United States Patent [19]

Armstrong

[11] **3,757,995**

[45] **Sept. 11, 1973**

[54] **SMALL PARTICLE DISPENSER**

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[22] Filed: **May 20, 1971**

[21] Appl. No.: **145,384**

[52] **U.S. Cl.** **221/211,** 221/278

[51] **Int. Cl.** **B65g 59/06**

[58] **Field of Search** 221/211, 278

[56] **References Cited**

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[57] **ABSTRACT**

A rotary pin dispenser utilizes vacuum to draw a predetermined number of pins from pin supply tubes into a cylindrical barrel. The barrel is rotated to a second position and air pressure is utilized to expel the pins into delivery tubes.

2 Claims, 3 Drawing Figures

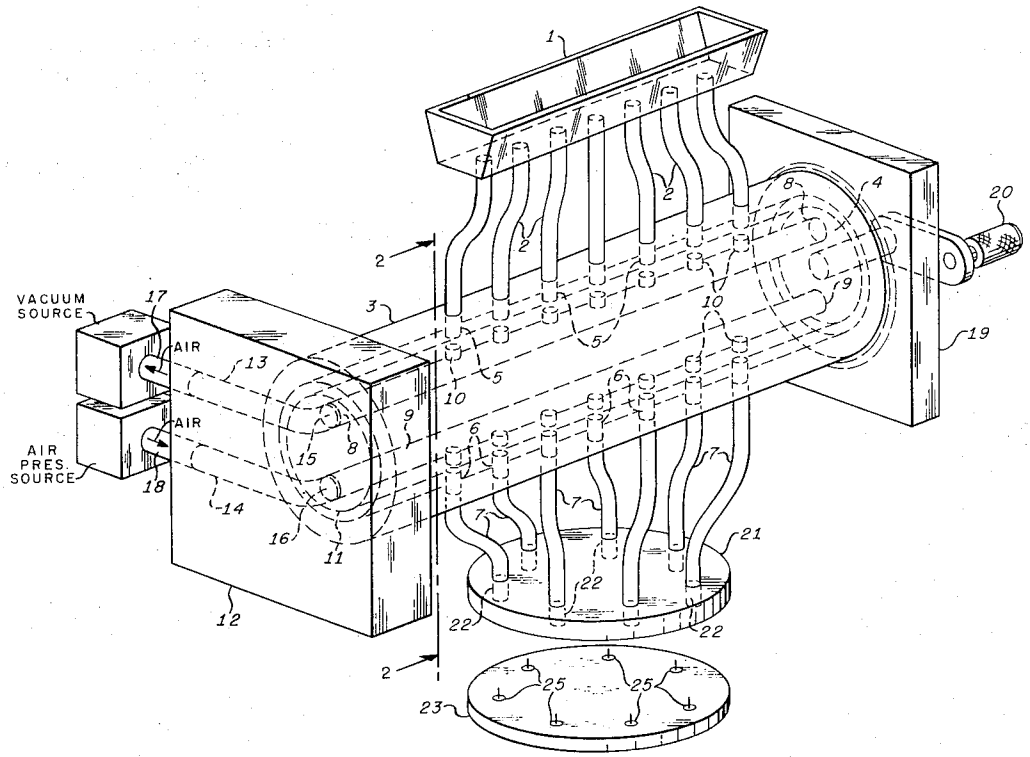


FIG. 1.

