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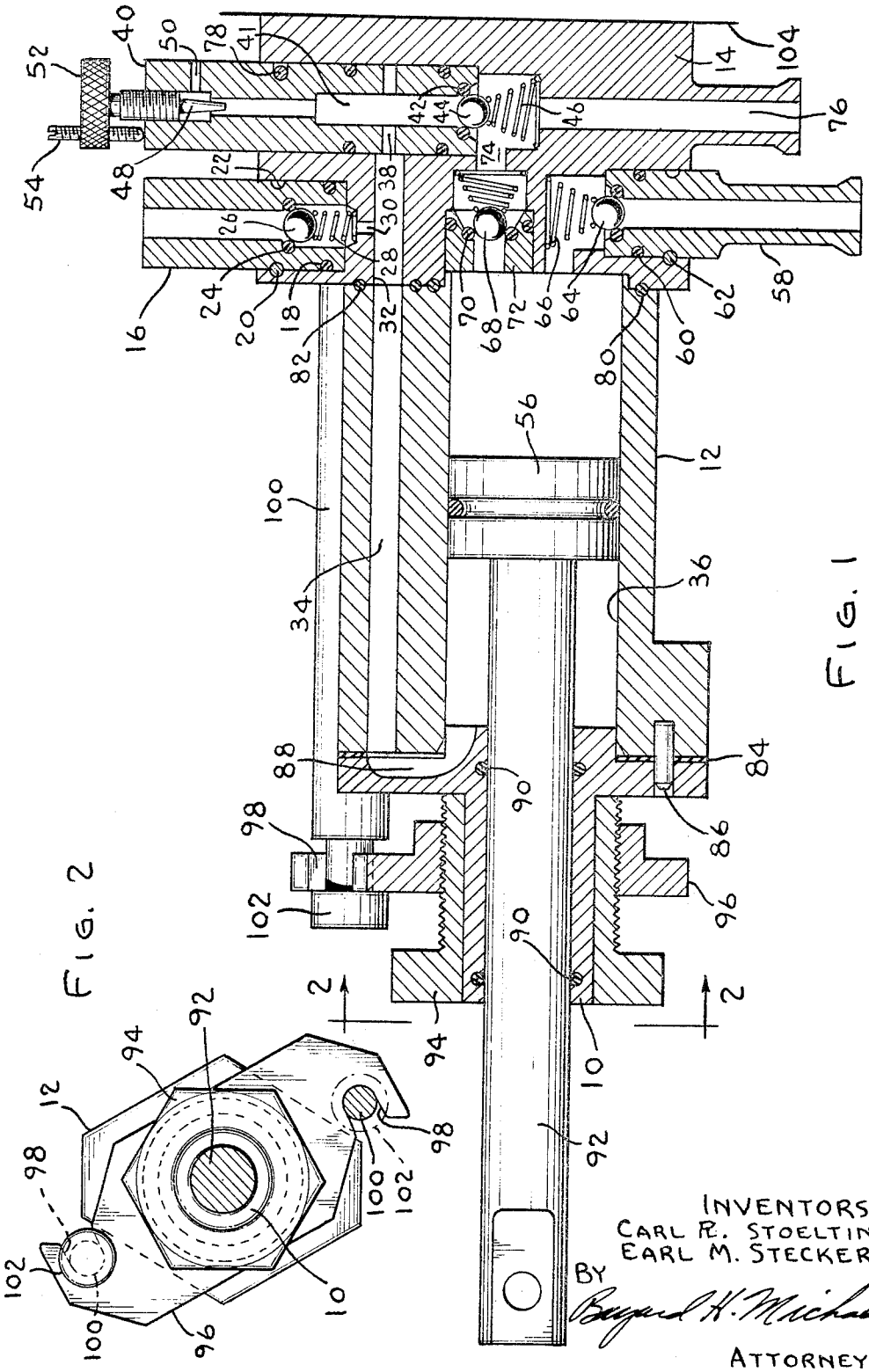


FIG. 1

FIG. 2

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This invention relates to a pump for delivering liquid and air in a desired ratio and has particular application to delivering a mix of air and liquid mix to the freezing cylinder of freezers of the type used in manufacture of ice milk, ice cream, sherbet, frozen custard, etc.

