July 3, 1962 D. E. TRUMBULL ETAL 3,042,264

DEMAND MIXING AND DISPENSING MACHINE

Filed Oct. 1, 1959 5 Sheets-Sheet 1

FIG. 1

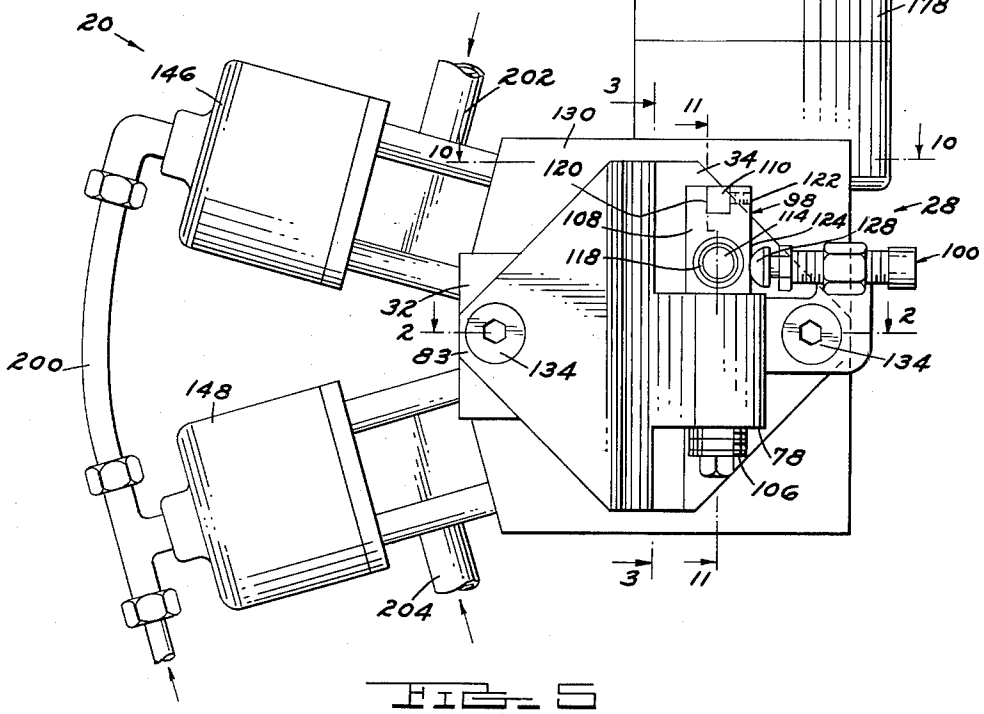
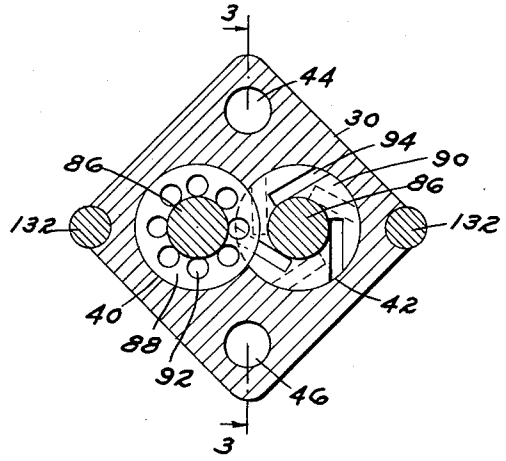


FIG. 5



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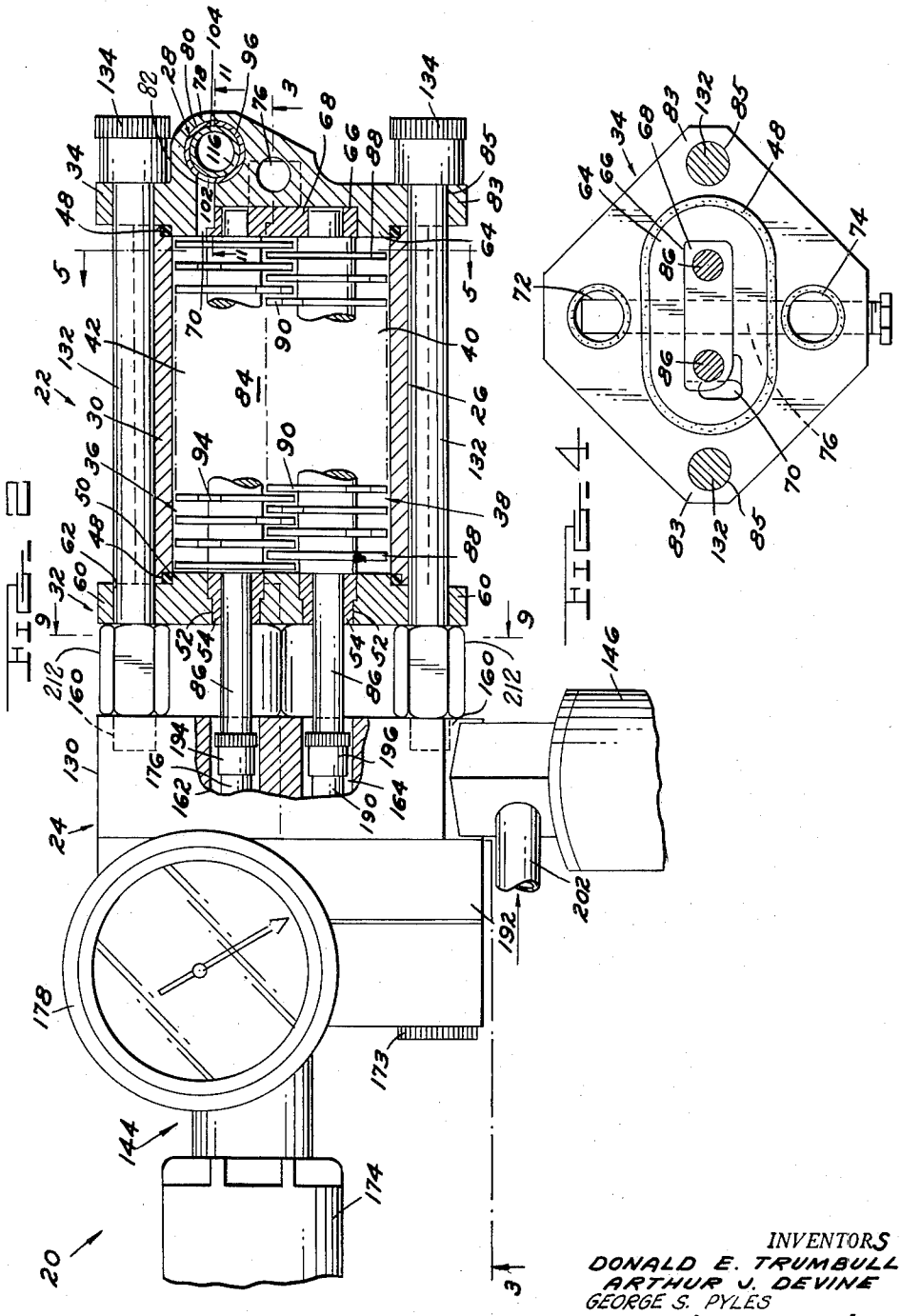

