United States Patent [19]

Eberle

[11] **3,741,441**

[45] **June 26, 1973**

[54] **METHOD AND APPARATUS FOR DISPENSING EPOXY**

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[21] Appl. No.: **94,478**

[52] **U.S. Cl.**..... **222/135**, 222/145, 222/146 H, 222/318, 222/504, 259/7

[51] **Int. Cl.**..... **B67d 5/62**

[58] **Field of Search**..... 222/135, 145, 146 H, 222/318, 504, 77; 259/7, 8; 239/218.5

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[57] **ABSTRACT**

A method and apparatus for mixing and dispensing liquid resin and catalyst in predetermined quantities for filling battery case tops or similar devices wherein the contents of, and the connections thereof, are encased and sealed in solidified resin material. The device has a mixing and dispensing head in which a convoluted member is rotatably disposed for mixing and delivering a mixture of resin and catalyst toward a discharge opening. The convoluted member has a valve member on the lower end thereof and is movable longitudinally of the head toward and away from a valve seat in the discharge opening for opening and closing same.

11 Claims, 16 Drawing Figures

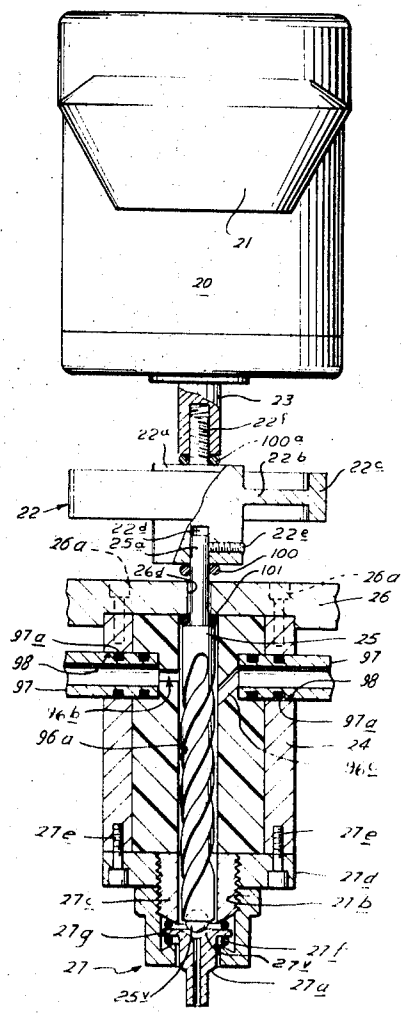


Fig. 1

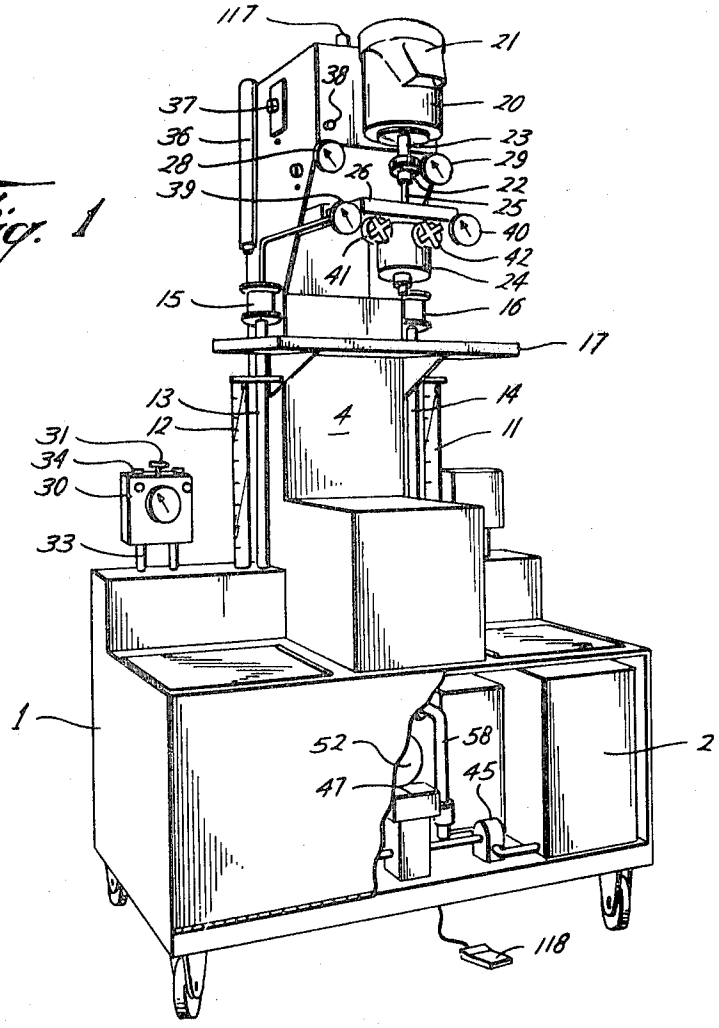
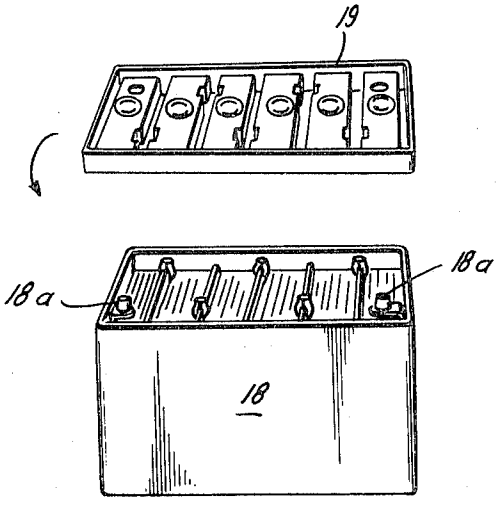


Fig. 2



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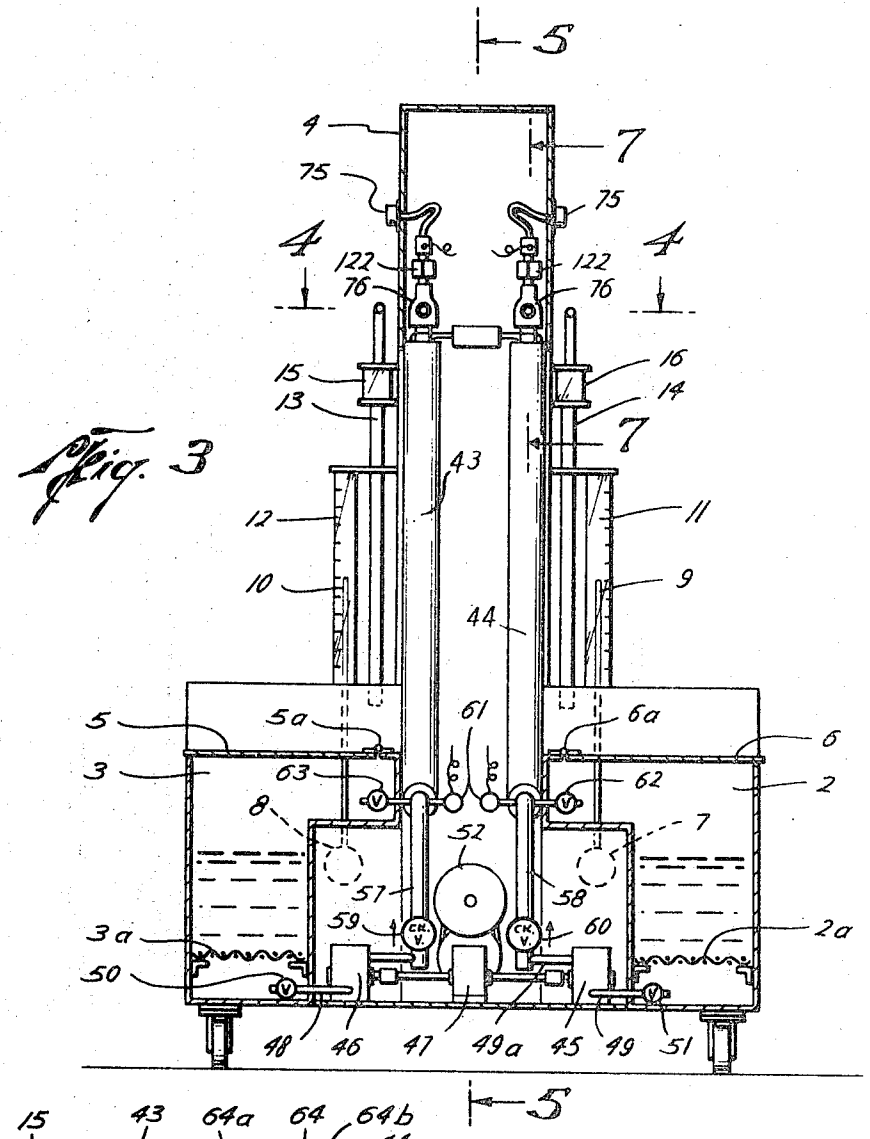

