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(54) Apparatus for dispensing liquids

(57) An apparatus 10 for dispensing liquids that harden under ambient atmospheric conditions includes a housing 12 for receiving one or more liquids and rotating rollers 22, 24 having roller surfaces 30, 36 that define an orifice 38 through which the liquid is dispensed. A doctoring surface 44 continuously cleans the roller surfaces 30, 36 to eliminate clogging of the orifice 38 or the deposition of hardened material on the housing 12.

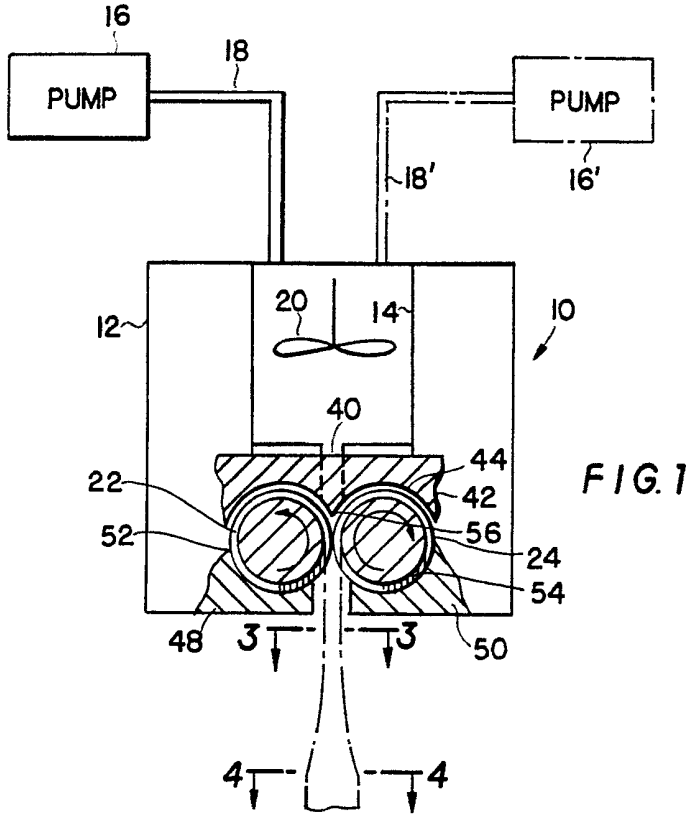

FIG. 1

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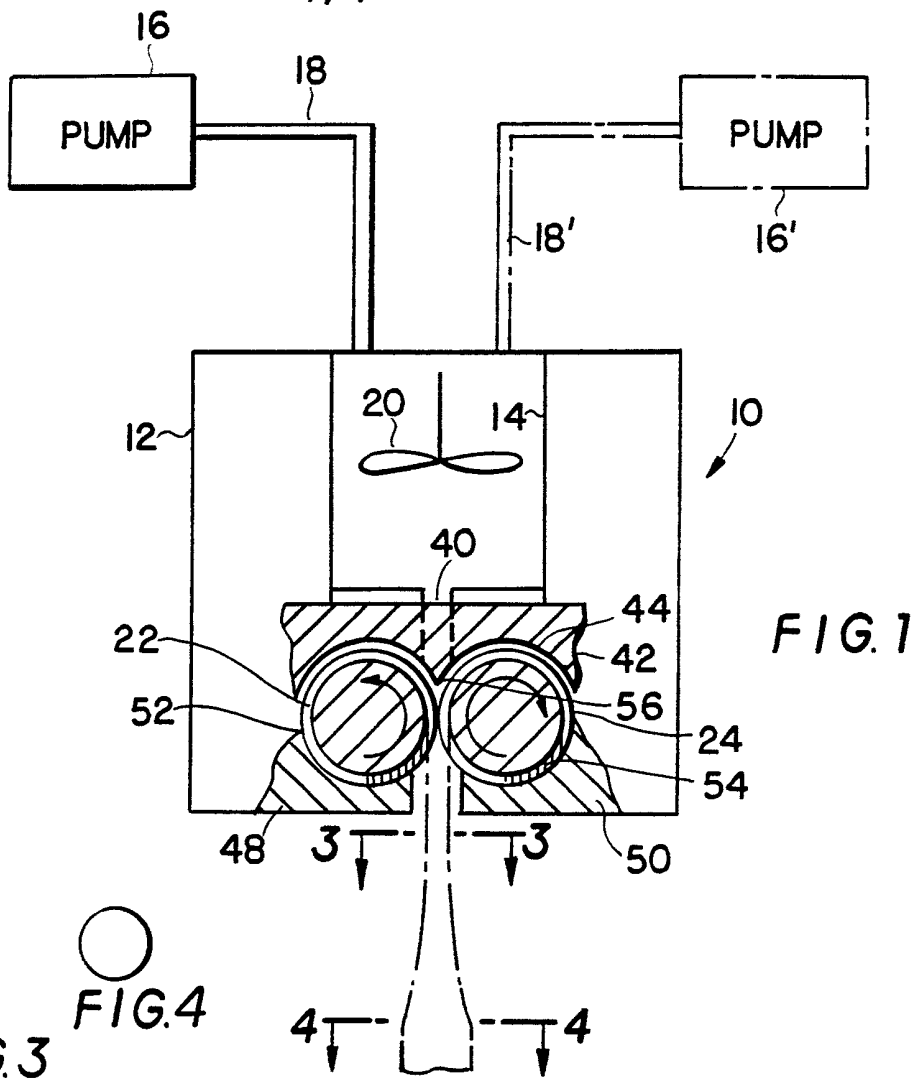

