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Robbins

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[54] **MULTIPLE COMPONENT MIXING DEVICE**

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[52] **U.S. Cl.** **222/135,** 222/275

[51] **Int. Cl.** **B67d 5/02**

[58] **Field of Search** 222/132, 134, 135, 137, 222/145, 255, 267, 275

[56] **References Cited**

UNITED STATES PATENTS

3,071,293	1/1963	Lewis-Smith et al.	222/135
3,304,966	2/1967	Reed	222/275 X
3,386,623	6/1968	Berrill et al.	222/135 X
3,496,970	2/1970	Pontigny	222/135 X
3,664,551	5/1972	Ferrari	222/145 X

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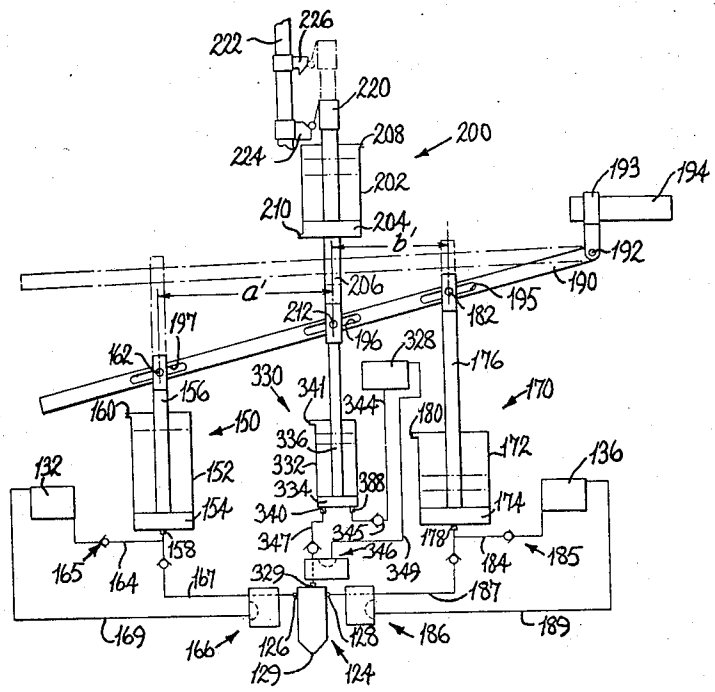
[57] **ABSTRACT**

Apparatus for instantaneous ratioing and mixing of a multicomponent composition of at least three component ingredients wherein at least two of the ingredients are supplied in predetermined ratio and wherein total quantity of ingredients or the ratio of said two ingredients may be varied without influencing the relative amount of the third component.

