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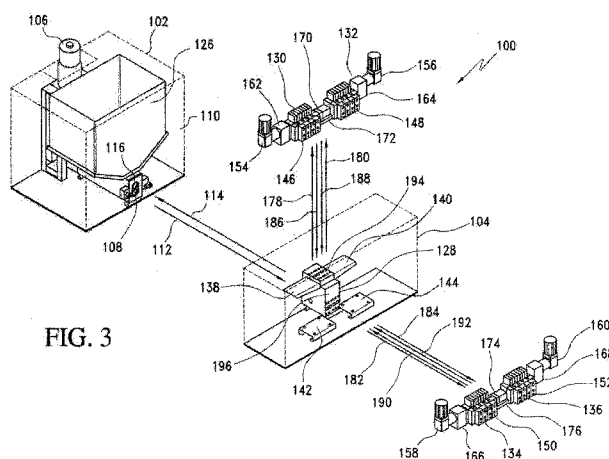
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(54) Title: MODULAR SYSTEM FOR THE DELIVERY OF HOT MELT ADHESIVE OR OTHER THERMOPLASTIC MATERIALS



(57) Abstract: A modular system (100), for delivering hot melt adhesive or other thermoplastic materials, comprises a modular metering assembly (104), having a plurality of metering stations disposed therein, which is able to be attachably and detachably mounted upon a modular tank (102) or supply assembly. Alternatively, one or more of the plurality of metering stations may be disposed externally of the modular metering assembly, and alternatively still further, one or more additional modular metering assemblies may be attachably and detachably connected to the first modular metering assembly. In this manner, the entire modular system exhibits enhanced versatility and flexibility in order to effectively implement different material application procedures that may be required by means of a particular end-user customer.



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**MODULAR SYSTEM FOR THE DELIVERY OF HOT MELT**  
**ADHESIVE OR OTHER THERMOPLASTIC MATERIALS**

**FIELD OF THE INVENTION**

5           The present invention relates generally to hot melt adhesive or other thermoplastic material dispensing systems, and more particularly to a new and improved modular system for the delivery of hot melt adhesive or other thermoplastic materials wherein, for example, a  
10 modular metering assembly, having a plurality of hot melt adhesive or other thermoplastic material metering stations contained internally therewithin, is able to be attachably and detachably mounted upon, and operatively and fluidically connected to, a modular hot melt adhesive or  
15 other thermoplastic material tank or supply assembly. Alternatively, one or more of the plurality of hot melt adhesive or other thermoplastic material metering stations may be disposed externally of, and yet operatively and fluidically connected in an attachable and detachable  
20 manner, to and from the modular metering assembly, and alternatively still further, one or more additional modular metering assemblies may be operatively and fluidically connected, in an attachable and detachable manner, to and from the original modular metering  
25 assembly. In this manner, the entire modular system exhibits enhanced versatility and flexibility in order to effectively accommodate, or permit implementation of, various or different hot melt adhesive or other thermoplastic material deposition or application  
30 procedures that may be required by means of a particular end-user or customer.

**BACKGROUND OF THE INVENTION**

In connection with the delivery of hot melt adhesive or other thermoplastic materials for use in implementing various or different hot melt adhesive or other thermoplastic material deposition or application procedures, conventional practices have dictated that depending upon, or as a function of, particular predetermined application requirements or parameters, a particularly or specifically structured system be designed, manufactured, and installed. As can therefore be readily appreciated, when considered from a somewhat opposite or reverse point of view or perspective, and as is well known in the industry, different deposition or application procedures require different structural systems to be designed, manufactured, purchased, and installed. For example, different deposition or application procedures may require differently sized hot melt adhesive or other thermoplastic material supply units or tanks. Alternatively, different deposition or application procedures, comprising, for example, different output material volume parameters or requirements, may dictate or require the use or employment of different hot melt adhesive or other thermoplastic material metering pump assemblies. Alternatively, still further, different deposition or application procedures, comprising, for example, the minimalization of pressure losses, or the optimalization of pressure values, occurring within the various fluid flow lines or conduits comprising the entire hot melt adhesive or other thermoplastic delivery system, may dictate or require that the hot melt adhesive or other thermoplastic material metering pump assemblies and their applicators be disposed or located relatively close to the

hot melt adhesive or other thermoplastic material supply units or tanks.

Still yet further, spatial or logistic parameters characteristic of a particular plant or manufacturing facility, that is, for example, the particular product manufacturing or production lines, may dictate or require that the hot melt adhesive or other thermoplastic material metering pump assemblies and their applicators be disposed or located remotely from the hot melt adhesive or other thermoplastic material supply units or tanks.

Accordingly, it can be readily appreciated that if various hot melt adhesive or other thermoplastic material delivery systems are to be erected or installed within particular manufacturing facilities in connection with various production lines for implementing various or different hot melt adhesive or other thermoplastic material deposition or application procedures, it is prohibitively expensive to in fact incorporate such a variety of delivery systems within any one manufacturing plant or facility, or considered from an alternative point of view or perspective, different manufacturing plants or facilities would have to be erected in order to in fact accommodate such a variety of delivery systems. Alternatively, still further, while a particular delivery system could effectively be converted from one type of delivery system to another type of delivery system, again, the costs involved in connection with such conversion procedures would effectively prevent the same from being economically viable.

A need therefore exists in the art for a new and improved system for the delivery of hot melt adhesive or other thermoplastic materials, wherein the delivery system

would be flexible and versatile as a result, for example, of the interchange or exchange of various components within the system, or as a result of the operative extension of the delivery system, whereby various  
5 different deposition or application procedures, having or characterized by means of various different operational parameters or requirements, can be readily achieved without the necessity of constructing or erecting a multitude of various different fixed or permanent delivery  
10 systems.

#### **SUMMARY OF THE INVENTION**

The foregoing and other objectives are achieved in accordance with the teachings and principles of the  
15 present invention through the provision of a new and improved modular system for the delivery of hot melt adhesive or other thermoplastic materials wherein, for example, a modular metering assembly, having a plurality of hot melt adhesive or other thermoplastic material  
20 metering stations contained internally therewithin, is able to be attachably and detachably mounted upon, and operatively and fluidically connected to, a modular hot melt adhesive or other thermoplastic material tank or supply assembly. Alternatively, one or more of the  
25 plurality of hot melt adhesive or other thermoplastic material metering stations may be disposed externally of, and yet operatively and fluidically connected in an attachable and detachable manner, to and from the modular metering assembly, and alternatively still further, one or  
30 more additional modular metering assemblies may be operatively and fluidically connected, in an attachable and detachable manner, to and from the first or original

modular metering assembly. In this manner, the entire modular system exhibits enhanced versatility and flexibility in order to effectively accommodate, or permit implementation of, various or different hot melt adhesive or other thermoplastic material deposition or application procedures that may be required by means of a particular end-user or customer.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Various other features and attendant advantages of the present invention will be more fully appreciated from the following detailed description when considered in connection with the accompanying drawings in which like reference characters designate like or corresponding parts throughout the several views, and wherein:

**FIGURE 1** is a perspective view of a first embodiment of a new and improved modular system, for the delivery of hot melt adhesive or other thermoplastic materials, as constructed in accordance with the principles and teachings of the present invention, and showing the cooperative parts thereof, wherein the modular metering assembly is independent of, and located remotely from, the modular tank assembly;

**FIGURE 2** is a perspective view, similar to that of **FIGURE 1**, showing, however, a second embodiment of a new and improved modular system, for the delivery of hot melt adhesive or other thermoplastic materials, and also constructed in accordance with the principles and teachings of the present invention, wherein the modular metering assembly is fixedly attached to, and effectively

forms an integral assembly with, the modular tank assembly;

**FIGURE 3** is a perspective view, similar to, and corresponding to that of **FIGURE 1**, showing, however, the internal components of the modular tank assembly and the internal components of the modular metering assembly with some of the internal components of the modular metering assembly illustrated in an exploded format for clarity purposes;

**FIGURE 4** is a side elevational view of the distribution manifold of the modular metering assembly, schematically showing the mounting of some of the metering station metering interfaces upon the upper and front wall members of the distribution manifold as well as some of the fluid conduits defined internally within the distribution manifold for supplying the hot melt adhesive or other thermoplastic material into and out from the distribution manifold;

**FIGURE 4a** is a cross-sectional view of the distribution manifold as illustrated within **FIGURE 4** and as taken along lines **4a-4a** of **FIGURE 4**;

**FIGURE 4b** is a cross-sectional view of the distribution manifold as illustrated within **FIGURE 4a** and as taken along lines **4b-4b** of **FIGURE 4a**;

**FIGURE 4c** is a cross-sectional view of the distribution manifold as illustrated within **FIGURE 4a** and as taken along lines **4c-4c** of **FIGURE 4a**;

**FIGURE 5** is a cross-sectional view of the integral modular tank assembly-modular metering assembly entity as illustrated within **FIGURE 2** and as taken along the lines **5-5** of **FIGURE 2**;



**FIGURE 6** is a partial perspective view of the hot melt adhesive or other thermoplastic material collector housing, the distribution manifold, and a rotary clamping fastener assembly mounted upon the hot melt adhesive or other thermoplastic material collector and the distribution manifold for attachably and detachably mounting the distribution manifold upon the hot melt adhesive or other thermoplastic material collector housing, wherein the rotary clamping fastener assemblies are illustrated as being disposed at their unlocked positions such that distribution manifold can be detached from the hot melt adhesive or other thermoplastic material collector housing;

**FIGURE 7** is a partial perspective view, similar to that of **FIGURE 6**, showing, however, one of the rotary clamping fastener assemblies disposed at its locked position such that the distribution manifold is able to be fixedly attached to the hot melt adhesive or other thermoplastic material collector housing;

**FIGURE 8** is a cross-sectional view, similar to that of **FIGURE 5**, showing, however, a third embodiment of a new and improved modular system, for the delivery of hot melt adhesive or other thermoplastic materials, and also constructed in accordance with the principles and teachings of the present invention, wherein the modular metering assembly is fixedly attached to, and effectively forms an integral assembly with a modular pump assembly, the modular tank assembly being separate, and located at a remote location, from the modular pump assembly;

**FIGURE 9** is a perspective view, similar to that of **FIGURE 3**, showing, however, a fourth embodiment of a new and improved modular system, for the delivery of hot melt

adhesive or other thermoplastic materials, and also constructed in accordance with the principles and teachings of the present invention, wherein one, or more, or all of the plurality, of metering stations is or are in fact located externally of, and remote from, the modular metering assembly and the distribution manifold disposed therein; and

**FIGURE 10** is a perspective view, similar to those of **FIGURES 1** and **9**, showing, however, a fifth embodiment of a new and improved modular system, for the delivery of hot melt adhesive or other thermoplastic material, and also constructed in accordance with the principles and teachings of the present invention, wherein one or more additional modular metering assemblies can be located remote from and serially connected to the original or first modular metering assembly and the distribution manifold disposed therein.