FIG. 1

FIG. 3

FIG. 4

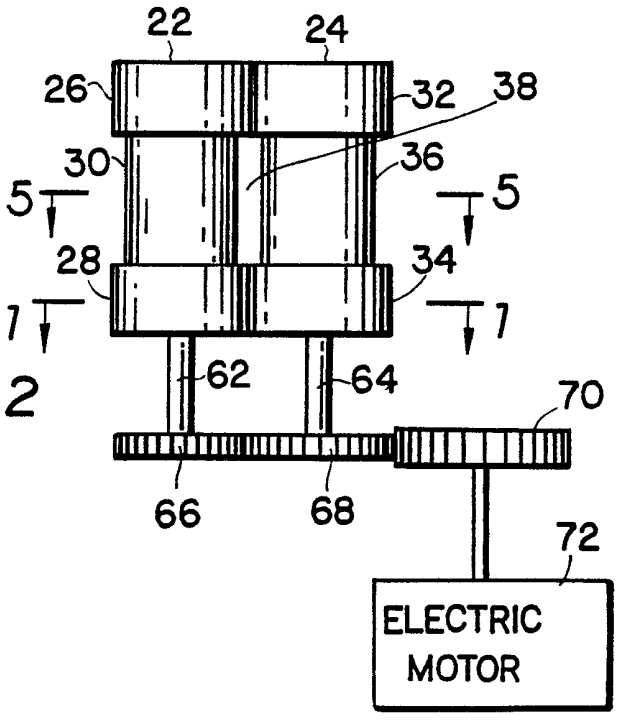

FIG. 2

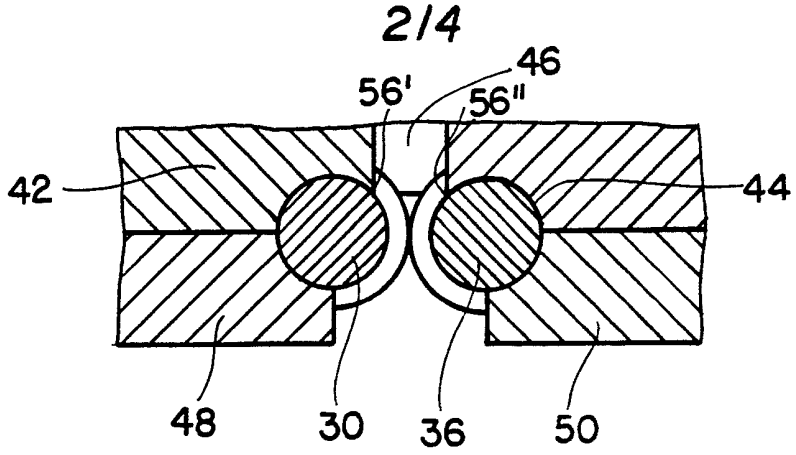

FIG. 5

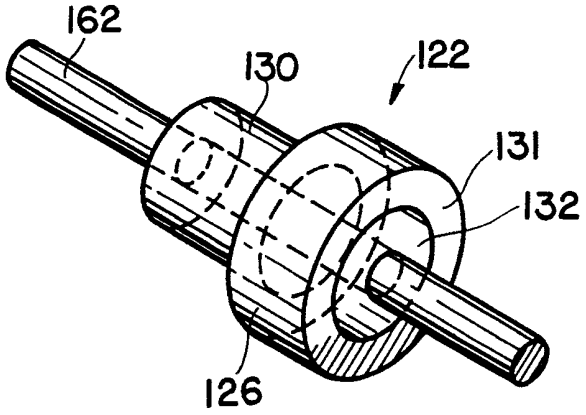

FIG. 7

