

[54] **FLUID-OPERATED PISTON FOR
METERING GRAVITY FED MATERIAL**[72] Inventor: **Russell G. Rutherford**, 8045 Beach Drive,
Rockford, Ill. 61103[22] Filed: **Feb. 9, 1970**[21] Appl. No.: **9,553**[52] U.S. Cl. **222/309, 222/389**[51] Int. Cl. **B67d 3/00**[58] Field of Search **222/309, 334, 389**[56] **References Cited****UNITED STATES PATENTS**

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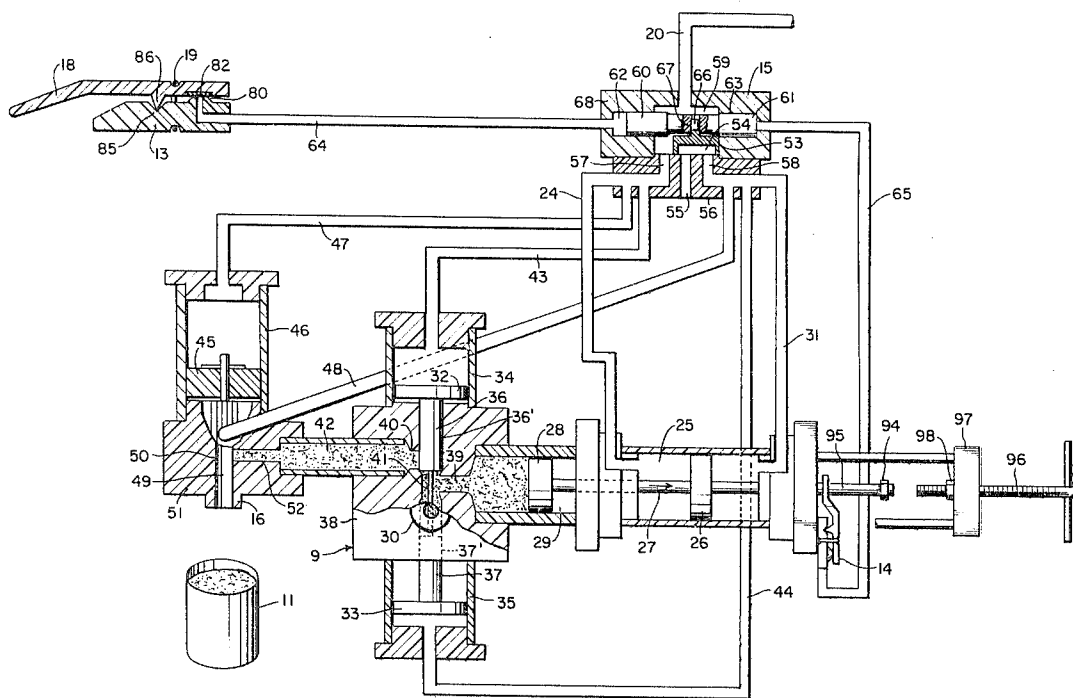
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[57] **ABSTRACT**

A pump piston in one cylinder is connected with a power piston operated by compressed air in a second cylinder rigid with the first, and a common rod connecting the pistons extends from the second cylinder so an adjusting screw abutting

its end serves to give fine adjustments to the stroke to give accurate measurement of the amount of slurry dispensed in each operation. The slurry is delivered by gravity to the pump cylinder, and air operated valves control the communication between the pump cylinder and the gravity supply conduit and also between said cylinder and a discharge nozzle, where an air operated plunger clears the nozzle of slurry at the end of each discharge. A servo valve cooperates with two trip valves to control the air flow for operating the power piston, as well as the air-operated valves and nozzle plunger, one trip valve being operated automatically at the end of the forward stroke of the pistons to start the return stroke and the other being either operated automatically by a cam moving into filling position or at the end of the return stroke of the pistons. The servo valve is of novel plastic construction, as are also the two trip valves. In the servo valve, the reciprocable slide valve is of a plastic material having appreciable lubricity in relation to the plastic material of the seat for easy operation and long wear, while in the trip valves both the body part with the valve projection on it and the fulcrummed arm that carries a valve seat gasket are of extremely hard rigid plastic material to avoid any flexing of the arm in the opening of the trip valve against the resistance of its return band, close accuracy of movement of this arm both ways being important for close accuracy of measurement of the material dispensed.