Fig. 3

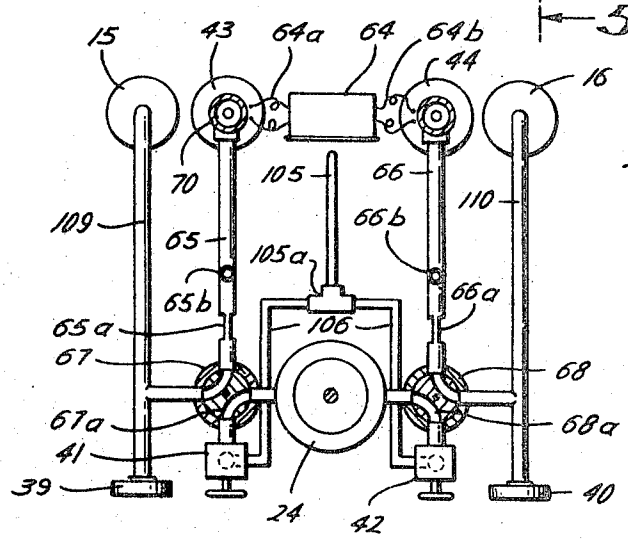

Fig. 4

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Fig. 5

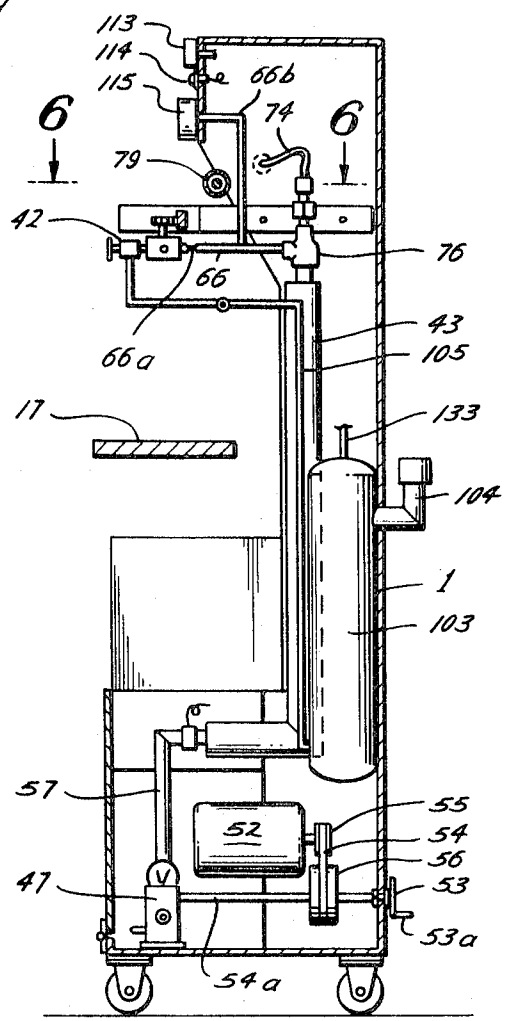


Fig. 7

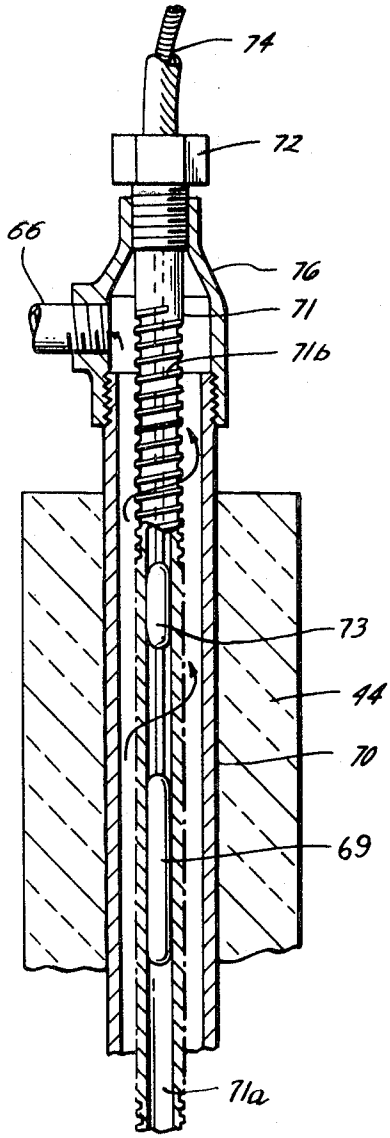
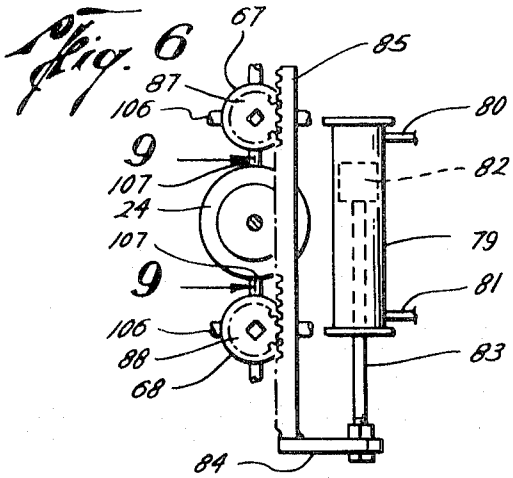


Fig. 6



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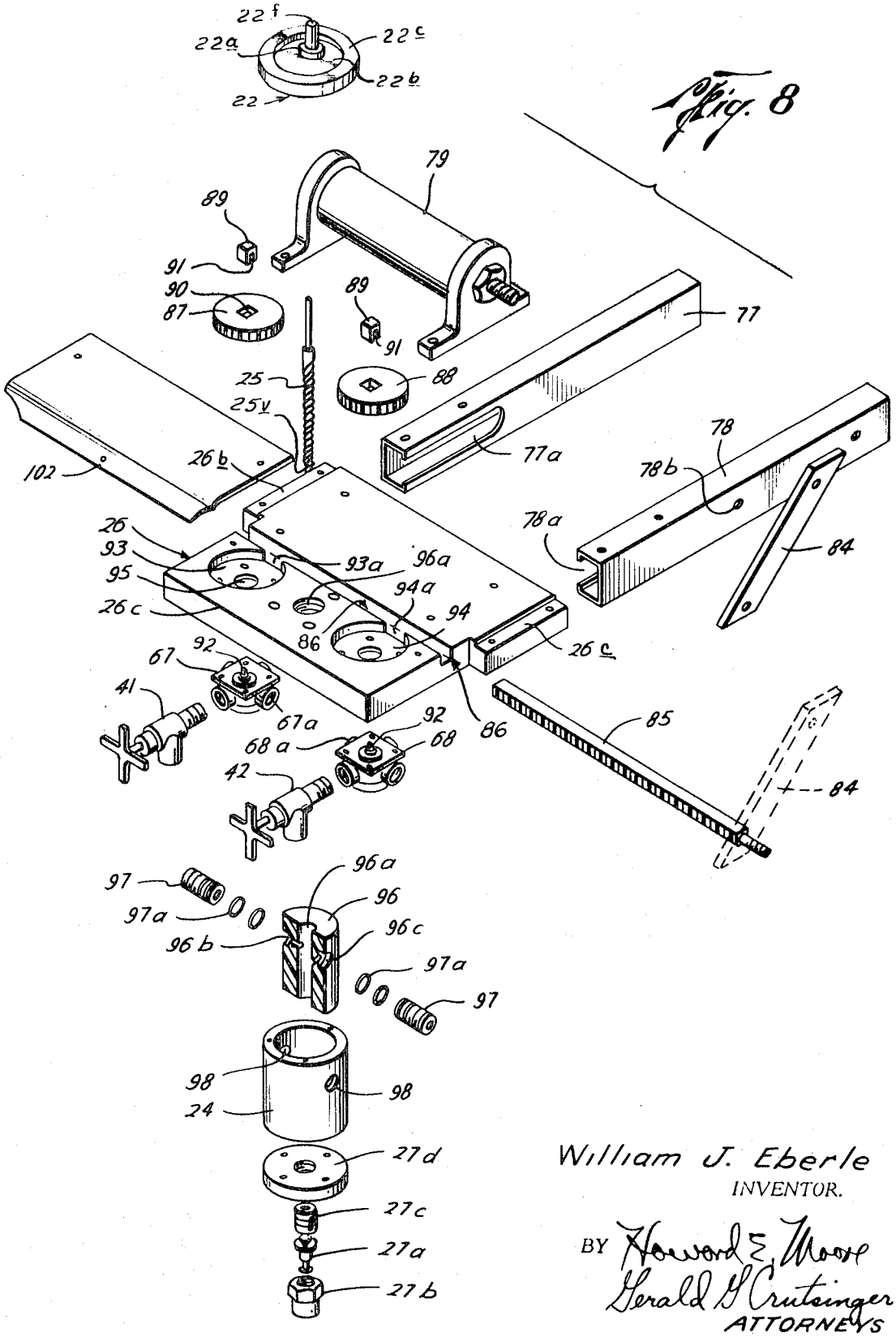