7 Claims, 2 Drawing Figures



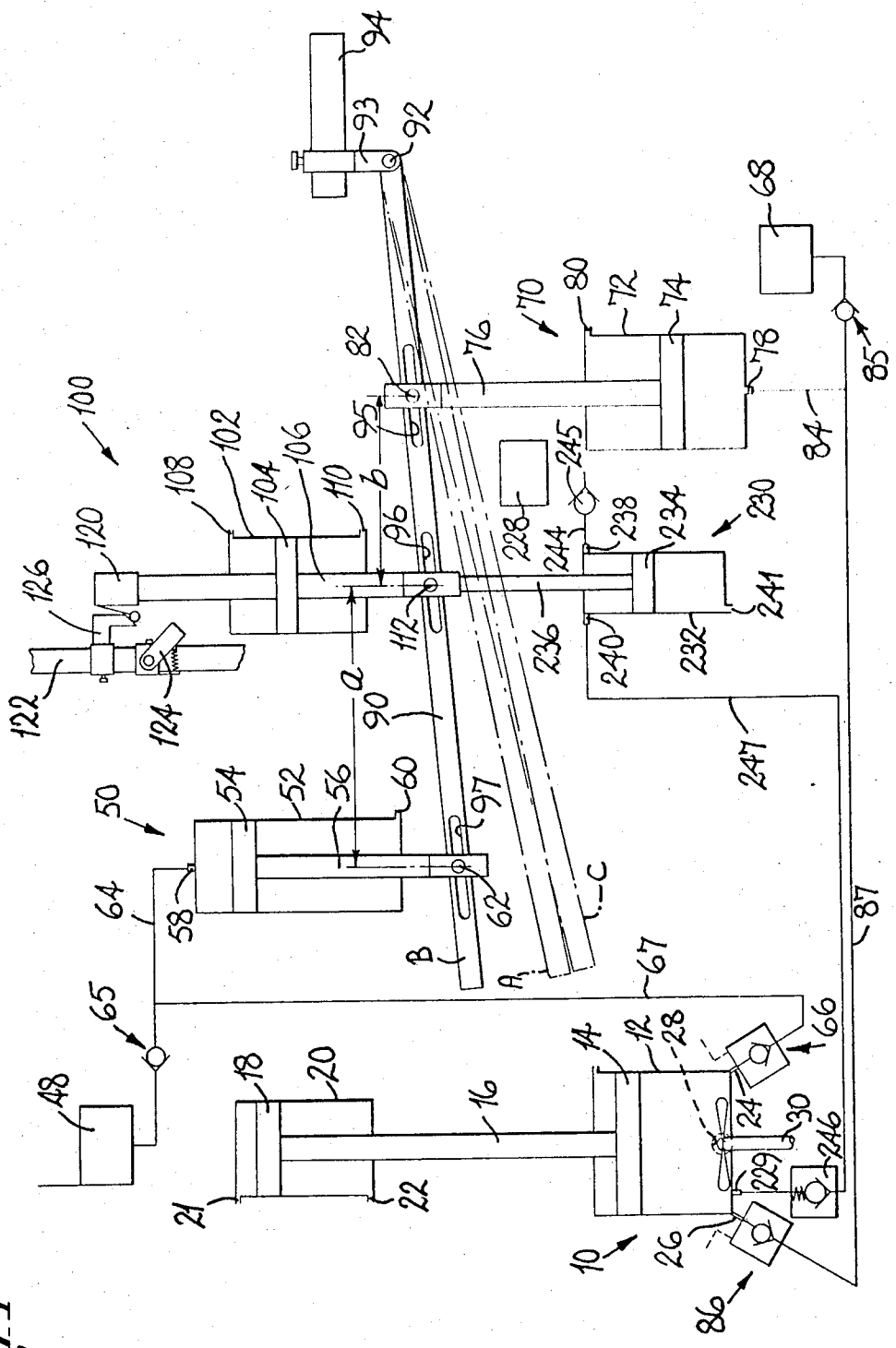

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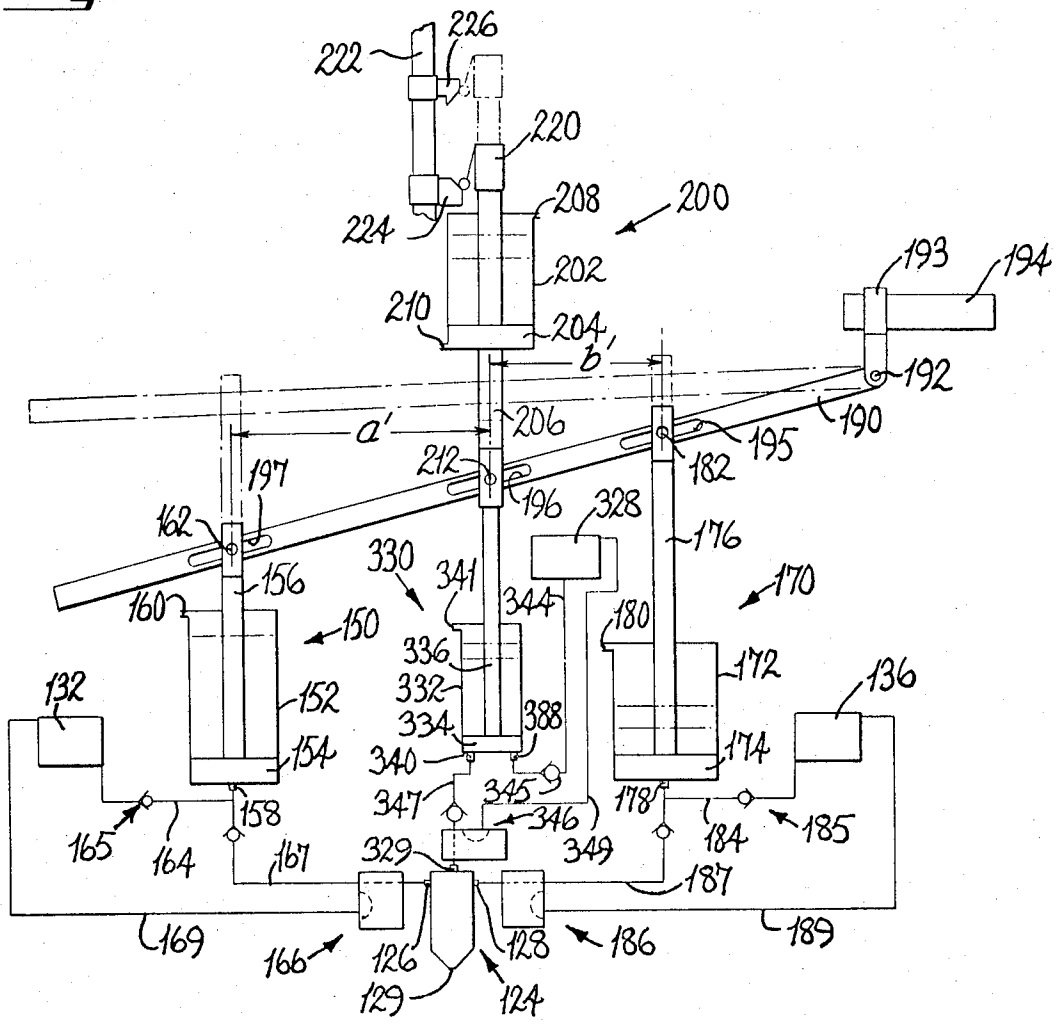
Fig. 1