7 Claims, 8 Drawing Figures

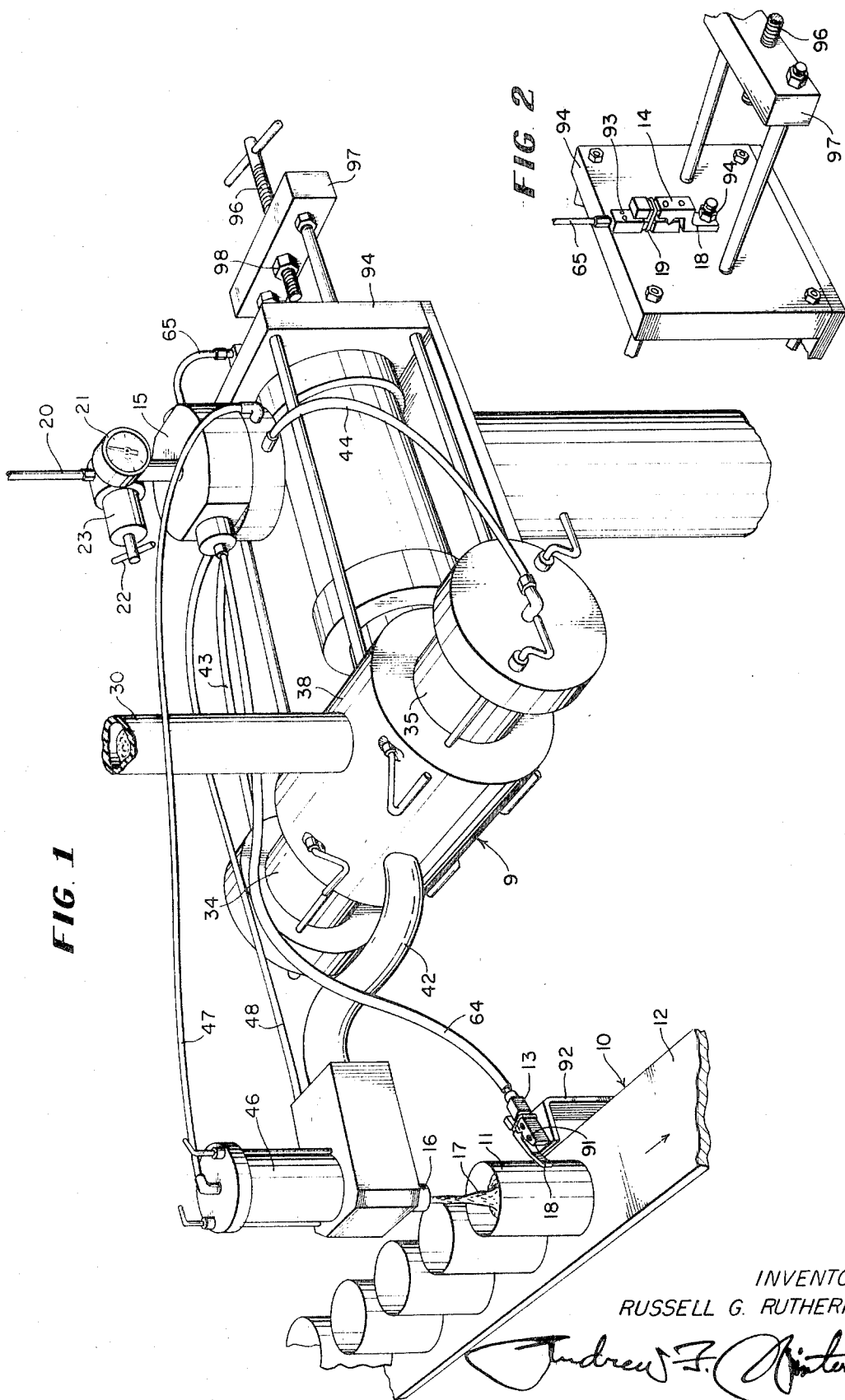


FIG. 1

FIG. 2

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FIG 4

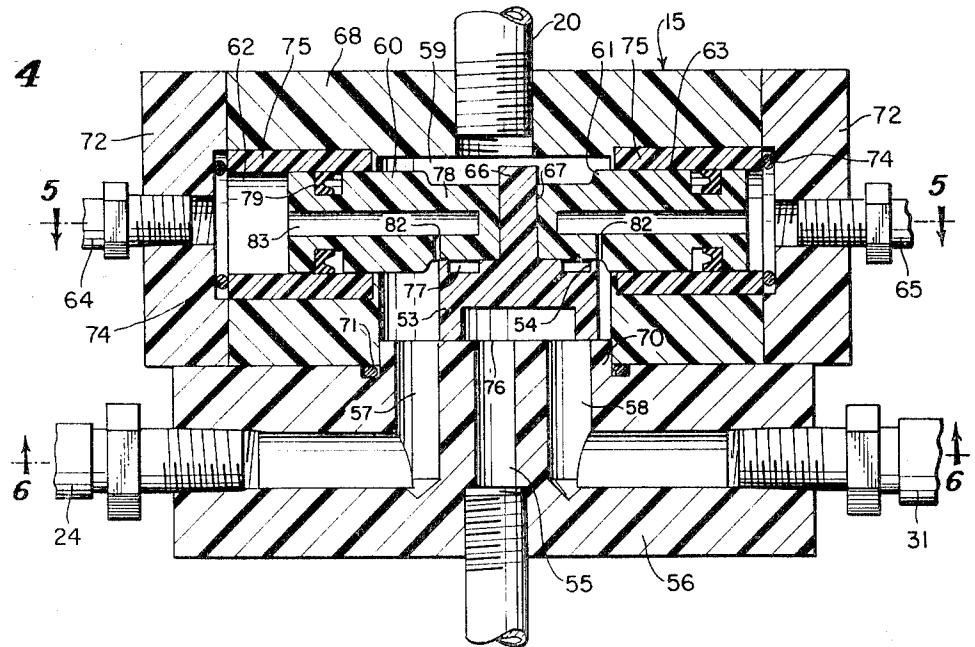


