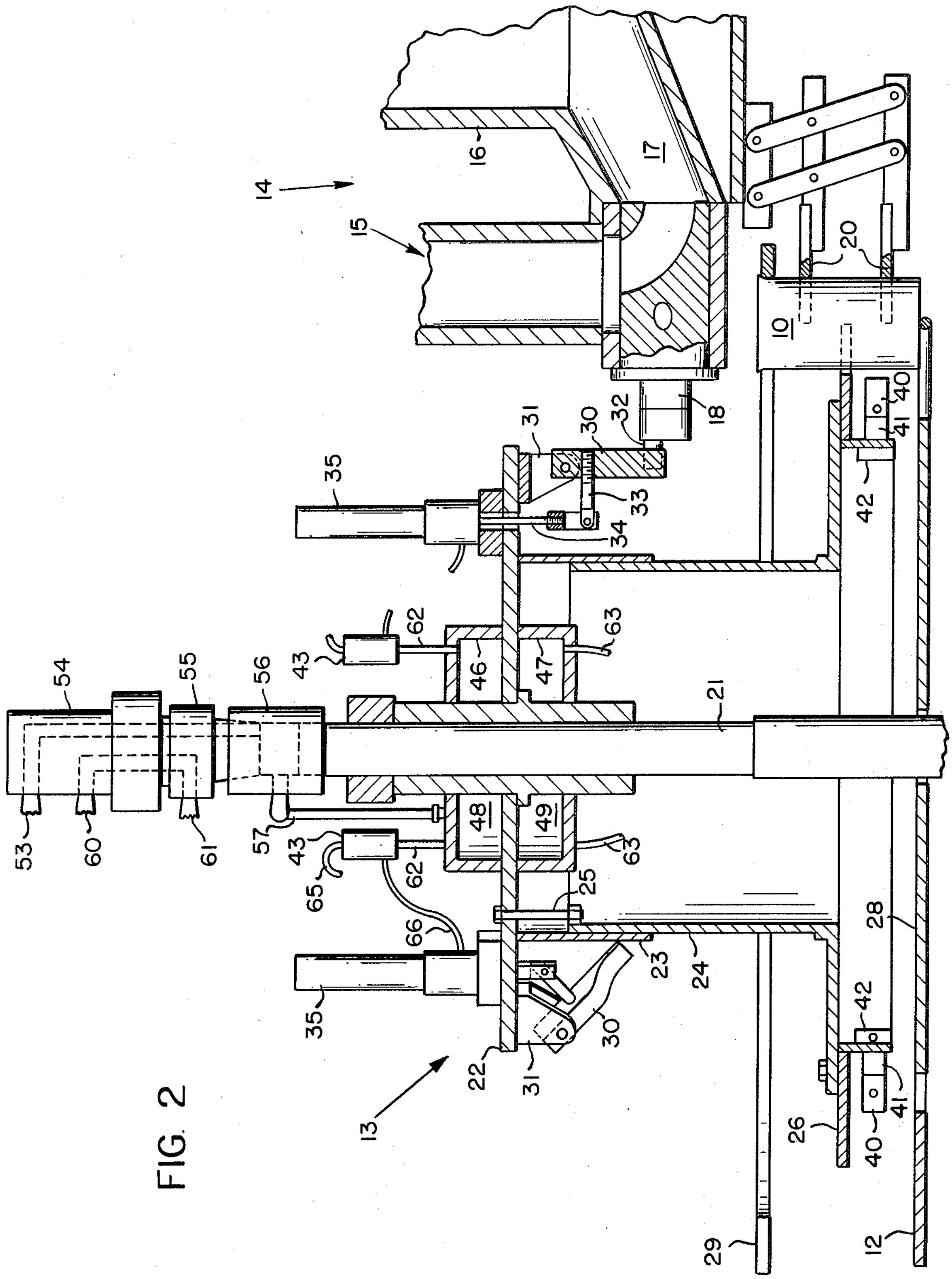
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FIG. 2