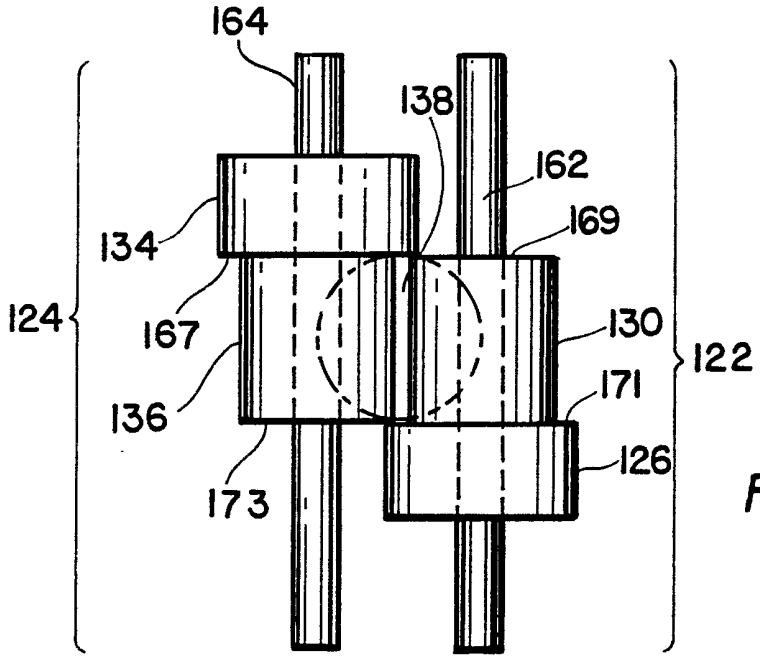

FIG. 8

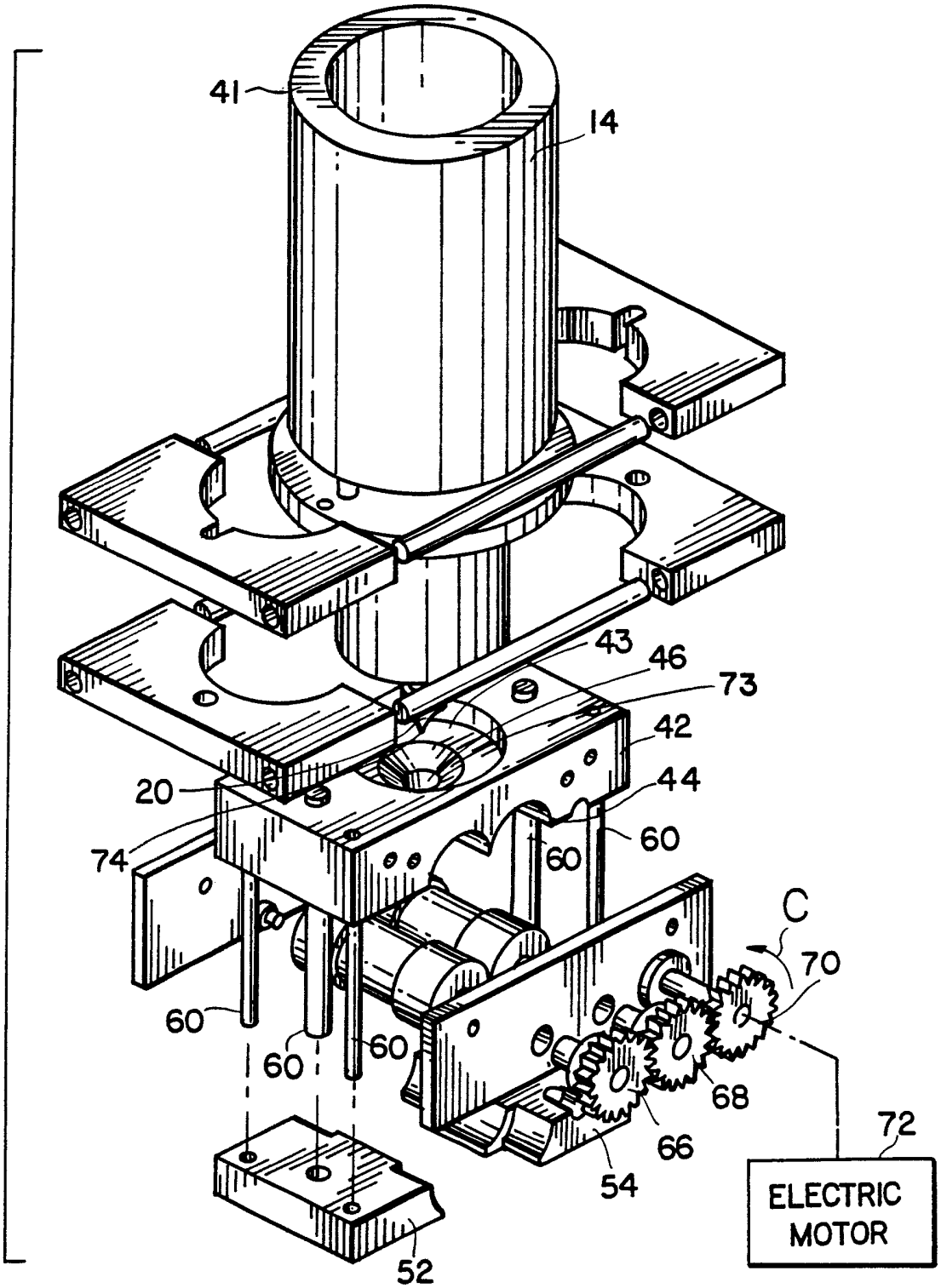
41
14
43
46
73
42
44
20
74
60
60
60
60
60
C
70
68
66
54
72
ELECTRIC MOTOR
52