FIG 5

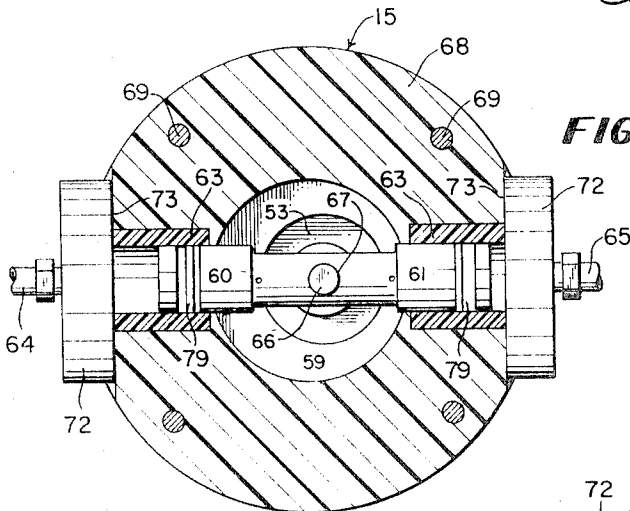


FIG 6

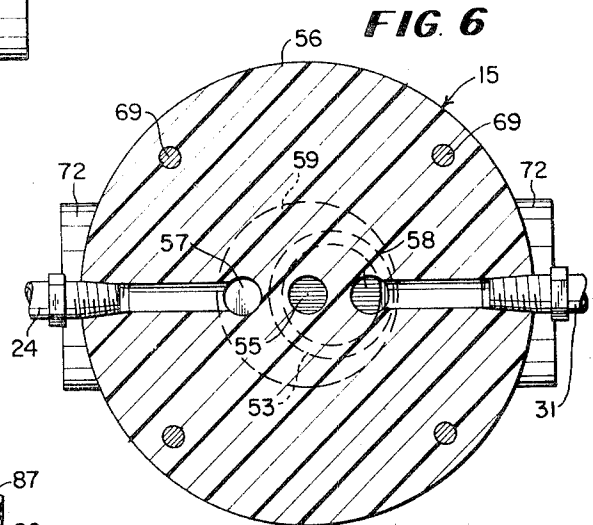
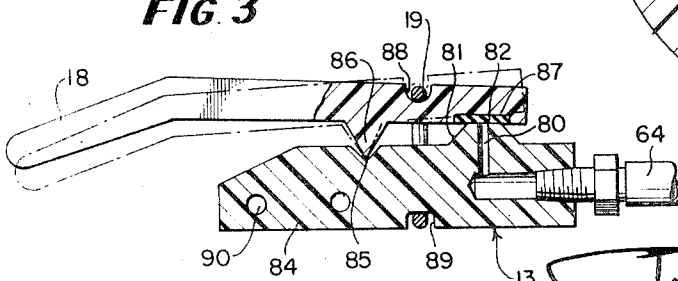
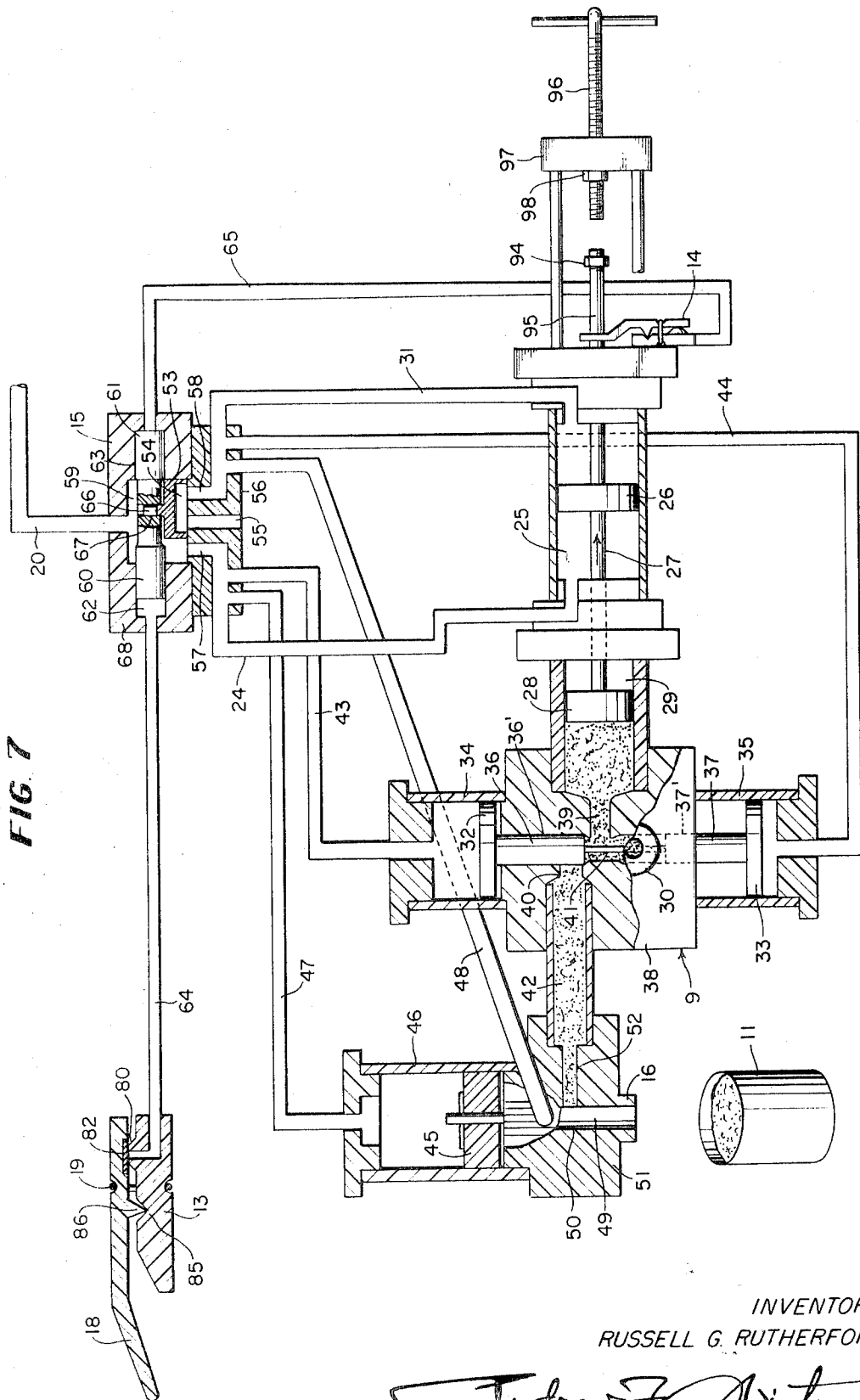