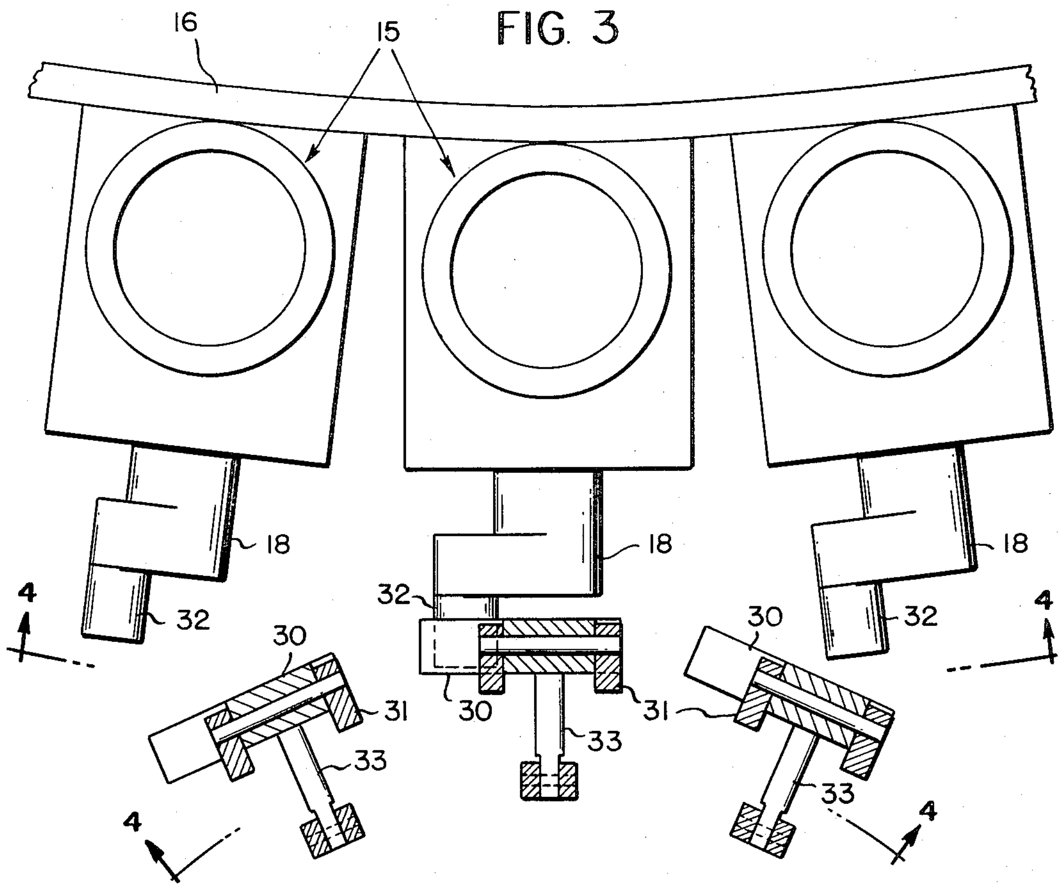
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FIG. 3