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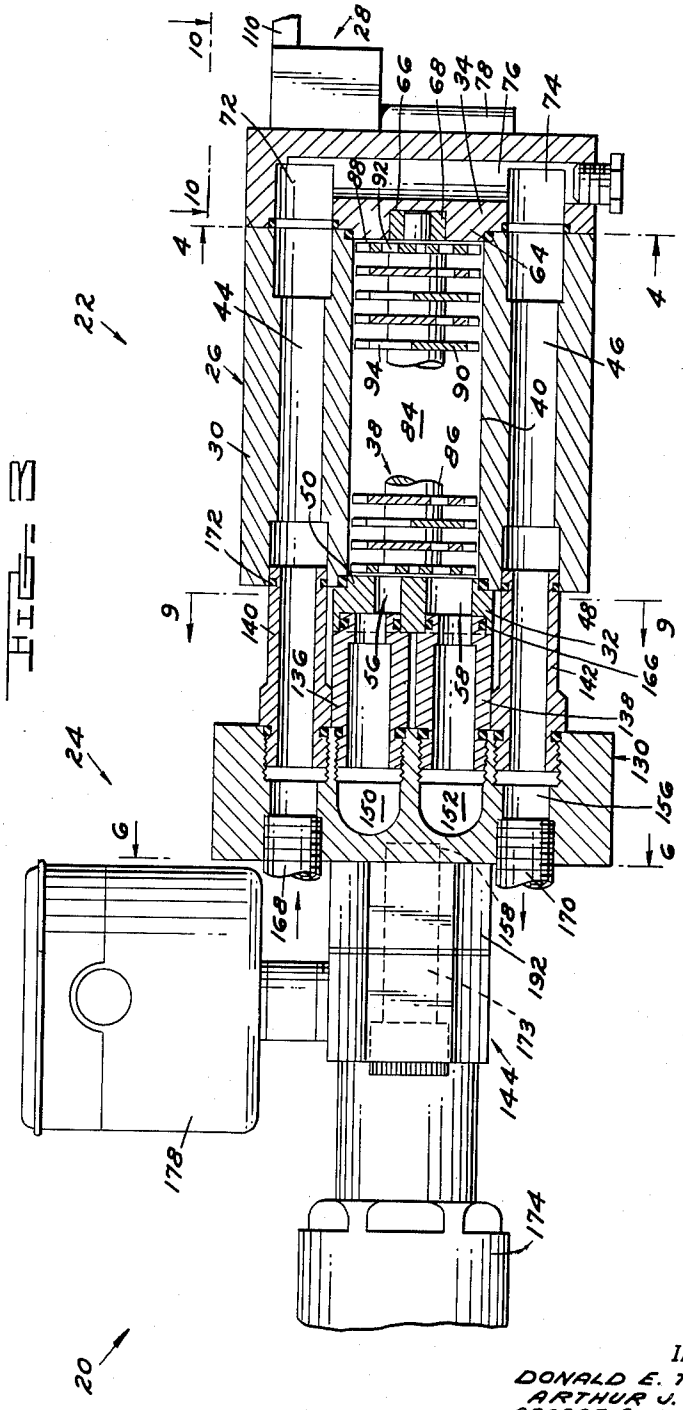

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DEMAND MIXING AND DISPENSING MACHINE

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FIG. 6

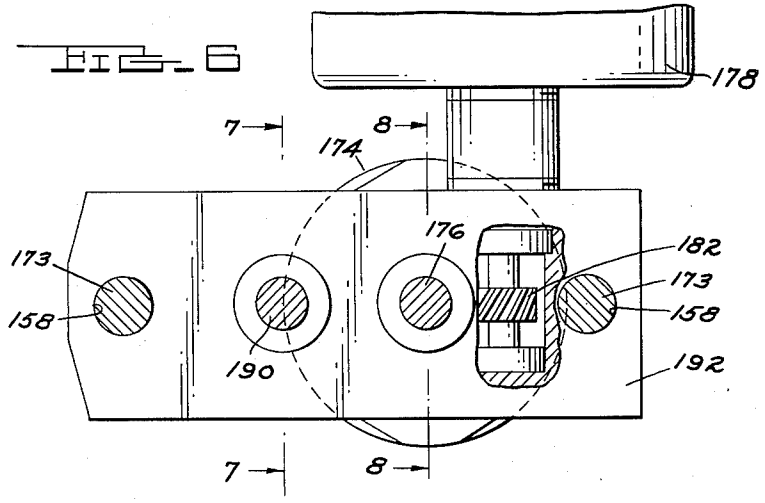


FIG. 7

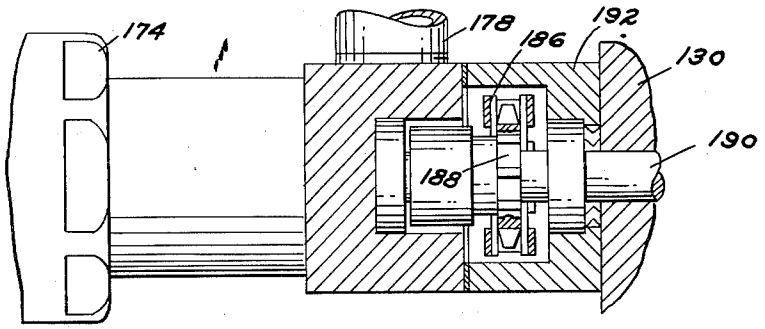
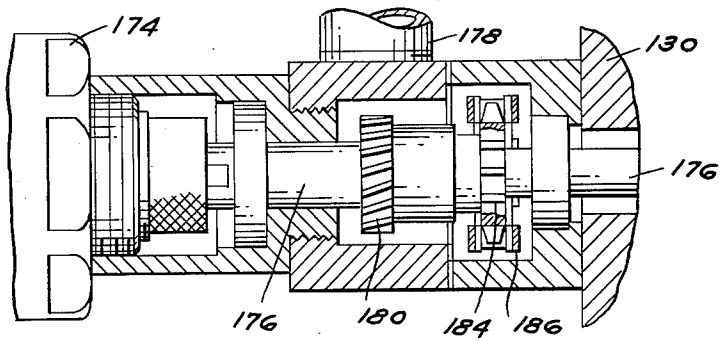


FIG. 8



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DEMAND MIXING AND DISPENSING MACHINE

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FIG. 9

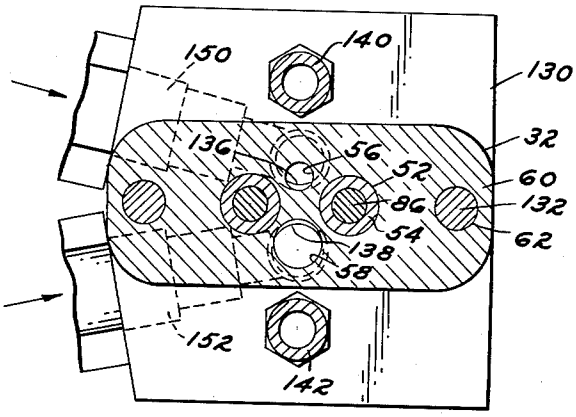


FIG. 10

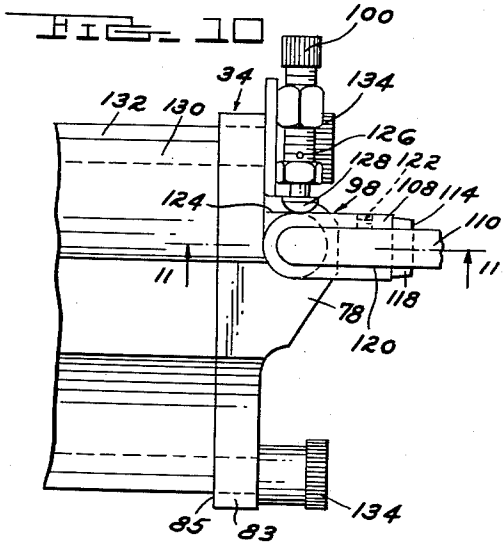
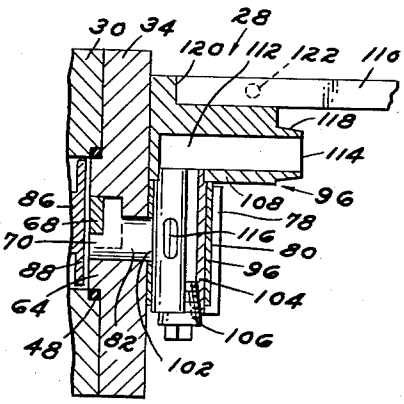