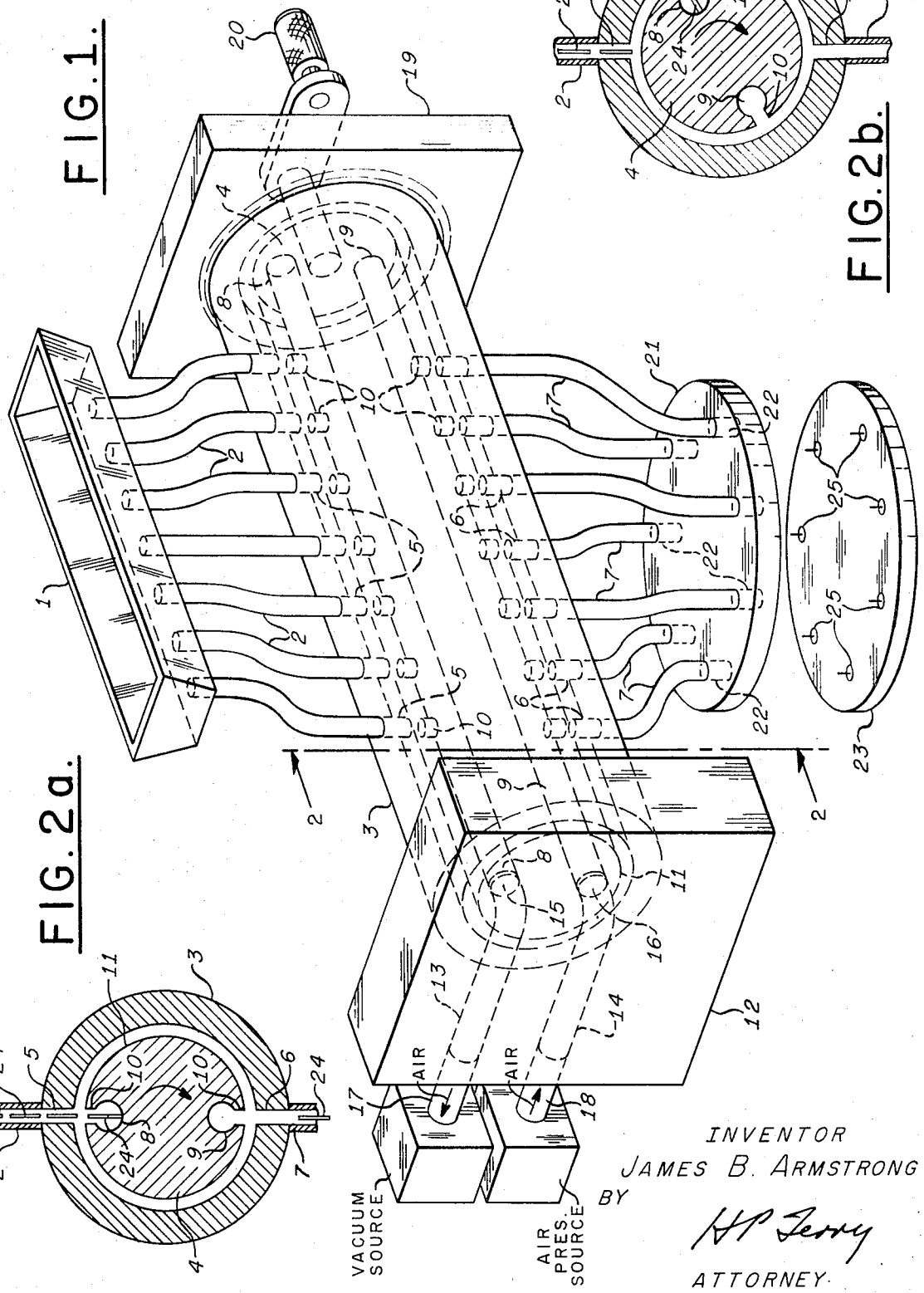


FIG. 2b.

FIG. 2a.

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SMALL PARTICLE DISPENSER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to apparatus useful in loading and/or prepositioning a plurality of small sized particles into predetermined positional relationships in a receiving member.

2. Description of the Prior Art

Commonly used shuttle-type pin dispensers operate using gravity to transfer the pins from a loading plate into a shuttle plate. The shuffle plate containing the pins is moved laterally and aligned with a dispensing plate. On alignment, gravity acting upon the mass of the pins causes the pins to fall out of the shuttle plate and through coinciding apertures within the dispensing plate. Dispensing tubes attached to the dispensing plate guide the pins to their respective position on the final pin receiving member.

SUMMARY OF THE INVENTION

The invention comprises a pin dispenser which is not wholly dependent on the force of gravity for aligning and dispensing a plurality of pins. A plurality of feed tubes feed small and lightweight pins to a rotary dispenser having a sleeve with a plurality of apertures equivalent in number to the number of pins to be dispensed simultaneously. A rotor within the sleeve contains a number of cavities extending radially into the rotor and corresponding in number and position to the apertures in the sleeve, with each said radial cavity interconnected by a longitudinal cavity. A vacuum source and an air pressure source are alternately connected to said longitudinal cavity and controlled by the rotation of the rotor acting as a rotary valve, such that in the feed phase of the operation the air pressure differential created by the vacuum source assists in feeding the pins to the rotor. Upon completion of the feed phase, the rotor rotates within the sleeve until the rotor cavities are aligned with a second set of apertures within the sleeve. Simultaneously, the longitudinal cavity becomes aligned with the air pressure source. The air pressure differential created by the air pressure source expels the pins from the axial cavities in the rotor and through the apertures in the sleeve. Suitable dispensing means or output tubes may be attached to the sleeve to direct the pins to the unit within which the pins are to be accurately positioned.