Fig. 2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MULTIPLE COMPONENT MIXING DEVICE

BACKGROUND OF THE INVENTION

This invention is concerned with improvements in or relating to apparatus adapted for use in dispensing a composition provided by the mixing together a plurality of constituent compositions, and is an improvement in or modification of the invention described in U.S. Pat. No. 3,642,175 issued to the present inventors and also assigned to the assignee of the present invention.

In the above mentioned patent, there is described by way of example two dispensing apparatuses, each of which is adapted for use in dispensing a multiple component composition, and which are described in reference to their illustrative use in the mixing of polyhydroxyl and polyisocyanate compositions to form the reaction of the polyurethane composition dispensed.

In the utilization of such mixing and dispensing apparatus as above described, it has been found that means for providing a third constituent component to the mixing chamber, however not necessarily at the ratio determined by the previously described apparatus. Accordingly an independent third feeding device for the third of the constituent composition is necessary which is arranged so that its feed ratio may be made dependent upon such as the total of the first two components dispensed or with the ratio of one or the other first two components dispensed.

SUMMARY OF THE INVENTION

This invention provides, in accordance with one of its several features, apparatus for use in dispensing a composition provided by the mixing together of three constituent compositions and comprising:

a. a mixing chamber to which the constituent compositions are fed, wherein the constituent compositions are mixed and from which mixed constituent composition is dispensed;

b. a first feeding device for feeding a first of said constituent compositions to the mixing chamber;

c. a second feeding device for feeding a second of said constituent compositions to the mixing chamber;

d. ratio control means adapted to vary the ratio in which the first and second constituent compositions are fed to the mixing chamber;

e. a third feeding device for feeding a third of said constituent compositions to the mixing chamber; and

f. control mechanism adapted to control the total quantity of mixed constituent composition dispensed from the mixing chamber, wherein the proportion of third constituent composition present in mixed constituent composition dispensed from the mixing chamber is independent of both the ratio control means and the control mechanism.

This invention provides, in accordance with another of its several features, apparatus for use in dispensing a composition provided by the mixing together of three or more constituent compositons and comprising:

a. a mixing chamber to which the constituent compositions are fed, wherein the constituent compositions are mixed and from which mixed constituent composition is dispensed;

b. a first feeding device for feeding a first of said constituent compositions to the mixing chamber;

c. a second feeding device for feeding a second of said constituent compositions to the mixing chamber;

d. ratio control means adapted to vary the ratio in which the first and second constituent compositions are fed to the mixing chamber; and

e. a third feeding device for feeding a third of said constituent compositions to the mixing chamber;

The construction and arrangement being such that in the use of the apparatus the third feeding device feeds a quantity of third constituent composition to the mixing chamber proportional to the total quantity of first and second constituent composition fed to the mixing chamber and independent of the ratio in which said first and second constituent compositions are so fed to the mixing chamber.