FIG. 6

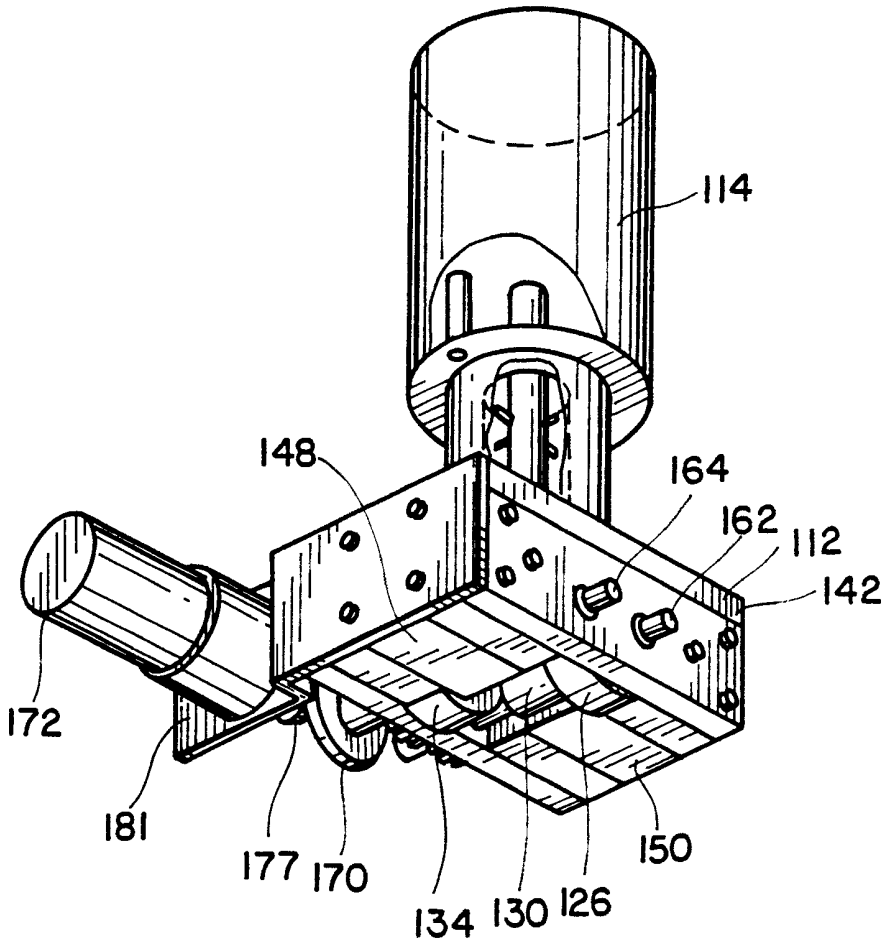

FIG. 9

Apparatus for Dispensing Liquids

This invention pertains to an apparatus for dispensing fluids and, in particular, relates to apparatus for dispensing liquids that harden rapidly on exposure to ambient conditions; more particularly, the invention relates to an apparatus in which a dispensing nozzle is defined by two rotating members.

Various liquids are normally dispensed through a nozzle with a fixed orifice. However this type of apparatus is unsuitable for dispensing liquids such as various resins including urethane-based materials which harden rapidly when exposed to air, or when they undergo a change of temperature or other ambient atmospheric characteristics. One problem with using standard dispensing apparatus with these liquids is that the orifice gets clogged with hardened material and hence it must be frequently changed or cleaned. Another problem has been that the liquid tends to harden and form deposits in elongated shapes around the nozzle in a random manner, a phenomenon referred to in the art as 'bearding'. This build up interferes with the dispensing operation and when it gets too long it can re-direct the flow of the liquid causing various problems.

In view of the above-mentioned disadvantages of the prior art, it is an objective of the present invention to provide an apparatus for dispensing resinous liquids in

which the nozzle is not blocked over time by solids.

Yet another objective is to provide a liquid dispensing apparatus which does not require frequent changes of nozzles.

A further objective is to provide an apparatus with a novel nozzle design which prevents the bearding phenomenon associated with liquids which solidify when exposed to ambient atmospheric conditions.

Other objectives and advantages shall become apparent from the following description of the invention.

The present invention provides an apparatus for dispensing liquids comprising:

a housing;

a pair of rollers rotatably mounted on said housing, said rollers having opposed roller surfaces defining a nozzle;

liquid supply means for providing a liquid flow through said nozzle; and,

drive means for rotating said rollers with said roller surfaces moving in a direction opposite said liquid flow.

Each of the said roller surfaces may have a first surface portion and a second surface portion, said second surface portion having a smaller diameter than said first surface portion, said second surface portions being spaced apart from each other to define a nozzle having a preselected cross-section.