FIG 3



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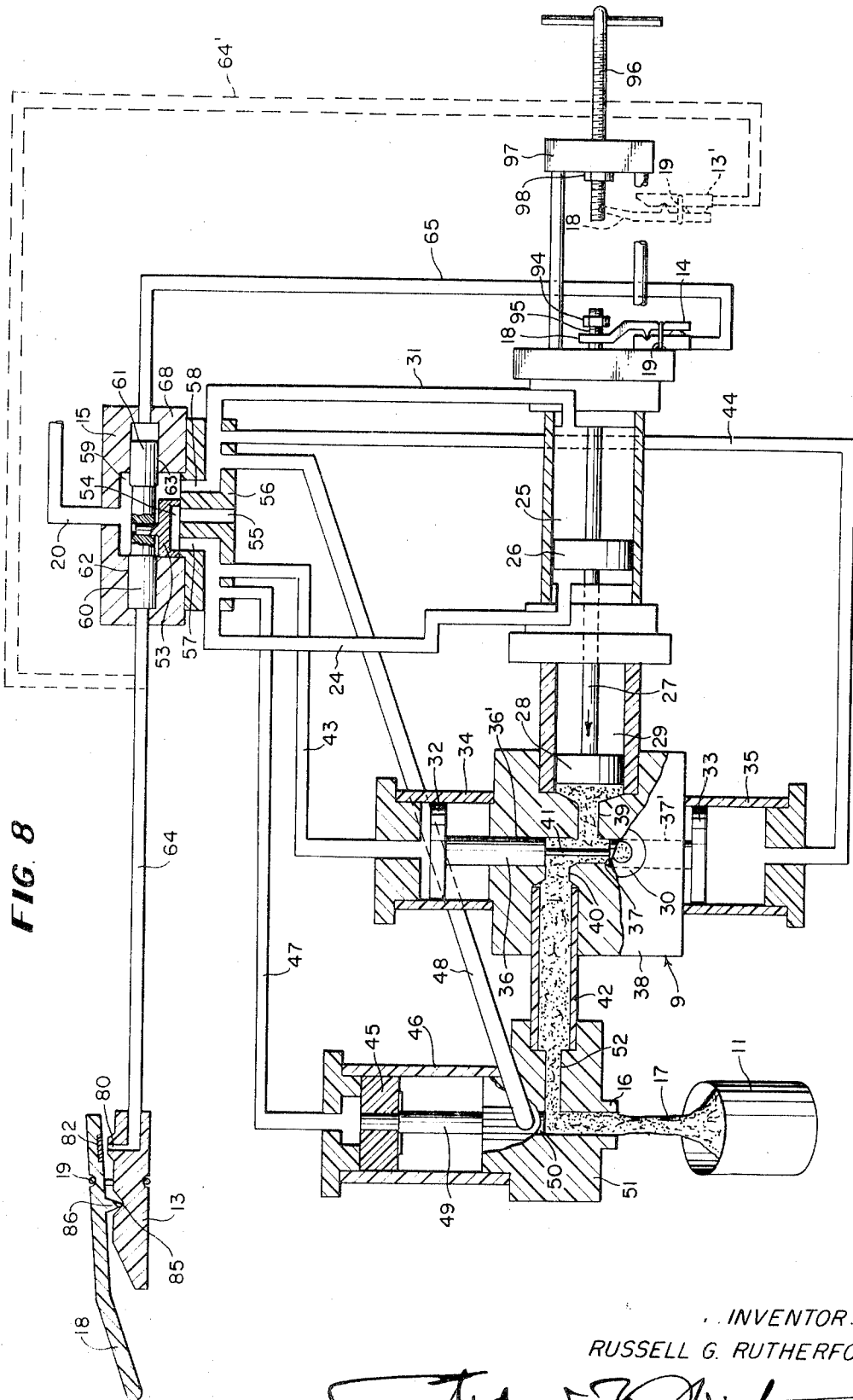