Fig. 8

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Fig. 9

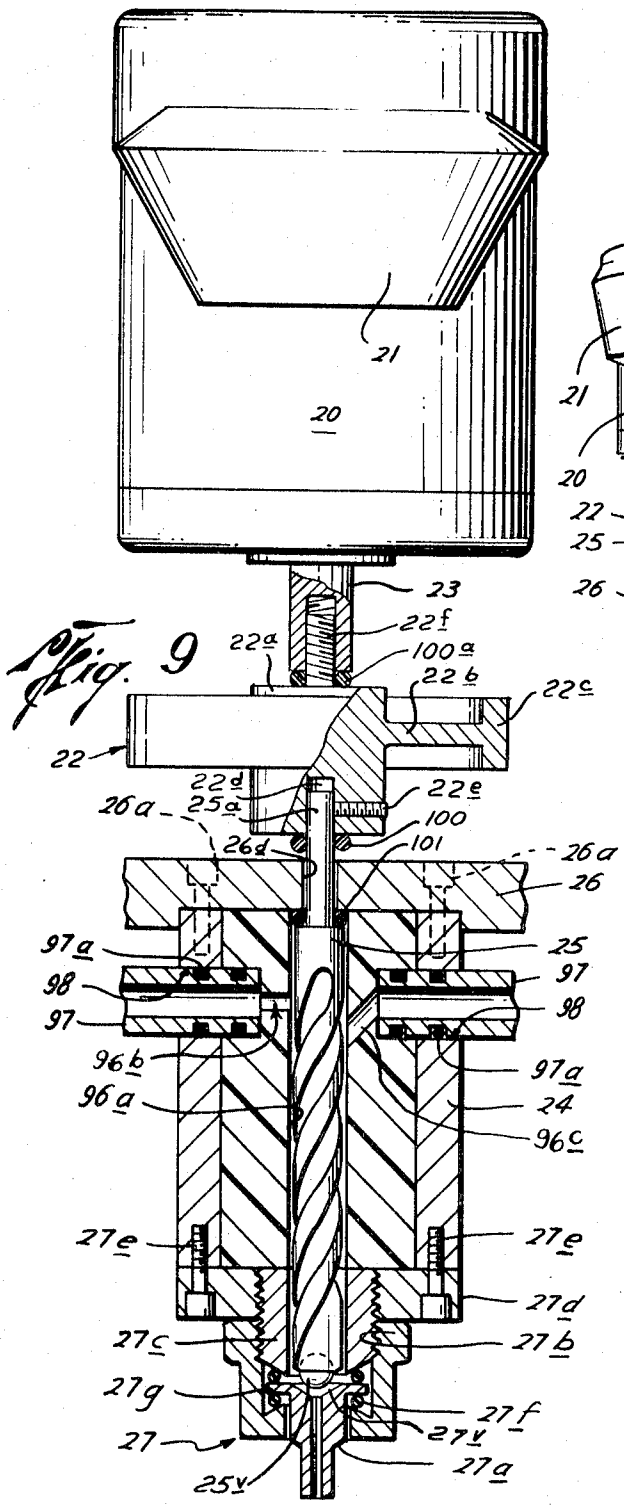


Fig. 10

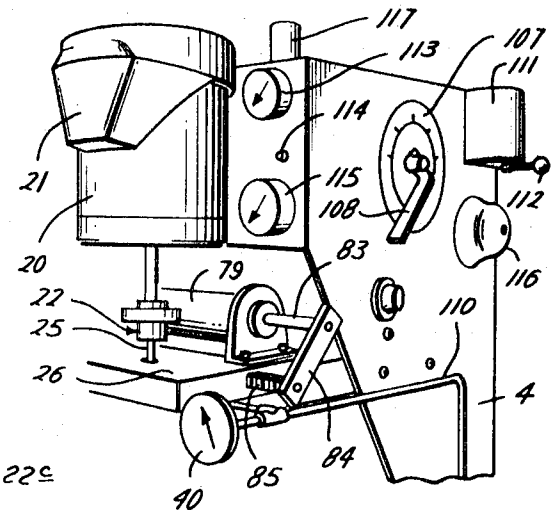
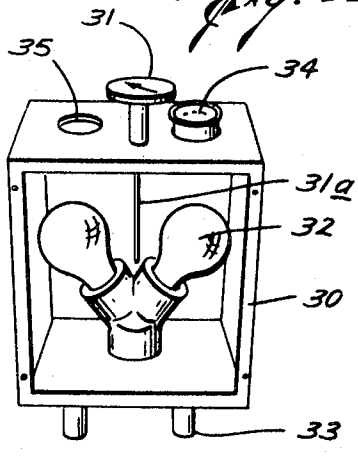


Fig. 11



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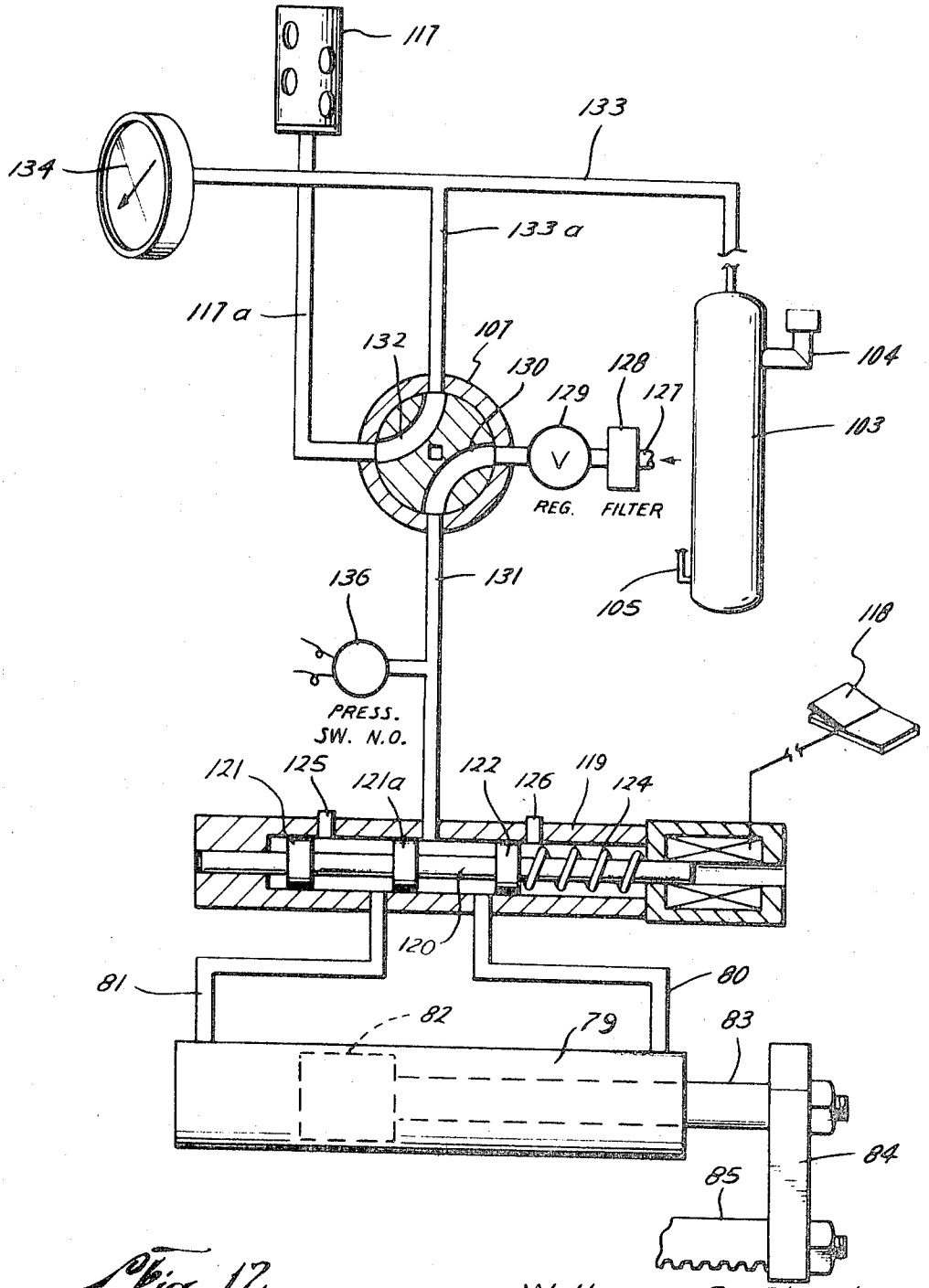

Fig. 12

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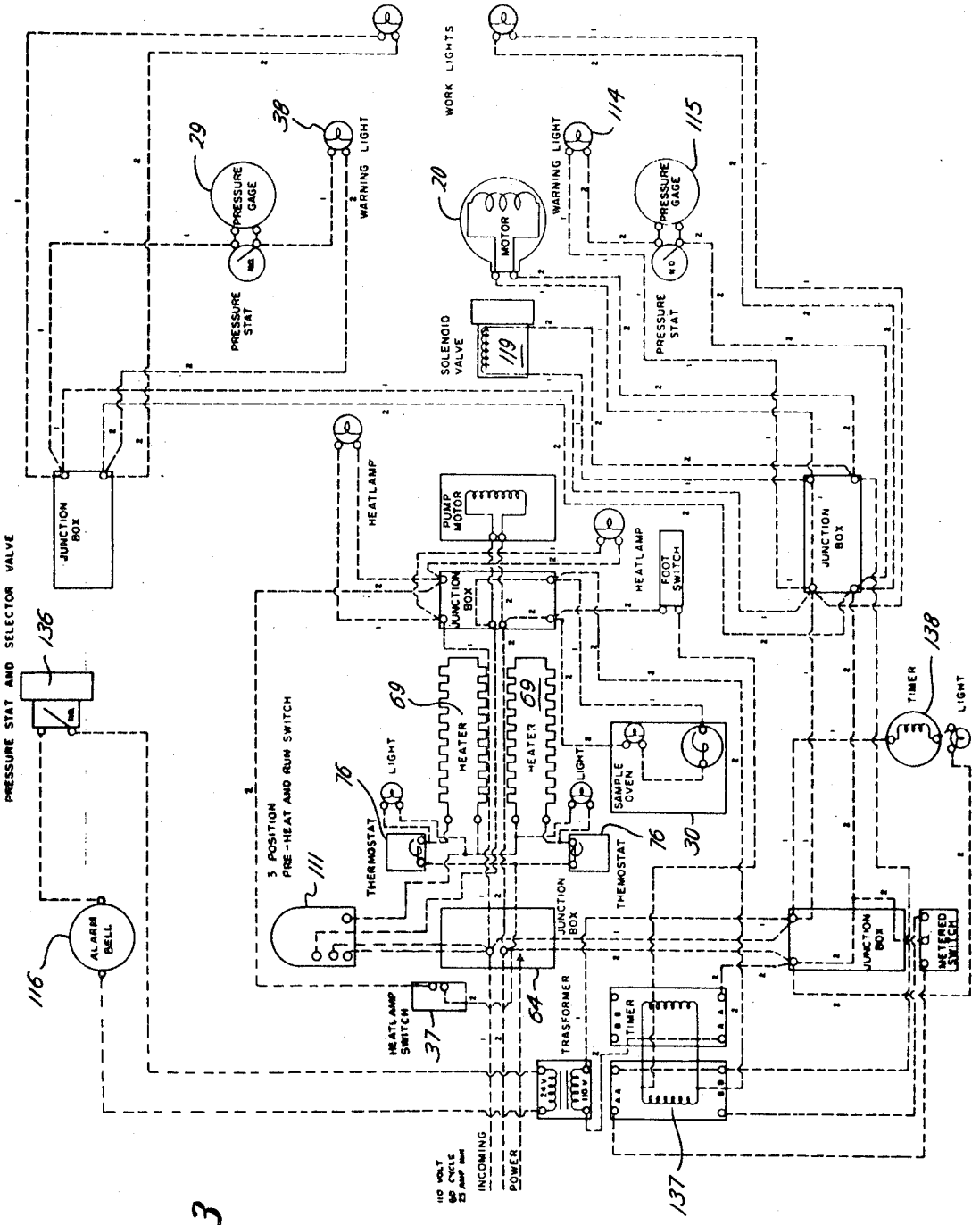

