

PATENT SPECIFICATION

(11)

1 454 300

1 54 300

- (21) Application No. 59282/73 (22) Filed 20 Dec. 1973
(31) Convention Application No. 318 167 (32) Filed 26 Dec. 1972 in
(33) United States of America (US)
(44) Complete Specification published 3 Nov. 1976
(51) INT. CL.² B67D 5/00//B01F 15/06
(52) Index at acceptance
A4T 24A2 24B3 24B5 24C1A 24E5 24E8
BIC 10 14



(54) IMPROVEMENTS RELATING TO DISPENSING SYSTEMS FOR LIQUIDS

(71) We, INSTAPAK CORPORATION, a corporation organised and existing under the laws of the State of New York, United States of America, of Old Sherman Turnpike, Danbury, State of Connecticut, United States of America, (assignee of CHARLES RICHARD SPERRY), do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a dispensing system for liquids, especially polyurethane foam precursor chemicals, and more particularly is directed to such a system wherein the chemicals are heated under precisely controlled conditions in the conducting lines thereof.

In the work which led to the present invention, polyurethane foam components have principally been dealt with, which components require heating above ambient temperatures in order to result in a useful foam product. While such chemicals are well known to those skilled in this art, in order to fully explain the operation of this system a brief reference to these reactants is made herebelow.

Polyurethane foams are normally produced by the reaction of two principal constituents generically classified as polyols and polyisocyanates.

The polyols generally are selected from the group consisting of polyethers, polyesters, polythioethers, polyesteramides, alkylene glycols and polyisocyanate modifications thereof, which materials are characterized by a molecular weight greater than 500 and which have at least two reactive hydroxyl groups per molecule. Examples of the foregoing are poly (oxyethylene) glycols and poly (oxypropylene) glycols or copolymers of these materials which collectively may be referred to as poly (oxyalkylene)

ethers. As is well known to the chemists skilled in this art, there are numerous compounds which fall within this "polyol" category and the literature thereon is quite extensive.

The other principal reactant in the polyurethane foam making reaction are aromatic or aliphatic polyisocyanates. Also included are substitute of aromatic polyisocyanates. Representative examples of these materials are 2,4-toluene diisocyanate; 2,6-toluene diisocyanate; ethylene diisocyanate; ethylidene diisocyanate; propylene-1,2-diisocyanate; butylene-1,2-diisocyanate; hexylene-1,6-diisocyanate; cyclohexylene-1,2-diisocyanate and many others.

In addition to the polyols and polyisocyanates, the usual polyurethane precursor materials also contain one or more of blowing agents, surfactants, catalysts, fillers and stabilizers. These are usually contained in either the polyol or polyisocyanate constituent.

Certain polyurethane foam compositions are usable at ambient temperatures but these are not basically the materials which are to be used in the present dispensing system. We are principally interested in using those foam materials herewith wherein a modest, but very carefully controlled heating thereof is required. To understand why such careful heating is necessary requires some additional discussion.

While polyurethane foam has become a staple item of commerce it should be recognized that the production of such foam involves the use of rather sensitive chemicals, somewhat difficult to work with, and that it is extremely important, if acceptable foams are to result, that there be good mixing of well measured, fairly exacting amounts, of the two basic materials. If the two constituents are not well mixed prior to dispensing or prior to the initiation of

the foaming reaction, one does not obtain an acceptable foam. Furthermore, if there is an excess of one reactant over the other acceptable foams will not result.

5 These general statements are especially true in the area of polyurethane foaming in place packaging where most of our efforts in the present invention have been directed. The foam going into the package has
10 to be correct or the package has to be remade or may fail in use which are not particularly attractive from either a functional or economic standpoint.

While the polyurethane foaming reaction
15 is usually exothermic in nature most of the regularly used chemical components have to be moderately heated prior to the initiation of the reaction. This is normally done, of necessity for several reasons. The constituents are usually viscous and heating
20 brings one or both of them down to a viscosity range where it or they can be reasonably handled. Also, since the two components normally widely differ in viscosity, but
25 change in viscosity differently as a function of increasing temperature by controlling the temperature of the reactants, one can substantially match the two viscosities. This is important in obtaining good mixing of
30 the two chemicals.