#### **DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS**

Referring now to the drawings, and more particularly to **FIGURE 1** thereof, a first embodiment of a new and improved modular system, for the delivery of hot melt adhesive or other thermoplastic materials, is disclosed and is generally indicated by the reference character 100. More particularly, it is seen that the new and improved modular delivery system 100 comprises a modular tank assembly 102 within which a supply of hot melt adhesive or other thermoplastic material is melted and stored, and a modular metering assembly 104 within which a plurality of metering stations, each comprising a plurality of metering gear pumps as will be disclosed more fully hereinafter,

are disposed for outputting predetermined or precisely metered amounts of the hot melt adhesive or other thermoplastic materials. In accordance with additional structural features characteristic of the new and improved modular system 100 for delivering hot melt adhesive or other thermoplastic materials, it is further seen that the modular tank assembly 102 comprises a primary pump 106 which pressurizes the hot melt adhesive or other thermoplastic material, contained within the modular tank assembly 102, to a predetermined constant pressure value, and that the pressurized hot melt adhesive or other thermoplastic material is then supplied, at variable volume rates to the modular metering assembly 104 depending upon or as a function of the demand of the plurality of metering gear pumps disposed within the modular metering assembly 104, by means of a fluid supply outlet port 108, defined within a front wall member 110 of the modular tank assembly 102, and a fluid supply conduit 112 which may comprise a suitable heated hose. Unused hot melt adhesive or thermoplastic material is returned to the modular tank assembly 102, from the modular metering assembly 104, by means of a fluid return conduit 114 and a fluid return inlet port 116 also defined within the front wall member 110 of the modular tank assembly 102.

It can therefore be appreciated that, in accordance with the principles and teachings of this first embodiment of the present invention, the modular metering assembly 104 is independent of, and can be remotely located at various distances from, the modular tank assembly 102 as defined, for example, by means of various, predetermined length dimensions of the fluid supply and fluid return conduits 112, 114. In addition, it is seen that the front

wall member 118 of the modular metering assembly 104 is provided, for example, with sixteen fluid supply outlet ports 120, wherein the sixteen fluid supply outlet ports 120 are arranged in four sets or arrays, with each set or array of the fluid supply outlet ports 120 comprising four individual fluid supply outlet ports 120. As will become more apparent hereinafter, the outputs of the plurality of metering gear pumps, comprising the plurality of metering stations disposed within the modular metering assembly 104, are fluidically connected to the plurality of fluid supply outlet ports 120, and a plurality of applicator hoses, schematically shown at 122, may be respectively fluidically connected to the plurality of fluid supply outlet ports 120 so as to in fact supply the predetermined or precisely metered amounts of the hot melt adhesive or other thermoplastic materials to hot melt adhesive or thermoplastic material applicator heads.

With reference now being made to **FIGURE 2**, a second embodiment of a new and improved modular system, for delivering hot melt adhesive or other thermoplastic materials, is disclosed and is generally indicated by the reference character 200. It is to be appreciated that this second embodiment modular system 200 is substantially similar to the first embodiment modular system 100 as disclosed within **FIGURE 1**, except as will be discussed hereinafter, and therefore a detailed discussion of the second embodiment modular system 200 will be omitted for brevity purposes, the disclosure and description of the same being confined substantially to the differences between the first and second embodiment modular systems 100, 200. In addition, it is also noted that in view of the similarity between the first and second embodiment

modular systems 100,200, component parts of the second embodiment modular system 200 which correspond to component parts of the first embodiment modular system 100 will be designated by corresponding reference characters except for the fact that they will be within the 200 series. More particularly, one of the differences between the first and second embodiment modular systems 100,200 resides in the fact that, in accordance with the principles and teachings of the second embodiment modular system 200, the modular metering assembly 204 has been fixedly attached to the modular tank assembly 202 in order to effectively form a single integral unit. Cooperative fastener means, which will be disclosed hereinafter, are mounted upon the front wall member 210 of the modular tank assembly 202 and upon the rear wall member 224 of the modular metering assembly 204 so as to in fact attachably and detachably secure the modular metering assembly 204 to the modular tank assembly 202. In addition, as a result of such attachment of the modular metering assembly 204 to the modular tank assembly 202, and the formation of the aforementioned integral entity, the fluid supply and fluid return conduits 112,114, characteristic of the first embodiment modular system 100 and utilized to fluidically interconnect the modular tank assembly 102 to the modular metering assembly 104, are able to be eliminated.

With reference now being made to **FIGURE 3**, and effectively reverting back to, or considered in conjunction with, **FIGURE 1** disclosing the first embodiment modular system 100, the internal structural details of the modular tank assembly 102 and of the modular metering assembly 104 will now be discussed. More particularly, it is seen that the modular tank assembly 102 has disposed

therein a hot melt adhesive or other thermoplastic material reservoir or hopper 126 within which a supply of the hot melt adhesive or other thermoplastic material is melted and maintained at a predeterminedly desired

5 temperature level and viscosity. The primary pump 106 receives the hot melt adhesive or other thermoplastic material from the hot melt adhesive or other thermoplastic material reservoir or hopper 126, pressurizes the material to a predetermined pressure value, and conveys the same

10 toward the modular metering assembly 104 through means of the fluid supply conduit 112. As can also be readily appreciated from **FIGURE 3**, the modular metering assembly 104 has a distribution manifold 128 disposed internally thereof, and the distribution manifold 128 has a plurality

15 of metering stations, such as, for example, four metering stations 130, 132, 134, 136, fixedly mounted thereon and operatively or fluidically connected thereto. While the four metering stations 130, 132, 134, 136 are illustrated as being disposed externally of the modular metering assembly

20 104, it is to be understood and appreciated that the four metering stations 130, 132, 134, 136 are, in effect, being simply illustrated in an exploded format with respect to the modular metering assembly 104 for illustrative purposes only and that the four metering stations

25 130, 132, 134, 136, for delivering the hot melt adhesive or other thermoplastic materials to downstream applicator heads, are, in accordance with the principles and teachings of this first embodiment of the new and improved modular system, in fact adapted to be disposed internally

30 within the modular metering assembly 104.

Accordingly, it is further seen that a plurality of mounting brackets 138, 140, 142, 144 are fixedly secured

internally within the modular metering assembly 104, and that the plurality of metering stations 130,132,134,136 are adapted to be respectfully mounted and fixedly secured thereon. Continuing still further, it is also seen that

5 each one of the plurality of metering stations 130,132,134,136 is seen to respectively comprise a set of metering gear pumps 146,148,150, 152, a drive motor 154,156,158,160 for respectively rotatably driving each set of metering gear pumps 146,148,150,152 through means

10 of a gearbox assembly 162,164,166,168, and a metering interface 170,172,174,176 for respectively providing a fluidic interface between the distribution manifold 128 and each set of metering gear pumps 146,148,150,152. In addition, it can also be appreciated that hot melt

15 adhesive or other thermoplastic material fluid supply paths 178,180,182, 184, and hot melt adhesive or other thermoplastic material fluid return paths 186,188,190,192, are respectively defined between the distribution manifold 128 and each one of the metering interfaces

20 170,172,174,176 respectively associated with each set of metering gear pumps 146,148,150,152. Still yet further, it is seen that each one of the four sets of metering gear pumps 146,148,150,152 comprises, for example, four serially arranged metering gear pumps, and therefore, the

25 total number of metering gear pumps operatively associated with and fluidically connected to the distribution manifold 128 disposed within the modular metering assembly 104 comprises sixteen metering gear pumps, the fluidic outputs of which are adapted to be fluidically connected

30 to the fluid supply outlet ports 120 defined within the front wall member 118 of the modular metering assembly 104 as disclosed within **FIGURE 1**.

It can therefore be appreciated that, in connection with the supply and return of the hot melt adhesive or other thermoplastic material, the hot melt adhesive or other thermoplastic material, disposed within the hot melt adhesive or other thermoplastic material reservoir or hopper 126, will be conveyed to the fluid supply outlet port 108, defined within the front wall member 110 of the modular tank assembly 102, by means of the primary pump 106, and the hot melt adhesive or other thermoplastic material will, in turn, be conveyed along the fluid supply conduit 112 to the distribution manifold 128 which, in turn, will convey the hot melt adhesive or other thermoplastic material to each set of metering gear pumps 146,148,150,152 by means of the hot melt adhesive or other thermoplastic material fluid supply paths 178,180,182, 184 and the metering interfaces 170,172,174,176. Conversely, hot melt adhesive or other thermoplastic material that is to be returned to the hot melt adhesive or other thermoplastic material reservoir or hopper 126 will be conveyed from each set of metering gear pumps 146,148,150,152 through means of its respective metering interface 170,172,174,176, the hot melt adhesive or other thermoplastic material fluid return paths 186,188,190,192, the distribution manifold 128, and the fluid return conduit 114.

With reference still being made to **FIGURE 3**, and with additional reference being made to **FIGURES 4-4c**, it is seen that the metering interfaces 170,172, operatively and fluidically associated with the metering stations 130,132, are adapted to be mounted upon the upper or top wall member 194 of the distribution manifold 128, and that the metering interfaces 174,176, operatively and fluidically



associated with the metering stations 134,136, are adapted to be mounted upon the front wall member 196 of the distribution manifold 128. In addition, as can best be appreciated and understood from **FIGURES 4-4c**, the

5 different hot melt adhesive or other thermoplastic material fluid supply and fluid return passageways, defined internally within the distribution manifold 128 and leading toward and away from the metering interfaces 170, 172,174,176, and the sets of metering gear pumps

10 146,148,150, 152 operatively and fluidically connected thereto, will now be disclosed and described. More particularly, as can be appreciated from **FIGURES 4, 4a, and 4c**, as well as **FIGURE 3**, the fluid supply conduit 112 fluidically connected to, and extending outwardly from,

15 the front wall member 110 of the modular tank assembly 102, is operatively and fluidically connected to a lower portion of the rear wall member 198 of the distribution manifold 128 by means of an inlet port 230. A first horizontal, longitudinally oriented fluid supply

20 passageway 232 leads internally into the distribution manifold 128 from the inlet port 230, in the direction of the fluid supply conduit 112, so as to fluidically connect to a first one of the metering interfaces 174,176 disposed upon the front wall member 196 of the distribution

25 manifold 128, while a first vertically oriented fluid supply passageway 234, fluidically connected to or intersecting the first horizontal fluid supply passageway 232, fluidically connects to a first one of the metering interfaces 170,172 disposed upon the upper or top wall

30 member of the distribution manifold 128.