A primary object of the invention is to provide a simple means for distributing lightweight particles from a magazine into predetermined positions in a receiving member.

Another object of the invention is to provide a means which is essentially independent of the force of gravity to feed small lighweight particles into a receiving member.

Another object of the invention is to provide a means having a high confidence level in simultaneously feeding a plurality of particles to a receiving member.

Another object of the invention is to provide a particle dispensing machine which has a minimum of moving parts and bearing surfaces.

Another object of the invention is to provide a particle dispensing means which uses readily available peripheral equipment to thereby reduce the cost of incorporating the invention into present manufacturing environments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the particle loading apparatus; and FIGS. 2*a* and 2*b* illustrate a cross-sectional view of the rotating member of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Pin loading devices are generally used as part of the manufacturing process in making various types of electric and electronic devices. The portion of the devices made during this phase of the manufacturing process is the means by which the resulting device communicates with the outside world, that is, the means by which power is introduced to it and control signals are entered, as well as the basic input and output connections. In many types of devices, the means for communication is by way of electrically conducting pins extending from the device and mating with a suitable receptacle in the apparatus to which the device is attached. In most cases, the pins are short thin lengths of wire piercing but sealably connected to a part of the envelope of the device. Often, the location of th pins is within a defined area or portion of the envelope, usually the base of the device. A common illustration of this type of device is the well known electronic tube.

In the manufacturing process, all of the pins to be attached to each envelope base must usually be attached in the same step, that is, the base is simultaneously perforated by all of the pins. As these pins are difficult to handle from the manufacturing standpoint, various means employing gravity have been used. One well known method is that of the "shaker box." wherein, the pins are placed in an oscillating box and by the motion of the box are urged to travel in one direction. Combs or comb like devices are placed in the path of the pins to orient them in a uniform direction. As the pins pass through the combs, they are further directed into one of a plurality of tubes. The tubes are usually oriented vertically, such that the entering pins will tend to slide down the tube due to gravity. The exit of each of the tubes corresponds with and is operably connected to one of the perforations of the envelope base within which the pins will be positioned.

This system is reasonably reliable and generally satisfactory for many applications requiring pins of greater than a minimum size. The minimum pin size is a variable function dependent primarily on the weight of the pin and the friction of the passageways through which it must travel. As the ratio of friction to weight increases, the reliability of each tube simultaneously depositing a pin within the envelope base decreases rapidly as a function of the number of pins to be deposited. Consequently, the rejection rate of incomplete or faulty pin assembly in the envelope base is substantially increased. In some devices, magnets or electromechanical coils are used to orient or guide the pins into the feed tubes. The pins may become magnetized and will then tend to attach themselves to other magnetic materials, resulting in an impeded flow of pins and a decreased operational reliability. Either situation raises the over-all cost of manufacture, and for devices having low profit margins, the economic feasibility of the devices is in jeopardy.

The pin assembly technique taught in the instant invention overcomes the prior reliance on gravity and provides a measure of reliability relatively independent

of the pin size and only incidentally associated with the sliding friction present in the pin channelling passageways.

The preferred embodiment of the invention will be described in terms of assembling a plurality of pins within an envelope base, but it is to be understood that the invention may also be used in the assembly of numerous other small sized components, such as ceramic tops for integrated circuit packages, or glass preforms for metal transistor packaging. The invention will first be described in terms of apparatus, and followed by a description of the operation where such operation is not readily apparent from the apparatus. Referring to FIG. 1, a hopper 1 or magazine, which may be any one of several configurations, serves the purpose of orienting the pins along their longitudinal axis in a plurality of streams. A plurality of feed tubes 2, each associated with a stream of pins, are attached to the hopper 1 in a receiving relationship, whereby the pins are fed into the tubes 2. The feed tubes 2 are also connected to a circular sleeve 3. The sleeve 3, enveloping a cylindrical member 4, is perforated by a first set of apertures or holes 5, which may be aligned in a row along the longitudinal dimension of the sleeve. Each of the feed tubes 2 is associated with one of the holes in this first set of holes. A second set of holes 6, which may also be aligned in a row in the direction of the longitudinal aixs of sleeve 3, are located in the same longitudinal positional relationship as the first set of holes 5. Each one of a plurality of output tubes 7 is associated with each of the holes 6 in the second set.