And, of course, heating is important in "triggering" the foam reaction.

It is, of course, understood that the heating cannot be too high without serious
35 detrimental effects. As a practical matter with the polyurethane reactants that we have been using a temperature of 130°F is preferred.

In the past the materials have been heated
40 to the appropriate temperature in their containers. This requires heaters for the containers, heavily insulated lines, and still does not assure that the temperature is correct at the critical point of mixing and
45 pour. Also, the heating of the containers detracts from the instantaneous operation of the system—when a new container replaces a depleted one, the operator must wait until the appropriate temperature is
50 achieved. In standard usage the containers have to be pre-heated and in most cases the user leaves the heat on overnight in order to assure that the unit will function properly at the start of operations the next
55 morning. Combined with this are the limitations on hose length between container and pour point. Cooling down at the latter has to be avoided.

All of the foregoing problems are overcome by the use of the present invention in which the reactants are electrically heated in the conduits thereby making it unnecessary to heat or preheat in the container and reactant temperatures are carefully sensed
65 at and appropriately fed back from the dis-

persing end of the system.

According to the present invention there is provided a system for dispensing a reactive mixture of at least two reacting liquids wherein said liquids are required to
70 be heated above ambient temperature to cause proper reaction thereof comprising respective receptacles for said reacting liquids, a conduit member for each such
75 reacting liquid extending from the respective receptacle to a common dispensing means at the output ends of the conduits, respective electrically conducting wire heating elements constituting the sole heating
80 means in the present system positioned in the bore of each such conduit and adapted to be in intimate contact with the reacting liquid therein, which heating elements extend essentially to the output ends of the
85 respective conduits adjacent to said common dispensing means, and which heating elements are capable of raising the temperature of flowing reactive liquid from ambient temperature lower than reaction temperature to proper and constant reaction
90 temperature as it passes through the length of the conduit, an electrical power supply for said heating elements and a temperature sensing device positioned in the bore of
95 at least one of said conduits adjacent the output end thereof, said device controlling the energization of said heating elements whereby the temperature of said reacting liquids at said output ends is maintained at
100 proper reaction temperature.

According to a further feature of the present invention there is provided a process for dispensing polyurethane foam precursor chemicals which chemicals are
105 required to be controllably heated above ambient temperature prior to mixing and dispensing and which chemicals are passed from respective receptacles at ambient temperature through conduits to a mixing and dispensing means, comprising: controllably
110 heating said precursor chemicals in the conduits therefor from ambient temperature in the receptacles by means of electrical wire heating elements in the bores of said conduits to proper mixing and dispensing temperature at the output end of said conduits
115 adjacent to said mixing and dispensing means.

The present invention will now be further described by way of example, with
120 reference to the accompanying drawings, in which:—

FIGURES 1 and 2 schematically illustrate the system of the present invention;

FIGURE 3 is a cross-sectional view illustrating the structure of the heater lines of
125 the present invention;

FIGURE 4 illustrates the heating control system of this invention.

Figure 1 generally illustrates the present 130

(12)

polyurethane foam dispensing system and as illustrated merely in the drawing is of course comparable to known systems in the prior art. There is a container of polyol 11 and one for isocyanate 12. These feed respectively via conduits 13 and 14 to a dispensing gun 15. There may be intervening metering pumps or the like (not illustrated) to propel the polyol and isocyanate constituents to and through the dispensing gun or in the embodiments which we prefer the containers are merely pressurized, e.g., with dry nitrogen, for the same purpose.

In the preferred embodiments hereof, the two chemical containers are at an equal internal pressurization and by this means the chemicals are forced therefrom when the dispensing gun is in the open or pour position.