FIG. 8

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FLUID-OPERATED PISTON FOR METERING GRAVITY FED MATERIAL

This invention relates to a measured slurry dispenser, which, while specially designed for use in canning plants to dispense various kinds of slurries in accurately measured amount into each can as it is fed to the filler in a canning line and constructed to assure continuous operation properly in such humid environments, where electrical components would not be at all satisfactory, making pneumatic operation the ultimate in reliability, and requiring operation as fast as the can fillers, even on lines handling up to about 120 cans per minute, is not limited to that specific application, inasmuch as materials varying either way from a medium slurry may be dispensed and the amount dispensed at each operation is variable to suit practically any requirement that might arise.

The versatility of the present dispenser in the dispensing of light, medium, and heavy slurries, is best emphasized by listing below typical materials that can be, and have been dispensed:

mashed potatoes	jellies	meat slurries
potato salad	honey	coleslaw
calking cement	molasses	fruit salad
peanut butter	paints	cream herring
corn relish	glues	chop suey
cottage cheese	syrups	chow mein
cheese spreads	sausage	barbecue
crook cheese	hamburger	cream cheese
pickle relish	butter	shrimp cocktail
pie fillings	harvard beets	cream spinach
jams	salad dressings	pumpkin
fruit slurries	candied fruit	cream corn
macaroni & cheese	macaroni salad	

hand cleaner

Salient features of the present dispenser are:

1. It is fully automatic in that the unit offers the all important—no can, no fill—feature;
2. It is easy to take apart for cleaning and servicing;
3. A manually operated volume control adjustment at one end of the air cylinder accurately predetermines the intake stroke of the air piston and accordingly of the slurry piston so that infinite adjustment as to volume of slurry dispensed is made possible, and, once the desired adjustment is obtained a locknut on the adjusting screw can be tightened to eliminate any likelihood of alteration accidentally or otherwise, and
4. Two trip valves of performance. tappet-type construction cooperate with a two-position reciprocable slide valve to control the pneumatic operation of the slurry dispenser, one of the trip valves being preferably operated by engagement by each can as it arrives in filling position, and the other being preferably operated at the end of the discharge stroke of the slurry and air pistons so that there is perfect timing and no lost motion as the reciprocating valve moves one way in response to deflection of the first valve and the other way in response to deflection of the second valve, to cause the air piston to move on the discharge stroke in the first instance and on the intake stroke in the second instance, neither of the valves being subject to sticking like so many plunger valves and all of them being easier to clean and keep clean and being in no way subject to the common objection that wear through ordinary usage impairs their usefulness and gives rise to leakage and unreliable performance,

The invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view showing a typical slurry dispensing installation using the measured slurry dispenser of my invention;

FIG. 2 is a perspective view of the back plate behind the air cylinder showing the second trip valve arranged to be operated by the projecting end of the air piston rod at the end of the forward stroke of the slurry and air pistons to start the rearward movement thereof for the intake stroke of the slurry piston;

FIG. 3 is a cross section through one of the trip valves;

Referring to the drawing and at first mainly to FIG. 1,

FIG. 4 is a vertical section through the slide valve that is operatively associated with the two trip valves;

FIGS. 5 and 6 are cross sections on the lines 5—5 and 6—6, respectively, of FIG. 4, and

FIGS. 7 and 8 are diagrammatic views of the dispenser showing the parts on the intake stroke in FIG. 7 and on the discharge stroke in FIG. 8, the latter figure having indicated in dotted lines an alternative arrangement of one of the trip valves, whereby both of the trip valves are operable by the piston rod at opposite ends of the stroke thereof instead of having the second trip valve operated by a can as it arrives in filling position.

