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Parts supply device

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GB2179643 A
GB1017071 A
GB0807442 A

(58) Field of search

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UK CL(Edition J) **B8U UAB**
UAG UB UD UF UGB
INT CL[4] **B65G**
updated as appropriate

FIG.1

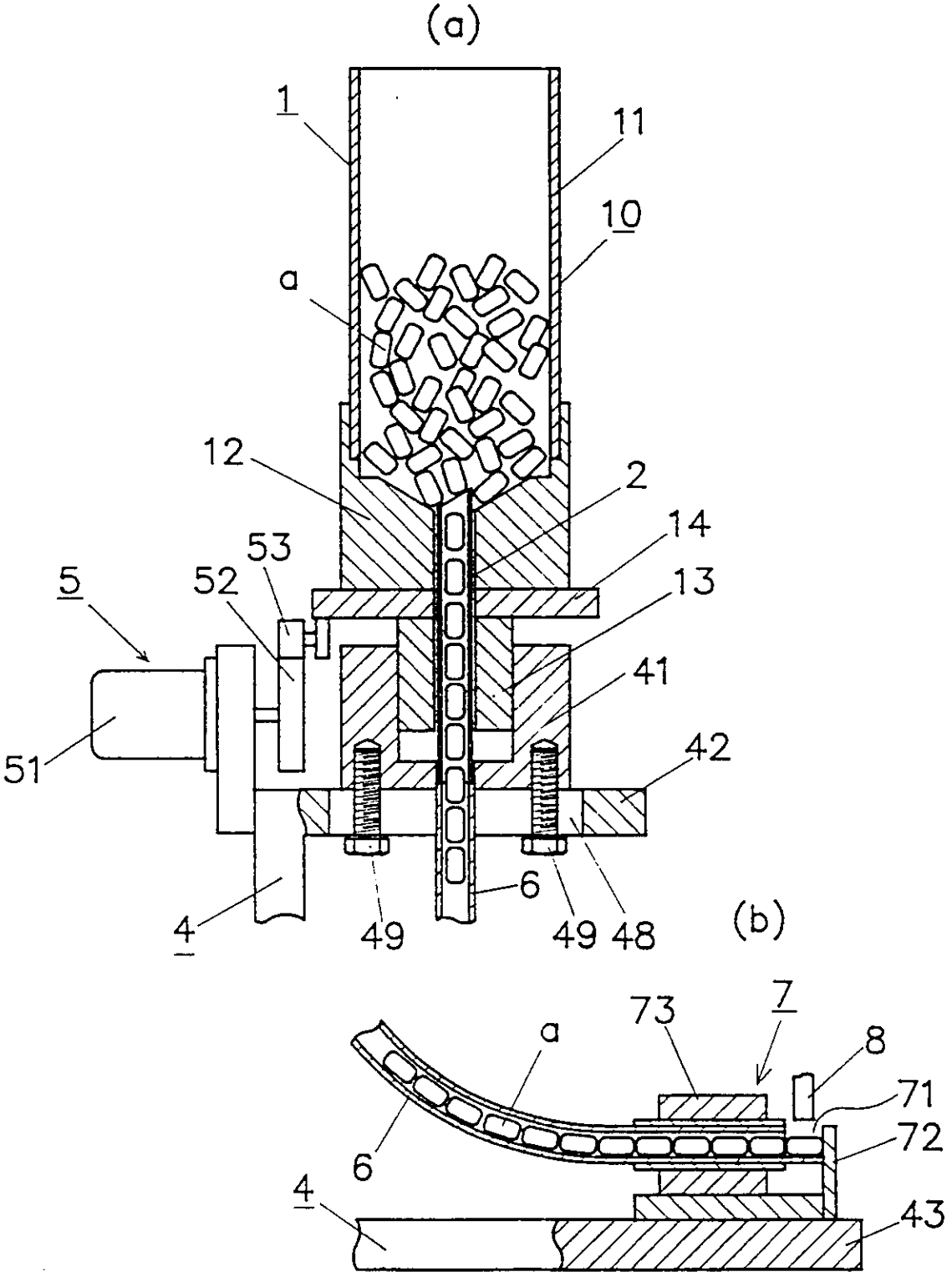


FIG. 2

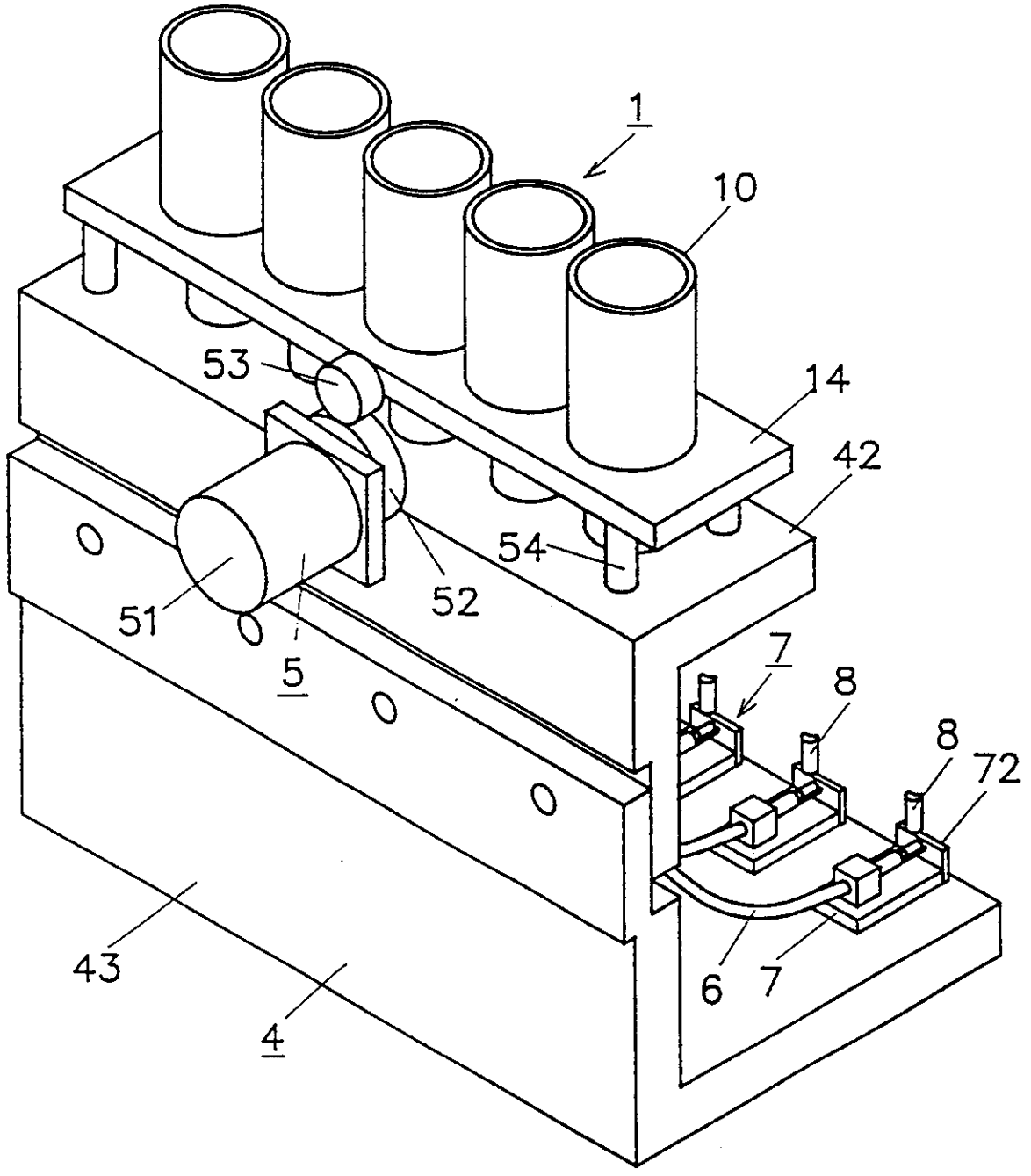