The dispensing gun 15 may take a variety of forms, many of which are known in the prior art. In the most simple terms this may be a mixing chamber for the two basic polyurethane constituents to insure good mixing thereof before ejection of the material to where it is to be used. Where the containers 11 and 12 are controlled by on-off metering pumps, the gun 15 may be a simple tube if clogging is not particularly a problem. On the other hand, when the containers are pressurized, there must be some dispensing control mechanism adapted on the gun itself.

While the present system may employ a variety of dispensers, we prefer to use the gun which is described in British Patent Specification No. 1380341 and the disclosure of such earlier patent is incorporated by reference herein. With the use of such or similar dispensing guns, a mechanism must be provided for the opening and closing thereof. Although other means can be used, we prefer a compressed air system for moving a piston which in turn moves a valving rod from a retracted to a protracted position within the confines of a mixing chamber. Ports open into such mixing chamber which ports are controlled by the valving rod. In Figure 1 the numeral 16 denotes an air supply for controlling the valving rod of the dispenser 15.

By employing the present system we are able to move polyurethane precursor chemicals from their respective receptacles at ambient temperature to a dispensing point where such chemicals are at the proper temperature for mixing and reacting. For example, we start with chemicals at room temperature and pass them through a 25 foot conduit at the outlet of which the temperature has been raised to 130°F. And such temperature is very carefully controlled as herein provided. For a general understanding as to how this is accomplished reference should next be had to Figure 2.

Again there are the two containers, 11 and 12, for the polyurethane precursor materials with their respective outlet conduits 13 and 14. Both said receptacles are equally pressured by a gas (e.g. dry nitrogen) from source 17 via gas conduits 18 and 19.

Such pressurization technique is standard in the art. The receptacles must be of adequate strength to withstand the pressurization. The chemicals employed are liquids. Pressurization is from above the liquid level while the chemicals are drawn off from the bottom. While they are not illustrated in Figure 2 appropriate fittings are employed between the various members.

At this point in the disclosure reference should be had to Figures 3 and 4 for an understanding of the heater mechanism in the lines hereof and the control mechanism therefor.

Figure 3 schematically illustrates in cross-section the composite conduit member for use herewith. Conduit 13 (polyol) has a relatively thick wall 20 made of rubber or "Teflon" (Registered Trade Mark) with an electrical wire 21 running therethrough. Such wire is preferably copper having an insulating lacquer coated thereon. When current is passed through said wire it serves as the heating element.

Conduit 14 is an exact counterpart to 13 having a wall member 22 with a lacquer coated electrical wire 23 running therethrough.

A third conduit, 24, may be provided for compressed air when such is used to activate the dispensing gun. The three conduits are encased in a flexible covering 25.

Reference should now be had to Figure 4 illustrating the heating and control for one such reactant conduit. The wire 21 is energized by an electrical power source, 26, preferably a.c. A calibrated thermistor 27, or other equivalent temperature sensing device, is positioned in the downstream end of the conduit. (Direction of flow is indicated by the arrow 30.) Signals from the thermistor are fed via lead 31 back to the electrical power supply 26 to control the output thereof. If the temperature of the reactant flowing in the conduit is slightly too high the thermistor generated signal shuts off or reduces the input power to the line 21. Or it increases such power if the temperature is slightly too low.

Exactly the same mechanism is provided in the other conduit. There is thermistor temperature sensing with feedback to the electrical power supply. Alternatively a temperature sensing device can be located only in one conduit, the single device being used to control the heating elements in both conduits.

It should be noted that with the present

system one may have different, but controlled, temperatures in the two conduit lines. By this means the viscosity of the reactants may be well-controlled. Furthermore, more than two lines can be used where more than a two component reaction is employed.

It will be understood that various modifications and variations hereof may be effected without departing from the scope of the invention as defined by the appended claims.