Apparatus as set out in the above paragraphs may operate in a "hold-up" manner in which the first and second compositions are fed to the mixing chamber one after the other, to be mixed herein and then dispensed therefrom, the third feeding device feeding third constituent composition to the mixing chamber during the feeding thereto of either the first or the second constituent compositions: apparatus as set out in the last preceding paragraph may operate in a "continuous" manner in which the three constituent compositions are fed to the mixing chamber at the same time to be dispensed directly from the mixing chamber, the first and second constituent compositions being fed to the mixing chamber at a desired rate ratio, the third constituent composition being fed to the mixing chamber at a rate proportional to the total rates of feeding of first and second constituent composition.

The above and other of the various objects and several features of this invention will become more clear from the following description, to be read with reference to the accompanying drawings, of the two illustrative apparatuses. It is to be understood that these illustrative apparatuses have been selected to illustrate this present invention by way of example only, and not by way of limitation thereof.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a schematic view of the first illustrative apparatus; and

FIG. 2 is a schematic view of the second illustrative apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. 1 of the drawings, the first illustrative apparatus is adapted for use in dispensing a multiple component, polyurethane composition and comprising a mixing chamber **10** of variable volume provided by a cylinder **12** and a piston **14,** to which is secured a piston rod **16,** fitting snugly therein. Connected to an end portion of the piston rod **16** remote from the piston **14** is a piston **18** slidably mounted in a cylinder **20.** On admission of fluid under pressure to an inlet port **21** of the cylinder **20,** the piston **14** may be moved within the cylinder **12** to decrease the volume of the mixing chamber **10,** air flowing from the cylinder **20** through an exhaust port **22** thereof.

Extending into the cylinder **12** at lower portions thereof are first and second inlet ports **24, 26,** respectively. Extending from the cylinder **12** at a lower por-

tion thereof is an outlet port **28** controlled by an outlet valve (not shown). Mounted in the cylinder **12** is a stirrer **31** connected to a shaft **30** and means (not shown) for operating said shaft **30** and stirrer **31.**

The first illustrative apparatus also comprises first and second storages comprising first and second tanks **48** and **68,** respectively in which first and second constituent compositions, comprising, respectively, reactive hydroxyl groups and reactive isocyanate groups, are maintained under a pressure in excess of atmospheric pressure, and feeding means comprising first and second feeding devices **50,70** respectively adapted to feed first and second constituent composition respectively, from their respective tanks to the mixing chamber **10.**

The first feeding device **50** comprises a cylinder **52** having a piston **54,** to which is secured a piston rod **56,** slidably mounted therein. Extending into an upper portion of the cylinder **52** is an inlet port **58,** and extending from a lower portion of the cylinder is an exhaust port **60.** A free, lower end portion of the piston rod **56** is bifurcated, a roller **62** extending between the bifurcated portions thereof.

The second feeding device **70** comprises a cylinder **72,** of a diameter different from that of the cylinder **52,** having a piston **74,** to which is secured a piston rod **76,** slidably mounted therein. Extendig into a lower portion of the cylinder **72** is an inlet port **78;** extending from an upper portion of the cylinder is an exhust port **80.** A free, upper end portion of the piston rod **76** is bifurcated, a roller **82** extending between the bifurcated portions thereof.

The feeding means also comprises operating mechanism **100** adapted to move the feeding means between first, second and rest conditions to feed constituent composition from the storages to the mixing chamber and comprising a correlating member **90** provided by an elongated bar, mounted on a pivot **92.** The pivot is carried on a bracket **93** slidably mounted on a support arm **94.**

The member **90** is provided with three slots **95, 96** and **97,** extending lengthwise of the member and spaced at intervals from the pivot **92,** respectively.

The operating mechanism **100** also comprises a fluid operated piston/cylinder operating device comprising cylinder **102** having a piston **104,** to which is secured a piston rod **106,** slidably mounted therein, ports **108, 110** extending into upper and lower portions of the cylinder respectively. A lower end portion of the rod **106** is bifurcated, a roller **112** extending between the bifurcated portions thereof.

The first illustrative apparatus also comprises control mechanism comprising a microswitch **120** secured to an upper end portion of the rod **106,** a first contact **124** mounted at a fixed position on a support **122** and a second contact **126** mounted at an adjustably variable position on the support **122.**

The piston rods **56, 76** and **106** are parallel, the rollers **62, 82** and **112** thereof extending through the slots **97, 95** and **96** of the correlating member, respectively. The piston rods **56** and **106** extend from the correlating member in the same direction, the piston rod **76** extending therefrom in the opposite direction.