In soft serve freezers it has long been customary to add air to the liquid mix to be incorporated in the product. One type of freezer incorporates this added air by means of a beating action during the freezing process but this is difficult to control and the amount of air added to the end product is subject to considerable variation. Another type of freezer incorporates a positive pressure freezing cylinder and the blend of air and liquid mix is delivered under pressure to the cylinder. Much effort has been directed to the provision of various types of pumps for the liquid and air to accurately control the ratio of the two. The problem is complicated somewhat by the fact that the entire pump must permit of complete disassembly for cleaning and inspection purposes.

The principal object of this invention is to provide a simple pump capable of accurately blending a liquid and air to obtain a desired ratio. A further object is to provide such a pump which will meet all the sanitary requirements imposed upon such equipment.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the single embodiment shown in the drawings, in which:

FIG. 1 is a vertical section through the present pump; and

FIG. 2 is an end view taken as indicated by line 2—2 on FIG. 1.

The pump housing or body is basically made up of three principal parts, the left-hand portion being the cylinder head **10**, the middle or cylinder portion **12**, and the right-hand portion **14** containing valving, inlets and outlets. The right-hand portion of the body is provided with an air inlet fitting **16** which is provided with a peripheral groove containing an O-ring **18** and is inserted in the cooperating smooth bore aperture in the body portion and retained therein by means of a cross-pin **20** which captures a portion of the upper peripheral groove **22**. The fitting **16** is provided with an O-ring valve seat 24 against which the ball type check valve **26** seats under influence of the compression spring **28** seated on the shoulder leading to the passage **30**. Passage **30** leads to the passage **32** in this body portion and this, in turn, communicates with passage **34** in the cylinder portion with the passage **34** running parallel to the cylinder **36** up through passage **88** in the cylinder head **10** and into the left-hand end of the cylinder. Passage **32** also communicates with the cross-bore **38** in fitting **40** which is mounted in a cooperating smooth bore in the right-hand body portion **14** with O-ring seals both above and below the cross-bore **38**. The lower end of the axial bore **41** terminates in an O-ring valve seat **42** against which the ball check valve **44** seats under influence of spring **46**. The upper end of the axial bore **41** leads to the adjustable bleed valve **48** and the air which is bled past this valve can escape through passage **50**. The position of the bleed valve **48** is adjusted by turning knob **52** and may be retained in a set position by tightening the set screw **54**.

As the piston **56** travels to the right in cylinder **36** ball check **26** will open and air will be drawn in through the air inlet and into the left-hand end of the cylinder. When the piston starts moving to the left the inlet check valve **26** will close and the outlet check valve **44** will open but some of the air will be bled out past the bleed valve **48**.

The right-hand body portion **14** of the pump housing is also provided with a liquid inlet fitting **58** which is similar in construction to the air inlet fitting **16** in that it has an O-ring seal **60** and is retained in position by means of a cross-pin **62** capturing a portion of the peripheral groove. The inner end of the liquid inlet fitting **58** is also provided with an O-ring valve seat against which the check valve **64** will seat under influence of spring **66**. As the piston **56** moves to the left liquid will be drawn past the check valve **64** into the cylinder **36**. When the piston starts moving to the right this check valve will seat but the outlet check valve **68** will be moved off its seat **70** carried by insert **72** which is held against the shoulder in the cooperating cavity by means of the projecting annular portion of the cylinder wall (as may be seen in FIG. 1) which also locates the parts in alignment. Therefore, liquid is delivered under pressure past the check valve **68** to the chamber **74** to which chamber the air is also delivered under pressure. This chamber is provided with a common outlet duct or fitting **76** for delivering the liquid and air in the desired ratio with this ratio being determined by the amount of bleed past valve **48**. If valve **48** is closed, then you will get the maximum amount of air in the mix. Since air is pumped on the rod side of the piston the maximum air can be controlled by the diameter of the rod.