Fig. 13

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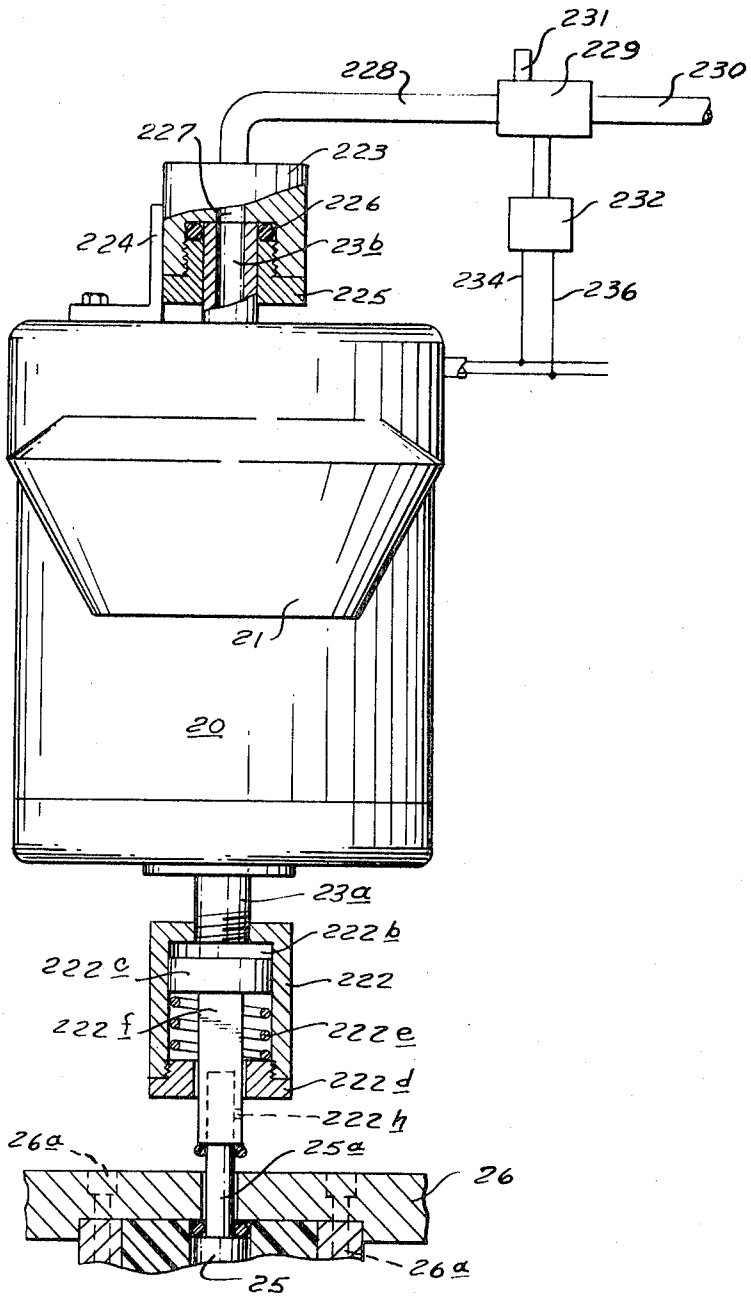

Fig. 14

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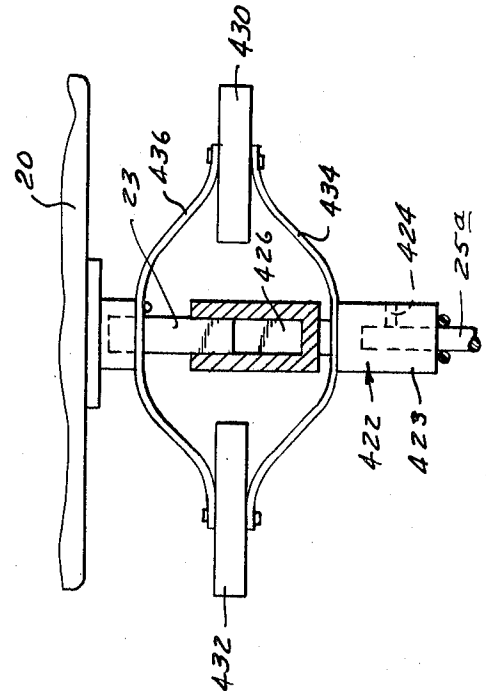

Fig 16

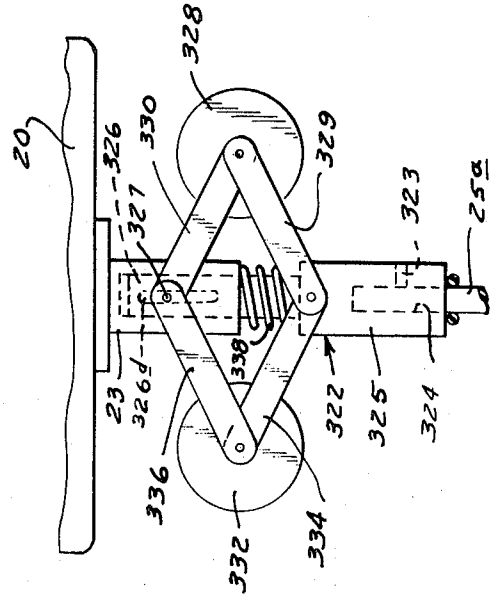

Fig 15

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METHOD AND APPARATUS FOR DISPENSING EPOXY

CROSS REFERENCE TO RELATED APPLICATIONS

This application is an improvement of the invention disclosed in U.S. Pat. No. 3,540,626 issued Nov. 17, 1970.

BACKGROUND OF INVENTION

The resin mixer and dispenser described and claimed in the aforementioned patent offered significant improvements over dispensing devices previously developed. However, under certain operating conditions the epoxy formed by mixing catalyst and resin tended to drip from the pouring spout of the mixing and dispensing head between dispensing cycles.

Leakage at the pouring spout is undesirable since the accuracy of measurement of the quantity of epoxy to be dispensed is affected.

SUMMARY OF INVENTION

I have developed an improved mixing and dispensing apparatus comprising a mixing head having a rotatable convoluted member disposed in a central passage therein. The passage in the mixing head has a valve seat adjacent an end thereof and the convoluted member has a valve member secured thereto such that the valve member is moved into and out of sealing relation with the valve seat when the convoluted member is moved longitudinally through the passage in the head.

The convoluted member is rotated by a motor connected to the upper end thereof through a coupling which is adapted to move the convoluted member through the passage in the mixing and dispensing head when the motor starts rotating to disengage the valve member from the valve seat. As the motor is deenergized the valve member is urged back into sealing relation with the valve seat thus sealing the pouring spout of the dispensing head to prevent leakage of fluid therefrom.

The apparatus for preparing and proportioning the resin and catalyst before injecting same into the mixing head comprises containers for liquid resin and catalyst with pumps to simultaneously withdraw resin and catalyst therefrom and pass same through heated conduits to the dispensing head.

The resin and catalyst are preferably circulated continuously through heated conduits to maintain same in non-viscous fluid state and to eliminate the necessity of further agitation to maintain the resin and catalyst in suspension. When valves in the conduits are opened the catalyst and resin flow into the dispensing head where they are agitated, mixed and dispensed therefrom in selected quantity.

Thermostatically controlled heating devices are provided for maintaining the resin and catalyst at equal or different temperatures as desired and temperature gauges are provided to indicate the temperature of each ingredient. Pressure indicator gauges are provided in combination with an alarm device to assure that pressure in catalyst and resin conduits are properly maintained to facilitate proportioning of ingredients in the mixing head.

A purge system is provided wherein purging fluid may be directed through the mixing head to clean same by the simple manipulation of valves. When the valve is in one position, air pressure from the purging tank is exhausted and when in the other position, air pressure is exhausted from the mixing head valve mechanism so as to avoid any possibility of solvent or purging agent mixing with the resin while the device is in the run position. The system may be purged of resin and catalyst without the necessity of disconnecting or reconnecting lines thus assuring that the mixing head can be easily and quickly flushed at any time.