A first supply conduit **64** extends from the first tank **48** through one-way valve **65** to the inlet port **58** of the cylinder **52;** extending from the supply conduit **64,** downstream of the valve **65** through a one-way valve **66** to the inlet port **24** of the cylinder **12** is a supply conduit **67.**

A second supply conduit **84** extends from the second tank **68** through a one-way valve **85** to the inlet port **78** of the cylinder **72;** extending from the supply conduit **64,** downstream of the valve **85** through a one-way valve **86** to the inlet port **26** of the cylinder **12** is a supply conduit **87.**

The first illustrative apparatus however additionally comprises a third storage comprising a third tank **228** in which third constituent composition, specifically a colouring material, is maintained under a pressure in excess of atmospheric pressure, the feeding means comprising a third feeding device **230** adapted to feed third constituent composition from the tank **228** to the mixing chamber **10.**

The third feeding device comprises a cylinder **232** having a piston **234,** to which is secured a piston rod **236,** slidably mounted therein. Extending into an upper portion of the cylinder are inlet and outlet ports **238** and **240,** respectively, and extending into a lower portion of the cylinder is an exhaust port **241.** An upper end portion of the piston rod **236** remote from the cylinder **232** is attached directly to the piston rod **106** of the operating mechanism **100,** said piston rods **236** and **106** being co-linear.

A third supply conduit **244** extends from the third tank **228** through a one-way valve **245** to the inlet port **238** of the cylinder **232;** a third delivery conduit **247** extends from the outlet port **240** through a one-way valve **246** to an inlet port **229** extending into the mixing chamber **10.**

In the rest condition of the feeding means the correlating member **90** is in a rest position, shown in dotted lines A in FIG. **1.** In this condition, the mixing chamber contains a small amount of first constituent composition together with a small amount of third constituent composition, together with residual polyurethane composition from an immediately preceding cycle of operation of the apparatus.

On operation of a starter switch of the control mechanism to initiate an operating cycle of the apparatus fluid under pressure is admitted to the port **110** of the cylinder **102,** the port **108** thereof and the port **21** of the cylinder **20** being opened by the control mechanism to atmosphere.

The operating mechanism moves the correlating member clockwise (FIG. **1**) about its pivot, forcing a first quantity of first constituent composition from the cylinder **52** through the port **58** along the conduits **64** and **67** through the one-way valve **66** and into the mixing chamber through the port **24,** and a first quantity of third constituent composition from the cylinder **232** through the port **238** along the conduit **247** through the one-way valve **246** and into the mixing chamber through the port **229.** A first proportionate quantity of second constituent composition is fed simultaneously into the cylinder **72** from the second storage, said quantity depending upon the position of the pivot **92** on the support arm **94.**

On engagement of the microswitch **120** with the contact **126,** (with the feeding means in its first condition shown in FIG. **1,** the correlating member **90** being in the position indicated B), the control mechanism reverses the direction of movement of the piston **104,** fluid under pressure being admitted to the port **108,** and the port **110** being opened to atmosphere.

The correlating member is now moved anticlockwise about the pivot **92**, forcing the piston **74** downwardly to feed a first quantity of second constituent composition from the cylinder **72** along the conduits **84** and **87** through the one-way valve **86** and into the mixing chamber **10** through the port **26**. Simultaneously, a proportionate quantity of first constituent composition is fed into the cylinder **52** from the first storage, and third constituent composition is fed into the cylinder **232** from the third storage.

On the correlating member reaching the position in which it is indicated in dotted lines C in FIG. **1**, in which the feeding means is in its second condition, the operating mechanism is maintained stationary whilst the constituent compositions are mixed within the mixing chamber and discharged by the piston **14** therefrom through the port **28**.

The operating mechanism is then caused by the control mechanism to move the feeding means to its rest condition, in which the correlating member is in its rest position (indicated A), second, small quantity of first constituent composition and a second, small quantity of third constituent compoisition being fed to the mixing chamber, the first constituent composition acting to dissolve residual polyurethane composition, and simultaneously a second proportionate quantity of second constituent composition is fed into the cylinder **72**. On reaching said rest condition, the microswitch **120** engages the contact **124** and the apparatus comes to rest.