The present invention further provides an apparatus for dispensing a resinous liquid which hardens when in contact with ambient atmospheric conditions, said apparatus comprising:

a pump for continuously supplying an input liquid;

a housing for receiving said input liquid;

roller means mounted rotatably on said housing and including opposed roller surfaces defining an output nozzle for generating an output liquid flow from said input liquid; and,

drive means for rotating said roller means with said roller surfaces moving in a direction opposite said liquid flow.

Each roller surface may include a first surface portion and a second surface portion, said second surface portion having a diameter smaller than said first surface portion, wherein the second surface portions define the output nozzle.

In another aspect of the invention there is provided an apparatus for dispensing a resinous liquid which hardens in contact with ambient atmospheric conditions, said apparatus comprising:

a housing with a tank;

a first and a second roller mounted in said housing and having opposed roller surfaces for defining an orifice for a liquid flow from said tank; and

drive means for rotating said rollers.

Each roller surface may include a first surface portion and a second surface portion, said second surface portion having a diameter smaller than said first surface portion, wherein the second surface portions define the orifice. Each said first surface portions may include a first cylindrical section and each said second surface portion may include a second cylindrical portion disposed co-axially with said first section, the second sections of said rollers defining said orifice therebetween.

Briefly, a liquid dispensing apparatus constructed in accordance with this invention includes a housing receiving one or more liquids for dispensing, and a pair of rollers with rotating roller surfaces. The roller surfaces define an orifice through which the liquid is dispensed. Advantageously, as the rollers rotate, their edges are constantly cleaned by doctoring surfaces for avoiding clogging of the orifice and bearding. Another purpose for doctoring is to return the doctored liquid into the turbulent mixing area of the main liquid stream where it is combined with and exits the orifice with said main liquid stream.