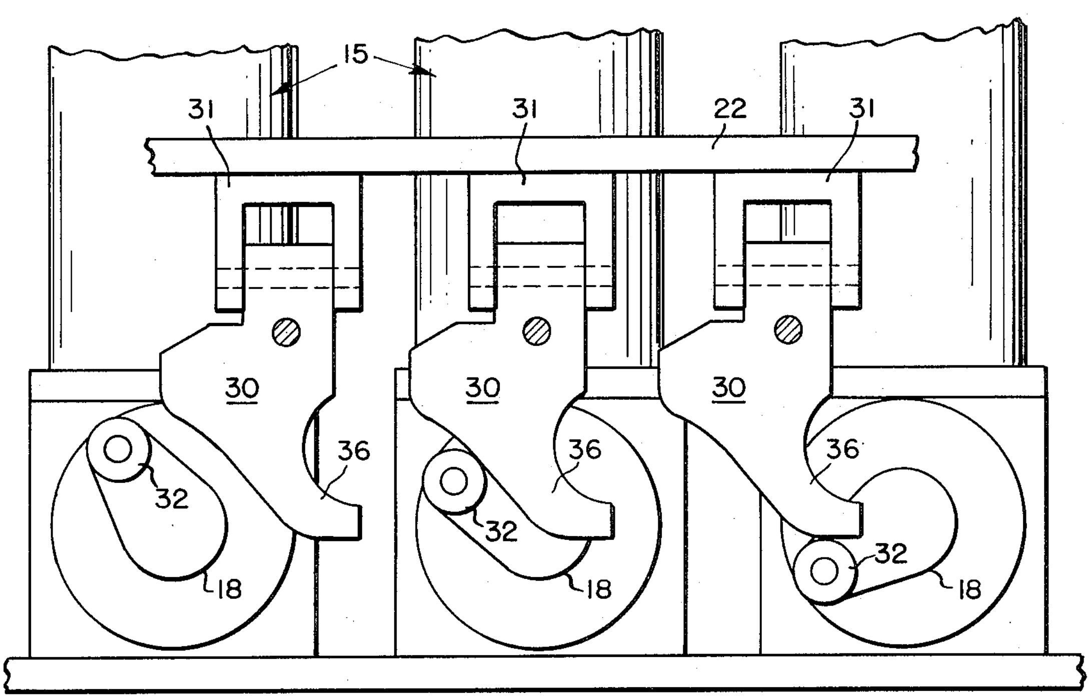
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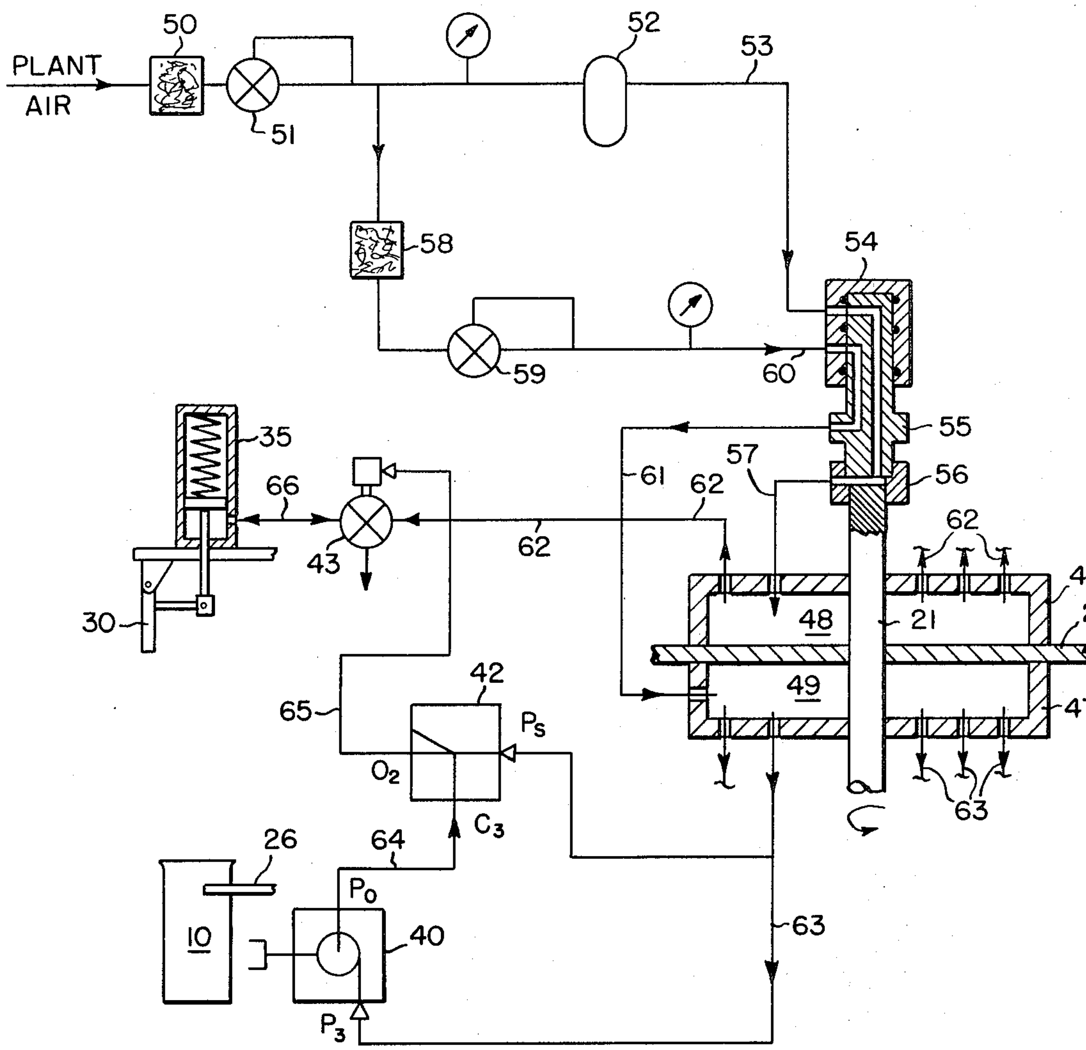
FIG. 4