Referring to the drawings and at first mainly to FIG. 1, the reference numeral 9 designates the measured slurry dispenser of my invention generally, which is shown adjacent a filler 10 in a canning plant, cans 11 being delivered to the filler one by one on a belt 12, the forward indexing of which is timed with the operation of trip valves 13 and 14 and the related servo valve 15 so that in the pauses between these index movements the foremost can 11 disposed in the station below the nozzle 16 will receive its measured amount of slurry, as indicated at 17 in FIGS. 1 and 8, from the nozzle 16, the can being then moved forwardly by the next can out of the way to allow positioning of this next can in that same station. The cans 11 are conveyed to the filler 10 in any suitable way from a supply source for final discharge down a chute (not shown) leading to the belt 12, so that there will always be another can ready to receive the slurry discharged from the nozzle 16. Should there be a failure of supply of cans for any reason, the trip valve 13 which is operated automatically by the oscillation of the arm 18 against the resistance of a tension spring or rubber band 19 by abutment of the foremost can 11 with the arm 18, as shown in FIG. 1, will automatically shut off the dispensing of the slurry and stop the filler 10 until a fresh supply of cans is provided. The compressed air for operating the dispenser 9 is delivered to the servo valve 15 through a flexible hose 20 connected with a pipe in the canning plant air supply system, a gauge 21 at the point of connection of hose 20 with valve 15 indicating the air pressure to the operator, so that, in starting up, if there is insufficient air pressure indicated by the gauge 21 to operate the dispenser 9, the operator can hold up the feeding of cans 11 to the filler 10 until the right pressure is indicated. A handle 22 operates an air shutoff valve 23 provided on the back of the gauge 21. With each retracting movement of the arm 18 under action of the encircling spring or rubber band 19, air is delivered, as shown best in FIG. 7, from the servo valve 15 through a flexible hose 24 to the forward end of the air cylinder 25 to force the piston 26 therein to the rear, and, by virtue of the latter's rod connection 27 with the piston 28 working in the slurry cylinder 29, pump a measured amount of slurry from a gravity supply tank (not shown) through a supply tube 30 (FIG. 1) into the cylinder 29. Then, when the foremost can 11 engages and moves the arm 18 of trip valve 13 forwardly against the action of the spring or band 19, this measured amount of slurry will be discharged from the cylinder 29 through the nozzle 16 by reason of air being discharged through the flexible tube 31 to the rear end of the air cylinder 25 to force the piston 26 forwardly and with it piston 28 in cylinder 29 on the discharge stroke. Hose 24 serves as an exhaust line during the forward movement of piston 26, and hose 31 serves as an exhaust line during the rearward movement of piston 26.

The servo valve 15 also controls the pneumatic operation of interconnected pistons 32 and 33 working in cylinders 34 and 35, respectively, to reciprocate the plunger valves 36 and 37 slidable in bores 36' and 37' in the valve body 38 to control communication between the ports 39 and 40 provided in the body 38 and also control communication of the supply tube 30 with port 39. Thus, on the intake stroke of the slurry piston 28, as shown in FIG. 7, slurry is supplied to the cylinder 29 past the plunger valve 37, which, as clearly appears, is connected by the reduced rod connection 41 with the plunger valve 36, the latter in this position of valve 37 shutting off port 40 from communication with port 39 and discharge tube 42 so that

there is nothing to interfere with the combination of gravity and suction in the filling of the slurry cylinder 29 in front of piston 28. However, on the discharge stroke, as seen in FIG. 8, the valve 37 shuts off the tube 30 while valve 36 opens communication between the ports 39 and 40 to permit discharge of slurry through tube 42. Operation of pistons 32 and 33 requires only the two flexible tubes 43 and 44 extending from the servo valve 15 to the outer ends of cylinders 34 and 35.

A piston 45 is reciprocable in a cylinder 46 with which flexible tubes 47 and 49 are connected at opposite ends, the tubes extending from the servo valve 15. Piston 45 operates a plunger valve 49 in the bore 50 of the valve body 51 in either direction to close off communication with the discharge tube 42, as shown in FIG. 7, and at the same time expel whatever slurry would otherwise remain in the bore 50 at the end of the discharge stroke illustrated in FIG. 8, where the plunger valve 49 is shown in its fully retracted position during the discharge stroke of piston 28. A port 52 in the valve body 51 provides communication between the discharge tube 42 and the bore 50 in which the plunger 49 operates.

In describing the operation, it should first be noted that the servo valve 15 comprises a reciprocable slide 53 valve member of circular form having a circular recess 54 large enough in diameter to overlap the center port 55 in the base 56 along with either of the side ports 57 and 58, so that in one position, as for example the intake stroke of piston 28, shown in FIG. 7, compressed air is delivered from pressure chamber 59 through port 57 and tube 24 to the air cylinder 25 to move the piston 26 to the rear and operate the piston 28 on its intake stroke, while at the same time operating the valve 49 by means of piston 45 to expel into the can 11 whatever slurry might otherwise remain in the bore 50, the valves 36 and 37 also being shifted to shut off the outlet port 40 and open the inlet port 39 to the tube 30 by virtue of the delivery of compressed air through tubes 47 and 43, while tubes 31, 44, and 48 are all placed in communication with the exhaust port 55 so as not to interfere with movement of the pistons 26, 33, and 45. Then, as shown in FIG. 8, with the valve in its other extreme position for the discharge stroke, compressed air is delivered from chamber 59 to tubes 31, 44 and 48 to cause the reverse operation of pistons 26, 33, and 45, while the tubes 24, 43, and 47 are all placed in communication with the exhaust port 55 so as not to interfere with operation of the pistons mentioned, the piston 28 in the forward movement of piston 26 serving to discharge an accurately measured amount of slurry into the can 11 while valve 37 cuts off communication with tube 30 for port 39, and valve 36 opens communication between ports 38 and 40 for free flow of the slurry through the discharge tube 42 and nozzle 16 into can 11, valve 49 having been retracted to uncover port 52.