Various embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a side cross-sectional, somewhat schematic view of a dispensing apparatus constructed in accordance with this invention;

Figure 2 shows a plan view of the apparatus of Figure 1;

Figure 3 shows a cross-sectional view taken along line 3-3 of Figure 1 of the liquid being dispensed as it exits the nozzle of the apparatus;

Figure 4 shows a cross-sectional view taken along line 4-4 of Figure 1 of the dispensed liquid stream somewhat below the dispensing nozzle;

Figure 5 shows a side cross-sectional view taken along line 5-5 of Figure 2 of the nozzle;

Figure 6 shows an exploded perspective view of an apparatus substantially similar to that shown in Figures 1, 2 and 5;

Figure 7 shows a side perspective view of a roller for use in accordance with an alternative embodiment of the invention;

Figure 8 shows a plan view of a nozzle formed by two rollers constructed in accordance with Figure 7; and

Figure 9 shows a perspective view taken from below of a dispensing apparatus incorporating the rollers of Figures 7 and 8.

Referring to the drawings, and in particular Figure 1, there is shown an apparatus 10 including a housing 12 with a holding tank 14. A pump 16 supplies a resinous liquid to tank 14 through a pipe 18. The apparatus may also be used to dispense a material obtained by mixing several liquid phases, which material hardens when exposed to ambient atmospheric conditions. This may be

accomplished, for example, by supplying to tank 14 one phase via pump 16 and pipe 18 and a second phase through a pump 16' and a pipe 18'. Additional phases may be added by the use of additional pumps as required. The different phases are then mixed in tank 14 for example by using a mixing blade 20.

Under tank 14, apparatus 10 is provided with two rollers 22, 24. Each of the rollers is generally bar-bell shaped although the rollers may have other shapes as well. Thus, roller 22 has two axially spaced cylindrical sections 26, 28 having the same diameter. A third cylindrical section 30 has a smaller diameter and extends coaxially between the sections 26, 28. Roller 24 similarly has two sections 32, 34 with diameters equal to the diameters of sections 26, 28 and a third section 36 having the same diameter as section 30. The two rollers are disposed rotatably within housing 12 with their axes in parallel, and with sections 26, 32 and 28, 34 in an abutting relationship as shown in Figure 2. Since sections 30, 36 are smaller, they define a generally rectangular space or orifice 38.

Also within housing 10 there are provided three other members. As best seen in Figure 6, one top doctoring member 42 is disposed above rollers 22, 24 and it has a bottom surface 44 profiled to conform to the surfaces of the rollers. Surface 44 includes a tongue 56 extending between the rollers 22, 24. Member 42 also has a through-hole 46 leading from the bottom of tank 14 to

orifice 38. Tank 14 may be provided as an integral unit with a bottom hole 40, as shown in Figure 1. Alternatively, as shown in Figure 6, tank 14 may be formed with a cylindrical wall 41 closed off by member 42. In this latter configuration, member 42 is shaped at the top with a circular depression 43 which forms the bottom for the tank 14.

Under the doctoring member 42, there are two bottom members 48, 50. Each of these members has a top surface, 52, 54 (Figure 1) shaped to conform to the surfaces of the rollers 22, 24 to retain the rollers 22, 24 against the upper doctoring surface 44. In this manner, as the rollers rotate about their respective axes, the surfaces of their circular sections 26-36 are constantly wiped by the shaped surfaces 44, 52, 54 to keep the rollers clean. More specifically, the two rollers have surfaces which are continuously rotating in directions opposite to the flow of liquid through orifice 38, as shown by the arrows in Figure 1 and therefore most of the doctoring occurs at the tongue 56 and leading edges 56', 56" of member 42 (Figure 5). Tongue 56 doctors the surfaces of the larger cylindrical sections of the rollers while edges 56', 56" doctor the surfaces of the smaller cylindrical sections.

Members 52, 54 are attached to member 42 and to the housing by rods 60.

Each of the rollers 22, 24 is mounted for rotation on an axle 62, 64, respectively. Axle 62 is terminated with a toothed gear 66, while axle 64 is terminated with

a toothed gear 68. The toothed gears 66, 68 are intermeshed. In addition, toothed gear 68 is intermeshed with a third toothed gear 70. Gear 70 is coupled to a driving member such as an electrical motor 72. Motor 72 drives gear 70 in the counterclockwise direction as indicated by arrow C in Figure 6 causing gears 68, 66 to rotate in the clockwise and counterclockwise directions respectively.