The total quantity of first and second constituent composition fed to the mixing chamber may be varied by movement of the contact **126**. Such movement of the contact **126** has no effect on the ratio in which the two constituent compositions are fed to the mixing chamber. The total quantity of first constituent composition dispensed from the mixing chamber in a particular operating cycle of the apparatus comprises the second quantity fed thereto in the immediately preceding cycle and the first quantity fed thereto in said particular cycle, and the quantity of second constituent composition fed to the mixing chamber in said particular cycle comprises the first proportionate quantity fed from the storage thereof to the second feeding device in said particular cycle and the second porportionate quantity fed from the storage to the second feeding device in said immediately preceding cycle.

The ratio of the transverse distance *a* from the connection of the piston rod **56** to the member **90** to the connection of the piston rod **106** to the member **90**, to the transverse distance *b*, from the connection of the piston rod **76** to the member **90** to the connection of the piston rod **106** to the member **90**, is equal to the inverse ratio of the cross-sectional areas of the cylinders **52** and **72**. Specifically, in the first illustrative apparatus the ratio of said distance *a*/*b* is as shown in FIG. **1**, 3/2, and the inverse ratio of the cross-sectional areas of the cylinder **52** (A) to that of the cylinder **72** (B) viz., *B*/*A* is also 3/2. Thus, the total quantity of first and second constituent composition fed to the mixing chamber in any one operation of the illustrative apparatus is independent of the distance of the pivot **92** from the piston rods. Thus, variation may be made to the ratio in which the first and second constituent compositions are fed to the mixing chamber (by movement of the bracket **93** on the support arm **94**) without having any substantial effect to the total quantity of first and second constituent composition fed to the mixing chamber.

Said total quantity of first and second constituent composition is thus dependent on the axial distance moved by the piston rod **106**, as determined by the position of the contact **126**. The total quantity at third constituent composition fed to the mixing chamber in an operating cycle of the first illustrative apparatus is also dependent upon the axial distance moved by the piston rod **106**, and is of course not dependent upon the position of the pivot **92** and hence the ratio in which the first and second constituent compositions are mixed.

Thus, in the use of the first illustrative apparatus, variation may be made to both the total quantity of mixed constituent composition fed to the mixing chamber in an operating cycle thereof, and to the ratio in which the first and second constituent compositions are so fed, without causing variation to the proportion of third constituent composition present in mixed constituent composition dispensed from the mixing chamber.

The second illustrative apparatus is (FIG. **2**) also adapted for use in dispensing a multiple component, polyurethane, composition, comprising a mixing chamber **124** comprising first and second inlet ports **126**, **128** respectively and an outlet nozzle **129**.

The second illustrative apparatus also comprises first and second storages comprising first and second tanks **132**, **136** in which first and second constituent compositions, comprising, respectively, reactive hydroxyl groups and reactive isocyanate groups, are maintained and feeding means comprising first and second feeding devices **150**, **170** adapted to feed first and second constituent composition, respectively, from their respective storages to the mixing chamber **124**.

The first feeding device **150** comprises a cylinder **152** having a piston **154**, to which is secured a piston rod **156**, slidably mounted therein. Extending into a lower portion of the cylinder **152** is an inlet port **158**; extending into an upper portion of the cylinder is an exhaust port **160**. A free, upper end portion of the piston rod **156** is bifurcated, a roller **162** extending between the bifurcated portions thereof.

The second feeding device **170** comprises a cylinder **172**, of a diameter different from that of the cylinder **152**, having a piston **174**, to which is secured a piston rod **176**, slidably mounted therein. Extending into a lower portion of the cylinder **172** is an inlet port **178**; extending into an upper portion of the cylinder is an exhaust port **180**. A free, upper end portion of the piston rod **176** is bifurcated, a roller **182** extending between the bifurcated portions thereof.

The second illustrative apparatus also comprises operating mechanism comprising a correlating member **190**, provided by an elongated bar, mounted on a pivot **192**. The pivot is carried on a bracket **193** slidably mounted on a support arm **194**.

The member **190** is provided with three slots **195**, **196** and **197**, extending lengthwise of the member and spaced at intervals from the pivot **192**, respectively.

The operation mechanism also comprises a fluid-operated piston/cylinder operating device **200** comprising a cylinder **202** having a piston **204**, to which is secured a piston rod **206**, slidably mounted therein, ports **208**, **210** extending into upper and lower portions of the cylinder **202** respectively. A lower end portion

of the rod **206** is bifurcated, a roller **202** extending between the bifurcated portions thereof.

The operating mechanism also comprises a control device comprising a microswitch **220** secured to an upper end portion of the rod **206**, a first contact **224** mounted at a fixed position on a support **222** and a second contact **226** mounted at a fixed position on the support **222**.