FIG.3

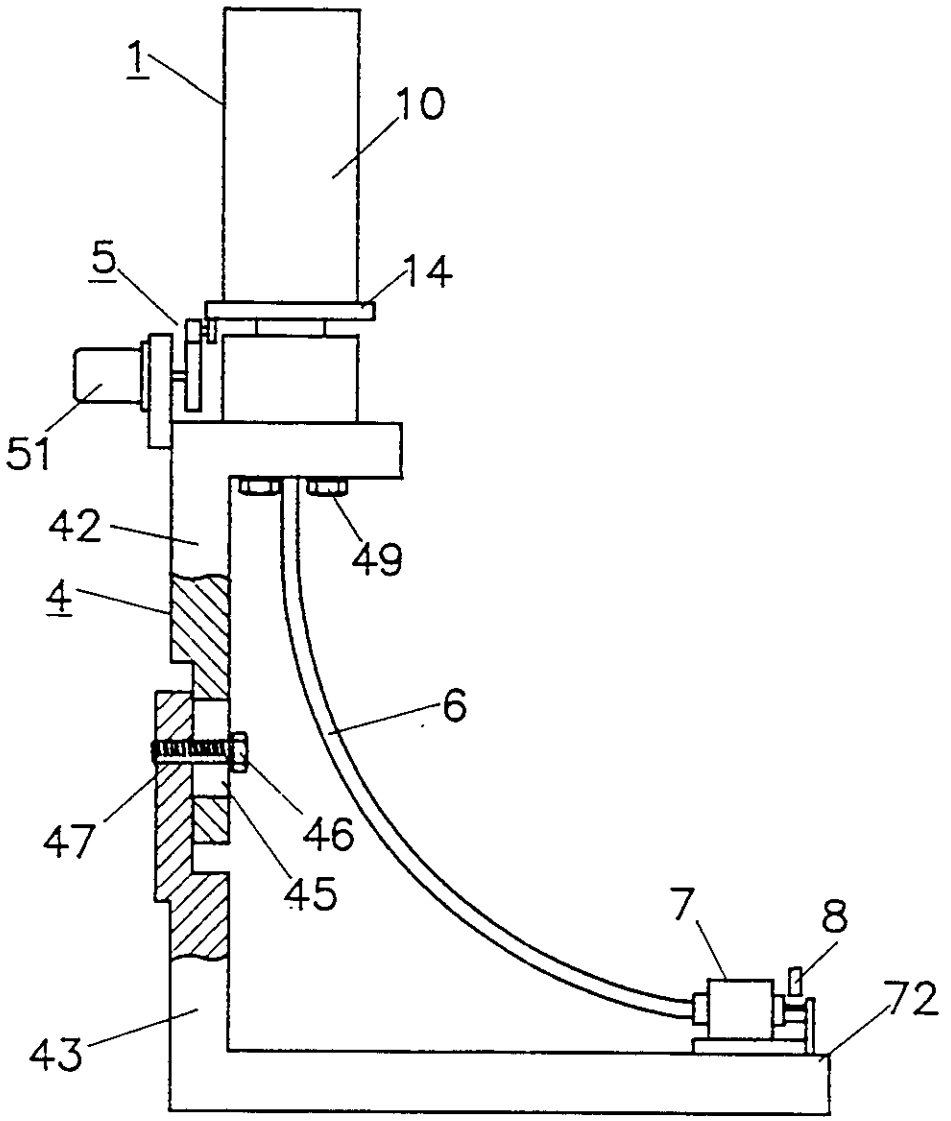


FIG.4

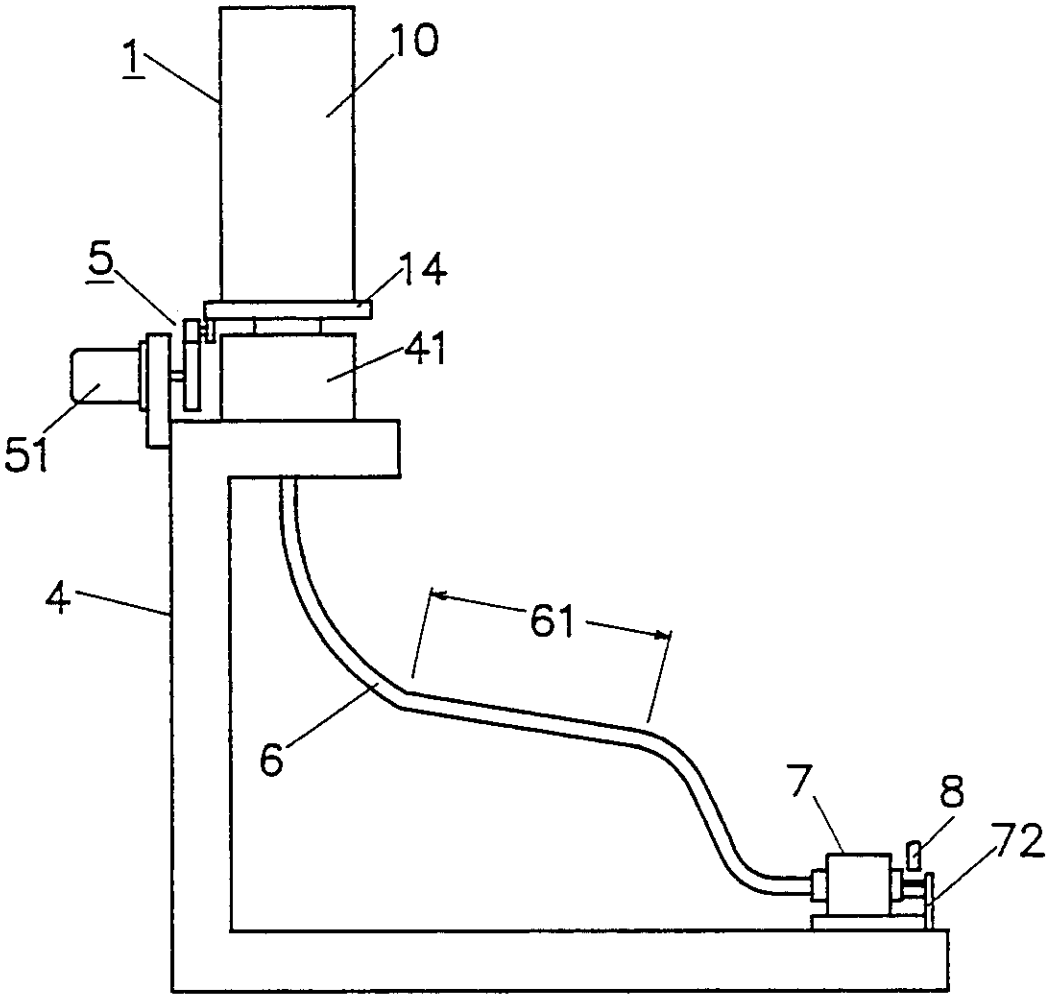


FIG.5