In addition, a second horizontal, transversely oriented fluid supply passageway 236, as seen in **FIGURE 4**,

fluidically interconnects the first horizontal fluid supply passageway 232 to a third horizontal fluid supply passageway 238, which extends substantially parallel to the first horizontal fluid supply passageway 232 and is  
5 seen in **FIGURE 4a**, so as to provide hot melt adhesive or other thermoplastic material to a second one of the metering interfaces 174,176 disposed upon the front wall member 196 of the distribution manifold 128, while a second vertically oriented fluid supply passageway 240,  
10 disposed substantially parallel to the first vertically oriented fluid passageway 234, is fluidically connected to or intersects the third horizontal fluid supply passageway 238 so as to provide hot melt adhesive or other thermoplastic material to the second one of the metering  
15 interfaces 170,172 disposed upon the upper or top wall member 194 of the distribution manifold 128. After being conducted along the first and second vertically oriented fluid supply passageways 234,240, the hot melt adhesive or other thermoplastic material will effectively be conducted  
20 along the fluid supply paths 178,180, which are also schematically illustrated within **FIGURE 3**, so as to respectively enter into the metering interfaces 170,172 from which the hot melt adhesive or other thermoplastic material will then be supplied to the metering gear pumps  
25 146,148 of the metering stations 130,132. Similar fluid flow paths are of course provided in connection with the supply of the hot melt adhesive or other thermoplastic material to the metering interfaces 174,176 and the metering gear pumps 150,152 of the metering stations  
30 134,136.

In connection with the return of the hot melt adhesive or other thermoplastic material from the metering

stations 130,132,134,136 back to the hot melt adhesive or other thermoplastic reservoir or storage tank 126 of the modular tank assembly 102, through means of the distribution manifold 128, reference to **FIGURES 4, 4a, and**  
5 **4b**, as well as to **FIGURE 3**, illustrates that, in a similar manner to the supply of the hot melt adhesive or other thermoplastic material to the distribution manifold 128, the distribution manifold 128 is provided with various internal fluid passageways so as to fluidically  
10 interconnect the metering interfaces 170,172,174,176 of the metering stations 130,132,134,136 to the fluid return conduit 114. More particularly, it is seen that the fluid return conduit 114 is fluidically connected to, and extends outwardly from, the rear wall member 198 of the  
15 distribution manifold 128, through means of a fluid outlet port 242, so as to fluidically mate with the fluid return inlet port 116 of the modular tank assembly 102. A first vertically oriented fluid return passageway 244 extends downwardly within the distribution manifold 128 from a  
20 first one of the metering interfaces 170,172 disposed upon the upper or top wall member 194 of the distribution manifold 128, and a first horizontal, longitudinally oriented fluid return passageway 246 extends inwardly within the distribution manifold 128 from a first one of  
25 the metering interfaces 174,176 disposed upon the front wall member 196 of the distribution manifold.

The first vertically oriented fluid return passageway 244 and the first horizontal, longitudinally oriented fluid return passageway 246 fluidically intersect or merge  
30 into a second horizontally oriented fluid return passageway 248 which is fluidically connected to the fluid outlet port 242, and as can best be seen from **FIGURE 4a**, a

second vertically oriented fluid return passageway 250, operatively and fluidically connected to a second one of the metering interfaces 170,172, is also provided internally within the distribution manifold 128 so as to  
5 extend substantially parallel to the first vertically oriented fluid return passageway 244 and to be fluidically connected to the second horizontally oriented fluid return passageway 248 leading to the fluid outlet port 242. In addition, a third horizontally oriented fluid return  
10 passageway 252 is provided for fluidically connecting the second one of the metering interfaces 174,176 to the second horizontally oriented fluid return passageway 248 and the fluid outlet port 242, and in this manner, return hot melt adhesive or other thermoplastic material is able  
15 to be returned to the hot melt adhesive or other thermoplastic material reservoir or hopper, from the metering stations 130,132, 134,136, along the fluid return paths 186,188,190,192, the distribution manifold 128, and the fluid return conduit 114.

20 It is to be noted further that in connection with the plurality of supply and return fluidic interfaces defined, for example, between the plurality of metering interfaces 170,172,174,176 and the distribution manifold 128, as well as the fluidic interface defined, for example, between the  
25 fluid supply conduit 112 and the distribution manifold 128, and the fluidic interface defined, for example, between the fluid return conduit 114 and the distribution manifold 128, a pair of oppositely disposed check valves are respectively incorporated within the distribution  
30 manifold 128 and the plurality of metering interfaces 170,172,174,176, at the junctions of such components, as illustrated at 254,256 in **FIGURE 4b**, and in a similar

manner, a pair of oppositely disposed check valves are respectively incorporated within the distribution manifold 128 and the fluid supply and fluid return conduits 112, 114, at the junctions of such components, as illustrated  
5 at 258,260 in **FIGURES 4c** and **4b**, although it is noted that only the check valves incorporated within the distribution manifold 128 are illustrated. As a result of the presence of such oppositely disposed check valves 254,256,258,260, the various structural components are able to be separated  
10 from each other without any inadvertent discharge or leakage of the hot melt adhesive or other thermoplastic material across the noted interfaces. It is also noted that in connection with, for example, the fluid supply and return conduits 112,114, such conduits 112,114 may be  
15 readily and easily attachably and detachably connected to the distribution manifold 128 and the modular tank assembly 102 by means of suitable threaded fittings or the like.

With reference now being made to **FIGURE 5**, and  
20 effectively reverting back to, or considered in conjunction with, **FIGURE 2** disclosing the second embodiment modular system 200, additional internal structural details of the modular tank assembly 202, and its operative and fluidic connection to the modular  
25 metering assembly 204, will now be discussed. More particularly, it is seen that the modular tank assembly 202 has the primary pump 206 and a hot melt adhesive or other thermoplastic material reservoir or hopper 226, similar to the hot melt adhesive or other thermoplastic  
30 material reservoir or hopper 126, disposed therein, and that the modular metering assembly 204 has a distribution manifold 228, similar to the distribution manifold 128,

disposed therein. The hot melt adhesive or other thermoplastic material reservoir or hopper 226 contains a supply of hot melt adhesive or other thermoplastic material 262 therewithin, and the lower end or bottom  
5 portion of the hot melt adhesive or other thermoplastic material reservoir or hopper 226 is effectively apertured, as at 264, so as to permit the melted hot melt adhesive or other thermoplastic material 262 to discharge into a horizontally oriented collection passageway 266 which is  
10 fluidically connected to a pump supply passageway 268 which leads to the inlet end of the primary pump 206. The primary pump 206 then outputs the hot melt adhesive or other thermoplastic material 262 to its pump outlet passageway 270 whereby the hot melt adhesive or other  
15 thermoplastic material 262 then passes through a strainer-filter member 272 so as to remove unwanted or undesirable particles or impurities there-from.

After passing through the strainer-filter member 272, the hot melt adhesive or other thermoplastic material 262  
20 then enters a first horizontally oriented output passageway 274, which is formed within the lower region of the primary pump housing 276, and a second horizontally oriented output passageway 278 which is formed within the base region or lower collector housing portion 279 of the  
25 reservoir or hopper 226 and which is fluidically connected to the distribution manifold 228 through means of a pair of oppositely disposed check valves 280 which may be similar to the aforementioned check valves 258. The hot melt adhesive or other thermoplastic material 262 is then  
30 conducted through a vertically oriented supply passageway 282, which may be similar to either one of the vertically oriented supply passageways 234, 240, so as to be

conducted along a fluid supply path 284, which may be similar to either one of the fluid supply paths 178,180, leading to metering interfaces similar to the metering interfaces 170,172. In a similar manner, hot melt  
5 adhesive or other thermoplastic material 262 can be returned, from the metering interfaces, to the collection passageway 226 along a fluid return path 286, which may be similar to either one of the fluid return paths 186,188, a vertically oriented return passageway 288 which may be  
10 similar to either one of the vertically oriented passageways 244, 250, and a pair of oppositely disposed check valves 290 which may be similar to the aforementioned check valves 260.

Continuing further, in order to fixedly secure  
15 together the distribution manifold 228 and the lower collector housing portion 279 of the reservoir or hopper 226, in an attachable and detachable manner, suitable fastener assemblies, such as, for example, a pair of rotary clamping fastener assemblies may be utilized. More  
20 particularly, as can best be seen in **FIGURE 6**, each one of the pair of rotary clamping fastener assemblies comprises a pair of mounting blocks 292, 292, which are fixedly mounted upon opposite sides of the lower collector housing portion 279 of the reservoir or hopper 226, and a pair of  
25 clamping brackets, only one of which is visible as at 294, mounted upon opposite sides of the distribution manifold 228. Each one of the clamping brackets 294 has a substantially C-shaped cross-sectional configuration, and each one of the mounting blocks 292,292 is internally  
30 threaded so as to respectively receive an externally threaded adjustment or tightening screw 296,296.

A rotary or pivotal clamping member 298 is freely rotatably mounted upon each one of the adjustment or tightening screws 296, and accordingly, when the distribution manifold 228 is to be fixedly mounted upon and connected to the lower collector housing portion 279 of the reservoir or hopper 226, the clamping members 298,298 are initially disposed at their unlocked position as illustrated within **FIGURE 6**. The lower collector housing portion 279 of the reservoir or hopper 226, with the mounting blocks 292,292 and the clamping members 298,298 mounted thereon, is then, in effect, moved in a direction parallel to the longitudinal axes of the adjustment or tightening screws 296,296 such that the enlarged portions of the clamping members 298,298 pass through the C-shaped clamping brackets 294. After effectively clearing the C-shaped clamping brackets 294, the clamping members 298,298 are then rotated or pivoted around the adjustment or tightening screws 296,296 through means of an angular extent of 180°, and subsequently, the adjustment or tightening screws 296,296 are tightened so as to cause the projecting lug portions of the clamping members 298,298 to respectively tightly engage the clamping brackets 294 thereby causing the lower collector housing portion 279 of the reservoir or hopper 226 and the distribution manifold 228 to be tightly engaged with each other.