FIG. 11



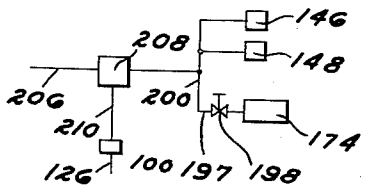


FIG. 12

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3,042,264

DEMAND MIXING AND DISPENSING MACHINE

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Filed Oct. 1, 1959, Ser. No. 843,823
11 Claims. (Cl. 222—142)

This invention relates to the mechanical arts. More particularly, it relates to mixing and dispensing equipment.

Recent advances in the chemical arts have resulted in resin based compositions useful as sealants, potting compounds and caulking compounds. Typical examples of such compositions are the polysulphide dihalide products. Such compositions are generally obtained by mixing together a monomeric resin and the like component with an appropriate catalyst or accelerator component which causes the resin to rapidly polymerize and cure. In some instances additional components such as fillers, pigments and the like may also be included in the mix. Because of the speed with which the resin is made to polymerize, it is usually necessary in preparing such compositions to do so either in the field or close to the place of their application, or to prepare and store the compositions at sufficiently low temperatures to drastically slow down the polymerization process. In either case it is necessary to provide mixing and dispensing equipment for preparing the composition and for placing the same in applicators such as cartridges and the like and hoses and the like.

Heretofore, such equipment has been constructed and operated on batch principles. Indeed, preparation of such compositions on other than a batch basis has not heretofore appeared to be feasible because of the lack of economical and practical ways and means for doing so, especially when dealing with components and compositions of high consistencies. Only in batch type equipment has it been practical to obtain the proper proportions of the components and to obtain sufficient intimate mixing of the components. On the other hand batch type equipment has a number of disadvantages.

One disadvantage results from the fact that batch mixing and dispensing equipment involves a considerable amount of machinery and manpower. Moreover, mix times are lengthy.

Another disadvantage arises out of the fact that in order for the procedure to be economical each batch must be of substantial quantity. On the other hand, the quantity of composition in each batch cannot be too large relative to the rate at which the composition is dispensed or used. Otherwise, before the entire batch can be dispensed or used a substantial portion of the batch may set up or harden or change in other properties on which there are maximum and minimum limitations and have to be dumped. In those cases where large heats of reaction are released because of chemical reaction between the components being mixed, the total quantity of the batch cannot be too large for the reason that the composition may become scorched or otherwise heat damaged. Even the presence of cooling means may not be adequate and in this regard it may be observed that cooling equipment in combination with batch mixing and dispensing equipment leads to such a costly investment that fairly large batches must be made in order to obtain the most economical use of the equipment.

Still another disadvantage with batching equipment arises out of the difficulty in excluding air from the components and composition in mixing and dispensing the same. Air inclusion or entrapment in the mix and resultant composition is to be avoided in a number of instances.

There is, therefore, a need for ways and means for continuously preparing and dispensing composition on demand with air excluded and rapid heat removal without having to prepare the same in batches.

Attempts have been made to satisfy this need but without notable success. The equipment proposed has been deficient for a number of reasons. One reason is due to the inability of such equipment to provide sufficient and adequate mixing of the components. Another reason is the complicated and costly structure involved. Still another reason is the difficulty in cleaning the equipment after it has been shut down. A further reason is the lack of positive flow stoppage, which lack results in "drooling" of composition from the dispenser part or nozzle of the machine. Other disadvantages exist.

A general object of this invention is to provide a mixing and dispensing machine which has none of the noted disadvantages.

More particularly, it is an object of this invention to provide a demand mixing and dispensing machine. Stated another way, it is an object of this invention to provide a mixing and dispensing machine which will mix components and dispense the resultant composition as needed without a large quantity of the composition being in the machine.

Still another object of this invention is to provide a demand mixing and dispensing machine which will intimately and sufficiently mix together the components and dispense the resultant composition particularly when one or more of the components and the composition have a high consistency. A particular object of this invention is to provide a demand mixing and dispensing machine which will intimately and sufficiently mix together the components and dispense the resultant composition regardless of the consistency of the components and composition.

Still other objects of this invention are to provide such a machine with a relatively simple structure and one which can be readily taken apart for service and maintenance and for cleaning when the machine has been shut down.

These and other objects which may appear as this specification proceeds are achieved by this invention.

In summary, this invention comprises a machine for preparing and dispensing on demand a composition comprising at least a mixture of at least two pumpable components without having first to form said composition in batches. The machine of this invention is based on the concept of a mixing chamber having a back end with an inlet for each of the components and a front end with a relatively constructed outlet for the composition. Within the chamber are mixing means. Means are provided for simultaneously stopping the flow of components through the chamber inlets and composition through the chamber outlet when it is desired to stop the machine from dispensing composition.

In the narrower aspects of this invention there is employed the concept of the mixing means being arranged and adapted to function transversely to the general flow through the chamber of components and composition. Still another concept is that of the mixing chamber wall transversely from one end to the other conforming to the mixing means. A most important concept is that of the mixing means being adapted to apply kneading and shear forces to the components entering the mixing chamber and to the composition thus formed, to continuously impel components and composition from the mixing chamber walls inwardly and to impel composition through the chamber to the outlet thereof.

Another concept employed in the more specific aspects of this invention is that of a dispenser structure which

actuates the flow stoppage means for both the components and composition.

Still another concept involved in the more specific aspects of this invention is that of a mounting and service block and interconnecting conduits in combination with a readily demountable, readily dismantled, mixing head which contains the mixing chamber and mixing means. The mixing head may be provided with coolant passages for passing a coolant through the chamber walls.

These and other concepts are present in the specific embodiment of this invention disclosed in the drawings which form a material part of the disclosure.

Before turning to the drawings, however, it should be noted that in most instances it will be necessary to employ a component delivery system in operating the demand mixing and dispensing machine of this invention. Such a system has been developed and has functioned quite satisfactorily. This system involves pump assemblies, one for each component, a proportioning or metering device and interconnecting conduits for each component. Each component is usually supplied in cans and drums. The pump assembly, in each case, comprises a plate which conforms in plan view to the interior of the correponding component container and which has a sliding fit with the interior wall of the container. Mounted on the plate is a pump, the intake of which is coupled by a conduit to an opening through the plate. The pump discharge is coupled by a conduit, such as a hose and the like, to the corresponding intake of the metering device. The corresponding outlet of the metering device is coupled by a conduit to the mixing and dispensing machine of this invention. To prepare the system for use the lids of the respective containers are removed and the corresponding plates placed on the top surface of the liquid. The system functions to deliver separately each component in proper proportion to the others and in air free condition to the mixing and dispensing machine.