A primary object of the present invention is to provide an improved method and apparatus for mixing and dispensing resin wherein the catalyst and resin are continuously circulated and maintained in a heated state ready for use and may be quickly and thoroughly mixed and dispensed by simply closing a foot pedal operated switch.

Another object of the invention is to provide apparatus for mixing and dispensing resin having a convoluted member which is both rotatable for agitating and mixing resin and catalyst preparatory to dispensing, and which is movable longitudinally for opening and closing the pouring spout through which the material is dispensed to prevent leakage between dispensing cycles.

Another object of the invention is to provide a liquid resin-catalyst mixing and dispensing device wherein the mixing and dispensing head may be quickly and easily purged and cleaned to prevent the setting up of resin-catalyst mixture therein by the simple manipulation of a valve.

Still another object of the invention is to provide a liquid resin-catalyst mixing and dispensing device wherein the resin-catalyst mixture may be tested at any time.

Still another object of the invention is to provide adjustable heating means in a liquid resin-catalyst mixing and dispensing device wherein the resin and catalyst may be separately heated at selected temperatures as it is circulated therethrough and wherein the resin and catalyst is agitated as it is circulated.

A further object of the invention is to provide a heating element and a heat sensing device in a rod having a convoluted outer surface such that when the rod is positioned in a conduit the resin and catalyst may be heated to desired temperatures without cooking the material.

A still further object of the invention is to provide a mixing and dispensing head for a liquid resin-catalyst mixing and dispensing device which thoroughly mixes the resin and catalyst as it is dispensed, and wherein the mixing head may be quickly and easily disassembled for cleaning or replacement of parts.

Still another object of the invention is to provide a liquid resin-catalyst mixing and dispensing device with visual and audible warning means thereon to indicate when the device is functioning or is not functioning to the extent to allow resin-catalyst to set up therein.

A general object of the invention is to provide a simple, portable liquid resin-catalyst mixing and dispensing device which is relatively inexpensive to manufacture, safe and foolproof.

Other and further objects of the invention will become apparent upon reading the detailed specification hereinafter following and by referring to the drawings annexed hereto.

DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are shown in the attached drawings, in which:

FIG. 1 is a front perspective view of the machine incorporating the improvements described and claimed herein;

FIG. 2 is a perspective isometric view of a typical battery with cover to be filled with liquid resin and catalyst to seal and set the connections therein when the resin sets and hardens;

FIG. 3 is a cross-sectional elevational view of the machine showing the interior parts thereof;

FIG. 4 is a transverse sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a vertical sectional view taken along the line 5—5 of FIG. 3;

FIG. 6 is a transverse sectional view taken along the line 6—6 of FIG. 5;

FIG. 7 is a vertical sectional view taken along the line 7—7 of FIG. 3;

FIG. 8 is an exploded isometric view of the mixer and dispensing head assembly and rack gear and air cylinder drive therefor;

FIG. 9 is a vertical sectional view taken on the line 9—9 of FIG. 6 illustrating details of construction of a first embodiment of sealing apparatus in the pouring spout;

FIG. 10 is a front perspective view of the upper end of the device taken from the opposite side of that shown in FIG. 1;

FIG. 11 is a perspective view of the sample box;

FIG. 12 is a semi-diagrammatic, partially sectionalized, view of the air system operating the dispenser head and purge devices;

FIG. 13 is a diagrammatic view of the electrical circuit for operating the device;

FIG. 14 is a vertical section view similar to FIG. 9 illustrating the details of construction of a second embodiment of a coupling to actuate sealing apparatus in the pouring spout;

FIG. 15 is a view similar to FIG. 14 of a third embodiment of the coupling; and

FIG. 16 is a view similar to FIG. 14 of a fourth embodiment of the coupling.

DESCRIPTION OF A PREFERRED EMBODIMENT

Numeral references are employed to indication the various parts shown in the drawings and like numerals indicate like parts throughout the various figures of the drawings.

The numeral **1** indicates the general frame for the machine which includes an appropriate housing and support for the various parts hereinafter described.

In the bottom of the housing are provided a catalyst tank **2** and a resin tank **3** wherein liquid catalyst and resin are disposed. Appropriate screens **2***a* and **3***a* are provided across the containers **2** and **3** to prevent suspended solid or coagulated material from being dispensed through the system.

The housing **1** includes an upstanding portion **4** which supports the heaters, dispensing head motor, thermostats, pressure gauges and other parts as will be hereinafter described.

The containers **2** and **3** have lids **5** and **6** thereon which may be lifted about the hinges **5***a* and **6***a* therefor to fill the containers and to clean same when necessary and desirable.

The liquid level in the containers **2** and **3** may be visually indicated by means of floats **7** and **8** suspended on indicator arms **9** and **10** which have appropriate markers thereon to indicate the level in the containers on the indicator scales **11** and **12.**

Fluid return lines **13** and **14** have sight glasses **15** and **16** disposed therein to visually indicate when fluid is flowing therethrough. A support and work table **17** is provided underneath the mixing and dispensing head **24,** hereinafter described, on which battery cases or other devices to be filled with mixed resin and catalyst may be deposited for filling same.

In FIG. **2** there is shown a battery **18,** and a battery cover **19** which fits thereon, so that the connections **18***a* extend through appropriate holes in the cover **19.** A mixture of liquid resin-catalyst may be deposited in the top of the cover **19** to fill same and extend about the connections **18***a*, and when set and hardened thereon provides a seal and support for the connections which is absolutely watertight so as to prevent acid from the battery from escaping through the top and causing corrosion of the terminals and surrounding parts.

A mixer motor **20,** which may be operated by electrical power, is mounted on the upstanding portion **4** of the housing, and has a blower in the upper end thereof which expels through an outlet scoop **21** to cool the motor and is directed downwardly so as to cause the more rapid cooling and setting of the resin-catalyst mixture after it is deposited in the battery case or other device, and provides fresh air for the operator, and blows away fumes.

A rotating shaft **23** extends from the motor and is secured to a coupling **22** which is disengagedly secured to the convoluted member or mixing bit **25.** The mixing bit **25,** having a valve member **25** *v* on the lower end thereof, rotatably extends into a mixing chamber or head **24** (FIG. **9**).

The valve member **25***v* is preferably constructed of Teflon (a tetrafluoroethylene polymer) or Delrin (a thermoplastic resin) or other materials having good chemical resistance, heat stability, and sealing characteristics. Teflon is a resilient material which after being pressed into sealing engagement with another member springs back to its original configuration because it has no "memory."

As will be hereinafter more fully described, the coupling **22** is adapted to move the valve member **25***v* between a first position in sealing engagement with valve seat **27***v* and a second position spaced from the valve seat. Movement of the valve member **25***v* should be smooth and uniform to prevent formation of shock waves in the system.

The distance which valve member **25***v* is moved, while dependent upon several factors such as the characteristics of the fluids and pressure, is preferably at least three-sixteenths of an inch to assure proper flow. For dispensing twenty pounds of epoxy per minute movement of approximately one half inch is suggested.

A gear support platform **26** is secured to the upstanding portion **4** of the housing and the mixing chamber **24** is secured to same by means of machine screws **26***a*, extending thereinto.

The mixing head assembly includes a pouring spout generally indicated at **27.** (FIG. **9**) which includes a

spout 27*a* suspended in the retaining nut 27*b*. The retaining nut 27*b* is threadedly engaged to a bushing 27*c*, which in turn is threadedly engaged in a lower cover plate 27*d*. The lower cover plate 27*d* is secured to the mixing chamber 24 by machine screws 27*e*. O-ring seals 27*f* are provided above and below the flange 27*g* on the spout 27*a* and are sealingly pressed thereagainst.

The sealing rings 27*f* provide an appropriate seal to prevent leakage of fluid about the spout 27*a* and to direct the fluid through the central passage therethrough.

It should be noted that the spout 27*a* has a passage 27*p* extending therethrough and that a valve seat 27*v* is formed in the upper end of the passage for engagement with the valve member 25*v* on the lower end of mixing bit 25, as will be hereinafter more fully explained, to prevent leakage of fluid through the pouring spout between dispensing cycles.

Pressure gauges 28 and 29 (FIG. 1) for indicating the pressure in the catalyst and resin systems are mounted on the front face of the upper portion 4 of the housing.

A sample oven 30 (FIG. 11) is mounted on the upper surface of the lower portion of the housing 1 and has a thermometer 31 with a thermocouple 31a extending into the housing for indicating the temperature within the housing to which the lower portions of the sample cups are exposed. Electric light bulbs 32 are disposed within the housing 30 to provide heat to the sample cups.

Sample oven 30 is supported on the housing 1 by means of appropriate mounting legs 33.

Sample cups 34 with a mixture of catalyst and liquid resin therein may be inserted in the holes 35 and suspended in the upper wall of the sample oven 30.

A cup dispenser 36 is secured to the outer side of the housing from which cups 34 may be withdrawn.

A switch 37 may be pressed to energize a timer circuit for applying electrical power to light bulbs 32 in the heater oven 30 to provide heat for desired time to which material in the cups 34 is exposed.

A sample of resin-catalyst mixture may be withdrawn from the dispenser head 24 through the pouring spout 27 into a cup 34 and placed in one of the holes 35. The switch 37 may be energized to provide heat for sufficient length of time to set the resin-catalyst mixture in the cup 34. Thereby the proper mixture and temperature may be pre-tested prior to using the mixture to fill and seal a battery or other article.

A high pressure warning light 38 is provided on the outer face of the housing to indicate when the system is not properly functioning so that it may be turned off or purged.