With reference now being made to **FIGURE 8**, a third embodiment of a new and improved modular system for the delivery of hot melt adhesive or other thermoplastic materials, constructed in accordance with the principles and teachings of the present invention, and similar to the second embodiment modular system 200 as disclosed within



**FIGURES 2** and **5**, except as will be noted hereinafter, is disclosed and is generally indicated by the reference character 300. It is to be appreciated that in view of the fact that this third embodiment modular system 300 is similar to the second embodiment modular system 200 as disclosed within **FIGURES 2** and **5**, a detailed discussion of the third embodiment modular system 300 will be omitted for brevity purposes, the disclosure and description of the same being confined substantially to the differences between the second and third embodiment modular systems 200,300. In addition, it is also noted that in view of the similarity between the second and third embodiment modular systems 200,300, component parts of the third embodiment modular system 300 which correspond to component parts of the second embodiment modular system 200 will be designated by corresponding reference characters except that they will be within the 300 series. More particularly, one of the differences between the second and third embodiment modular systems 200,300 resides in the fact that, in accordance with the principles and teachings of the third embodiment modular system 300, the hot melt adhesive or other thermoplastic reservoir tank or hopper, and its operatively associated collector housing portion, as respectively disclosed at 226 and 279 within **FIGURE 5**, have effectively been eliminated, and therefore, in lieu of the modular tank assembly 202, characteristic of the second embodiment modular system 200, the third embodiment modular system 300 comprises a modular pump or supply assembly 303 within which the primary pump 306, and its strainer-filter member 372, are located. Still further, it is also to be appreciated that in accordance with the principles and

teachings of the third embodiment modular system 300, the modular metering assembly 304 is fixedly attached directly to, and effectively forms an integral assembly with the modular pump assembly 303, and that the modular tank  
5 assembly, not shown, now comprises a separate modular entity which may be located at a location remote from the modular pump assembly. Accordingly, the modularity concepts, inter-changeability of component parts depending upon, or as a function of, the various needs or  
10 requirements of the end-user or customer, are therefore enhanced still further.

With reference now being made to **FIGURE 9**, a fourth embodiment of a new and improved modular system for the delivery of hot melt adhesive or other thermoplastic  
15 materials, constructed in accordance with the principles and teachings of the present invention, and similar to the first embodiment modular system 100 as disclosed within **FIGURES 1** and **3**, except as will be noted hereinafter, is disclosed and is generally indicated by the reference  
20 character 400. It is to be appreciated that in view of the fact that this fourth embodiment modular system 400 is similar to the first embodiment modular system 100 as disclosed within **FIGURES 1** and **3**, a detailed discussion of the fourth embodiment modular system 400 will be omitted  
25 for brevity purposes, the disclosure and description of the same being confined substantially to the differences between the fourth and first embodiment modular systems 400,100. In addition, it is also noted that in view of the similarity between the fourth and first embodiment  
30 modular systems 400,100, component parts of the fourth embodiment modular system 400 which correspond to component parts of the first embodiment modular system 100

will be designated by corresponding reference characters except that they will be within the 400 series.

More particularly, one of the differences between the fourth and first embodiment modular systems 400,100  
5 resides in the fact that, in accordance with the principles and teachings of the fourth embodiment modular system 400, one or more, or all, of the plurality of metering stations, such as, for example, the metering station 434, which may be similar to the metering station  
10 134 of the first embodiment modular system 100 as disclosed within **FIGURE 3**, can in fact be located externally of, and remote from, the modular metering assembly 404. In connection with the external disposition of the metering station 434 with respect to the modular  
15 metering assembly 404, and the distribution manifold disposed internally thereof but not illustrated within **FIGURE 9**, the plurality of metering gear pumps of the other metering stations, disposed internally within the modular metering assembly 404 but also not illustrated  
20 within **FIGURE 9**, will function in a manner similar to the metering stations 130,132,136 of the modular metering assembly 104 as illustrated within **FIGURE 3** wherein such internally disposed metering stations of the modular metering assembly 404 will have their fluid outputs  
25 respectively fluidically conducted to the fluid supply outlet ports 420 defined within the front wall member 418 of the modular metering assembly 404. In this manner, a plurality of applicator hoses 422 can be respectively fluidically connected to the plurality of fluid supply  
30 outlet ports 420 for conducting the hot melt adhesive or other thermoplastic material to applicator heads or the like.

However, since, for example, the metering station 434 is disposed externally of, and remote from, the modular metering assembly 404, the fluid supply outlet ports, which would normally be defined within the front wall member 418 of the modular metering assembly 404 as a result of being respectfully fluidically connected to and associated with the metering gear pump outputs of the metering station 434, are not in fact defined or provided within the front wall member 418 of the modular metering assembly 404, but, to the contrary, the hot melt adhesive or other thermoplastic material will be routed internally within the distribution manifold disposed within the modular metering assembly 404 and outputted to the externally and remotely located metering station 434 from an outlet supply port 421 defined within the front wall member 418 of the modular metering assembly 404 and conducted along a hot melt adhesive or other thermoplastic material fluid supply path 482 which is similar to the hot melt adhesive or other thermoplastic material fluid supply path 182 as disclosed within **FIGURE 3** and which also may be similar in structure to the fluid supply conduit 412. In a similar manner, hot melt adhesive or other thermoplastic material, being conducted from the external, remote metering station 434 back to the modular metering assembly 404 and the distribution manifold disposed therewithin, will be conducted along a hot melt adhesive or other thermoplastic material fluid return path 490 which is similar to the hot melt adhesive or other thermoplastic material fluid return path 190 as disclosed within **FIGURE 3**, for entry into an inlet return port 423 defined within the front wall member 418 of the modular metering assembly 404 so as to be conducted back to the

distribution manifold disposed within the modular metering assembly 404, and which may be similar in structure to the fluid return conduit 414.

With reference lastly being made to **FIGURE 10**, a  
5 fifth embodiment of a new and improved modular system for the delivery of hot melt adhesive or other thermoplastic materials, constructed in accordance with the principles and teachings of the present invention, and similar to the first and fourth embodiment modular systems 100,400 as  
10 disclosed within **FIGURES 1** and **3**, and **9**, except as will be noted hereinafter, is disclosed and is generally indicated by the reference character 500. It is to be appreciated that in view of the fact that this fifth embodiment modular system 500 is similar to the first and fourth  
15 embodiment modular systems 100,400 as disclosed within **FIGURES 1** and **3**, and **9**, a detailed discussion of the fifth embodiment modular system 500 will be omitted for brevity purposes, the disclosure and description of the same being confined substantially to the differences between the  
20 fifth and first or fourth embodiment modular systems 500,100,400. In addition, it is also noted that in view of the similarity between the fifth and first or fourth embodiment modular systems 500,100,400, component parts of the fifth embodiment modular system 500 which correspond  
25 to component parts of the first or fourth embodiment modular system 100,400 will be designated by corresponding reference characters except that they will be within the 500 series.

More particularly, one of the differences between the  
30 fifth and first or fourth embodiment modular systems 500, 100,400 resides in the fact that, in lieu of all of the metering stations 130,132,134, 136 being located

internally within the modular metering assembly 104 as disclosed within the first embodiment modular system 100 as disclosed within **FIGURES 1 and 3**, and in lieu of one or more of the metering stations being located externally of the modular metering assembly 404 as has been disclosed within the fourth embodiment modular system 400 as illustrated at 434 in **FIGURE 9**, in accordance with the principles and teachings of the fifth embodiment modular system 500, one or more, but not all, of the metering stations, similar to the metering stations 130,132, 136 located internally within the modular metering assembly 104 of the first embodiment modular system 100 as disclosed within **FIGURES 1 and 3**, may, for example, be similarly located internally within the modular metering assembly 504, while concomitantly, for example, one or more of the metering stations, similar to the metering station 434 operatively and fluidically connected to the modular metering assembly 404 of the fourth embodiment modular system 400 as disclosed within **FIGURE 9**, may effectively be removed from the modular metering assembly 504 and replaced by, for example, a second modular metering assembly 505, which internally houses a second set or array of metering stations, not shown but similar to the first set or array of metering stations 130,132,134,136 disposed internally within the first modular metering assembly 504, such that the first and second modular metering assemblies 504,505 are fluidically connected together in a serial manner.

More specifically, in view of the fact that, for example, the metering station, normally disposed internally within the modular metering assembly 504 and similar to, for example, the metering station 134 or 434,

has effectively been replaced by means of the second modular metering assembly 505 which is located externally of, and remote from, the first modular metering assembly 504, the fluid supply outlet ports, which would normally be defined within the front wall member 518 of the first modular metering assembly 504 as a result of being respectfully fluidically connected to and associated with the metering gear pump outputs of the metering station 134 or 434, are not in fact defined or provided within the front wall member 518 of the first modular metering assembly 504, but, to the contrary, the hot melt adhesive or other thermoplastic material will be routed internally within the distribution manifold disposed within the first modular metering assembly 504 and outputted to the externally and remotely located second modular metering assembly 505 from a fluid supply outlet port 509, similar to fluid supply outlet port 508, defined within the front wall member 518 of the first modular metering assembly 504 and conducted along a fluid supply conduit 513 similar to the fluid supply conduit 512. In a similar manner, hot melt adhesive or other thermoplastic material, being conducted from the second modular metering assembly 505 back to the first modular metering assembly 504 and the distribution manifold disposed therewithin, will be conducted along a fluid return conduit 515, similar to the fluid return conduit 514, for entry into a fluid return inlet port 517, similar to fluid return inlet port 516, also defined within the front wall member 518 of the first modular metering assembly 504 so as to be conducted back to the distribution manifold disposed within the first modular metering assembly 504. Still yet further, it is also to be appreciated that a plurality of fluid supply

outlet ports 521, similar to the fluid supply outlet ports 120,420, are defined within the front wall member 519 of the second modular metering assembly 505, and that a plurality of applicator hoses 523, similar to the applicator hoses 122,422, are adapted to be respectively fluidically connected to the plurality of fluid supply outlet ports 521. In this manner, in accordance with the principles and teachings of the fifth embodiment modular system 500 of the present invention, it can be appreciated that a plurality of modular metering assemblies can be serially connected together, disposed at different, remote locations with respect to each other, and in turn, also permit different sets or arrays of metering stations, and their operatively associated applicators or the like, to likewise be located at different, remote locations.

Thus, it may be seen that in accordance with the principles and teachings of the present invention, a new and improved modular system for the delivery of hot melt adhesive or other thermoplastic materials has been disclosed wherein, for example, a modular metering assembly, having a plurality of hot melt adhesive or other thermoplastic material metering stations contained internally therewithin, is able to be attachably and detachably mounted upon, and operatively and fluidically connected to, a modular hot melt adhesive or other thermoplastic material tank or supply assembly. Alternatively, one or more of the plurality of hot melt adhesive or other thermoplastic material metering stations may be disposed externally of, and yet operatively and fluidically connected in an attachable and detachable manner, to and from the modular metering assembly, and alternatively still further, one or more additional



modular metering assemblies may be operatively and fluidically connected, in an attachable and detachable manner, to and from the first or original modular metering assembly. In this manner, the entire modular system  
5 exhibits enhanced versatility and flexibility in order to effectively accommodate, or permit implementation of, various or different hot melt adhesive or other thermoplastic material deposition or application procedures that may be required by means of a particular  
10 end-user or customer.