Turning now to the drawings, it will be observed that

FIG. 1 is a front end view of a preferred embodiment of the demand mixing and dispensing machine of this invention;

FIG. 2 is a plan view of the machine of FIG. 1, which view shows the mixing head and a portion of the service block sectioned as indicated by the sectioning plane 2—2 of FIG. 1;

FIG. 3 is a cross sectional view of the machine of FIG. 1, which view has been taken as indicated by the sectioning planes 3—3 of FIG. 1 and of FIG. 2;

FIG. 4 is a cross sectional view of the front end of the mixing head of the machine of FIG. 1, which view has been taken as indicated by the sectioning planes 4—4 of FIG. 3;

FIG. 5 is still another cross sectional view of the region of the front end of the machine of FIG. 1, which view has been taken as indicated by the sectioning plane 5—5 of FIG. 2;

FIG. 6 is a cross sectional view of the drive assembly of the machine, which view has been taken as indicated by the sectioning plane 6—6 of FIG. 3 and which has been partially cut away to reveal internal structure;

FIG. 7 is a longitudinal sectional view of the drive assembly, taken as indicated by the sectioning plane 7—7 of FIG. 6;

FIG. 8 is still another longitudinal sectional view of the drive assembly, taken as indicated by the sectioning plane 8—8 of FIG. 6;

FIG. 9 is a cross sectional view of the mounting and service block of the machine, taken as indicated by the sectioning plane 9—9 of FIGS. 2 and 3;

FIG. 10 is plan view of the front end of the mixing head and of the dispenser assembly of the machine, which view has been taken as indicated by the plane 10—10 of FIGS. 1 and 3;

FIG. 11 is a longitudinal sectional view of the front end of the mixing head and of the dispenser assembly of the machine, which has been taken as indicated by the sectioning planes 11—11 of FIGS. 1, 2 and 10; and

FIG. 12 is a schematic of the pressure air system employed to operate the machine.

In greater detail, FIGS. 1, 2 and 3 of the drawings disclose a demand mixing and dispensing machine 20 which involves a number of inter-related structural assemblies. In particular the machine 20 comprises a mixing head assembly 22 and a mounting and service block assembly 24.

The mixing head assembly 22 comprises a mixing head structure 26 and a dispenser structure 28.

The mixing head structure 26 comprises a body member 30, a back end closure member 32, a front end closure member 34 and a pair of rotors 36 and 38. The body member 30 as shown in FIGS. 2, 3 and 5 is in the form of a block, square in cross section and longitudinally rectangular, which is turned on edge. Extending from one end of the body member 30 to the other end generally in alignment with the longitudinal axis of the body member 30 are a pair of overlapping cylindrical apertures 40 and 42 and a pair of coolant passageways 44 and 46. The apertures 40 and 42 and the passageways 44 and 46 are open at each end of the mixing head body member 30. The mixer body at each end about and between the overlapping aperture openings, however, is recessed in order to accommodate suitable seals or gaskets 48 and an end closure plate embossment. The coolant passageways 44 and 46, at least in the region of the back end of the mixing head body member 30, have a larger diameter than the central portions thereof whereby coolant conduit receiving, annular spaces are provided.

The back end closure member 32, shown in FIGS. 9, 2 and 3, comprises an embossment 50 having parallel sides and semi-circular ends which conform in size to the outer peripheral portions of the apertures 40 and 42 through the mixing head body member 30. Disposed through the embossment 50 are the component inlet orifices 56 and 58 which are positioned so as to be as close as possible to the longitudinal center line of the mixer head body member 30. In addition, each orifice 56 and 58 is positioned for direct communication with the corresponding apertures 40 and 42 in the mixing head body member 30.

The back end closure member 32 further comprises lateral flanges 60 with longitudinally aligned, tie rod receiving openings 62 therethrough.

The front end closure member 34 comprises a plate having on the back side thereof (see FIG. 4) an embossment 64 having parallel sides and semi-circular ends conforming to the outer peripheral portion of the apertures 40 and 42 of the mixing head body member 30. Within the embossment 64 is a recess 66 in which is seated a rotor bearing plate 68. In addition, there is provided in the embossment 64 a discharge outlet slot 70 which is partially under the rotor bearing plate 68. On both sides of the embossment 64 (see FIGS. 3 and 4) and spaced therefrom are coolant passages 72 and 74 which are in alignment with the front ends of the coolant passageways 44 and 46 in the mixing head body member 30 and which are interconnected by a coolant return passageway 76 which is positioned on the front side of and spaced from, the recess 66. On the front side of the front end closure member 34 there is provided an embossment 78. Disposed through the embossment 78 is a transverse, normally vertical, dispenser assembly tube receiving hole 80. Between the outlet slot 70 and the dispenser assembly tube receiving hole 80 there is provided an interconnecting, discharge passageway 82. The front end closure member 34 is likewise provided with a pair of laterally extending flanges 83 with tie rod receiving openings 85 therethrough which are normally in alignment with the tie rod openings 62 through the flanges 60 of the back end closure member 32.

With the back and front end closure members 32 and 34 in position on the body member 30 of the mixing head

structure 26 the cylindrical apertures 40 and 42 are closed at both ends wherefore, an air tight mixing chamber 84 is formed with component inlets 56 and 58 in the region of the back end thereof and a composition discharge outlet 70 in the region of the front end thereof. Within the mixing chamber are the rotors 36 and 38.

Each rotor 36 and 38 comprises a rotor shaft 86 which is normally disposed in coaxial alignment with the longitudinal axis of the aperture in which the rotor is positioned. With the mixing head structure 26 assembled one end of each rotor shaft 86 is rotatably seated in a corresponding recess of the rotor bearing plate 68. See FIGS. 2 and 3. The shaft 86 in each case extends therefrom through the corresponding cylindrical apertures 40 and 42 and corresponding bushings 54 in the back end closure member 32, and terminates in an irregularly shaped end within the mounting and service block assembly 24. Each rotor shaft 86 comprises along the length thereof within the apertures 40 and 42 and thus the mixing chamber 84 transverse, circular vanes 88 and 90 which have outside diameters such that the circumferential periphery of each vane under normal operative conditions is adjacent the wall surface defining the corresponding cylindrical aperture but not in contact therewith. In other words, the outside diameter of each vane 88 and 90 is slightly less than the diameter of the adjacent wall surface. The vanes 88 and 90 of one rotor 36 are interleaved or interposed between the overlapping portions of the vanes 88 and 90 of the other rotor 38. In general, each vane 88 and 90 comprises an opening therethrough to permit the passage of components and composition from the back end of the mixing chamber 84 to the front end of the mixing chamber 84. The openings are preferably arranged and shaped to provide not only kneading and shearing action but also forward impelling action.