FIG. 6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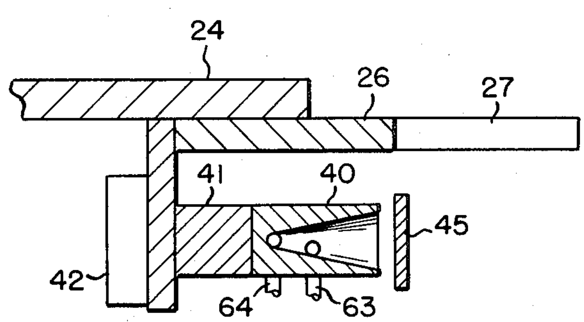
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FIG. 5

NO-CAN NO-FILL FEEDING STAR WHEEL

BACKGROUND OF THE INVENTION

This invention relates to apparatus for feeding workpieces to processing equipment and initiating operations on the workpieces. More particularly, this invention relates to a no-can no-fill mechanism for rotary filling machines.

Rotary filling machines are used for filling containers such as cans, bottles, cartons and the like with a wide variety of flowable materials such as juices, oils, soups, tomato pastes, baby foods, apple sauce and many others which run the gamut from thin, free-flowing liquids to material such as pulpous vegetable products with just sufficient liquid to render them sluggishly flowable. These machines usually have a rotating filling wheel with a number of fill assemblies spaced about its periphery. Each assembly typically includes a rotary valve with a cam follower attached thereto for opening and closing the valve.

The valves are usually opened by what is known as a "no-can no-fill" mechanism. These mechanisms usually include a cam which is normally positioned in the path of the cam followers on the filling valves, and detecting means positioned in the path of containers approaching the machine. As long as a steady stream of containers is fed to the machine, the cam remains in the path of the cam followers and each filling valve is opened when a container has been positioned beneath it. However, if there is a gap in the stream of incoming containers, the cam is moved out of the path of the cam followers so that valves at empty fill stations will not be opened. Typical no-can no-fill mechanisms of this sort are disclosed in U.S. Pat. Nos. 2,666,564 and 3,139,915 to E.S. Minard, U.S. Pat. No. 2,759,649 to J.T. Stigler and U.S. Pat. No. 3,489,186 to L. C. Riker.

The main drawback of this type of no-can no-fill mechanism is that the cam must be moved into and out of the path of the rapidly moving cam followers. Since the filling assemblies, and thus the cam followers, are spaced fairly closely together and are moving at a high rate of speed, the time available for moving the cam into and out of the path of the followers is usually on the order of a few hundredths of a second. As a result, the no-can no-fill mechanism is usually the factor that limits the top speed of the filler. Typically, prior art fillers have had a top speed of something less than 1,000 containers per minute.

SUMMARY OF THE INVENTION

It is an object of this invention to provide improved means for feeding workpieces, such as containers, to processing equipment, such as a filling machine, and initiating an operation on the workpieces. More specifically, it is an object of this invention to provide feeding means that permit the processing equipment to operate at a higher speed.

This invention provides feed means, such as a rotary star wheel, having a plurality of pockets adapted to pick up the workpieces at one point and deliver them to the processing equipment at another point. A sensor for detecting the presence of workpieces is mounted at each pocket. Control means, which in the preferred embodiment include a movable element such a a movable cam, are also provided at each pocket. The control means are adapted to initiate or prevent the initiation of the operation of the workpiece in response to signals from the sensor at the same pocket.

Another object of this invention is to provide a no-can no-fill mechanism that incorporates an inexpensive, reliable system for sensing containers in the individual pockets of a star wheel feeder. This is accomplished through the use of fluidic sensors at the individual pickets. The fluidic sensors eliminate the need for electrical commutator rings or similar sensitive, easily damaged equipment to supply electric current to the individual sensors. In addition, the fluidic sensors provide a system which can be more readily adjusted to a variety of types and sizes of containers than trip levers or similar mechanical detectors can be.

Other objects and advantages of this invention will be apparent from the following detailed description.

DRAWINGS

FIg. 1 is a plan view of one embodiment of this invention.

FIG. 2 is a cross-sectional elevation view taken along lines 2—2 of FIG. 1.

FIG. 3 is a fragmentary plan view, from the same vantage point as FIG. 1, illustrating the relative motion of the cam followers at the fill stations and the cams on the star wheel feeder.

FIG. 4 is a diagrammatic elevation view with the machine "unrolled" to illustrated the relative motion of the cams and cam followers.

FIG. 5 is a cross-sectional view taken along lines 5—5 of FIG. 1.

FIG. 6 is a schematic diagram of the means for supplying control fluid to the various elements of the star wheel.