Obviously, many variations and modifications of the present invention are possible in light of the above teachings. More particularly, various structural permutations and combinations of the various system  
15 components, as have been disclosed and illustrated within the aforementioned drawing figures, are also possible. For example, while all of the metering stations 130,132,134,136 of the modular metering assembly 104 have been disclosed as being located internally within its  
20 modular metering assembly 104 in accordance with the principles and teachings of the first embodiment modular system 100 as illustrated within **FIGURES 1 and 3**, while one or more of the metering stations, such as, for example, the metering station 434 of the modular metering  
25 assembly 404, have been disclosed as being located externally of its modular metering assembly 404 in accordance with the principles and teachings of the fourth embodiment modular system 400 as illustrated within **FIGURE 9**, and while one or more of the metering stations located  
30 internally within the modular metering assembly 504 have, in effect, been removed from the modular metering assembly 504 and have, in effect, been replaced by means of the

second modular metering assembly 505, it can be further appreciated or envisioned that one or more of the metering stations of a particular modular metering assembly can be located externally of such particular modular metering assembly while in addition, one or more of the other metering stations of such particular modular metering assembly can be removed from the particular modular metering assembly and be replaced by means of another serially connected modular metering assembly. It is therefore to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.

**WHAT IS CLAIMED IS:**

1. A modular system for delivering a fluid material, comprising:

5 a modular supply assembly for supplying a fluid material;

a modular metering assembly comprising a plurality of separate metering stations wherein each one of said plurality of separate metering stations comprises a  
10 plurality of metering pumps for outputting predetermined amounts of said fluid material toward a plurality of applicators; and

means for connecting said modular supply assembly, for supplying said fluid material, to said modular  
15 metering assembly, comprising said plurality of separate metering stations, in an attachable and detachable manner such that not only can said fluid material be supplied from said modular supply assembly to said plurality of metering pumps comprising said plurality of separate  
20 metering stations, but in addition, said modular supply assembly and said modular metering assembly can be readily attached and detached from each other whereby different modular assemblies and different modular metering assemblies may be readily interchangeably connected to  
25 each other in a modular manner.

2. The modular delivery system as set forth in Claim 1, wherein:

said means, for connecting said modular supply  
30 assembly to said modular metering assembly, comprises first and second fastener means respectively mounted upon wall members of said modular supply assembly and said

modular metering assembly whereby said modular supply assembly and said modular metering assembly are connected together as an integral unit.

- 5     3.     The modular delivery system as set forth in Claim 2, wherein:

          said first fastener means comprises a clamping bracket fixedly mounted upon a first one of said wall members of said modular supply assembly and said modular  
10   metering assembly; and

          said second fastener means comprises a rotary clamping member rotatably mounted upon a second one of said wall members of said modular supply assembly and said modular metering assembly so as to be movable between a  
15   first position at which said rotary clamping member is disengaged from said clamping bracket fixedly mounted upon said first one of said wall members of said modular supply assembly and said modular metering assembly, and a second position at which said rotary clamping member is engaged  
20   with said clamping bracket fixedly mounted upon said first one of said wall members of said modular supply assembly and said modular metering assembly.

4.     The modular delivery system as set forth in Claim 1,  
25   further comprising:

          a distribution manifold disposed within said modular metering assembly for distributing said fluid to said plurality of separate metering stations disposed within said modular metering assembly.

30

5.     The modular delivery system as set forth in Claim 4, wherein:

said means, for connecting said modular supply assembly to said modular metering assembly, comprises first and second fastener means respectively mounted upon wall members of said modular supply assembly and said  
5 distribution manifold of said modular metering assembly whereby said modular supply assembly and said modular metering assembly are connected together as an integral unit.

10 6. The modular delivery system as set forth in Claim 5, wherein:

said first fastener means comprises a clamping bracket fixedly mounted upon a first one of said wall members of said modular supply assembly and said  
15 distribution manifold of said modular metering assembly; and

said second fastener means comprises a rotary clamping member rotatably mounted upon a second one of said wall members of said modular supply assembly and said  
20 distribution manifold of said modular metering assembly so as to be movable between a first position at which said rotary clamping member is disengaged from said clamping bracket fixedly mounted upon said first one of said wall members of said modular supply assembly and said  
25 distribution manifold of said modular metering assembly, and a second position at which said rotary clamping member is engaged with said clamping bracket fixedly mounted upon said first one of said wall members of said modular supply assembly and said distribution manifold of said modular  
30 metering assembly.

7. The modular delivery system as set forth in Claim 1, wherein:

said means, for connecting said modular supply assembly in an attachable and detachable manner with respect to said modular metering assembly, comprises at least one fluid-conducting hose member interconnecting said modular supply assembly to said modular metering assembly.

8. The modular delivery system as set forth in Claim 7, further comprising:

oppositely disposed check valve means, disposed within opposite end portions of said at least one fluid-conducting hose member, and within port locations respectively provided within said modular supply and said modular metering assemblies, such that when either one of said opposite end portions of said at least one fluid-conducting hose member is disconnected from one of said modular supply and modular metering assemblies in order to implement the detachment of said modular supply and modular metering assemblies from each other, inadvertent leakage of said fluid material, from either one of said modular supply and modular metering assemblies, is prevented.

9. The modular delivery system as set forth in Claim 4, wherein:

said means, for fluidically connecting said modular supply assembly to said modular metering assembly in an attachable and detachable manner with respect to said modular metering assembly, comprises at least one fluid-conducting hose member interconnecting said modular supply

assembly to said distribution manifold of said modular metering assembly.

10. The modular delivery system as set forth in Claim 9,  
5 further comprising:

oppositely disposed check valve means, disposed within opposite end portions of said at least one fluid-conducting hose member, and within port locations respectively provided within said modular supply assembly  
10 and said distribution manifold of said modular metering assembly, such that when either one of said opposite end portions of said at least one fluid-conducting hose member is disconnected from one of said port locations respectively provided within said modular supply assembly  
15 and said distribution manifold of said modular metering assembly in order to implement the detachment of said modular supply and modular metering assemblies from each other, inadvertent leakage of said fluid material, from either one of said modular supply and modular metering  
20 assemblies, is prevented.

11. The modular delivery system as set forth in Claim 4, further comprising:

oppositely disposed check valve means, disposed  
25 within port locations respectively provided within said distribution manifold of said modular metering assembly and within said plurality of separate metering stations, such that when any one of said plurality of separate metering stations is disconnected from said distribution  
30 manifold, inadvertent leakage of said fluid material, from either one of said distribution manifold and said any one

of said plurality of separate metering stations, is prevented.

12. The modular delivery system as set forth in Claim 4,  
5 further comprising:

oppositely disposed check valve means, disposed within port locations respectively provided within said distribution manifold of said modular metering assembly and within said modular supply assembly, such that when  
10 said distribution manifold of said modular metering assembly and said modular supply assembly are disconnected from each other, inadvertent leakage of said fluid material, from either one of said distribution manifold and said modular supply assembly, is prevented.

15

13. The modular delivery system as set forth in Claim 1, wherein:

at least one of said plurality of separate metering stations, comprising said modular metering assembly, is  
20 disposed internally within said modular metering assembly.

14. The modular delivery system as set forth in Claim 1, wherein:

at least one of said plurality of separate metering  
25 stations, comprising said modular metering assembly, is disposed externally of said modular metering assembly.

15. The modular delivery system as set forth in Claim 14, further comprising:

30 means for fluidically connecting said at least one of said plurality of separate metering stations, disposed externally of said modular metering assembly, to said



modular metering assembly, in an attachable and detachable manner with respect to said modular metering assembly.

16. The modular delivery system as set forth in Claim 15,  
5 wherein:

said means, for fluidically connecting said at least one of said plurality of separate metering stations to said modular metering assembly, comprises at least one fluid-conducting hose member.

10

17. The modular delivery system as set forth in Claim 16, further comprising:

oppositely disposed check valve means, disposed within opposite end portions of said at least one fluid-conducting hose member, and within port locations  
15 respectively provided within said at least one of said plurality of separate metering stations and said modular metering assembly, such that when either one of said opposite end portions of said at least one fluid-conducting hose member is disconnected from one of said at  
20 least one of said plurality of separate metering stations and said modular metering assembly, inadvertent leakage of said fluid material, from either one of said at least one of said plurality of separate metering stations and said  
25 modular metering assembly, is prevented.

18. The modular delivery system as set forth in Claim 1, wherein:

said modular supply assembly comprises a modular tank  
30 assembly which has a fluid reservoir incorporated therein and a supply pump for supplying said fluid from said fluid reservoir to said modular metering assembly.

19. The modular delivery system as set forth in Claim 1, wherein:

5 said modular supply assembly comprises a modular pump assembly, adapted to be connected to a remotely located fluid reservoir, for supplying said fluid from said fluid reservoir to said modular metering assembly.

20. The modular delivery system as set forth in Claim 1, further comprising:

10 at least one additional modular metering assembly fluidically connected to said modular metering assembly and also comprising a plurality of separate metering stations wherein each one of said plurality of separate metering stations comprises a plurality of metering pumps for outputting predetermined amounts of said fluid material toward a plurality of applicators.

21. The modular delivery system as set forth in Claim 20, further comprising:

20 means for fluidically connecting said at least one additional modular metering assembly to said modular metering assembly.

22. The modular delivery system as set forth in Claim 21, wherein:

25 said means, for fluidically connecting said at least one additional modular metering assembly to said modular metering assembly, comprises at least one fluid-conducting hose member.

23. The modular delivery system as set forth in Claim 22, further comprising:

oppositely disposed check valve means, disposed within opposite end portions of said at least one fluid-conducting hose member, and within port locations respectively provided within said at least one additional modular metering assembly and said modular metering assembly, such that when either one of said opposite end portions of said at least one fluid-conducting hose member is disconnected from one of said at least one additional modular metering assembly and said modular metering assembly, inadvertent leakage of said fluid material, from either one of said at least one additional modular metering assembly and said modular metering assembly, is prevented.

24. The modular delivery system as set forth in Claim 1, wherein:

said modular system for delivering said fluid material comprises a modular system for delivering hot melt adhesive material.