The bleed valve fitting **40** is retained by means of a cross-pin **78** which passes through a suitable slot in the fitting and it should be noted that this slot would run tangential to the radius of the fitting so as to insure alignment of the cross-bore **38** with passage **32**. If desired, however, the slot could be replaced by means of a peripheral groove as with the inlet and outlet fittings previously described but in this case a peripheral groove would have to be provided around the cross-bore to insure communicating passages no matter what the position of the bleed fitting might be.

It will be noted that the fittings **16**, **58**, and **40** can all be withdrawn simply by removal of their corresponding cross-pins. This simplifies cleaning and inspection. Since there are no threads the entire unit can be thoroughly cleaned and inspected, there being no blind holes in the present construction.

The cylinder portion **12** is sealed with respect to the right-hand housing portion **14** by means of O-rings **80**, **82**. The joint between the cylinder head and the cylinder is provided with a suitable gasket **84** and it will be noted that a locating pin **86** is used to insure proper orientation of the passage **88** in the cylinder head with the passage **34**. The cylinder head includes a tubular portion provided with two O-ring seals **90**, **90** through which the piston rod **92** passes. This tubular portion also serves to mount the clamping nut **94** which is provided with external threads upon which the yoke **96** is mounted. The yoke is provided with suitable jaws **98**, **98** which are adapted to pass over the reduced diameter portion of assembly rods **100** and when it is desired to clamp the pump in assembled position the nut **94** is rotated to cause the yoke to back off to the left until it seats firmly, as illustrated in FIG. 1, against the right-hand shoulder of the head **102** of the assembly rods. The right-hand end of the assembly rods can either be fixed on a plate of the freezer as represented by line **104** or can be mounted on a separate plate, the important thing being to provide a plate against which the yoke can be drawn up to tighten the whole assembly into a sealed relationship and yet allowing rapid disassembly of the entire unit for cleaning.

Conceivably it would be possible to throttle the air inlet instead of bleeding from the air outlet but it is preferred to bleed from the air outlet since at this point you are dealing with higher air pressure and, hence, this is a more reliable type of control than trying to starve the pump at very low pressure values which could lead to considerable error or fluctuation.

Although but a single embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

We claim:

1. A pump for proportioning air and liquid comprising a housing having a cylinder therein, a piston reciprocable in said cylinder, liquid inlet and outlet means communicating with one side of the piston, air inlet and outlet means communicating with the other side of the piston, check valves in said inlet means and said outlet means, and a bleed valve in the air outlet means upstream of the check valve means associated therewith, each inlet means and the air outlet means comprising a fitting retained in a smooth bore cavity in the housing and provided with a seal, the inner end of each fitting being provided with a valve seat, said housing comprising two principal portions, one portion containing the inlet and outlet fittings and the other portion including the cylinder, seal means between the portions and compression means holding the portions together, the check valve means in the liquid outlet means including a seat assembly in said one housing portion communicating directly with the one end of the cylinder and retained in position by said other housing portion.

2. A double acting pump for pumping gas and liquid comprising a pump housing including a first housing part having a cylinder formed therein, a piston mounted for reciprocation within the cylinder, a second housing part, said first and second housing parts including wall portions disposed in overlying juxtaposed relation, one end of said cylinder opening through the said wall part of said first housing means, a fluid flow passage formed in said first housing part in communication with the opposite end of said cylinder and opening through the said wall portion

of said first housing part, said second housing part including first induction and eduction passages in communication with the cylinder on one side of the piston and second induction and eduction passages in communication with the cylinder on the opposite side of the piston, check valve means in said first and second mentioned induction and eduction passages respectively, a common discharge passage formed in said second housing part in communication with said first and second eduction passages, and means for securing said housing parts together, one of said eduction passages within said second housing part being provided with an auxiliary discharge port located upstream from the check valve means therein and a bleed valve controlling said auxiliary discharge port.

3. The double acting pump described in claim **2** wherein said first induction and eduction passages in said second housing part are in communication with said fluid flow passage and said second induction and eduction passages are in communication with the open end of the cylinder.

4. The double acting pump described in claim **3** wherein said check valve means comprises valved fittings disposed in smooth bores in said second housing and with one of said fittings retained within its bore by said first housing part.

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