A satisfactory arrangement is to provide the first and last vanes 88 of each rotor 36 and 38 with an annular row of circular openings 92. The intermediate vanes 90 between the first and last vanes 88 are provided with openings in the form of notches 94 which extend from adjacent the rotor shaft 86 to the circumferential periphery of the vanes 90 so that in an edge view of the vanes 90, as in FIG. 2, the appearance is somewhat like that of a dado blade. Preferably, the center line of each notch 94 of the intermediate vanes 90 is at an acute angle to the radius extending thereto at the outside diameter of the vane and preferably the center line of the notch 94 is at an acute angle with a line tangent to the rotor shaft 86 with the acute angle facing in the general direction of normal rotation of the rotor shaft as in FIG. 5. In employing vanes 90 with notches 94, it is preferred to angularly displace the notches 94 of one vane 90 from the notches 94 of the vanes on each side thereof. The reason is to minimize if not prevent short circuiting of components to the discharge outlet 70 of the mixing chamber 84.

The dispenser structure 28, shown in FIGS. 1, 2, 10 and 11 comprises a bushing 96, a dispenser 98 and a pilot valve 102.

The bushing 96, cylindrical in shape, is disposed in the transverse, dispenser assembly tube receiving hole 80 through the embossment 78 of the front end closure member 34. The bushing 96 is so disposed in the hole 80 in friction fit. On the side of the bushing 96 and in alignment and in conformity with the outlet of the discharge passageway 82 through the front end closure member 34 is a slot 102.

The dispenser 98 comprises a tube member 104, a threaded, removable plug 106, a nozzle member 108 and a lever arm 110. The tube member 104 is joined at one end as by brazing to the nozzle member 108 and at the other end is normally threadedly engaged by the plug 106. The tube member 104 and nozzle member 108 together provide a composition flow passageway 112 with an orifice 114 at the outer end thereof. The passageway 114 has a normally vertical portion in the tube member

104 and a normally horizontal portion in the nozzle member 108. The tube member 104 is disposed in sliding or rotatable fit through the bushing 28. In the side of the tube member 104 and displaced by a significant arc from the slot 102 of the bushing 96 when the tube member is in "no dispense" position is a slot 116 which conforms in shape to the slot 102 and outlet of the discharge passageway 82 in the front end closure member 34. When the tube member 104 is rotated to "dispense" position, the slot 116 is in alignment with the slot 102 and said outlet. The orifice 114 at the end of the flow passageway 112 is defined by an annular lip 118. The lip 118 is provided for receiving the tip of cartridges and the like to be filled with the composition and for receiving hoses and the like for conveying the composition to an applicator head. The lever arm 110 extends forwardly from, and above, the dispenser nozzle member 108. The back end thereof is seated in a corresponding slot 120 in the upper side of the nozzle member 108 and is secured thereto as by a set screw 122 through the nozzle member.

The dispenser 98 is rotatable on a vertical axis through the aforementioned significant arc. In the embodiment shown in FIG. 10, this arc is about 15°. With the center line of the orifice 114 of the nozzle member 108 in parallel with the longitudinal center line of the mixing head structure 26 the dispenser 98 in the embodiment shown in the drawings is in the "no dispense" position, which is to say, the position in which no components are introduced into the mixing chamber 84, in which no composition is impelled through the chamber 84 and in which the tube member 104, which functions as a valve, closes the outlet of the chamber discharge passageway 82. When the dispenser 98 is rotated through the selected arc, it is then in "dispense" position. In such position, components flow into the mixing chamber 84 and composition is formed, discharged through the outlet of the discharge passageway 82 and dispensed through the dispenser structure 28. Since it is intended that the position of the dispenser nozzle 98 determine whether or not the machine 20 is in operation, the pilot valve 100 is provided and the outside of the dispenser nozzle 98 is characterized by a cam surface 124 in the region of the back end which, upon rotation of the dispenser nozzle 98 through the selected arc of rotation, travels the greatest distance. The pilot valve 100 is of the poppet type. It comprises a pressure air escape vent 126. The valve 100 is disposed generally in the plane of said cam surface and comprises a push button member or cam member 128 which is adjacent the cam surface 124. The cam surface 124 is arranged so that upon rotation of the dispenser 98, it will cause the cam member 128 to be depressed into the poppet valve casing and actuate the valve therein to release pressure air from the pressure air conduit to which the valve 100 is coupled.

The mounting and service block assembly 24, positioned generally rearwardly of the mixing head assembly 22, as shown in FIGS. 2 and 3, comprises a service block 130, a pair of tie rods 132, a pair of cap nuts 134 for the front ends of the tie rods 132, interconnecting component tubes 136 and 138, interconnecting coolant tubes 140 and 142, a rotor drive assembly 144 and component flow shut-off valves 146 and 148. The service block 130 is held spaced apart from the mixing head assembly 22 by spacer means 212 positioned on the tie rods 132 as shown in FIG. 2.

The service block 130 comprises, as shown in FIG. 3, component flow passageways 150 and 152, coolant flow passageways 154 and 156, on the back side thereof a tapped hole 158 for a drive assembly mounting bolt and, as shown in FIG. 2, tapped holes 160 on the front side thereof for the tie rods 132, and shaft alleys 162 and 164.

The component flow passageways 150 and 152 have laterally disposed inlets and longitudinally aligned outlets which, when the block 130 is in position, are in alignment with the corresponding component orifices 56 and 58. The inlets to the component flow passageways 150 and

152 have seated therein in threaded engagement the corresponding component flow shut-off valves 146 and 148. The outlets have seated therein in threaded engagement the inlet ends of the corresponding interconnecting component tubes 136 and 138. The outlet ends of the component tubes, provided with O-ring seals 166, are seated in sliding fit in the corresponding component inlet orifices 56 and 58 through the back end closure member 32. The coolant flow passageways 154 and 156 have front and back side inlets and outlets, which, when the block 130 is in position, are in alignment with the coolant passageways 44 and 46 of the mixing head body member 30.

The coolant flow passageways 154 and 156 at the back side ends thereof have seated therein in threaded engagement corresponding coolant inflow and outflow conduits 168 and 170. On the front side of the service block 130 the coolant passageways 154 and 156 have seated therein in threaded engagement the back end of the coolant flow tubes 140 and 142, the front ends of which are mounted in sliding fit in the annular recessed end portions of the coolant passageways 44 and 46 in the mixing head body member 30. To prevent leakage of coolant past the outer walls of the coolant tubes 140 and 142 and the inner wall of the mixing head body defining the annular recessed portions of the coolant passageways 44 and 46 in the mixer head body 30, the front ends of the coolant tubes are encircled by O-ring seals 172.

The rotor drive assembly 144, mounted to the service block 130 by way of a mounting bolt 173, comprises an air motor 174 with a main rotor drive shaft 176, a tachometer drive gear 180, a tachometer driven gear 182, a drive sprocket 184, a chain drive 186, a driven sprocket 188 and a driven rotor drive shaft 190.

The main rotor drive shaft 176 extends forwardly from the air motor 174 through the base of the tachometer 178, through the chain drive housing 192 and into the corresponding shaft alley 162 of the service block 130. In the base of the tachometer, the main rotor drive shaft 176 has mounted thereon a tachometer drive gear 180 which is meshed with the tachometer driven gear 182 on the tachometer shaft. In the chain drive housing 192 the main rotor drive shaft 176 has mounted thereon the the drive sprocket 184. About the drive sprocket 184 and about the driven sprocket 188 is the chain drive 186. The driven sprocket 188 is mounted on the driven rotor drive shaft 190 which extends longitudinally from the chain drive housing 192 into the corresponding shaft alley 164 of the service block. Inside the service block 130 the front ends of the rotor drive shaft 176 and the rotor driven shaft 190 comprise socket members 194 and 196 for receiving the corresponding ends of the rotor shafts 86. The socket members 194 and 196 in end view conform in shape to the ends of the rotor shafts 86. This enables the rotor shafts 86 to be readily unseated therefrom. The advantage of this aspect is the ease in removal of the mixing head assembly from the service block and tie rod members thereof.