DETAILED DESCRIPTION

Referring to FIG. 1, containers 10 are fed by a feed screw 11 from a conveyor 12 onto a star wheel, generally referred to as 13. The star wheel delivers the containers to a rotary piston filler of the type illustrated in Minard U.S. Pat. No. 2,666,564 and Stigler U.S. Pat. No. 2,759,649, where the containers are positioned beneath filling assemblies 15 spaced about the periphery of a rotary filling wheel 14. The filling wheel is mounted on a suitable base (not shown) and rotated by drive means such as those illustrated in the Minard and Stigler patents.

Referring to FIG. 2, the filling wheel 14 has a central tank 16 which holds the material with which the containers are to be filled. Tank 16 is connected to the individual filling assemblies by ports 17. Each filling assembly has a filling valve 18 which, as is shown in the Minard patent, may be rotated between a closed position, in which material can pass from the tank into the filling assembly and an open position, in which the material is discharged to a container.

Gripping chucks 20, which hold the containers in position beneath the individual filling assemblies 15, are also attached to the filling wheel 14. Preferably the chucks are like those shown in our co-pending application Ser. No. 217,575 filed Jan. 13, 1972, which tilt the containers as they pass around the filler. These chucks facilitate operation of the machine at the higher speeds made possible by this invention.

The star wheel, which feeds the containers to the gripping chucks, is mounted on the same base as the filling wheel 14. The star wheel rotates about a central shaft 21 that is synchronized with the main shaft (not shown) of the filling wheel. Most of the components on the star wheel are carried by a mounting plate 22 which is attached to the central shaft 21. A skirt 23 is welded to the mounting plate 22. A mounting assembly 24 slides within the skirt and is attached to the mounting plate 22 by bolts 25.

A plurality of ring segments 26 are bolted to mounting assembly 24. These ring segments define a plurality of pockets 27 which, in co-operation with a fixed guide ring 29 and a fixed support plate 28, are adapted to individually pick up the containers from feed screw 11 and deliver them individually to the gripping chucks 20 on the rotating filling wheel 14. The height of the pockets 27 in relation to the gripping chucks 20 may be adjusted by the bolts 25 which attach the mounting assembly 24 to the mounting plate 22. These bolts may also be used to adjust the height of the pockets to suit different sized containers.

Mounting plate 22 also carries a plurality of cams 30, which are pivotally mounted in brackets 31. One cam is mounted at, or associated with, each pocket. As best seen in FIG. 2, the cams 30 are normally mounted in a path that intersects the path of cam followers 32 attached to the filling valves 18 on the filling wheel 14. A stud 33 extends from each cam and these studs are connected to the piston rods 34 of spring loaded pneumatic cylinders 35. A fluidic sensor 40 is mounted at each pocket and means (described in more detail below) are provided for moving each cam out of the path that intersects the path of the cam followers when the sensor at that pocket indicates that a container has not been picked up. In FIG. 2, the cam shown on the left hand side of the drawing has been pivoted out of the path that intersects the path of the cam followers into the "no-can", or inoperative, position.

Since the containers normally move through an arc of approximately 180° on the star wheel, there is plenty of time to move the cams either into or out of position for opening the filling valves. Thus, the no-can no-fill mechanism is no longer the factor which limits the top speed of the machine. Filling machines utilizing this invention have operated at speeds as high as 1,500 containers per minute, which is a 50 percent increase over the top speed of typical prior art filling equipment.

The relative speed of the cams and cam followers depends on the location of the cam followers with respect to the gripping chucks 20 on the rotating filling wheel and the location of the cams with respect to the pockets 27 on the star wheel. As was mentioned above, the star wheel is synchronized with the filling wheel, i.e., the peripheral speed of the star wheel at the center line of the containers in the pockets is the same as the peripheral speed of the filling wheel at the center line of the containers in the gripping chucks. As is best seen in FIG. 2, the cam followers are further away from the axis of rotation of filling wheel 14 than the gripping chucks are. Consequently, the cam followers move faster than the gripping chucks, i.e., their absolute velocity is greater. Similarly, since the cams are closer to the axis of rotation of the star wheel than the pockets are, they move more slowly. Since the cam followers are moving faster than the cams, as each container is transferred from the star wheel to the filling wheel the cam follower at the filling assembly which is receiving the container moves past the cam at the corresponding pocket on the star wheel and the filling valve is opened.