WHAT WE CLAIM IS:—

1. A system for dispensing a reactive mixture of at least two reacting liquids wherein said liquids are required to be heated above ambient temperature to cause proper reaction thereof comprising respective receptacles for said reacting liquids, a conduit member for each such reacting liquid extending from the respective receptacle to a common dispensing means at the output ends of the conduits, respective electrically conducting wire heating elements constituting the sole heating means in the present system positioned in the bore of each such conduit and adapted to be in intimate contact with the reacting liquid therein, which heating elements extend essentially to the output ends of the respective conduits adjacent to said common dispensing means, and which heating elements are capable of raising the temperature of flowing reactive liquid from ambient temperature lower than reaction temperature to proper and constant reaction temperature as it passes through the length of the conduit, an electrical power supply for said heating elements and a temperature sensing device positioned in the bore of at least one of said conduits adjacent the output end thereof, said device controlling the energization of said heating elements whereby the tempera-

ture of said reacting liquids at said output ends is maintained at proper reaction temperature.

2. The system as claimed in Claim 1 in which said reacting liquids are polyurethane foam precursor chemicals and there are two said conduits.

3. The system as claimed in Claim 1 in which said temperature sensing device is a thermistor.

4. A process for dispensing polyurethane foam precursor chemicals which chemicals are required to be controllably heated above ambient temperature prior to mixing and dispensing and which chemicals are passed from respective receptacles at ambient temperature through conduits to a mixing and dispensing means, comprising; controllably heating said precursor chemicals in the conduits therefor from ambient temperature in the receptacles by means of electrical wire heating elements in the bores of said conduits to proper mixing and dispensing temperature at the output end of said conduits adjacent to said mixing and dispensing means.

5. A system for dispensing a reactive mixture of at least two reacting liquids, constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

6. A process for dispensing polyurethane foam precursor chemicals in accordance with Claim 4 and substantially as hereinbefore described.

W. P. THOMPSON & CO.,
Coopers Building,
Church Street,
Liverpool L1 3AB.
Chartered Patent Agents.

system one may have different, but controlled, temperatures in the two conduit lines. By this means the viscosity of the reactants may be well-controlled. Furthermore, more than two lines can be used where more than a two component reaction is employed.

It will be understood that various modifications and variations hereof may be effected without departing from the scope of the invention as defined by the appended claims.

WHAT WE CLAIM IS:—

1. A system for dispensing a reactive mixture of at least two reacting liquids wherein said liquids are required to be heated above ambient temperature to cause proper reaction thereof comprising respective receptacles for said reacting liquids, a conduit member for each such reacting liquid extending from the respective receptacle to a common dispensing means at the output ends of the conduits, respective electrically conducting wire heating elements constituting the sole heating means in the present system positioned in the bore of each such conduit and adapted to be in intimate contact with the reacting liquid therein, which heating elements extend essentially to the output ends of the respective conduits adjacent to said common dispensing means, and which heating elements are capable of raising the temperature of flowing reactive liquid from ambient temperature lower than reaction temperature to proper and constant reaction temperature as it passes through the length of the conduit, an electrical power supply for said heating elements and a temperature sensing device positioned in the bore of at least one of said conduits adjacent the output end thereof, said device controlling the energization of said heating elements whereby the tempera-

ture of said reacting liquids at said output ends is maintained at proper reaction temperature.

2. The system as claimed in Claim 1 in which said reacting liquids are polyurethane foam precursor chemicals and there are two said conduits.

3. The system as claimed in Claim 1 in which said temperature sensing device is a thermistor.

4. A process for dispensing polyurethane foam precursor chemicals which chemicals are required to be controllably heated above ambient temperature prior to mixing and dispensing and which chemicals are passed from respective receptacles at ambient temperature through conduits to a mixing and dispensing means, comprising, controllably heating said precursor chemicals in the conduits therefor from ambient temperature in the receptacles by means of electrical wire heating elements in the bores of said conduits to proper mixing and dispensing temperature at the output end of said conduits adjacent to said mixing and dispensing means.

5. A system for dispensing a reactive mixture of at least two reacting liquids, constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

6. A process for dispensing polyurethane foam precursor chemicals in accordance with Claim 4 and substantially as hereinbefore described.

W. P. THOMPSON & CO.,
Coopers Building,
Church Street,
Liverpool L1 3AB.
Chartered Patent Agents.