The rotor or cylindrical member 4, shown in perspective in FIG. 1 and on end in FIGS. 2a and 2b, may be described as follows. The cylindrical member 4 may have two diametrically opposed longitudinally oriented cavities 8, 9. Each of the longitudinal cavities is associated with a plurality of radial cavities or passageways 10 connecting the longitudinal cavity with the surface of the cylindrical member 4. Each of these passageways is positionally oriented to and matches with a corresponding hole in each of the sets of holes in the sleeve 3. Thus, rotation of the cylindrical member 4 within the sleeve 3 will periodically cause the passageways 10 to be aligned with the holes in each of the sets of holes in the sleeve 3.

A first rectangular like member 12 shown in FIG. 1 is representative of apparatus acting as a rotary valve, and as the means by which the cylindrical member 4 is connected to both air pressure and vacuum sources. It contains two channels 13 and 14, one end of each having an aperture 15, 16, respectively, facing the cylindrical member 4 and the other ends connected to air pressure and vacuum sources through tubes 17 and 18, respectively. The orientation of the apertures 15, 16 is such that as the cylindrical member 4 rotates, the longitudinal cavities 8, 9 therein will periodically align themselves with each of the apertures 15, 16.

A second rectangular like member 19 is representative of the support and drive means for rotating the cylindrical member 4. Although a crank 20 is shown attached to the cylindrical member 4, it is to be understood that a geared shaft or any other means may be used to connect the cylindrical member 4 to the rotating drive means 20. Additionally, the drive means also includes the requisite timing apparatus, whether it is mechanical or electronic, to control the cylindrical member 4 rotation. The drive means may be arranged to rotate the cylindrical member 4 in a step like fashion so as to permit it to halt momentarily, whenever the radial cavities in the cylindrical member 4 are aligned with the holes in the sleeve 3. The drive means may also be designed to sequentially rotate the cylindrical member 4 in each direction within the angle represented by the input and output tubes attached to the sleeve. Such an arrangement permits the utilization of rotational limiters to insure that the apertures within the sleeve 3 are aligned with the axial cavities of the cylindrical member 4 during the pin injection and ejection operations. The use of a rotating member decreases the number of bearing surfaces required compared to prior art devices and thereby the wear characteristic is also improved.

The output tubes 7 attached to the sleeve 3 correspond in number to the input tubes 2. The receiving member 21 shown is illustrative of any member to which the exit end of the output tubes 7 may be attached. The receiving member 21 contains holes 22 each matched and aligned with a respective output tube exit. The orientation of the output tube exit ends shown is that of the pin positions normally used for a standard electronic tube. In practice, the portion of the envelope (base 23) discussed above which is to receive the pins may be operably connected to and aligned with the receiving member holes 22.

In operation, the hopper 1 aligns the pins 24 and feeds them into the respective input tubes 2. The pins 24 within the feed tubes 2 lie end to end and the foremost pin lies within at least a portion of the sleeve 3. The cylindrical member 4, then aligned as shown in FIG. 2a, will have the passageways 10, associated with the longitudinal cavity 8, aligned with the holes 5 in the sleeve 3 and the feed tubes 2. The foremost pins positioned within the feed tube 2 will then be free to enter the passageway 10. Simultaneously, the longitudinal cavity 8 is aligned with the aperture 15 of channel 13 and associated with a vacuum source connected to tube 17. Thereby, there will be a partial vacuum within the cavity 8. This vacuum aids in drawing the pins 24 through the feed tubes 2 and into the passageway 10 of the cylindrical member 4. Thus, the orientation of the feed tubes 2 need not be vertical as the pressure differential between the longitudinal cavity 8 and the input of input tube 2, not gravity, is relied upon to transport the pins 24 from the hopper 1 to the cylindrical member 4.