The movement of the cam followers past the cams is illustrated in FIGS. 3 and 4. The valve on the filling assembly at the left hand side of these drawings is closed and the cam follower attached to that valve is approaching the corresponding cam. The cam follower in the center is engaging that cam and is in the process of opening that valve. The cam follower on the right of these figures has moved past the corresponding cam and the valve to which that cam follower is attached is now open.

As may be seen in FIG. 4, a cut out 36 is provided in the leading edge of each cam 30. This enables the cam to clear the cam follower 32 in front of it if that cam follower remains in the closed position.

The sensors and the associated means for moving the cams are shown in FIGS. 2, 5 and 6. A fluidic sensor 40, which preferably is a vortex proximity sensor such as Corning Glass Works' Model 2X Vortex Sensor No. 192414, is mounted (with a spacer 41) at each pocket 27 on the star wheel 13. As long as something is in front of any particular sensor 40 it sends a signal to an inverter 42, such as Corning's inhibited OR gate No. 191451. When the sensor is uncovered it stops sending the signal to the inverter and the inverter then sends a signal to a fluidic-pneumatic interface control valve 43, such as Corning's Miniature Interface Valve No. 192728 or Northeast Fluidics' Model 2010 Fluidic Amplifier Valve, which supplies high pressure air to the spring loaded pneumatic cylinder to which it is connected, thereby moving the cam at that pocket to the "no-can" position. As is shown diagrammatically in FIG. 6, the pneumatic cylinders are spring loaded so that they will normally hold the cams in position to open the filling valves. However, when a fluidic sensor is uncovered, air is supplied to the corresponding pneumatic cylinder and the cam at that pocket is moved rapidly and positively out of the path that intersects the path of the cam followers. When the sensor is covered again, the control valve 43 closes and allows the air to escape from the pneumatic cylinder, whereby the spring in the cylinder moves the cam back into the aforementioned path.

Referring to FIGS. 1 and 5, a stationary shield 45, attached to the base of the filler, covers the sensors moving from the point where the containers are delivered to the filling wheel back to the point where the pockets normally pick up the containers. As a result, each sensor will continue to indicate that the pocket at which it is located is full (and the cams will all remain in position for opening the filling valves) unless a pocket does not pick up a container at the normal point.

The means for supplying control fluid to the various elements on the star wheel are shown in FIGS. 2 and 6. Two dish shaped members 46, 47 are mounted coaxial with the central shaft 21 of the star wheel. These dish shaped members, in co-operation with mounting plate 22, define a high pressure plenum chamber 48 and a low pressure plenum chamber 49. These chambers are supplied, by the system diagramed in FIG. 6, with compressed air from a suitable source such as a plant air line. The air passes through a filter 50 and a high pressure regulator 51 which provides a stream of air at a pressure of 40 to 60 psi. This stream is split in two. Part of the air passes through an oiler 52 and a connecting line 53 to a port on the stationary half 54 of a double passage rotating union such as a Deublin "Deuplex" model 1595–15. The rotating half 55 of the union is mounted by an adapter **56** on top of the central shaft **21** of the star wheel. The high pressure air passes from the rotating half of the union through adaptor **56** and another connecting line **57** to the high pressure plenum chamber **48**. The rest of the air from the high pressure regulator **51** passes through a second filter **58** and a low pressure regulator **59** which provides a clean, oil-free stream of air at a pressure of about four to six psi. This air then passes through connecting line **60** to another port on the stationary half **54** of the rotating union, through the rotating half **55** of the union and through another connecting line **61** to the low pressure plenum chamber **49**.

The high pressure air from plenum chamber **48** is fed through a number of connecting lines **62** to the individual control valves **43**. The air from the low pressure plenum chamber passes through a number of lines **63** connected to the supply ports Ps of the individual fluidic sensors **40** an inverters **42**. The output ports Po of the fluidic sensors are connected through lines **64** to the C_3 control ports of the inverters, and the O_2 output ports of the inverters are connected by lines **65** to the control valves **43**.

This system provides a reliable, relatively inexpensive means for supplying all of the various sensors and control elements on the star wheel. The rotating union is nowhere near as sensitive as electrical commutator rings are to dirt, steam or the various other contaminants which are likely to be present in an industrial processing operation. Since the sensors need not contact the containers, and neither the sensors or the inverters have any moving parts, there is, for all practical purposes, no wear on these elements. Thus, this system is not as likely to need maintanence as a system of electrical switches or a system of mechanical detectors such as trip levers would be. In addition, the fluidic sensors provide a system which is easier to adjust to a variety of types and sizes of containers than either switches or mechanical detectors would be.