Thermometers 39 and 40 are exposed on the outer face of the housing to indicate the temperature of the liquid resin and catalyst as it is circulated through the system. The thermometers 39 and 40 are exposed to the return lines 13 and 14 to indicate the temperatures therein.

Purge solvent valves 41 and 42 are provided to direct solvent through the mixing and dispensing head 24 to clean same when desired in the manner hereinafter described.

The conduits as indicated at 70 in FIG. 7 for the catalyst and liquid resin are encased in heat resistant casings 43 and 44 which may be suitably made of asbestos composition material.

Positive displacement pumps 45 and 46 are provided for pumping catalyst and liquid resin through the system. The pumps 45 and 46 are operated in unison through a transmission box 47 which is driven by an electric motor 52 through appropriate pulleys 55 and 56 about which extends a drive belt 54. The shaft 54*a* is rotated with the pulley 56, and the speed ratio of transmission 47 may be adjusted by the variable speed control 53 by rotating the crank 53*a*.

Intake lines 48 and 49 extend into the lower portions of the containers 2 and 3 and have check valves 50 and 51 therein. Fluids are drawn from the containers 2 and 3 by the pumps 45 and 46 through the intake lines 48 and 49 and are discharged through the discharge lines 48*a* and 49*a* and into the lines 57 and 58 which communicate with the vertical circulation conduits 70 in the manner hereinafter described.

Check valves 59 and 60 are disposed in the discharge lines 57 and 58 to prevent back flow of fluid into the pumps 45 and 46 when the system is not in operation. Pressure sensitive switches 61 are electrically connected to the warning lights to give warning and indication when the pressure in the system rises excessively, indicating a restriction of circulation.

Pressure relief valves 62 and 63 are provided in communication with the pump outlet lines 57 and 58 so that if the pressure rises excessively in the system the valves 62 and 63 will open to discharge and relieve the pressure and prevent damage to the system.

The heater wire junction box 64 (FIG. 4) is electrically connected to the heating element 69 disposed in the bore 71*a* of rod 71 (FIG. 7). The conductor wires 64*a* and 64*b* extend from the junction box 64 and are electrically connected to the resistance heating element 69.

Outlet lines 65 and 66 are provided to the conduits 70 for the catalyst and liquid resin, said outlet lines being connected in communication therewith through fittings 76 secured to the upper end thereof.

Referring to FIG. 4, identical four-way valves 67 and 68 are provided in communication with the circulation passages for the catalyst and liquid resin and the purging fluid which are constructed and operated in the manner hereinafter described.

A rod 71 extends centrally through the conduits 70 and is secured at the upper end by threaded connection within the fitting 76. A central passage 71*a* extends through the rod 71. Spiral ribs 71*b* extend about the rod 71 so as to provide a swirling rotary motion to the fluid as it passes through the annular space thereabout thereby agitating same and uniformly exposing it to the heating element 69 disposed in the bore 71*a* for imparting heat thereto.

A thermostat 72 is secured to the upper end of the fitting 76 and includes suitable heat sensor means, such as a thermocouple 73, suspended within the bore or passage 71*a*. The thermostat may be adjusted by flexible shaft 74 which may be rotated through appropriate adjustment fittings 75 secured to the outer face of the upper portion 4 of the housing 1.

The gear support platform 26 (FIG. 8) is secured to the upstanding portion 4 of the housing by means of channel members 77 and 78 which have slots 77*a* and 78*a* on the inner sides thereof which embrace the outwardly extending portions 26*b* and 26*c* and are secured thereto by appropriate bolts. The channel members 77 and 78 are secured to the upstanding portion of the housing by appropriate bolts which pass through holes 78*b* provided therein.

An air actuated cylinder **79** is mounted on the platform **26** and has inlet and outlet air pressure lines **80** and **81** communicating therewith on opposite sides of the piston **82** therein (FIG. **12**). The piston **82** is attached to a piston rod **83**. The outer end of the piston rod **83** is attached to one end of a link **84**. The other end of the link **84** is attached to the outer end of a rack **85**.

The rack **85** is slidably disposed in a slot **86** provided in the upper surface of the platform **26**.

Gears **87** and **88** are rotatably disposed in gear recesses **93** and **94** provided in the upper surface of the platform **26**. Recesses **93** and **94** are provided with openings **93***a* and **94***a* in the wall thereof through which the peripheries of the gears **87** and **88** extend and mesh with the teeth on the rack **85**.

The gears **87** and **88** are provided with square holes **90** therethrough into which a complementary square keys **89** may be inserted. The square keys **89** have transverse slots **91** in the lower surfaces thereof, said slots being arranged to engage correspondingly shaped engaging pins **92** provided on the operating shafts of the four-way valves **67** and **68**.

It will thus be seen that upon lateral movement of the rack **85** the gears **87** and **88** will be rotated to thereby rotate the operating shafts for the valves **67** and **68** to thereby selectively provide communication or non-communication between the passages in the valves as hereinafter explained.

The inner liner **96** (FIGS. **8** and **9**) in the mixing chamber **24** is preferably made of a plastic material such as Teflon or Delrin and has a central bore **96***a* therethrough in which the mixing bit **25** is rotatably disposed. The liner **96** has lateral passages **96***b* and **96***c* through the wall thereof communicating with the central bore **96***a*.

Nipples **97** are attached to the outlet openings **67***a* and **68***a* in the four-way valve **67** and **68** which may be brought into communication with the catalyst and resin supply lines respectively to cause mixing of same in the mixing head **24**. The nipples **97** are inserted through passages **98** in the wall of the mixing chamber **24** and are sealed therein by O-rings **97***a*, and are in communication with the lateral passages **96***b* and **96***c* through the wall of the liner **96**.

It will be seen that when the valves **67** and **68** are manipulated to allow the passage of catalyst and liquid resin through the nipples **97**, same is discharged into the central bore **96***a*, and as the bit **25** is rotated therein the liquid materials are thoroughly mixed and agitated before being discharged under pressure through the nozzle **27***a*.

As best illustrated in FIG. **9** of the drawing, an aperture **26***d* extends through the upper wall of the gear support platform **26** and the shaft **25***a* of mixing bit **25** rotatably and slidably extends therethrough.

The coupling means **22**, which is employed as a means for connecting the shaft **23** of motor **20** with bit **25**, comprises a body portion **22***a* connected by radially extending portion **22**b to a weighted portion **22***c* to provide a body having a large moment of inertia since the mass is spaced from the center of rotation causing the coupling **22** to provide a flywheel effect.

The body portion **22***a* of coupling **22** has a passage **22***d* formed therein for receiving the shaft **25***a* of mixing bit **25**. A set screw **22***e* is employed for securing shaft **25***a* in the passage **22***d*.

An O-ring seal **100** is secured to the lower surface of the body portion **22***a* of coupling **22** and is positioned to engage the upper surface of gear support platform **26** for sealing between aperture **26***d* in support platform **26** and to absorb shock as a result of impact between the coupling **22** and platform **26**.

A threaded member **22***f* extends upwardly from the body portion **22***a* and engages the internally threaded hollow shaft **23** of motor **20**. An O-ring seal **100***a* is connected to the lower surface of hollow shaft **23** to absorb shock as the body portion **22***a* moves toward shaft **23**.

The threaded element **22***f* and hollow shaft **23** are connected such that when motor **20** is energized after being stopped for a period of time, the coupling **22** acting as a flywheel will tend to resist rotation resulting in vertical movement of coupling **22** upwardly toward shaft **23**. As the upper surface of the body portion **22***a* of coupling **22** engages O-ring seal **100***a* the torque applied to the coupling **22** will be increased, causing the coupling to rotate.

It should be appreciated that as coupling **22** moves upwardly bit **25** moves therewith causing valve member **25***v* on the lower end of the bit **25** to be moved away from valve seat **27***v* allowing fluid to flow through the pouring spout **27***a*. It should be noted that the O-ring seal **101** on the upper end of the convoluted portion of bit **25** engages the lower surface of platform **26** to seal aperture **26***d*.

When motor **20** is de-energized shaft **23** stops rotating. The weight of coupling **22** moves downwardly to partially unscrew the threaded portion **22***f* from the hollow shaft **23** of motor **20** causing valve member **25***v* on the lower end of bit **25** to engage valve seat **27***v* thereby closing pouring spout **22**a to prevent leakage of fluid from the head between dispensing cycles.

Other means for moving valve member **25***v* on bit **25** longitudinally through the central passage in the head is illustrated in FIGS. **14, 15,** and **16** as will be hereinafter more fully explained.

A cover plate **102** (FIG. **8**) is secured to the outwardly extending portion **26***c* of the platform **26** to thereby cover and protect the gears **87** and **88**.

A solvent purge tank **103** is mounted to the back wall of the housing **1** and includes a filler spout **104** (FIG. **12**) extending outwardly of the housing.

A discharge line **105** communicates with the solvent tank and is connected to lines **106** by means of a T connection **105***a* (FIG. **4**). The branch lines **106** communicate with the solvent control valves **41** and **42**.

A four-way air valve **107** (FIG. **12**) is arranged to be selectively placed in communication with the solvent tank in purge position or to the air cylinder **79** in run position in the manner hereinafter described. The four-way air valve **107** is manually operated by means of an operating handle **108** (FIG. **10**) located exteriorally of the housing.

Resin and solvent return lines **109** and **110** may be caused to communicate with supply lines **65** and **66** through valves **67** and **68**, whereby the catalyst and liquid resin may be continuously recirculated through the system.

The supply lines **65** and **66** have restricted orifices **65***a* and **66***a* therein to sense pressure to be indicated on the pressure gauges **28** and **29** through the connections **65***b* and **66***b* provided in the supply lines **65** and **66**.