The air motor 174 is of a conventional type and need not, therefore, be described in detail. The pressure air thereto is preferably supplied through a conduit 197 comprising an air flow rate control valve 198 (see FIG. 12), which is coupled to a common, pressure air conduit 200.

The component flow shut-off valves 146 and 148 as shown in FIGS. 1 and 9 are pressure air actuated. Indeed, in accordance with this invention, pressure air is supplied to each flow shut-off valve from the common, pressure air conduit 200. The valves 146 and 148 have laterally disposed component intakes which are coupled to corresponding component supply conduits 202 and 204 which function to deliver to the machine 20 components from the previously mentioned metering device.

The pressure air system for the machine 20 is diagrammatically illustrated in FIG. 12. It comprises a main pressure air supply conduit 206, a pressure air master shut-off valve 208, the common pressure air conduit 200, a pressure air bleed-off conduit 210 and the pilot valve 100. The main pressure air suppiy conduit 206 is coupled to one side of the master shut-off valve 208. The other side of the master valve 208 is coupled to the common pressure air conduit 200. As long as pressure air is supplied to the actuating mechanism the master valve 208 will be closed. However, if the pressure air is removed from the actuating mechanism the master valve 208 opens. The actuating mechanism is in combination with the air bleed-off conduit 210 which is coupled to the pilot valve 100. Hence, when the cam member 128 of the pilot valve 100 is depressed as by rotating the dispenser 98 to the "dispense" position, the pressure air is bled-off from the actuating mechanism of the master valve 208 through the pilot valve vent 126 and the master valve 208 opens. This supplies pressure air to the air motor 174 and to the component flow shut-off valves 146 and 148. The air motor 174 commences to rotate and the component flow shut-off valves 146 and 148 open. When the cam member 128 of the pilot valve 100 is released as by rotating the dispenser 98 to the "no dispense" position the vent 126 of the pilot valve 100 is closed and the pressure air condition in the actuating mechanism of the master valve 208 is resumed, whereupon the same closes. The air motor 174 stops and the component flow shut-off valves 146 and 148 close.

To prepare the machine 20 for use the component supply conduits 202 and 204 from the metering device are coupled to the respective component flow shut-off valves 146 and 148. The master valve 208 with the common pressure air conduit 200 coupled thereto and to the air motor air feed conduit 197 and component flow shut-off valves 146 and 148 (and also to the metering device and component feed pumps) is coupled to the main pressure air supply conduit 206. The mixing head assembly 22 in assembled condition is mounted on the mounting and service block assembly 24 with the tie rods 132 passing through the corresponding tie rod openings 62 and 85, the component tubes 136 and 138 seated in the corresponding component orifices 56 and 58 of the back end closure member 32 and the coolant tubes 140 and 142 seated in the back ends of the coolant passageways 44 and 46 of the mixing head body member 30. The cap nuts 134 are mounted on the front ends of the tie rods 132 and tightened down, thereby making the mixing head structure 26 airtight. With the lever arm 110 in "no dispense" position, the coolant flow is turned on and the master pressure air valve 208 is turned on. The lever arm 110 is then rotated to "dispense" position whereupon components flow into the mixing chamber 84 and the rotors 36 and 38 rotate. When composition appears at the dispenser outlet 114 and air in the machine 20 appears to be expelled therefrom, the lever arm 110 is returned to "no dispense" position. The machine 20 is now ready for normal operation.

To use the machine 20, a hose type applicator and the like or a cartridge type applicator and the like is mounted on the annular lip 118 of the dispenser structure 28 and the lever arm 110 rotated to "dispense" position. When the cartridge is full or the particular job finished or when it is desired to stop the machine 20, the lever arm 110 is merely returned to "no dispense" position.

If, during operative conditions, the composition does not appear to be sufficiently mixed, the air flow rate control valve 198 on the air motor feed conduit 197 is turned until the tachometer 178 indicates a lower rate of rotation of the air motor drive shaft 176. If the composition is at a higher than specified consistency for the composition, the coolant flow rate should be increased and, if this is not sufficient, the air flow rate control valve 198 turned until the tachometer 178 registers a higher rate of rotation of the air motor drive shaft 176. These steps will usually suffice unless the formulation of the composition is faulty or the components are off specification.

When the machine **20** is shut down for any length of time it is recommended that the mixing head structure **26** and dispenser structure **28** be dismantled and cleaned. To do this, the master air valve **208** and coolant flow are first turned off. Then the cap nuts **134** are removed from the tie rods and the mixing head assembly **22** removed. The mixing head assembly **22** is then dismantled including the removal of the dispenser assembly plug **106**, and cleaned. This it will be seen is readily and easily accomplished since the assembly is no longer held together and the various structural elements can simply be taken apart. When the cleaning operation is completed the various structural elements of the mixing head assembly **22** are assembled and placed into position and the mixing head assembly **22** mounted on the mounting and service block assembly **24** as already described.

Thus, there is provided a mixing and dispensing machine for continuously mixing together components to form a composition and for dispensing the composition.

A major feature of advantage of this machine is that components are mixed together substantially only as needed. In other words, the inventory of composition in the machine under normal operative conditions at any one moment is quite low. Wastage of composition upon starting up and shutting down of the machine is insignificant.

Another major feature of advantage of the machine of this invention resides in the action of the rotors **36** and **38**. Because of the configuration of the mixing chamber **84**, and of the arrangement of the rotors **36** and **38** therein, all of the components and composition are subjected to intense kneading and shearing action and to impelling action throughout the length of the chamber **84**. Moreover, under operative conditions, components and composition at the chamber walls are continuously wiped therefrom and impelled inwardly to commingle with the components and composition inwardly of the chamber walls. Furthermore, this action and these effects are obtained regardless of the consistencies of the components and the resultant composition. In this regard the machine of this invention is particularly useful in preparing composition of high consistencies.

Still another feature of advantage of the machine of this invention resides in the air free mixing aspect thereof. Because the machine **20** presents a completely closed and pressurized system, air entrapment and material contamination due to air exposure is eliminated.

Yet another feature of advantage is that the machine is completely air powered, which not only enhances its value from a standpoint of economy of operation but also from the standpoint of safety.

A most important advantage of the machine of this invention is the ease with which the mixing time of the composition can be controlled. By regulating the coolant flow rate and by regulating the speed of the air motor **174** highly sensitive and accurate control of the required mixing time can be obtained.

Still another important feature of advantage of this invention resides in the combination of the component flow shut-off valves **146** and **148**, the air motor **174** and the dispenser valve, represented by the dispenser nozzle tube member **104**, together with the pressure air control system which includes the pilot valve **100**. When the lever arm **110** is rotated from "dispense" position to "no dispense" position positive and immediate stopping of component and composition flows is obtained. This prevents drooling of composition from the dispenser orifice **114**. This also eliminates back mixing of components and confines composition to the mixing chamber **84**.

Other major advantages of the machine of this invention are the small number of parts actually exposed to the composition, the ease with which the same may be dismantled and disassembled for cleaning and the ready accessibility to the interior surfaces exposed to the composition.