The piston rods **156, 176** and **206** are parallel, the rollers **162, 182** and **212** thereof extending through the slots **197, 195** and **196** of the correlating member, respectively.

A first supply conduit **164** extends from the first tank **132** through a one-way valve **165** to the inlet port **158** of the cylinder **152**; extending from the supply conduit **164**, downstream of the valve **165** towards the mixing chamber **124** is a first delivery conduit **167**.

The conduit **167** extends to a two-way valve **166**. In a first condition of the valve **166**, the conduit **167** is connected to the port **126** of the mixing chamber: in a second condition of the valve **166**, the conduit is connected to a return conduit **169** leading back to the tank **132**.

A second supply conduit **184** extends from the second tank **136** through a one-way valve **185** to the inlet port **178** of the cylinder **172**; extending from the supply conduit **164**, downstream of the valve **185** towards the mixing chamber **124** is a second delivery conduit **187**.

The conduit **187** extends to a two-way valve **186**. In the first condition of the valve **186**, the conduit is connected to the port **128** of the mixing chamber: in a second condition of the valve **186**, the conduit is connected to a return conduit **189** leading back to the tank **136**.

The second illustrative apparatus however additionally comprises a third storage comprising a third tank **328** in which third constituent composition, specifically a colouring material, is maintained under a pressure in excess of atmospheric pressure, the feeding means comprising a third feeding device **300** adapted to feed third constituent composition from its storage to the mixing chamber **124**.

The third feeding device comprises a cylinder **332** having a piston **334**, to which is secured a piston rod **336**, slidably mounted therein. Extending into a lower portion of the cylinder are inlet and outlet ports **338** and **340**, respectively, and extending into an upper portion of the cylinder is an exhaust port **341**. An upper end portion of the piston rod **336** remote from the cylinder **332** is attached directly to the piston rod **206** of the operating mechanism **200**, said piston rods **336** and **206** being co-linear.

A third supply conduit **344** extends from the tank **328** through a one-way valve **345** to the inlet port **338** of the cylinder **332**; extending from the outlet port **340** of the cylinder **332** towards the mixing chamber **124** is a third delivery conduit **347**.

The conduit **347** extends to a two-way valve **346**. In a first condition of the valve **346**, the conduit **347** is connected to an inlet port **329** extending into the mixing chamber: in a second condition of the valve **346**, the conduit is connected to a return conduit **349** leading back to the tank **328**.

The valves **166, 186** and **346** are moved between their first and second conditions simultaneously by a solenoid control, (not shown), connected to the valves by a control arm, of the control mechanism of the illustrative apparatus.

On operation of a starter switch of the operating mechanism, fluid under pressure is admitted to the port **210** of the cylinder **202**, the port **208** thereof being opened to atmosphere.

The operating device moves the correlating member clockwise about its pivot, first, second and third constituent compositions being drawn from their storages along the conduits **164, 184** and **344** through the one-way valves **165, 185** and **345** and into the cylinders **152, 172** and **332**, respectively.

On engagement of the microswitch **220** with the contact **226**, (with the apparatus in the condition shown on dotted lines in FIG. **2**) the operating mechanism reverses the direction of movement of the piston **204**, fluid under pressure being admitted to the port **208** and the port **210** being opened to atmosphere.

The corelating member is now moved anticlockwise about the pivot **192**, forcing the pistons **154, 174** and **334** downwardly to feed said first, second and third constituent compositions along the conduits **167, 187** and **347**.

With the valves **166, 186** and **346** in their second conditions, the compositions are returned along the conduits **169, 189** and **349** to their storage tanks. On operation of an injector switch, the solenoid control operates to move the said valves to their first conditions, the constituent compositions then being delivered simultaneously to the mixing chamber wherein the compositions are mixed and from which the mixed constituent compositions are dispensed directly from the nozzle **129**.

On completion of the flow from the nozzle of a desired quantity of mixed constituent compositions, the solenoid control is operated to return the valves **166, 186** and **346** to their second conditions.

On reaching the position in which it is shown in the drawing in which the feeding means is in its second condition, contact between the microswitch **220** and the contact **224** causes the operating mechanism to reverse the direction of movement of the correlating member.