Trip valves 13 and 14 serve to operate the slide valve 53 by unbalancing the air pressure on the remote ends of the interconnected pistons 60 and 61 operating in cylinders 62 and 63 that open into the pressure chamber 59, trip valve 13 having a flexible hose connection 64 with cylinder 63, while trip valve 14 has a flexible hose connection 65 with cylinder 63. Thus, when either of these trip valves is operated a port 80 in valve projection 81 normally sealed by a resilient compressible gasket 82 of Viton or the like is opened and the cylinder connected with that port is opened, of course, to atmosphere so the pistons 60-61 move in that direction under air pressure, accordingly moving the slide valve 53 by means of its pin and hole connection 66-67 in the same direction. Thus, in FIG. 7 with trip valve 13 closed and trip valve 14 open, slide valve 53 is in the one extreme position for the intake stroke of piston 28, whereas in FIG. 8, with trip valve 13 open and trip valve 14 closed, slide valve 53 is in the other extreme position for the discharge stroke of piston 28.

The cylinders 62 and 63 are provided in the body 68 of the servo valve 15 which is suitably secured in airtight relationship to the base 56, as by means of bolts 69, as indicated in FIGS. 5 and 6, the projecting cylindrical neck 70 on the base 56 that fits snugly in the bottom of the cylindrical pressure chamber

59 and the rubber O-ring 71 that surrounds the neck 70 and is set in an annular groove provided in the base 56 around the neck so as to be compressed when the two parts 56 and 68 of the valve are fastened together, serving to insure a good airtight sealing action. In a similar way, caps 72 are fastened to opposite sides of the body 68 on flats 73 provided therefor and compress rubber O-rings 74 that are interposed to provide a good airtight seal at these joints. Now, it is important to mention that the bushings 75 that I have provided in the cylinders 62 and 63 are of polyethylene, as is also the double-end piston 60-61 and the slide valve 53, whereas all of the other parts of the servo valve 15 are of polypropylene, the purpose of this being that polyethylene has the characteristic of high lubricity which is so desirable in the double-ended piston 60-61 and slide valve 53, whereas polypropylene, which defines the flat seat 76 integral with the base 56 on which the slide valve 53 operates, is approximately 60 percent harder than the polyethylene and has little or no lubricity, with the result that the slide valve 53, which relies upon the air pressure to hold it seated at 76 and is held positioned on said seat by reason of the engagement of its flat top surface 77 on the bottom of the reduced connecting portion 78 between the pistons 60 and 61, thus being free to turn with its stem 66 as a center, is self-lubricating and will give extremely long satisfactory service before it needs replacement. Replacement of such a small part as the slide valve 53 means a practically negligible outlay compared, for example, to the cost of replacing the base member 56, or for that matter any other part of the servo valve 15. In passing, attention is also called to the rubber O-rings 79 provided in annular grooves in the pistons 60 and 61 which serve to prevent leakage of air along the pistons 60 and 61 from the pressure chamber 59 in either position of the valve 53.

A feature of importance, only from the standpoint of enabling complete cleaning, bearing in mind the fact that the present invention is used in the canning industry, is the provision of the restricted vent holes 82 radially of the reduced portion 78 and communicating with the axial bores 83 provided in the opposite ends of the double-ended piston 60-61 to save material and make for lightness. These vent holes 82 provide for drainage of cleaning solution and rinse water when the servo valve 15 is taken apart and cleaned.

The trip valves 13 and 14 are both alike so that description of valve 13, shown in FIG. 3 will suffice for both. Each of these valves comprises a generally rectangular elongated plastic body 84 having a transverse V-groove 85 provided therein intermediate the ends thereof, in longitudinally spaced relation to the generally frustoconical valve projection 81, previously mentioned, the V-groove receiving in the bottom thereof the sharp straight edge portion of a generally V-shaped fulcrum projection 86 provided on the arm 18 transversely thereof intermediate the ends and in longitudinally spaced relation to a circular recess 87 in which the circular gasket 82, previously mentioned, is fixed, this gasket, as previously described, forming an airtight valve seat for the valve projection 81. An encircling rubber band (or spring) 19 serves normally to keep the valve closed and is disposed between the fulcrum projection 86 and the gasket 82 and held against displacement in either direction longitudinally of the trip valve by engagement in the grooves provided transversely of the two parts 18 and 84, as indicated at 88 and 89, respectively. Now, it is important to mention that the two valve parts 18 and 84 are both molded of polyvinyl chloride, which is a great deal harder than polypropylene and extremely rigid so that there is virtually no flexing of the arm 18 when it is operated by engagement with a can 11, despite the load imposed on the arm 18 by the band 19, immediate and complete response to deflection of the free end of arm 18 being important here because of (a) the need for close accuracy of measurement in the amount of slurry dispensed in each operation, and (b) the speed of operation of the dispenser, which allows for substantially no lag in the responsiveness of both trip valves 13 and 14. This trip valve construction is also virtually indestructible with normal usage and is very easily taken apart for thorough cleaning and as

easily put together, the band 19 being easily stretchable to the extent necessary to disassemble the arm 18 from the body 84. The holes indicated at 90 extending transversely through the body 84 at one end thereof facilitate mounting the valve 13 (or 14) by means of bolts 91 on any support, as for example, a supporting bracket 92 in a substantially horizontal plane, as illustrated in FIG. 1. Of course, either of the trip valves may be secured by bolts 93 extending at 90° to the first-mentioned bolts 91 through holes in the other end of the body portion, as shown in FIG. 2, where the trip valve 14 is shown mounted that way on the backplate 94 of the dispenser 9, the arm 18 of that valve being arranged to be operated by a projection 94 on the projecting end portion 95 of the piston rod 27, as is also shown in FIGS. 7 and 8. The screw 96 is adjustable with respect to the fixed end plate 97 and arranged to be locked in its adjusted condition by means of a locknut 98 to predetermine the exact amount of slurry that will be dispensed upon each operation of the dispenser by predetermining the length of stroke of pistons 26 and 28.