These and other meritorious features, advantages and embodiments will be apparent to those in the exercise of ordinary skill in the art upon reading the foregoing description. For example, the specific embodiment described can be readily modified to handle three and more components. Instead of a pressure air system an electrical system can be used. It should be understood, therefore, that the scope of this invention is defined by the appended claims rather than by the foregoing description and that all embodiments and variations and modifications thereof, which incorporate the true spirit and essential characteristics of this invention, are intended to be embraced by those claims unless expressly excluded by their language.

We claim:

1. A demand mixing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial back-log of composition in the machine which comprises: a mixing chamber having a back end and a front end with an inlet for each of said components in the region of said back end and a relatively constricted outlet in the region of said front end for said composition, whereby the overall flow path of said components and composition in said chamber is from the region of said back end to the region of said front end, said chamber from the region of said back end to the region of said front end having the shape of a pair of overlapping, longitudinally aligned cylinders whereby said chamber has a pair of longitudinally aligned axes of radial symmetry; mixing means in said chamber transversely arranged to said overall flow path, said mixing means comprising a pair of longitudinal shaft means in coaxial alignment with the corresponding longitudinal axis of radial symmetry and extending through openings through the back end of said mixing chamber, each shaft means inside said mixing chamber comprising a plurality of transversely disposed, parallel, generally radially symmetrical vane means interposed between the vane means of the other shaft means, each of said vane means having an outside diameter slightly less than the inside diameter of the cylinder portion of the mixing chamber in which said vane means is disposed, at least some of said vane means of each shaft means having openings therethrough disposed at an angle with respect to the rotation of the shaft means to impel components transversely radially inwardly of the overall flow path and from one cylindrically shaped portion of the mixing chamber to the other cylindrically shaped portion thereof; prime mover means for rotating said shaft means; and separate conduit means for each of said components from the supply sources thereof to the chamber inlets therefor.

2. A demand mixing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial back-log of composition in the machine which comprises: a mixing chamber having a back end and a front end with an inlet for each of said components in the region of said back end and a relatively constricted outlet in the region of said front end for said composition, whereby the overall flow path of said components and competition in said chamber is from the region of said back end to the region of said front end, said chamber from the region of said back end to the region of said front end having the shape of a pair of overlapping, longitudinally aligned cylinders whereby said chamber has a pair of longitudinally aligned axes of radial symmetry; mixing and impelling means in said chamber transversely arranged to said overall flow path, said mixing and impelling means comprising a pair of longitudinal shaft means in coaxial alignment with the corresponding longitudinal axis of radial symmetry and extending through openings through the back end of said mixing chamber, each shaft means inside said mixing chamber comprising a plurality of transversely disposed, parallel, generally radially symmetrical vane means interposed between the vane means of the other shaft means,

each of said vane means having an outside diameter slightly less than the inside diameter of the cylinder portion of the mixing chamber in which said vane means is disposed, and comprising openings therethrough, said openings in the vane means between the first and last vane means on each shaft means being in the form of notches angulated in the normal direction of rotation of said vane means to impel components radially inwardly away from the mixing chamber wall toward the shaft means; prime mover means for rotating said shaft means; separate conduit means for each of said components from the supply sources thereof to the chamber inlets therefor; and discharge valve means in combination with said relatively constricted discharge outlet.

3. A demand mixing and dispensing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial backlog of composition in the machine which comprises: a mixing chamber having a back end and a front end with an inlet for each of said components in the region of said back end and a relatively constricted outlet in the region of said front end for said composition, whereby the overall flow path of said components and composition in said chamber is from the region of said back end to the region of said front end, said chamber from the region of said back end to the region of said front end having the shape of a pair of overlapping, longitudinally aligned cylinders whereby said chambers has a pair of longitudinally aligned axes of radial symmetry; mixing and impelling means in said chamber transversely arranged to said overall flow path, said mixing and impelling means comprising a pair of longitudinal shaft means in coaxial alignment with the corresponding longitudinal axis of radial symmetry and extending through openings through the back end of said mixing chamber, each shaft means inside said mixing chamber comprising a plurality of transversely disposed, parallel, generally radially symmetrical vane means interposed between the vane means of the other shaft means, each of said vane means having an outside diameter slightly less than the inside diameter of the cylinder portion of the mixing chamber in which said vane means is disposed, and comprising openings therethrough, said openings in the vane means between the first and last vane means on each shaft means being in the form of notches angulated in the normal direction of rotation of said vane means to impel components radially inwardly from the periphery of the vane means toward the center of the shaft means; prime mover means for rotating said shaft means; separate conduit means for each of said components from the supply sources thereof to the chamber inlets therefor, each of said conduit means comprising flow shutoff valve means; dispenser means in combination with said discharge outlet, said dispenser means comprising discharge valve means operatively connected with said flow shut-off valve means and said prime mover means whereby said flow shut-off valve means are closed and said prime mover means is non-operative when said discharge valve means is closed and said flow shut-off valve means are open and said prime mover means is in operation when said discharge valve means is open.

4. A demanded mixing and dispensing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial back-log of composition in the machine, which comprises a mixing head assembly in combination with a service block assembly, said mixing head assembly comprising: a body member having therein a mixing chamber in the form of a pair of overlapping, longitudinally aligned, side-by-side cylinders extending from one end of said body member to the other; a back end closure member having separate component orifices and rotor shaft passageways therethrough and laterally extending flanges with tie rod holes therethrough; a front end closure member having a relatively constricted discharge passageway therethrough, laterally extending flanges with tie rod holes therethrough normally in alignment with the tie rod holes of said flanges of said back end closure member and on the front side thereof dispenser means including a valve in combination with the outlet of said discharge passageway; rotor means in each of said cylinder portions of said spaces comprising shaft means normally extending through said shaft passageways in said back end closure member and vane means for applying kneading and shearing forces to components and composition in said chamber and for impelling said components and composition forwardly through said chamber; and said service block assembly comprising: a block having tie rod members positioned thereon extending forwardly of said block, said tie rod members having mounted thereon said end closure members and said body member, spacer means interposed between said block and said back end closure member, shaft alleys corresponding to said rotor shaft passageways into which said shafts extend and component flow passageways with inlets and outlets; rotor drive means with drive shafts extending into said shaft alleys and in engagement with said rotor shafts; component infeed conduits with flow shut-off valves connected to said inlets of said component flow passageways; component flow tubes connected to said outlets of said component flow passageways and seated in said component orifices of said back end closure member; and cap nut means for threaded engagement with the front ends of said tie rod members and for holding said mixing head assembly together and in place on said tie rod members.