OPERATION

To recapitulate, containers **10** are picked up from a conveyer **12** by the pockets **27** of a rotary star wheel and fed to gripping chucks **20** positioned beneath filling assemblies **15** spaced around the periphery of a rotating filling wheel **14**. A fluidic sensor **40**, inverter **42**, control valve **43**, pneumatic cylinder **35** and cam **30** are mounted at each pocket **27** on the star wheel. The cams are normally positioned in a path which intersects the path of cam followers **32** attached to the valves **18** at the filling assemblies **15**. As each container is transferred from the star wheel **13** to the filling wheel **14** the cam follower **32** at the filling assembly receiving the container moves past the corresponding cam on the star wheel and the filling valve is opened. However, if one of the pockets on the star wheel does not pick up a container at the normal point, the fluidic sensor **40** at that pocket stops sending a signal to the inverter **42** to which it is connected. The inverter then sends a signal to the corresponding control valve, which opens and supplies high pressure air to the corresponding pneumatic cylinder **35**, thereby pivoting the cam **30** at that pocket to the inoperative position, where it will not open a valve at an empty filling assembly.

Since the containers travel through an arc of approximately 180° on the star wheel, there is plenty of time to move the cams either into or out of the operative position. Thus, this no-can no-fill mechanism does not limit the top speed of the filler and significant increases in the speed of the machinery are made possible.

The no-can no-fill mechanism described above is but one example of many possible uses of this invention. For example, it is equally applicable to arts associated with filling such as washing, painting or coating containers prior to filling; or capping or labeling containers subsequent to filling. Moreover, this invention is applicable not only to filling machines and the like but also to a variety of other situations wherein workpieces are transferred to moving processing equipment where an operation is performed on the workpieces. The foregoing description is merely illustrative and is not intended to limit the scope of this invention, which is defined by the appended claims.

We claim:

1. Apparatus for feeding workpieces to processing equipment and initiating an operation on the workpiece comprising:

a. feed means having a plurality of pockets adapted to pick up the workpieces at one point and deliver the workpieces to the processing equipment at another point;

b. a sensor at each of the pockets for detecting the presence of workpieces at that pocket;

c. a cam at each of said pockets, said cam being adapted to be moved into and out of position for initiating the operation on a workpiece located at that pocket; and

d. means for moving each cam in response to signals from the sensor at the same pocket.

2. Apparatus according to claim **1** wherein the feed means comprises a star wheel.

3. Apparatus according to claim **1** wherein the sensors are fluidic sensors.

4. Apparatus according to claim 3 wherein;

a. the cam is normally in position for initiating the operation on the workpiece; and

b. the means for moving the cam comprises a hydraulic or pneumatic cylinder adapted to move the cam when the sensor at that pocket indicates that the pocket has not picked up a workpiece.

5. Apparatus according to claim **4** further comprising a stationary shield that covers the fluidic sensors while they move from the point where the workpieces are delivered to the processing equipment back to the point where the workpieces are picked up, whereby each sensor will continue to indicate that the pocket at which that sensor is located is full unless that pocket does not pick a container at the pickup point.

6. Apparatus according to claim **4**, wherein the feed means comprises a rotary star wheel, further comprising;

a. a high pressure plenum chamber and a low pressure plenum chamber on the star wheel;

b. a double passage rotary union coaxial with the axis of rotation of the star wheel;

c. means for feeding a high pressure control fluid from a source of supply to the rotary union and from the rotary union to the high pressure plenum chamber;

d. means for feeding a low pressure control fluid from a source of supply to the rotary union and from the rotary union to the low pressure plenum chamber;

e. a control valve connected to each hydraulic or pneumatic cylinder;

f. means for supplying the high pressure control fluid from the high pressure plenum chamber to the individual control valves;

g. means for supplying the low pressure control fluid from the low pressure plenum chamber to the individual fluidic sensors; and

h. means for opening each control valve when the sensor with which that control valve is associated indicates that that pocket has not picked up a work piece, whereby the control valve supplies high pressure control fluid to the hydraulic or pneumatic cylinder to which it is connected and the cam associated with that pocket is moved out of the position for initiating the operation of the work piece.