The above-described apparatus operates as follows. One or more resinous liquids are fed to tank 14 as described above. If necessary, the contents of the tank are mixed continuously to insure that the liquid is dispensed as a homogenous mass. For this purpose, the top of hole 46 may be chamfered as at 73 so that the tip 74 of blade 20 (seen in Figure 6) may extend to the hole 46.

Importantly, while the liquid flows between the rollers, the rollers continuously rotate with their opposed, facing surfaces moving in a direction opposite (that is, upward) to the direction of the flow. In this manner the two rollers define therebetween a moving nozzle. Because roller surfaces are constantly being doctored, the liquid does not solidify on the rollers' surfaces and hence there is no need to clean or replace them. Furthermore the continuous doctoring of the roller surfaces insures that no material is solidified on the housing and hence the bearding phenomenon is also avoided.

The liquid from tank 14 flows through hole 46 and out of housing 12 through the orifice 38. Because orifice 38 is generally rectangular the liquid flow out of housing 12 is also generally rectangular as shown in Figure 3. However surface tension forces the liquid flow into a normal circular cross-section as shown in Figure 4.

The size, shape and speed of the rollers depends on the nature of the material to be dispensed, including its viscosity, specific gravity and so on, as well as the desired dispensing rate. It has been found that acceptable results are obtained if the rollers have a maximum diameter in the range of 1/2-1" and form a nozzle 38 having dimensions ranging from 1/2 x 1/16" to 1 x 1/4". A rectangular or square shaped nozzle is preferable because it can easily be provided between rollers having straight cylindrical sections as described above. However nozzles having other cross-sectional shapes, such as circles, ellipses can also be made using rollers with appropriately profiled surfaces. The rollers are preferably made of stainless steel or alternatively of plastics material.

As mentioned above, the orifice may be formed by rotating rollers having other shapes as well. For example, Figure 7 shows a roller 122 formed of an axle 162, a first cylindrical member 130 and a second cylindrical member 126. Member 126 is axially shorter than member 130 and is formed with a cylindrical bore of

the same size as the outer diameter of member 130. Similarly, member 130 is formed with an axial bore of the same size as the diameter of axle 162. These members are made separately, for example, of hardened steel. The roller 122 is then formed by first shrink fitting member 126 on one side of member 130 with their respective axial faces 131, 132 disposed in a co-planar relationship, and then mounting and shrink fitting member 130 on axle 162 in the position shown in Figure 7. A second roller 124 is made in a similar manner having an axle 164, with a first member 136 and a second member 134, as shown in Figure 8. These two members may then be positioned as shown in Figure 8 with axles 162, 164 disposed in parallel and spaced in such a manner that an inner axial face 167 of member 134 is abutting an outer face 169 of member 130, and an inner face 171 of member 126 is abutting an outer face 173 of member 136. In this manner a rectangular orifice 138 is formed between the rollers 122, 124. The rollers 122, 124 are rotated in opposite directions in the same manner as described in the first embodiment. Preferably, the rollers 122, 124 are made of hardened steel so that the faces do not wear off easily. In addition, the rollers, or at least their faces 167, 169, 171, 173 are coated with a material to reduce friction therebetween during rotation. In addition, springs may be used on the axles to urge the rollers toward each other in the position shown in Figure 9 whereby the orifice 138 is maintained automatically even

if the faces are worn off.

As shown in Figure 9, rollers 122, 124 are disposed in a housing 112. The housing includes an upper portion 142 shaped and sized to doctor the cylindrical surfaces of members 126, 130, 134, 136 in a manner similar to the previously described embodiment. The housing also includes two lower support portions 148, 150. A holding tank 114 is disposed on top of the housing 112, as shown.

Advantageously, the two axles 162, 164 are provided with meshing toothed gears (not shown) similar to the gears 66, 68 of Figure 2. In addition, a beveled or helical gear 170 is mounted on axle 164. This gear 170 is meshed with a gear 177 mounted on a motor 172. Motor 172 is mounted on housing 112 by a bracket 181.