1/9

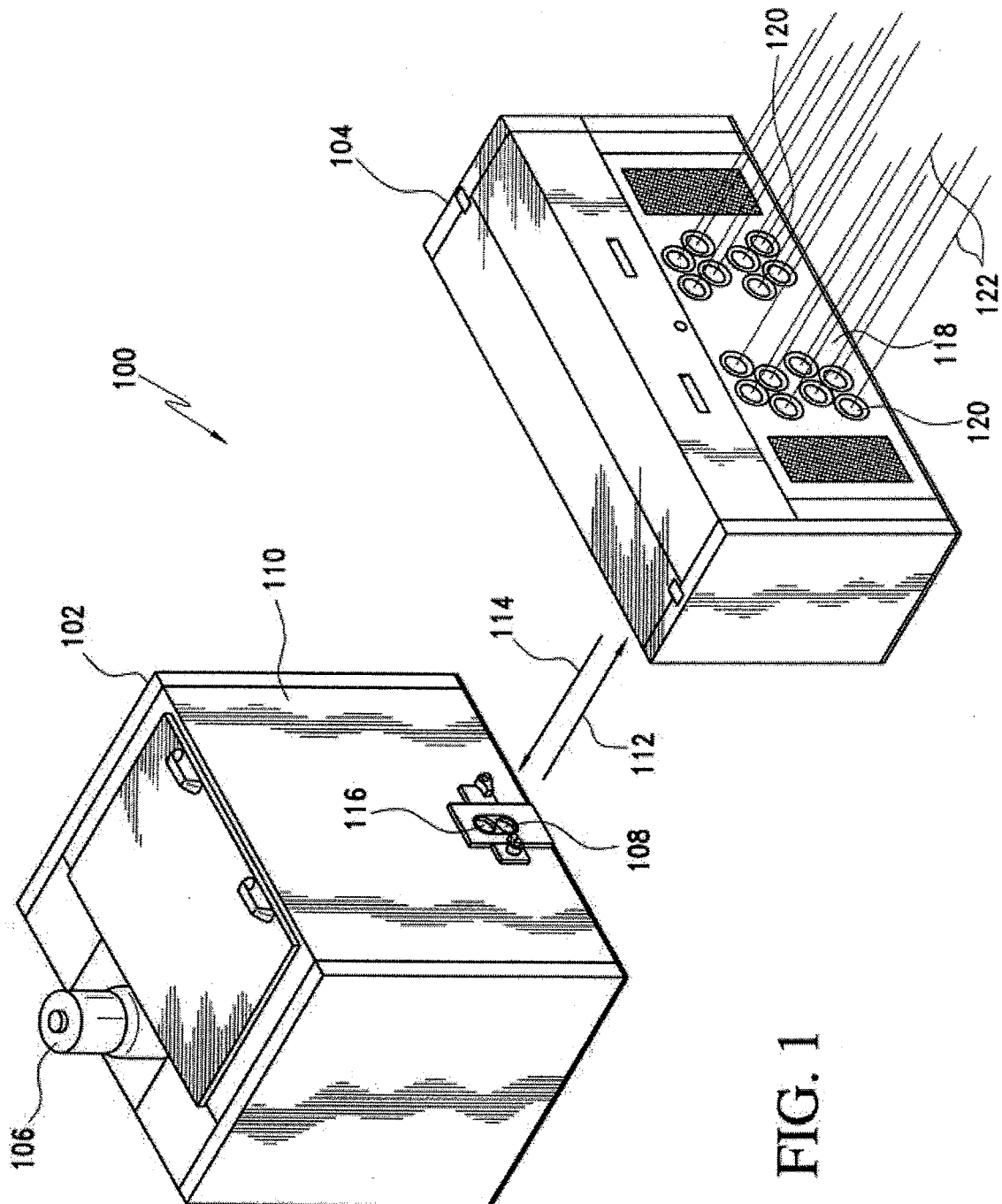


FIG. 1

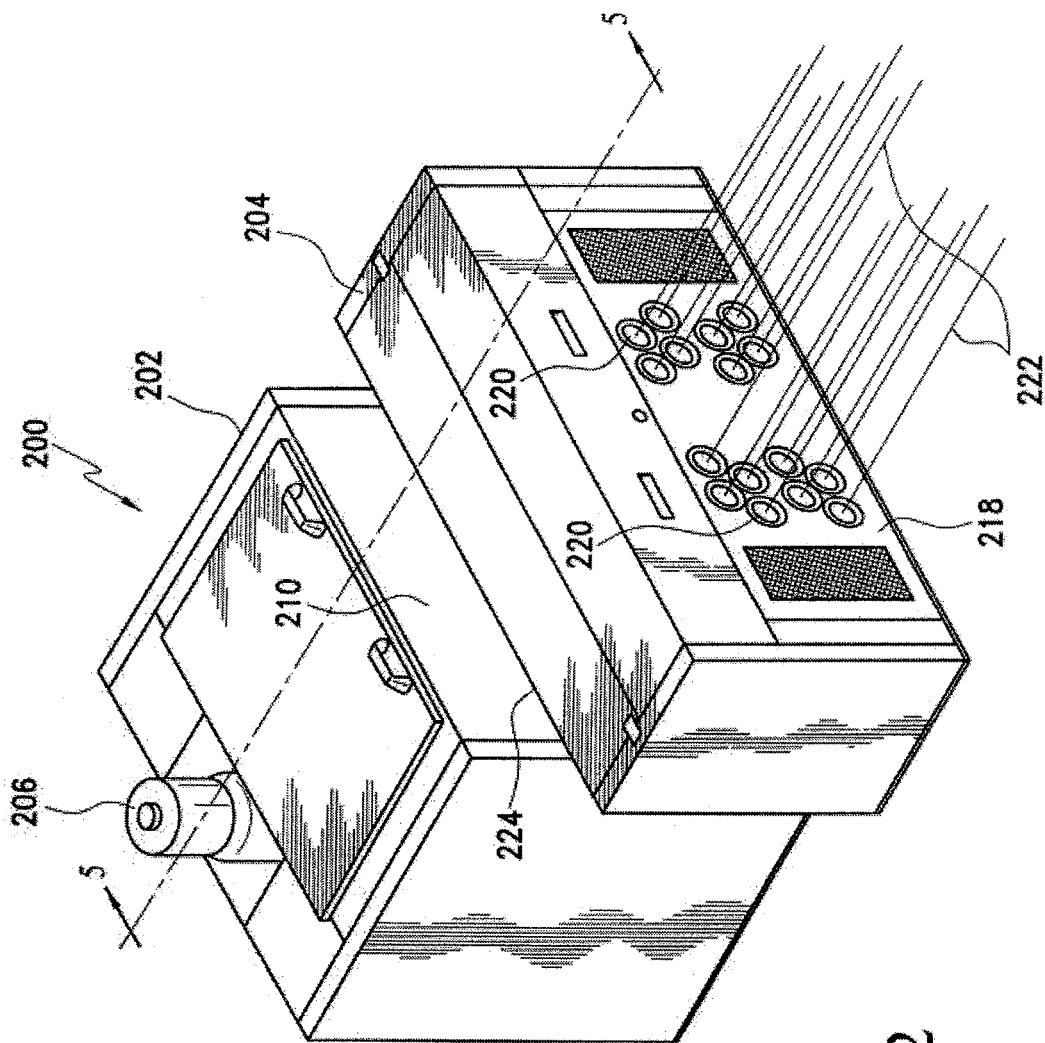
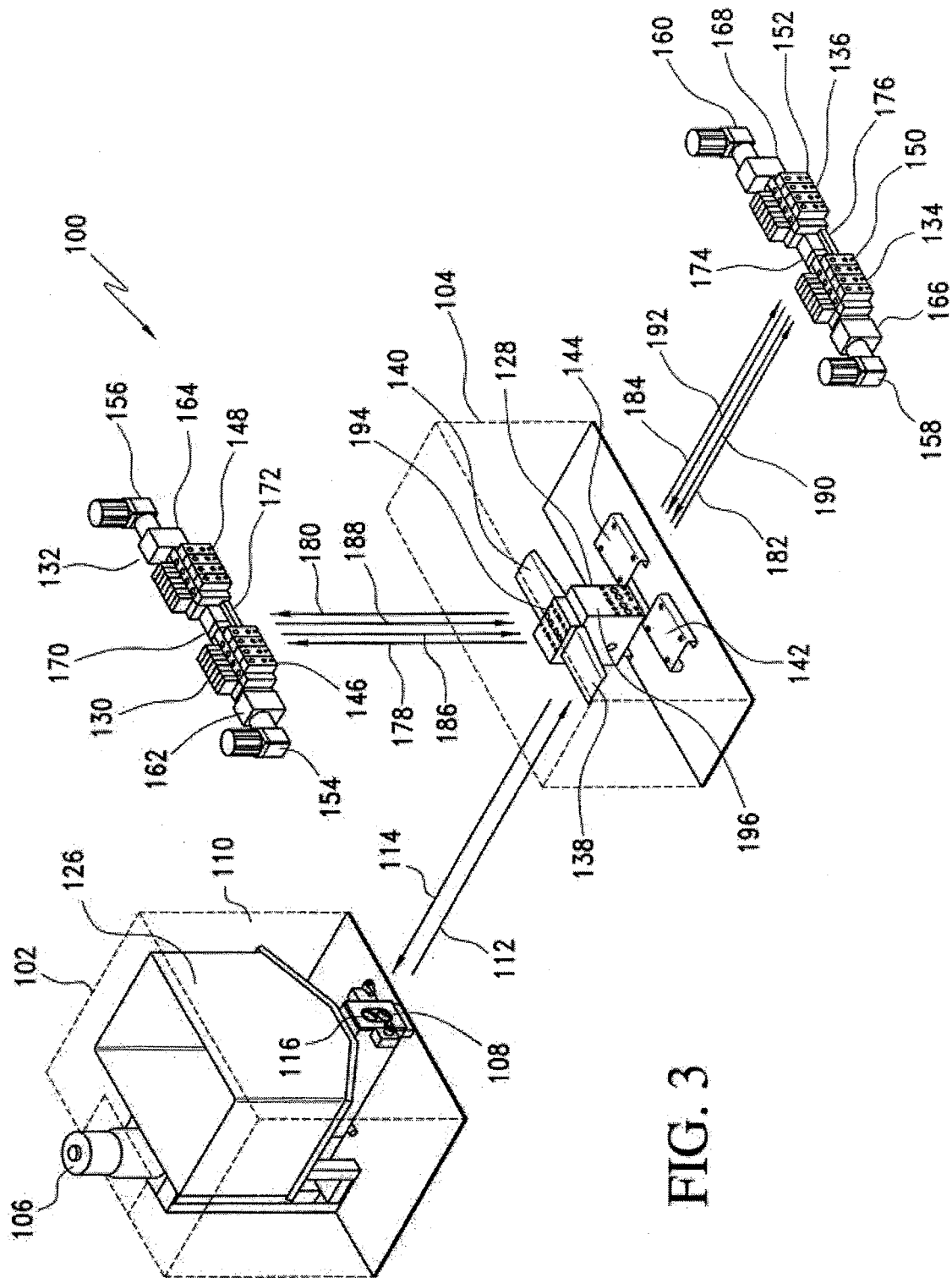