A pre-heat, run and off switch **111** is provided exteriorally of the upper portion of the housing for the purpose of allowing preheating of the heater elements **69** prior to turning the switch to the run position which would start the motors **52** and **20** to cause circulation of fluids through the system. The switch **111** is controlled by a suitable control lever **112.**

An air pressure gauge **113** is provided on the outer surface of the upper portion of the housing and a warning light **114** is provided for visual indication on the outer surface of the housing when the pressure becomes excessive.

There is also provided a catalyst pressure gauge **115** on the outer face of the upper portion of the housing to indicate pressure of the catalyst as it is circulated through the system. An alarm bell **116** is also positioned on the outer wall of the upper portion of the housing which audibly indicates when a predetermined delay has occurred between ejections thus warning that the system should be purged if ejections are further appreciably delayed.

An exhaust port **117** is connected through the valve **107** with the purge tank **103** so that air pressure may be exhausted therefrom when the device is in run condition.

A foot pedal switch **118** is provided for actuation of the air cylinder **79** to thereby laterally move the rack **85** to operate the four-way valves **67** and **68** in the manner hereinafter described.

When the foot pedal switch **118** is closed by pressure thereon the solenoid valve **119** is energized to move the shaft **120** outwardly to move the piston **121, 122** and **121***a* to a position as shown in FIG. **12** wherein the air supply line **131** is in communication with the line **80** communicating with the air cylinder **79** to thereby push the piston **82** inwardly of the cylinder **79** and move the rack gear **85** inwardly of the slot **86** to thus rotate the gears **87** and **88** to rotate the four-way valves **67** and **68** to cause communication between the catalyst and resin supply line **65** and **66** and the nipples **97** leading into the mixing head **24** to thereby cause mixing and dispensing of catalyst and liquid resin. Upon inward movement of the shaft **120,** the spring **124** is depressed. The solenoid valve is maintained in energized position by a timer **137** (FIG. **13**) which may be set to allow dispensing of a predetermined quantity of mixed catalyst and resin. When the timer switch releases, the spring **124** will relax to move the shaft **120** and pistons **121, 121a** and **122** outwardly of the solenoid valve housing **119** to a position where the air supply line **131** no longer communicates with the line **80** but communicates with the line **81** to thereby move the piston **82** outwardly of the air cylinder **79** to move the rack **85** outwardly of the slot **86** and thereby counter-rotate the gears **87** and **88** to thereby rotate the valves **67** and **68** to a position where the passages therethrough cause communication between the inlet lines **65** and **66** and return lines **109** and **110** to resume the recirculation of catalyst and resin through the system. Thereby a measured quantity of catalyst and liquid resin material is mixed and ejected through the mixing head **24,** and after each measured quantity has been ejected the catalyst and resin material is continued to be recirculated through the system and heated.

Exhaust ports **125** and **126** are provided through the wall of the solenoid valve body **119** so that air is exhausted from the areas behind the piston **121** and **122,** said exhaust ports being alternately brought into communication with the lines **80** and **81** as the air cylinder **79** is operated in the manner hereinbefore described.

A compressed air supply line **127** is provided for supplying compressed air for the operation of the air cylinder **79** through the solenoid valve **119.** A filter **128** is provided in the air supply line **127** and said supply line has a pressure regulator **129** therein to regulate the pressure supplied to the air cylinder **79.**

The four-way air supply valve **107** (FIG. **12**) is shown in dispensing position and compressed air is being supplied to the passage **130** through said valve and through line **131** and solenoid valve **119** to the air cylinder **79.**

When the device is in dispensing position an exhaust passage **132** through the valve **107** is in communication with an outlet line **133** from the solvent tank **103** and said line **133** is in communication through the valve passage **132** with the air exhaust outlet **117.** Therefore, it will be seen when the device is in run position, i.e., when catalyst and resin are being circulated through the system and periodically ejected in mixed quantities, the air is exhausted from the solvent tank **103** so that no solvent is dispensed therefrom.

However, if the valve **107** is rotated to a position where the passage **132** therethrough connects the air pressure supply line **127,** and the line **133** and passage **130** connects line **131** with exhaust line **117***a* air pressure will be supplied to the solvent tank **103,** forcing solvent through the outlet line **105** and through solvent supply lines **106** to the valves **41** and **42.** If the valves **41** and **42** are opened, solvent will be supplied through the valve passages **67***a* and **68***a* and through nipples **97** in passages **96***b* and **96***c* to the bore **96***a* so that solvent passes therethrough and outwardly through the nozzle **27***a* to thereby clean the mixing and dispensing head of residue of resin and catalyst mixture which could solidify and cause damage thereto.

It will be noted that when the valve **107** is in purge position the solenoid valve **119** is cut off from supply of air and is exhausted through the exhaust port **117** so that the air cylinder **79** cannot be actuated to cause communication between the supply lines **65** and **66** and the mixing head **24.**

A pressure actuated switch **136** is connected in communication with the line **131** and is connected in the circuit for the transformer for the alarm bell circuit and the timer **137** to turn on the alarm bell **116** when an ejection of liquid has been delayed more than a preselected time, to indicate that the system should be purged. The alarm may be turned off by closing the control switch **118** and causing another ejection.

The electrical circuit shown in FIG. **13** is labeled in such a manner that it is believed unnecessary to describe same in detail, except to point out that the timer **137** may be set to allow the operation of the device to dispense fluid through the dispensing head **24** for a preselected period of time and in a selected quantity and the timer **138** is set to allow the heat lamp for the sample oven to be energized for a predetermined time period.

The operation and function of the device hereinbefore described is as follows:

The switch **111** is turned to preheat position which causes the heater elements **69** to heat and prepare the system for operation. The switch **111** is then turned to run position, which energizes the motors **20** and **52,**

thereby rotating shaft 23 connected to the mixing bit 25 in the mixing and dispensing head 24.

Initial rotation of shaft 23 causes the threaded portion 22*f* of coupling 22 to move longitudinally through the threaded passage in shaft 23 thereby disengaging valve member 25*v* from valve seat 27*f* to open pouring spout 27*a*.

It will be noted that the bit 25 is rotated clockwise, which is opposite from the normal direction of the rotation for drilling so that the flights thereon provide a downward movement of the resin catalyst mixture when directed thereinto. The pumps 45 and 46 are started which picks up catalyst and resin from the reservoirs 2 and 3 and circulates same through the heated conduits 70 where the materials are heated. At this time the valves 67 and 68 are in position so that the supply lines 65 and 66 are in communication with the return lines 109 and 110 so that catalyst and resin are continuously circulated through the system in segregated condition, and is maintained in heated condition while it is being so circulated.

When it is desired to eject a mixed quantity of catalyst and resin to fill a battery case or other device, the foot pedal switch 118 is pressed to energize the solenoid 119 thereby placing the air line 131 in communication with the air line 80 and allowing air under pressure to enter the air cylinder and move the piston 82 inwardly thereof to thereby move the rack 85, and rotate the gears 87 and 88 to bring the inlet lines 65 and 66 into communication with the nipples 97 to allow catalyst and liquid resin to enter the bore 96*a* of the mixing head 24 and thereby mix the catalyst and resin as the mixing bit 25 rotates and agitates same in said bore. Said mixture is ejected through the spout 27*a* into the battery casing or other device to be filled and sealed whereby the mixed material will set and harden.

The temperatures of the catalyst and resin may be adjusted by adjustable thermostats 72 so that if desired, they may be maintained at different temperatures. Furthermore, as the resin and catalyst pass through the conduits 70 uniform heating is assured by reason of the fact that it takes a spiral path about the central rods 71 by reason of the convolutions 71*b* thereon.

After the timer 137 runs out the solenoid 119 is deenergized, which allows counter-rotation of the gears 87 and 88 and the rotation of the valves 67 and 68 back to position as shown in FIG. 4 wherein the resin and catalyst is again cut off from the mixing head 24 and are recirculated in segregated condition through the system while the temperature thereof is maintained.

When the system is to be turned off or if for any reason the mixing head 24 is to be cleaned and flushed, the valve 107 is rotated through the control 108 to a position where the air supply line 127 is in communication with the solvent tank 103 and the air supply line 127 is out of communication with the solenoid valve 119. Thereby solvent may be ejected from the tank 103 through the outlet line 105 and through branches lines 106 to the air solvent control valves 41 and 42. Upon opening the valves 41 and 42 solvent is passed through the nipples 97 into the bore 96*a*, and as the mixer bit 25 is rotated said solvent is agitated in a swirling motion and ejected through the nozzle 27*a* to thereby clean and purge the mixer and dispensing head 24. During this time the catalyst and resin material is continuously circulated through the system and maintained in heated condition. After sufficient purge solvent has been passed through the head the valves 41 and 42 may be closed and valve 107 may be rotated to a position where the air supply line 127 is in communication with the line 131 and the solenoid valve 119 so that measured quantities of mixed catalyst and resin can be dispensed through the head 24 by pressing upon the foot operated switch 118.

If it is desired to determine whether the resin-catalyst mixture is in proper proportion and the temperatures thereof are properly regulated so that same will properly set and harden after being dispensed, a sample thereof may be taken through the mixing and dispensing head 24 in one of the cups 34. The cup may be suspended in one of the holes 35, the timer switch 37 for the sample oven 30 may be pressed to energize the heater bulbs 32 to thereby heat the material in the cup 34 for sufficient length of time to determine whether same will set at the temperature determined on the thermometer 31 and within the time set on the timer 37. It is important that each batch of resin-catalyst mixture be tested since it may be of different consistency and that the times and temperatures be adjusted accordingly.