7. A no-can no-fill mechanism for a container filling machine having a plurality of filling valves, comprising a star wheel having:

a. a plurality of pockets for individually feeding containers into position beneath the filling valves;

b. a fluidic sensor at each pocket adapted to sense the presence of containers at that pocket;

c. means for opening one of the filling valves when the container sensed by one of the sensors has been positioned beneath that valve;

d. a plenum chamber on the star wheel;

e. a rotary union coaxial with the axis of rotation of the star wheel;

f. means for feeding a control fluid from a source of supply to the rotary union and from the rotary union to the plenum chamber; and

g. means for supplying control fluid from the plenum chamber to the individual fluidic sensors.

8. A no-can no-fill mechanism for a container filling machine having a plurality of filling valves, comprising a star wheel having:

a. a plurality of pockets for individually feeding containers into position beneath the filling valves;

b. a fluidic sensor at each pocket adapted to sense the presense of containers at that pocket;

c. means for opening one of the filling valves when the container sensed by one of the sensors has been positioned beneath that valve;

d. a stationary shield that covers the fluidic sensors while they move from the point where the containers are delivered to the filling machine back to the point where the containers are picked up, whereby each sensor will continue to indicate that the pocket at which it is located is full unless that pocket does not pick up a container at the normal pick-up point.

9. A no-can no-fill mechanism according to claim **8** wherein the fluidic sensors are vortex proximity sensors.

10. A no-can no-fill mechanism for a multi-station, high speed container filling machine having a filling valve at each filling station, said filling valves being movable from a closed to an open position by cam followers attached to the valves, comprising a star wheel having:

a. a plurality of pockets for individually feeding containers into position at said filling stations;

b. a sensor at each pocket for detecting the presence of containers at that pocket;

c. a cam mounted at each pocket for movement into and out of a path which intersects the path of the cam followers; and

d. means for moving each cam in response to signals from the sensor at the same pocket.

11. A no-can no-fill mechanism according to claim **10** wherein the cams are normally positioned in the path that intersects the path of the cam followers and the means for moving each cam are adapted to move each cam out of said path when the sensor at the same pocket indicates that that pocket has not picked up a container.

12. A no-can no-fill mechanism according to claim **11** wherein the means for moving each cam comprises a hydraulic or pneumatic cylinder and a control valve connected to the cylinder.

13. A no-can no-fill mechanism according to claim **12** further comprising:

a. a high pressure plenum chamber on the star wheel;

b. a rotary union coaxial with the axis of rotation of the star wheel;

c. means for feeding a high pressure control fluid from a source of supply to the rotary union and from the rotary union to the high pressure plenum chamber; and

d. means for supplying the high pressure control fluid from the plenum chamber to the individual control valves.

14. A no-can no-fill mechanism according to claim **13**, wherein the sensors are fluidic sensors and the rotary union is a double passage union, further comprising;

a. a low pressure plenum chamber on the star wheel;

b. means for feeding a low pressure control fluid from a source of supply to the rotary union and from the rotary union to the low pressure plenum chamber;

c. means for supplying the low pressure control fluid from the low pressure chamber to the individual fluidic sensors; and

d. means for opening each control valve when the sensor with which that control valve is associated indicates that that pocket has not picked up a container, whereby the control valve supplies high pressure control fluid to the hydraulic or pneumatic cylinder to which it is connected and the cam at that pocket is moved out of the path that intersects the path of the cam followers.

15. A no-can no-fill mechanism according to claim **14** further comprising a stationary shield that covers the fluidic sensors while they move from the point where the containers are delivered to the filling machine back to the point where the pockets normally pick up containers, whereby each sensor will continue to indicate that the pocket at which that sensor is located is full unless that pocket does not pick up a container at the normal pickup point.

16. A multi-station, high speed rotary filling machine comprising:

a. a rotating filling wheel;

b. a plurality of filling assemblies spaced around the periphery of the filling wheel, each filling assembly having a filling valve operable by a cam follower attached thereto;

c. gripping members attached to the filling wheel and adapted to hold containers beneath the filling assemblies; and

d. a star wheel for feeding containers to the gripping members comprising:

i. a plurality of pockets for individually feeding the containers to the gripping members;

ii. a sensor at each pocket for detecting containers at that pocket;

iii. a cam mounted at each pocket for movement into and out of a path which intersects the path of said cam followers; and

iv. means for moving each cam in response to signals from the sensor at the same pocket.

17. A multi-station, high speed rotary filling machine according to claim **11** wherein:

a. the cam followers are further away from the axis of rotation of said filling wheel than said gripping members are; and

b. the cam path that intersects the path of the cam followers is closer to the axis of rotation of the star wheel than the pockets are, whereby when the pockets are synchronized with the gripping members the cam followers move faster than the cams.

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