In conclusion, attention is called to the dotted line connection 64' shown in FIG. 8 between the servo valve 15 and the dotted line showing of a trip valve 13', in lieu of the full line showing the trip valve 13. With that arrangement the projection 94 on the outer end portion 95 of the piston rod 27 is arranged to operate the trip valve 13' at the end of the intake stroke of the pistons 26 and 28 to start the discharge stroke, in lieu of having the discharge stroke started by deflection of arm 18 by a can 11. Then at the end of the discharge stroke, the projection 94 operates the arm 18 of the valve 14 to start the intake stroke, similarly as in the previous description. This arrangement is suitable for a hand feed canning machine where the cans are fed one after another by hand as they are filled, or in an automatic machine where the mere filling of the cans to its predetermined weight causes automatic kicking of each filled can out of the way and automatic kicking of an empty can into filling position. The intake stroke of the piston represents a time interval that is very short, but long enough to enable that kind of operation.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention. While a preferred embodiment of the invention has been illustrated and described, this is only for the purpose of illustration, and it is to be understood that various modifications in structure will occur to a person skilled in this art.

I claim:

1. A dispensing apparatus of the character described comprising, in combination, coaxially arranged air and pump cylinders in fixed relationship to one another with interconnecting pistons reciprocable therein, one piston being a power piston operable back and forth in the air cylinder by compressed air, the other piston being a pump piston adapted for drawing in flowable material on an intake stroke into the pump cylinder and discharging it on a return stroke, manually adjustable screw means for limiting the return stroke of the power piston whereby to predetermine the amount of material taken in and discharged by the pump piston in each reciprocation, a gravity source of flowable material supply above and connected with said material cylinder, a discharge nozzle, two-position valve means which in one position establishes communication between said pump cylinder and said material supply source and in its other position establishes communication

between the pump cylinder and said discharge nozzle, a first piston and cylinder means for operating said two-position valve means by compressed air, a source of compressed air, a servo valve connected with the source of compressed air and including a reciprocable valve operable by a second piston and cylinder means by compressed air which reciprocable valve in one position supplies compressed air from said source to operate said two-position valve means simultaneously with said power piston in one direction for an intake stroke of the pump piston and in the other position supplies compressed air from said source to operate said two-position valve means simultaneously with said power piston in the opposite direction for the discharge stroke of the pump piston, first and second trip valves connected with opposite ends of said second piston and cylinder means for alternately relieving air pressure on one or the other end for causing back and forth movements of said reciprocable valve, said trip valves tending normally to close, means whereby one of said trip valves is operated to open position automatically upon arrival of said power piston at a predetermined position, and means for operating the other trip valve to start an operating cycle.

2. A dispensing apparatus as set forth in claim 1 including in combination with the discharge nozzle of a two-position plunger valve which in one stroke clears the discharge bore of said nozzle of any flowable material while cutting off its communication with said pump cylinder on the intake stroke of its piston and in the return stroke opens communication between the discharge bore of said nozzle and said pump cylinder on the discharge stroke of its piston, and means for reciprocating said plunger valve in timed relation to said pump piston.

3. A dispensing apparatus as set forth in claim 2 wherein the last-named means comprises a third cylinder and piston means connected with said two-position plunger valve and operable by compressed air from the reciprocable valve of the servo valve simultaneously with the other two-position valve means.

4. A dispensing apparatus as set forth in claim 1 wherein said trip valves are operable to open position in response to arrival of said power piston at the opposite ends of its stroke.

5. A dispensing apparatus as set forth in claim 1 wherein said trip valves are operable to open position in response to arrival of said power piston at the opposite ends of its stroke, one of the trip valves being adjustable relative to the other in accordance with the adjustment of said manually adjustable screw means limiting the return stroke of the power piston.

6. A dispensing apparatus as set forth in claim 1 including a discharge conduit between said pump cylinder and said discharge nozzle, said two-position valve means comprising interconnected coaxial valve plungers reciprocable transversely relative to and between the adjacent ends of said pump cylinder and said discharge conduit, these plungers in one position closing the end of said conduit but opening communication between said pump cylinder and said source of flowable material, and in the other position closing communication between said pump cylinder and said source of flowable material while opening communication between said pump cylinder and said discharge conduit.

7. A dispensing apparatus as set forth in claim 1 wherein one of said trip valves is operated to open position automatically upon arrival of the power piston at one end of its stroke, the other of said trip valves being operable in predetermined relationship to the first trip valve.

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