FIG. 2



**FIG. 3**

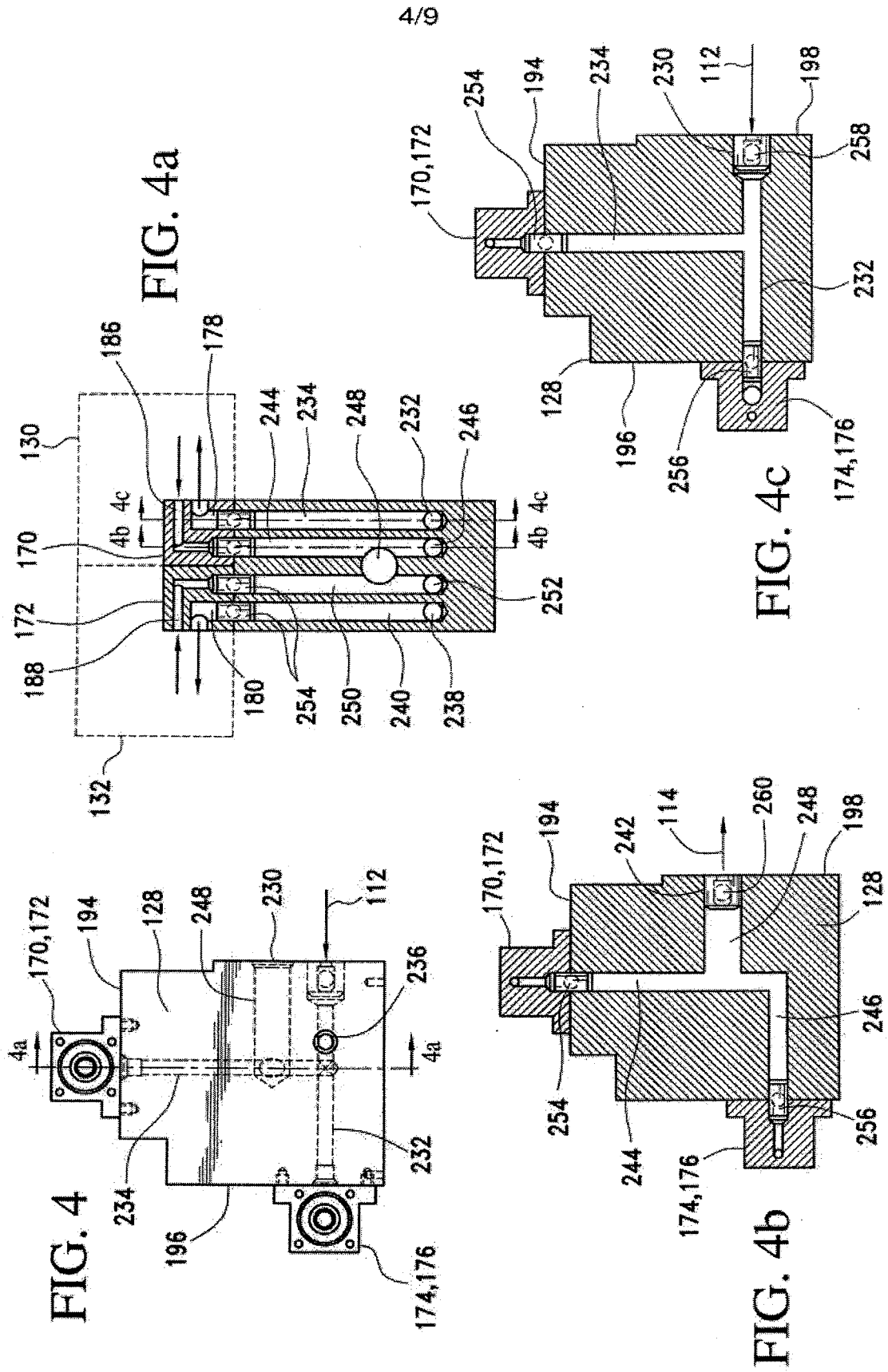
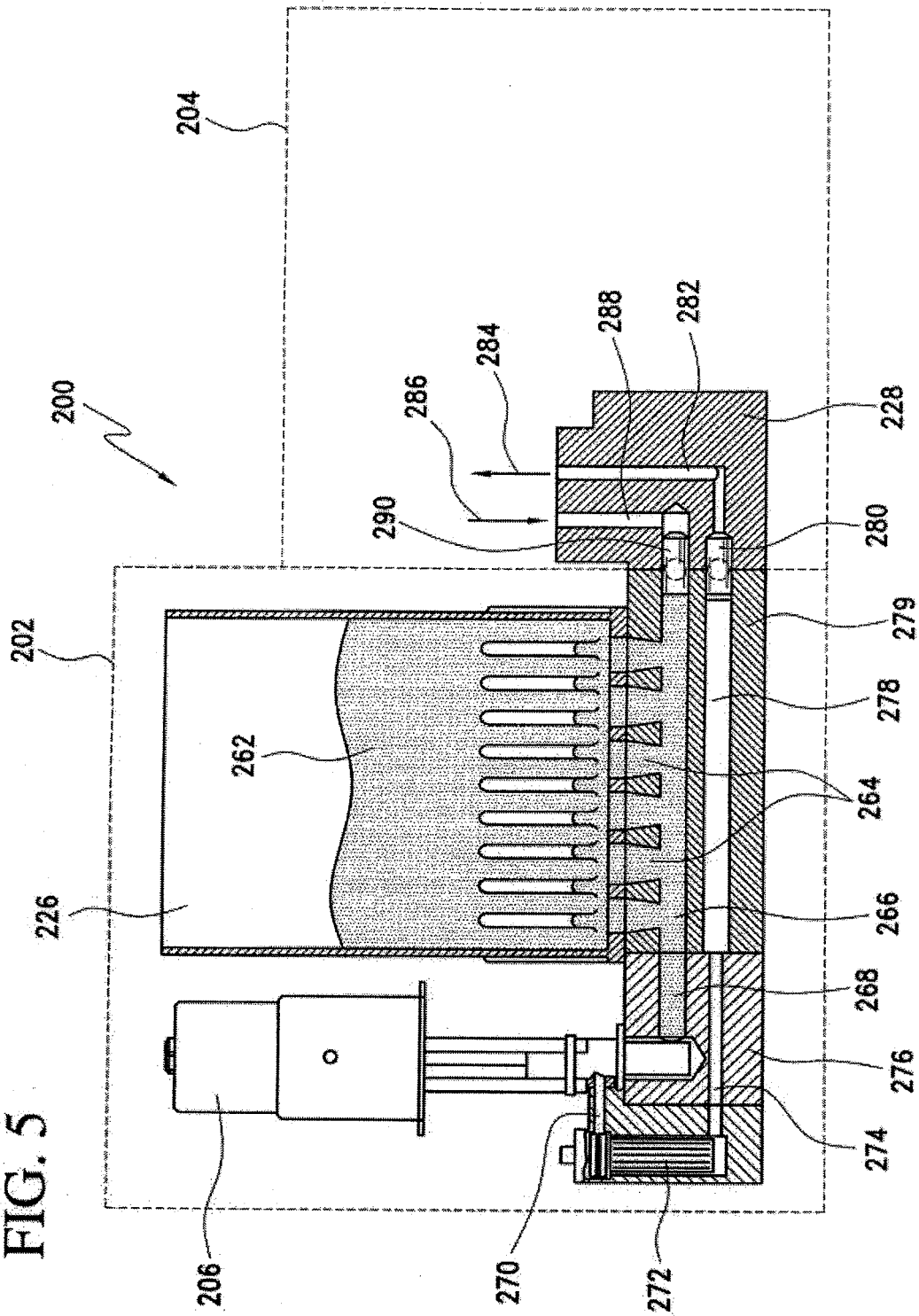


FIG. 5





6/9

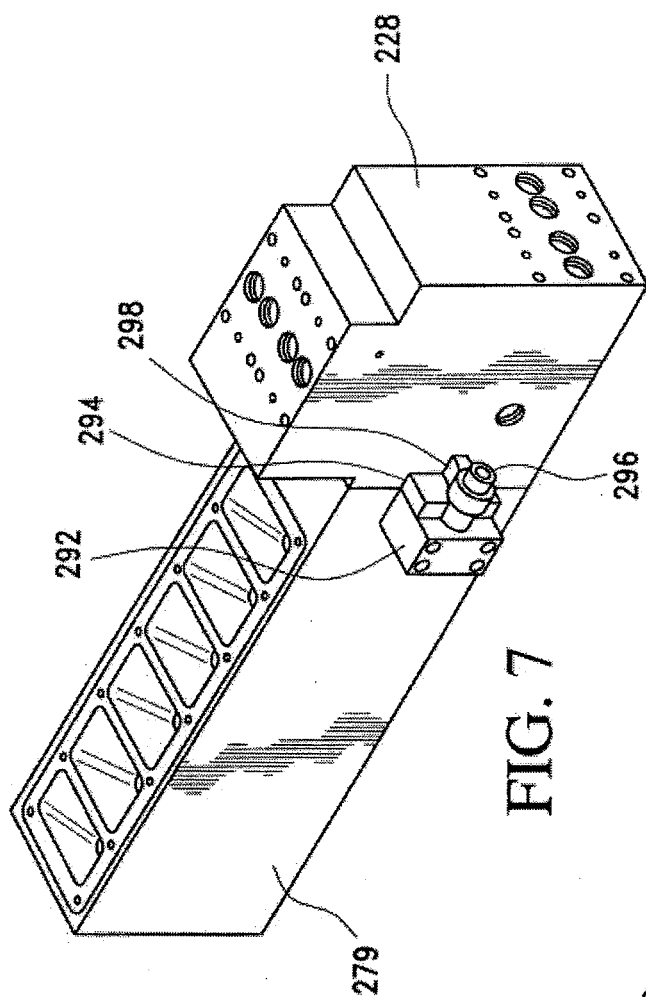
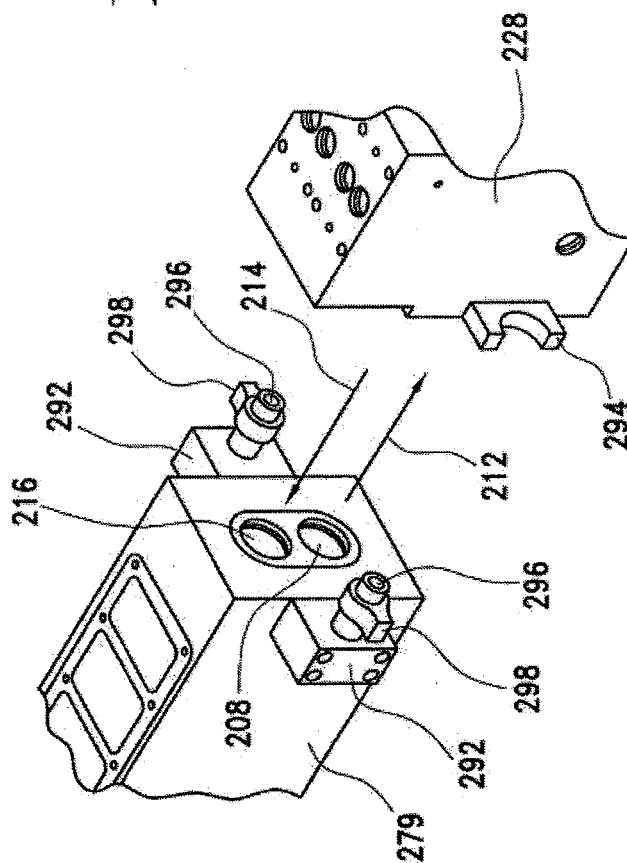