It will be noted that while the device is in operation the air produced by the circulating fan in the motor housing 20 is directed downwardly through the scoop 21 to cool the resin-catalyst mixture dispensed in the battery case or other device to cause same to more quickly set and to provide fresh air for the operator.

MODIFIED FORMS

Modified forms of the coupling 22 for moving bit 25 longitudinally through the central passage of mixing and dis-pensing head 24 for opening and closing the passage in pouring spout 27*a* are illustrated in FIGS. 14, 15 and 16.

As best illustrated in FIG. 14 the coupling 222 provides a means to extend and retract bit 25 by application of force through a pressurized fluid.

Coupling 222 comprises a body portion 222*a* threadedly secured to a hollow shaft 23*a* having a passage 23*b* extending therethrough. Body portion 222*a* has a passage or chamber 222b formed therein in which piston 222*c* is slidably disposed. A stuffing nut 222*d* is threadedly secured to the lower end of passage 222*b* forming an abutment upon which compression spring 222*e* rests to urge piston 222*c* upwardly.

Piston 222*c* has a hollow stem 222*f* extending downwardly therefrom into which the shaft 25*a* of mixing bit 25 is secured by a set screw 222*h*. Any suitable means may be employed to prevent rotation of stem 222*f* in the body 222*a*. In the drawing, the stem is shown as a non-circular member. It should be appreciated that other means such as keys or spline connections could be employed to prevent rotation while allowing longitudinal movement.

A swivel 223 is secured by suitable means such as angle bracket 224 to the housing of motor 20. The upper end of the hollow shaft 23*a* of motor 20 extends into and is rotatably disposed in a central passage in swivel 223. A stuffing nut 225 is threadedly secured in the lower end of swivel 223 to urge O-ring seal 226 into sealing engagement with shaft 23*a*.

Swivel 223 has a passage 227 extending therethrough to which conduit 228 connected through valve 229 and pressurized fluid line 230 is connected.

The valve 229 has a movable element disposed therein for connecting line 228 selectively with pressure line 230 or with an exhaust port 231. Valve 229 is actuated by a solenoid device 232 connected through conductors 234 and 236 to the leads of motor 20.

From the foregoing it should be readily apparent that when motor 20 is energized solenoid 232 will be energized causing valve 229 to be manipulated to connect line 228 to the vent port 231, allowing spring 222*e* to urge piston 222*c* and consequently, the mixing bit 25 upwardly to move the valve member 25*v* away from valve seat 27*v*.

When motor 20 is de-energized solenoid 232 is also deenergized causing valve 229 to connect pressure line 230 with line 228 to deliver pressure fluid through passage 227 in swivel 223, through passage 23*b* in shaft 23*a* to the hollow portion 222*b* of coupling 222 thus urging the piston 222*c* and valve member 25*v* downwardly to close the dispensing spout 27*a*.

A third form of the coupling is designated by the numeral 322 in FIG. 15 of the drawing wherein the shaft 25*a* of the mixing bit is secured by set screw 323 in a passage 324 in tubular member 325. A guide pin 326 extends into a passage in the hollow shaft 23 of motor 20. A pin 327 is slidably disposed in a slotted opening 326d in the wall of guide pin 326 allowing the guide pin 326 to move longitudinally through the opening therein.

A weight 328 is connected through links 329 and 330 to body member 325 and to pin 327, respectively. A second weight 332 is connected through links 334 and 336 to body portion 325 and pin 327, respectively.

A spring 338 is positioned between the lower end of shaft 23 and the upper surface of body portion 325 to urge the body portion 325 and consequently valve member 25v on the lower end of mixing bit 25 downwardly to bias the sliding joint in the coupling toward an extended position.

It should be readily apparent that when motor 20 is deenergized spring 328 urges the valve member 25v into engagement with valve seat 27*v*. However, when motor 20 is energized centrifugal force will urge weights 328 and 332 outwardly, applying an upward force to the body portion 325 and bit 25 to move the valve member 27*v* away from seat 27*v*.

A fourth form of the device generally designated by the numeral 422 is illustrated in FIG. 16.

Shaft 25*a* of mixing bit 25 extends into a hollow portion of tubular member 423 and is retained therein by a set screw 424. The upper portion of body member 423 has a hollow passage 426 formed therein and the squared end of shaft 23 of motor 20 is telescopically disposed therein.

Weights 430 and 432 are connected through spring members 434 and 436 to the shaft 23 of motor 20 and to the body portion 423. Springs 434 and 436 are adapted to urge the body portion 423 downwardly.

When motor 20 is energized centrifugal force urges weights 430 and 432 outwardly causing springs 434 and 436 to apply an upward force on body member 423 to thereby move the valve member 25*v* upwardly.

The forms of the coupling 22 illustrated in FIGS. 9, 14, 15 and 16 provide alternate means for moving mixing bit 25 longitudinally through the head for opening and closing the passage in the pouring spout 27*a*.

It should be appreciated that other means, such as a solenoid device for urging the bit longitudinally for opening the valve and for engaging suitable friction drive means, may be employed to impart the desired movement to valve member 25*v* and the mixing bit 25.

It will thus be seen that I have provided a resin-catalyst mixing and dispensing device wherein the resin and catalyst may be continuously circulated while it is heated and maintained in such state to maintain the desired viscosity for optimum dispensing, wherein the resin-catalyst mixture may be dispensed in measured quantities and thoroughly agitated and mixed before dispensing, and wherein the mixing and dispensing head may be quickly cleaned and purged while the catalyst and resin material are continued to be circulated through the system and the temperatures thereof are maintained. Safety alarms, both visual and audible, are provided for indicating when the system is in operation when the pressure increases therein to a dangerous extent, and when dispensing has been discontinued for a dangerous length of time to thereby require purging.

I have provided a portable device which is relatively inexpensive to manufacture, easy to use, disassemble and repair and which is economical in its operation and provides for maximum production.

It will be understood that other and further embodiments of my invention may be devised without departing from the basic con-cept of the invention.

Having described my invention I claim:

1. In a mixing and dispensing device, a head having a central passage therethrough; a valve seat in said passage adjacent an end thereof; a member having spiral convolutions on a portion of the outer surface thereof; valve means on said member; means to rotatably secure the member in the central passage; means to move said member longitudinally in said passage to move the valve means between positions engaging and disengaging said valve seat; means to rotate said member in said passage; a container for liquid resin; a container for catalyst; separate circulation conduits for the resin and catalyst; means to circulate fluid through each of the conduits; a heater device arranged in heat exchange relation with each of the conduits; heat sensor means in heat exchange relation with each of said circulation conduits; means to operably connect the heat sensor means to the heater device to control the temperature of the fluid as it flows through each conduit; and separate valve means between the head and the conduits arranged to operate in unison to simultaneously bring the conduits into communication with the central passage through the head.

2. The combination called for in claim 1 wherein the means to rotate the member in the passage comprises a motor having a shaft; and means to connect the shaft to the said member.

3. The combination called for in claim 2 wherein the means to move the member longitudinally in the passage comprises means to change the length of the means to connect the shaft to the member to cause said member to move relative to the motor.

4. The combination called for in claim 1 wherein the valve means comprises a ball secured to an end of the member.

5. The combination called for in claim 1 wherein the means to move the member to move the valve means comprises pressure actuated means adapted to selectively urge the member in opposite directions.

6. The combination called for in claim 1 wherein the means to move the member to move the valve means

comprises means actuated by centrifugal force when the convoluted member is rotated to impart force longitudinally of the rotating con-voluted member.

7. The combination called for in claim **1** wherein the means to move the member to move the valve means comprises a threaded shaft; a coupling having a large moment of inertia threadedly connected to said shaft such that initial rotation of the shaft imparts movement of the coupling longitudinally of the shaft before overcoming the inertia of the coupling to rotate same.

8. In a device of the class described, a container for liquid resin; a container for catalyst; separate circulation conduits for the catalyst and resin; means to circulate fluid through each of the conduits; a heater device arranged in heat exchange relation with each conduit; heat sensor means in heat exchange relation with each of said circulation conduits; means to operably connect the heat sensor means to the heater device to control the temperature of the fluid as it flows through each conduit; a mixing and dispensing head having inlet passages arranged to be simultaneously placed in communication with the conduits, said head having an outlet passage; dispensing valve means in said outlet passage; and separate valve means between the head and the conduits arranged to operate in unison to simultaneously bring the conduits into communication with the interior of the head.

9. The combination called for in claim **8** wherein the mixing and dispensing head includes a central passage therethrough into which the resin and catalyst are injected; a rotatable member having spiral convolutions on the outer surface thereof; and motor means for rotating said convoluted member.

10. In a device of the class described, separate circulation conduits for catalyst and resin; means to circulate fluid through each of the conduits; heater means in heat exchange relation with portions of said conduits to maintain the fluids at a pre-selected temperatures as it flows through the said conduits; a mixing and dispensing head arranged to be simultaneously placed in communication with the conduits, said head having an outlet opening; means to open and close said opening; valve means between the head and conduits arranged to simultaneously bring the conduits into communication with the interior of the head; and control means operably connected to the heater and to the means to circulate fluid through the conduits, said control means having an off position, a first position arranged to activate the heater means, and a second position arranged to activate the means to circulate fluid through the conduits.

11. In a device of the class described, a container for liquid resin; a container for catalyst; separate circulation conduits for the catalyst and resin; means to circulate fluid through each of the conduits; a rod extending through a portion of each circulation conduit; means to heat each of said rods; convolutions on the outer surface of said rods to cause spiral movement of fluid as it passes thereabout in each conduit; a mixing and dispensing head arranged to be placed in communication with the conduits; and valve means between the head and the conduits arranged to bring the conduits into communication with the interior of the head.

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