The ratio of the transverse distance a', from the connection of the piston rod **156** to the member **190** to the connection of the piston rod **206** to the member **190**, to the transverse distance b', from the connection of the piston rod **176** to the member **190** to the connection of the piston rod **206** to the member **190**, is equal to the inverse ratio of the cross-sectional areas of the cylinders **152** and **172**. Specifically, in the second illustrative apparatus the ratio of the distances a'/b' is shown in FIG. **3** to be 3/2, and the inverse ratio of the cross-sectional areas of the cylinder **152** (A') to that of the cylinder **172** (B') viz., B'/A' is also 3/2. Thus, the total rate at which the first and second constituent compositions are delivered to the mixing chamber and dispensed therefrom in the operation of the illustrative apparatus is independent of the distance of the pivot **92** from the piston rods. Thus, variation may be made to the ratio in which the first and second constituent compositions are delivered to the mixing chamber (by movement of the brackt **193** on the support arm **194**) without having any substantial effect on the total rate at which the first and second constituent compositions are delivered to the mixing chamber.

Having thus described my invention, what I claim as new and desire to secure by letters Patents of the United States is:

1. Apparatus for use in dispensing a composition provided by the mixing together of at least three constituent compositions and comprising: first storage means for containing a first of said constituent compositions; second storage means for containing a second of said constituent compositions means for mixing constituent compositions; first and second cylindrical chambers of different diameters and having pistons slidable therein in one direction to feed one composition from the first storage means to the first chamber while the other composition is fed from the second chamber to the mixing device, said pistons being slidable in the opposite direction to reverse the actions of the chambers; correlating means comprising a pivoted member connected to the pistons and means connected to said member between the connections for said pistons for operating said member to operate the pistons alternately in said directions, the ratio of the distances between the respective connections of the pistons of the first and second chambers and the connection for the operating means being equal to the inverse ratio of the diameters of the respective first and second chamber, the relation of said connections to the pivot of said member being so arranged as to cause the pistons to feed a predetermined ratio of said first and second compositions; third stage means for containing a third constituent composition, a third cylindrical chamber of predetermined diameter having a piston slidable therein in one direction to feed the third composition from the third storage means to the third chamber while one of the other compositions is fed from its chamber to the mixing device said third pistons being slidable in the opposite direction to reverse the action of its chamber, said third piston connected to said correlating intermediate said first and second pistons and co-linearly with said operating means, the realtion of said third piston connection to said correlating member being such that action of said third chamber and piston is independent of the spacing of the first and second chambers and piston and directly depending upon said operating means.

2. Apparatus according to claim **1** including means to adjust the distance between said pivot and the connection of the operating means for varying the ratio of said first and second compositions fed by the pistons and maintaining constant the quantity of the third composition fed.

3. Apparatus according to claim **2** including means to vary the extent of movement as said correlating member varying the total quantity of compositions fed and maintaining constant the ratio of the first and second quantities fed.

4. Apparatus for use in dispensing a composition provided by the mixing together of at least three constituent compositions and comprising first feeding means operable to feed a first of said constituent compositions and comprising a cylindrical chamber having a piston slidably disposed therein; second feeding means operable to feed a second of said constituent compositions and comprising a cylindrical chamber having a piston slidably disposed therein; third feeding means operable to feed the third of constituent compositions and comprising a cylindrical chamber having a piston slidably disposed therein, said cylindrical chambers being of different diameters; correlating means controlling the operation of the first and second feeding means according to an operating ratio equal to the inverse ratio of the diameters of the first and second cylinders and controlling the operation of said third feeding means independent of the ratio of said first and second means, said correlating means being adjustable for varying the effectiveness of said operating ratio to vary the quantities of the first and second of the constituent compositions fed and maintaining constant the quantity of the third composition fed.

5. Apparatus as set forth in claim **4** wherein said correlating means comprises a pivoted member movable about a pivot and connected to the three pistons, and further including operating means for moving said pivoted member about its pivot and connected to said pivoted member between the said first and second piston connections to said pivoted member and co-linearly with said third piston, the ratio of the distances between the connections of the first and second pistons and the operating means being equal to the inverse ratio of the diameters of the first and second chambers.

6. Apparatus according to claim **5** including means to adjust the distance between said pivot and the connection of the operating means for varying the ratio of the respective quantities fed by the first and second feeding means and maintaining constant the quantity of the third composition fed.

7. Apparatus according to claim **5** including means to vary the extent of movement of the pivoted member for varying the total quantity of the compositions fed and maintaining constant the ratio of the respective quantities fed by the first and second feeding means.

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