The embodiment of Figures 7-9 operates in the same manner as the embodiment previously described.

Claims

1. An apparatus for dispensing liquids comprising:

a housing;

a pair of rollers rotatably mounted on said housing, said rollers having opposed roller surfaces defining a nozzle;

liquid supply means for providing a liquid flow through said nozzle; and,

drive means for rotating said rollers with said roller surfaces moving in a direction opposite said liquid flow.

2. Apparatus as claimed in claim 1, wherein said housing includes one or more doctoring members for doctoring said roller surfaces.

3. Apparatus as claimed in claim 1 or claim 2, wherein said housing includes a tank for holding liquid from said liquid supply means.

4. Apparatus as claimed in claim 3, wherein said liquid supply means is capable of supplying several input liquids to said tank.

5. Apparatus as claimed in claim 4, further comprising mixing means for mixing said input liquids into a homogenous liquid.

6. An apparatus for dispensing a resinous liquid which hardens when in contact with ambient atmospheric conditions, said apparatus comprising:

a pump for continuously supplying an input liquid;

a housing for receiving said input liquid;

roller means mounted rotatably on said housing and including opposed roller surfaces defining an output nozzle for generating an output liquid flow from said input liquid; and,

drive means for rotating said roller means with said roller surfaces moving in a direction opposite said liquid flow.

7. Apparatus as claimed in claim 6, wherein said housing includes a tank for holding said input liquid.

8. Apparatus as claimed in claim 7, further comprising mixing means for mixing the input liquid in said tank.

9. Apparatus as claimed in any one of claims 6 to 8, further comprising doctoring means disposed in said housing for doctoring said roller surfaces.

10. Apparatus as claimed in any one of claims 6 to 9, wherein said roller surfaces define a rectangular orifice therebetween.

11. An apparatus for dispensing a resinous liquid which hardens in contact with ambient atmospheric conditions, said apparatus comprising:

a housing with a tank;

a first and a second roller mounted in said housing and having opposed roller surfaces for defining an orifice for a liquid flow from said tank; and

drive means for rotating said rollers.

12. Apparatus as claimed in claim 11, wherein said drive means rotates said rollers with said roller surfaces moving in a direction opposite said liquid flow.

13. Apparatus as claimed in claim 11 or claim 12, wherein said rollers define a rectangular orifice.

14. Apparatus as claimed in any one of claims 11 to 13, wherein said rollers each include a first cylindrical section and a second cylindrical section disposed co-axially with and having a diameter smaller than said first section, the second sections of said rollers defining said orifice therebetween.

15. Apparatus as claimed in claim 14, wherein each said roller further comprises a third cylindrical section, said second section being disposed between said third and said first sections.

16. Apparatus as claimed in any one of claims 11 to 15, further comprising a doctoring member disposed above said rollers and having a doctoring member surface contoured to match said rollers.

17. Apparatus as claimed in claim 16, wherein said doctoring member surface includes a doctoring edge extending between said rollers.

18. Apparatus as claimed in any one of claims 14 to 17, wherein said first sections have inner surfaces and said second sections have outer surfaces, with said rollers being spaced with the inner surfaces of the first sections abutting the outer surfaces of the second sections to define said orifice therebetween.

19. Apparatus as claimed in any one of claims 14 to 18, wherein each of said rollers consists of an axle, a first member mounted on said axle and having a first member axial length and a second member mounted on said first member and having a second member axial length shorter than said first member axial length.

20. An apparatus as claimed in any one of claims 11 to 19 for dispensing a resinous liquid composed of several phases, wherein said apparatus comprises supply means for supplying said phases and mixing means for mixing said several phases in said tank.

21. An apparatus substantially as hereinbefore described with reference to, and as shown in, Figures 1 to 9 of the accompanying drawings.

22. Any novel feature hereinbefore described or any novel combination of hereinbefore described features.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report) - 16 -

Application number
GB 9403535.9

Relevant Technical Fields

(i) UK Cl (Ed.M) B2F (FEX, FJC)

(ii) Int Cl (Ed.5) B05B 1/00, B05B 15/02

Search Examiner
J H WARREN

Date of completion of Search
31 MAY 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES WPI AND CLAIMS

Documents considered relevant following a search in respect of Claims :-
1-21

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P: Document published on or after the declared priority date but before the filing date of the present application.

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Category	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

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