FIG. 7

FIG. 6





8/9

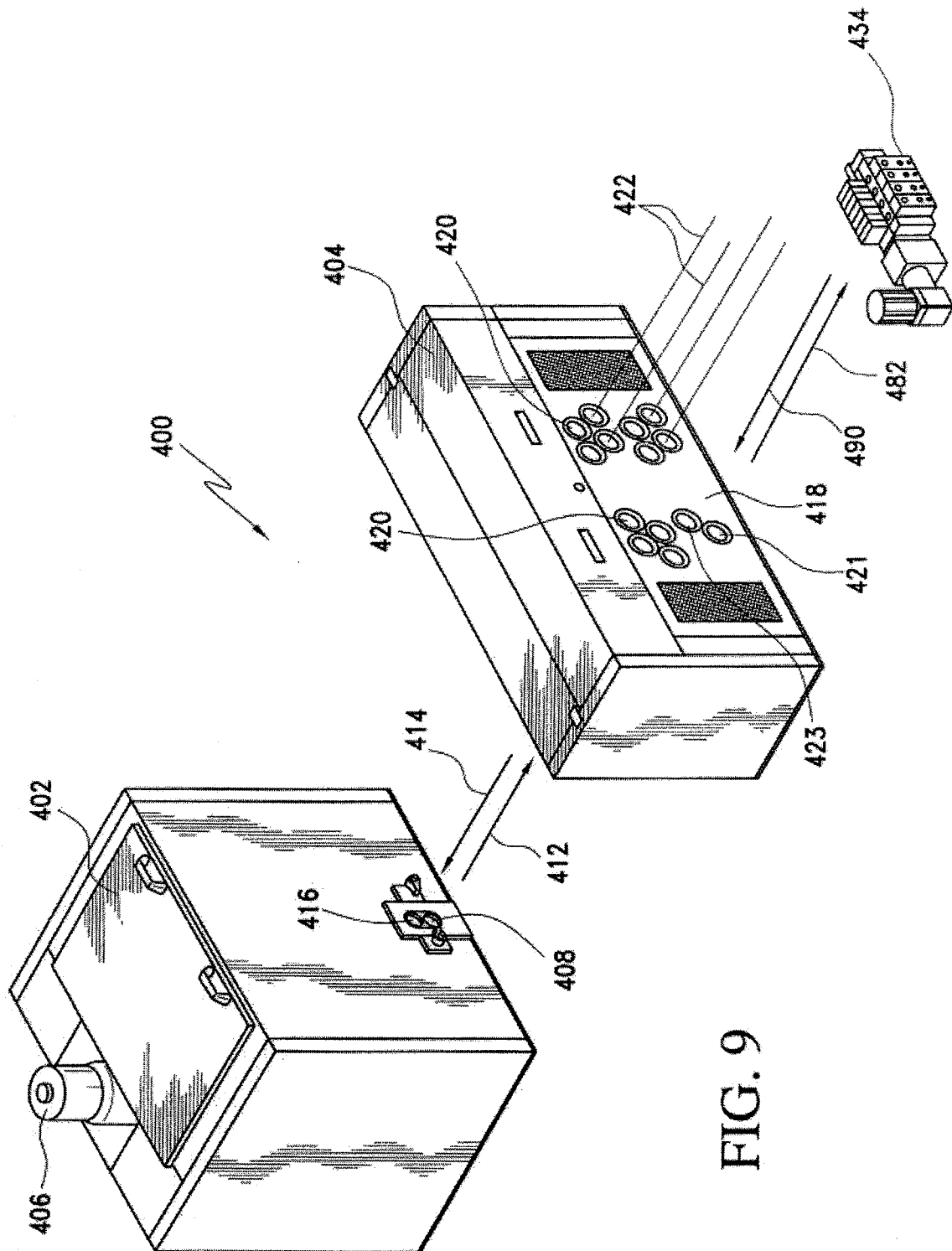
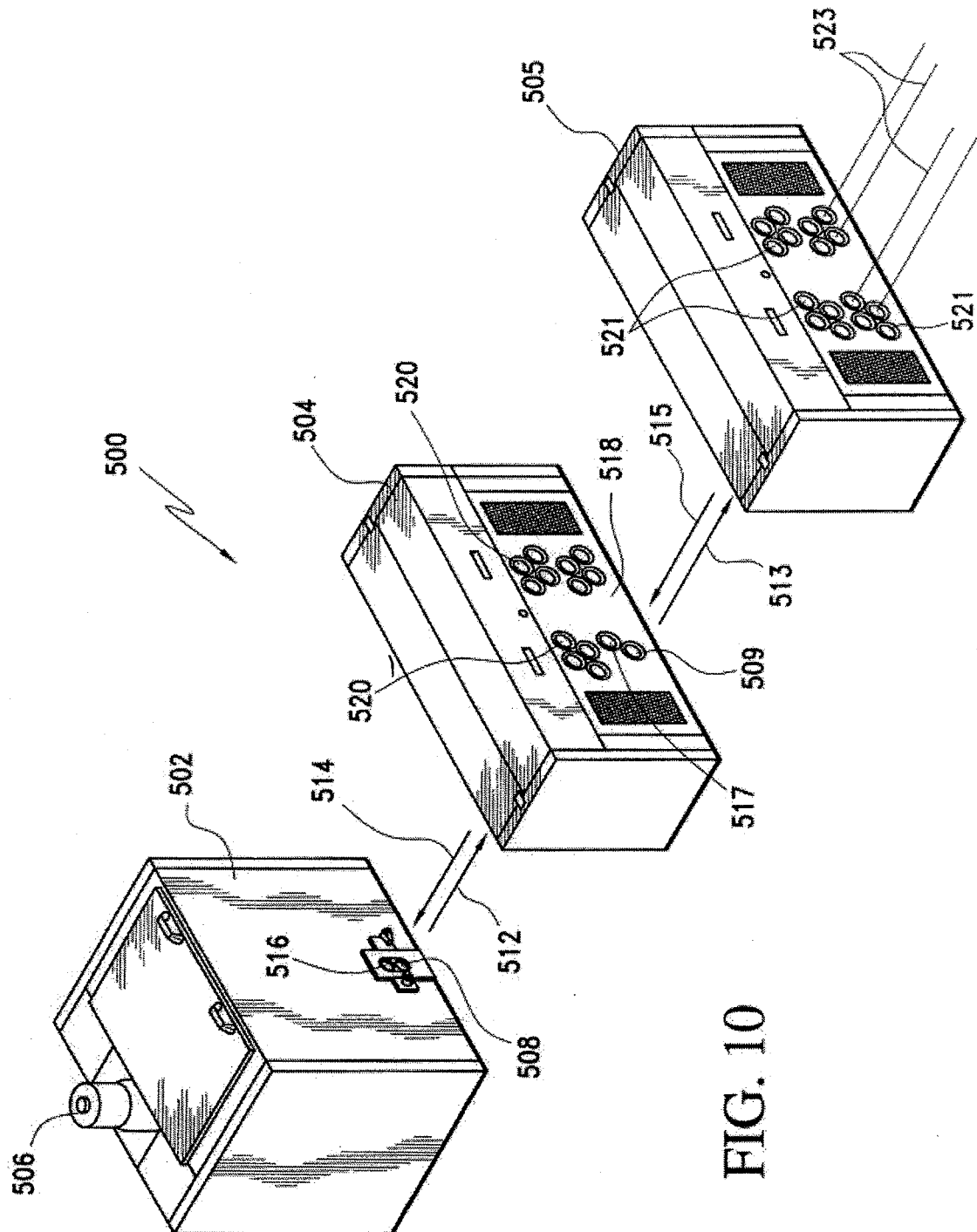


FIG. 9



# INTERNATIONAL SEARCH REPORT

International application No

PCT/US2008/052818

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. B05B7/00 B05C5/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B05B B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                | Relevant to claim No. |
|-----------|---|-----------------------|
| X         | WO 99/54055 A (NORDSON CORP [US])<br>28 October 1999 (1999-10-28)<br>the whole document           | 1                     |
| X         | US 5 605 720 A (ALLEN MARTIN A [US] ET AL)<br>25 February 1997 (1997-02-25)<br>the whole document | 1                     |
| X         | US 6 422 428 B1 (ALLEN MARTIN A [US] ET AL)<br>23 July 2002 (2002-07-23)<br>the whole document    | 1                     |
| X         | US 6 089 413 A (RINEY JOHN M [US] ET AL)<br>18 July 2000 (2000-07-18)<br>the whole document       | 1                     |
| -/--      |   |                       |



Further documents are listed in the continuation of Box C.



See patent family annex.

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\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

11 June 2008

Date of mailing of the international search report

02/07/2008

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# INTERNATIONAL SEARCH REPORT

International application No

PCT/US2008/052818

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                | Relevant to claim No. |
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| X         | EP 1 591 167 A (NORDSON CORP [US])<br>2 November 2005 (2005-11-02)<br>the whole document<br>----- | 1                     |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2008/052818

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s)   | Publication<br>date  |
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