5. A demand mixing and dispensing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial back-log of composition in the machine, which comprises a mixing head assembly in combination with a service block assembly, said mixing head assembly comprising: a body member having therein a mixing chamber in the form of a pair of overlapping, longitudinally aligned, side-by-side cylinders extending from one end of said body member to the other; a back end closure member having separate component orifices and rotor shaft passageways therethrough and laterally extending flanges with tie rod holes therethrough; a front end closure member having a relatively constricted discharge passageway therethrough, laterally extending flanges with tie rod holes therethrough normally in alignment with the tie rod holes of said flanges of said back end closure member and on the front side thereof dispenser means including a valve in combination with the outlet of said discharge passageway, said dispenser means comprising an embossment portion of said front end closure member with a transverse passageway along the side of which said discharge passageway has an outlet, a rotatable tube seated in said transverse passageway, said tube having a lateral opening corresponding to said discharge passageway outlet and a head with a dispenser orifice and passageway extending thereto from said tube, and means for rotating said tube and head from a no-dispense position to a dispense position whereat said lateral opening in said tube is in register with said discharge passageway outlet; rotor means in each of said cylinder portions of said spaces comprising shaft means normally extending through said shaft passageways in said back end closure member and vane means for applying kneading and shearing forces to components and composition in said chamber and for impelling said components and composition forwardly through said chamber; and said service block assembly comprising: a block having tie rod members positioned thereon extending forwardly of said block, said tie rod members having mounted thereon said end closure members and said body member, spacer means interposed between said block and said back end closure member, shaft alleys corresponding to said rotor shaft passageways into which said shafts extend and component flow passageways with inlets and outlets; rotor drive means with

drive shafts extending into said shaft alleys and in engagement with said rotor shafts; component infeed conduits with flow shut-off valves connected to said inlets of said component flow passageways; component flow tubes connected to said outlets of said component flow passageways and seated in said component orifices of said back end closure member; and cap nut means for threaded engagement with the front ends of said tie rod members and for holding said mixing head assembly together and in place on said tie rod members.

6. A demand mixing and dispensing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial backlog of composition in the machine, which comprises a mixing head assembly in combination with a service block assembly, said mixing head assembly comprising: a body member having therein a mixing chamber in the form of a pair of overlapping, longitudinally aligned, side-by-side cylinders extending from one end of said body member to the other; a back end closure member having separate component orifices and rotor shaft passageways therethrough and laterally extending flanges with tie rod holes therethrough; a front end closure member having a relatively constricted discharge passageway therethrough, laterally extending flanges with tie rod holes therethrough normally in alignment with the tie rod holes of said flanges of said back end closure member and on the front side thereof dispenser means including a valve in combination with the outlet of said discharge passageway, said dispenser means comprising an embossment portion of said front end closure member with a transverse passageway along the side of which said discharge passageway has an outlet, a rotatable tube seated in said transverse passageway, said tube having a lateral opening corresponding to said discharge passageway outlet and a head with a dispenser orifice and passageway extending thereto from said tube, said head having on the outside thereof a cam surface with a protruding portion, means for rotating said tube and head from a no-dispense position to a dispense position whereat said lateral opening in said tube is in register with said discharge passageway outlet, and a pilot valve means with a cam positioned relative to said cam surface, said cam being depressed into said pilot valve means by said protruding portion of said cam surface when said head is in dispense position and being extended from said pilot valve means when said head is in no-dispense position; rotor means in each of said cylinder portions of said spaces comprising shaft means normally extending through said shaft passageways in said back end closure member and vane means for applying kneading and shearing forces to components and composition in said chamber and for impelling said components and composition forwardly through said chamber; and said service block assembly comprising: a block having tie rod members positioned thereon extending forwardly of said block, said tie rod members having mounted thereon said end closure members and said body member, spacer means interposed between said block and said back end closure member, shaft alleys corresponding to said rotor shaft passageways into which said shafts extend and component flow passageways with inlets and outlets; rotor drive means with drive shafts extending into said shaft alleys and in engagement with said rotor shafts; component infeed conduits with flow shut-off valves connected to said inlets of said component flow passageways; component flow tubes connected to said outlets of said component flow passageways and seated in said component orifices of said back end closure member; means in combination with said flow shut-off valve means and said rotor drive means and responsive to the cam of said pilot valve means for causing said shut-off valve means to open and said rotor drive means to operate when said cam is depressed and for causing said shut-off valve means to close and said rotor drive means to be inoperative when said cam is extended; and cap nut means for threaded engagement with the front ends of said tie rod members and for holding said mixing head assembly together and in place on said tie rod members.

7. A demand mixing and dispensing machine according to claim 6 wherein said body member comprises coolant flow passages with an inlet and an outlet at the back end thereof, said service block comprises coolant passageways in alignment with said inlet and outlet and said service block assembly includes coolant flow tubes extending forwardly from said passageway into and in sliding fit with said inlet and outlet.

8. A demand mixing and dispensing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial backlog of composition in the machine, which comprises: a mixing chamber having a back end with an inlet for each of said components and the front end with a relatively constricted discharge outlet for said composition whereby the overall flow path of said components and composition is from the region of said back end to the region of said front end; mixing and impelling means in said chamber arranged transversely to said overall flow path; motive means connected to said mixing and impelling means; separate feed conduits for each of said components to the mixing chamber inlets therefor, each of said conduits having flow shut-off valves therein for positively stopping or allowing flow to the mixing chamber; dispenser means cooperating with said outlet, said dispenser means including a discharge valve and a control device, said flow shut-off valves having actuating means for opening and closing same connected to said control device, and said motive means connected to said control device, whereby upon closing said discharge valve said control device is actuated to close said flow shut-off valves and stop said motive means, and upon opening said discharge valve said control device is actuated to open said flow shut-off valves and start said motive means.

9. A demand mixing and dispensing machine essentially as defined in claim 8 characterized in that said motive means is a fluid pressure motor; said actuating means for opening and closing the flow shut-off valves is a fluid pressure motor; and said control device is a fluid pressure pilot valve.

10. A demand mixing and dispensing machine for mixing together as needed at least two pumpable components and for dispensing the resultant composition without a substantial backlog of composition in the machine, which comprises: a mixing chamber having a back end and a front end with an inlet for each of said components in the region of said back end and a relatively constricted discharge outlet in the region of said front end for said composition, whereby the overall flow path of said components and composition in said chamber is from the region of said back end to the region of said front end; mixing and impelling means in said chamber transversely arranged to said overall flow path and operable to mix together components in the chamber; separate conduit means for each of said components from supply sources thereof to the chamber inlets therefor, each of said conduit means comprising positive acting flow shut-off valve means for allowing or positively preventing component flow into said mixing chamber; and dispenser nozzle means in combination with said outlet, said dispenser nozzle means including discharge valve means; and a control system coupled to said mixing and impelling means and to said positive acting flow shut-off valve means and to said discharge valve means with said flow shut-off valve means whereby said flow shut-off valve means are closed and said mixing and impelling means are stopped when said discharge valve means is closed and said flow shut-off valves are open and said mixing and impelling means are started when said discharge valve means is open.

11. A mixing head assembly for a demand mixing and

dispensing machine characterized by a service block assembly and a mixing head assembly, which comprises: a body member having therein a mixing chamber in the form of a pair of overlapping, longitudinally aligned, side-by-side cylinder portions extending from one end of said body member to the other; a back end closure member having a separate component orifice for each cylinder portion and a rotor shaft passageway therethrough for each cylinder portion and laterally extending flanges with tie rod holes therethrough; a front end closure member having a relatively constricted discharge passageway therethrough for communication with said cylinder portions, laterally extending flanges with tie rod holes therethrough normally in alignment with the tie rod holes of said flanges of said back end closure member and on the front side thereof dispenser means including a valve in combination with the outlet of said discharge passageway; rotor means in each of said cylinder portions comprising shaft means normally extending through said shaft passageways in said back end closure member and interleaved vane means in said cylinder portions extending from and carried by said shaft means for applying kneading and shearing forces to components and composition in said chamber, said vane means having component impelling surface portions disposed at an angle to the direction of rotation of the shaft means to sweep component from adjacent the walls of the cylindrical portions inwardly toward the shaft means and transfer component from one cylindrical portion to the other cylindrical portion during overall flow of the components from back closure member toward the front closure member.

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