The hole depth used must be such that the pin 24 entering the cylindrical member 4 comes to rest without any portion of it extending beyond the perimeter 11 of the cylindrical member 4. Similarly, the pin will extend approximately up to the perimeter 11 of the cylindrical member 4 in order to support and prevent the succeeding pin 24 from extending beyond the sleeve 3 into the passageway 10 of the cylindrical member 4. If these caveats are not observed, the pins 24 lodged between the sleeve 3 and the cylindrical member 4 may hinder the rotation of the cylindrical member 4 within the sleeve 3. The cylinder surface may be relieved about the passageway 10 to accommodate the normal range of tolerances in pin length.

When the passageways 10 are all filled, the drive means within support 19 is instructed to rotate the cylindrical member 4. This instruction may be of any well known type such as time delays, or any type of sensing means. The rotation will continue (see FIG. 2b) until

the loaded passageways 10 become aligned with the output holes 6 and output tubes 7 (as shown in the lower portion of FIG. 2a). At this stage, the cavity 8 becomes aligned with the aperture 16 of channel 14 and associated with an air pressure source connected to tube 18. Thus, pressure differential between the longitudinal cavity 8 and the output of output tube 7 will tend to force the pins from the passageways 10 through the holes 6 in the sleeve 3 and into the output tubes 7. The other end of the output tubes 7 are connected to a receiving member 21 whereby the ejected pins 24 are spatially oriented to match the receiving holes 25 of the envelope base 23.

Although two cavities 8,9 are shown in the cylindrical member 4, it is to be understood that only one cavity and associated passageways still function within the teaching of the invention. Likewise a plurality of cavities and associated passageways may be used whereby there may be several cycles of pin injection and ejection per revolution of the cylindrical member 4.

The invention may easily be expanded to include a plurality of sets of output tubes operating in conjunction with a plurality of axial passageways whereby the output tubes may be fed alternately, or seriatum, or in some other scheme. Similarly, there may be a plurality of pairs of input and output tubes whereby several sets of pins may be fed to their respective envelope bases per revolution of the cylindrical member. Appropriate modifications will then have to be made to channels 13 and 14.

While the invention has been described in its preferred embodiment, it is to be understood that the words which have been used are words of description rather than limitation, and that changes may be made within the purview of the appended claims without departing from the true scope and spirit of the invention in its broader aspects.

I claim:

1. Pin aligning apparatus for positioning electrical contact pins in a pin support member of an electron tube, comprising

a rotatable cylinder having a plurality of radially directed cavities arrayed lengthwise of the cylinder, each radial cavity extending inwardly from the periphery of the cylinder to a depth substantially equal to or less than the length of a pin, and a longitudinally directed cavity interconnecting the bottom region of the radial cavities adapted for alternately coupling to an air source and a vacuum source,

a sleeve concentrically disposed about the cylinder in closely spaced relation therewith having first and second pluralities of apertures spaced peripherally on the sleeve and each plurality respectively arrayed lengthwise of the sleeve at distances corresponding to the distances between the cylinder radial cavities, each aperture being shaped to accommodate an individual pin oriented lengthwise for passage through the aperture,

input means for supplying pins to the first plurality of apertures,

output means for receiving pins from the second plurality of apertures, said output means being so constructed and arranged as to direct individual pins to prescribed positions in the electron tube pin support member, and

means for rotating the cylinder to align each radial cavity with a respective aperture of the first plurality of sleeve apertures whereat the longitudinal cavity is coupled to the vacuum source to draw an individual pin from an aligned sleeve aperture into each radial cavity and hold the pin therein to be transported upon further rotation of the cylinder into alignment with a respective aperture of the second plurality of apertures whereupon the longitudinal cavity is coupled to the air source to force the pins from the radial cavities through the second plurality of apertures into the output means.

2. The apparatus of claim 1 wherein the cylinder has an additional plurality of radially directed cavities arrayed lengthwise of the cylinder and spaced peripherally on the cylinder from said plurality of radial cavities an amount corresponding to the spacing between the first and the second pluralities of sleeve apertures, each radial cavity of said additional plurality extending inwardly from the periphery of the cylinder to a depth substantially equal to or less than the length of a pin, and an additional longitudinal cavity interconnecting the bottom region of the additional radial cavities so that when said plurality of cavities is aligned with the first plurality of sleeve apertures the additional plurality of radial cavities is aligned with the second plurality of sleeve apertures and the additional longitudinal cavity is coupled to the air source to enable concurrent loading of pins from the input means into said plurality of radial cavities and emptying of pins from said additional plurality of radial cavities into the output means.

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