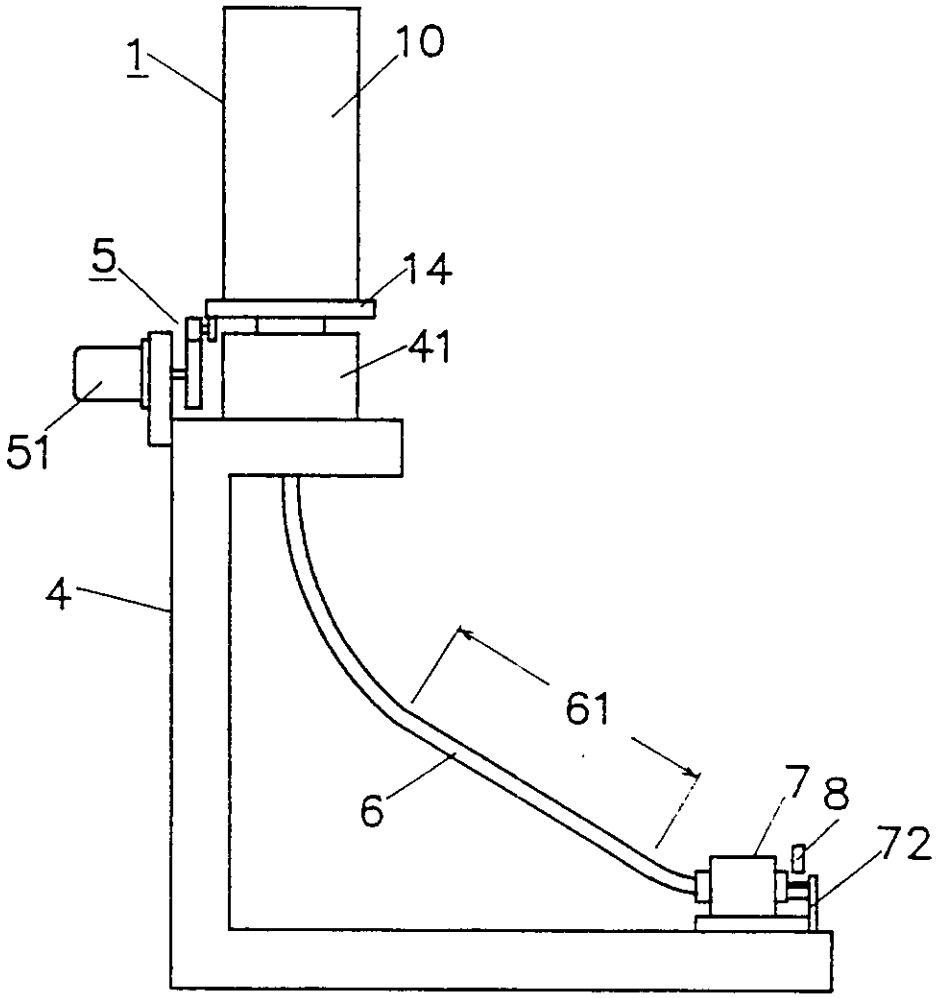


FIG.6

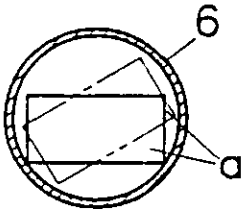


FIG.7

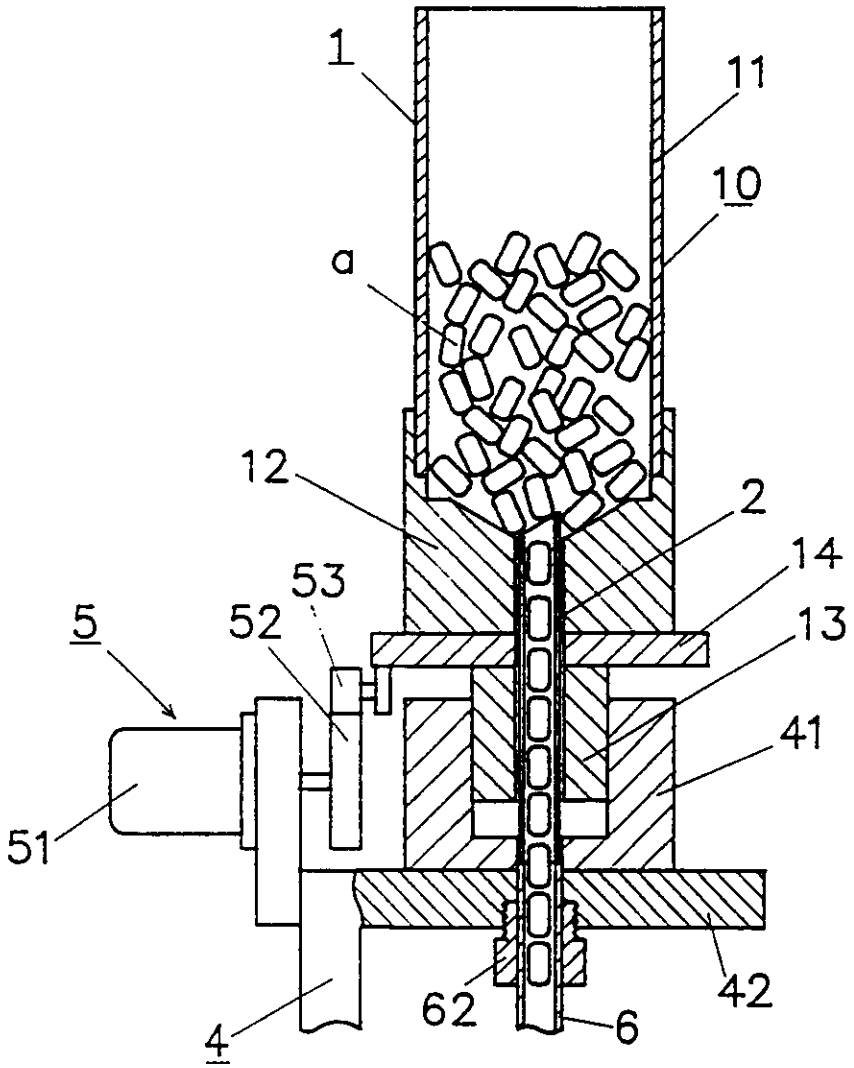


FIG.8

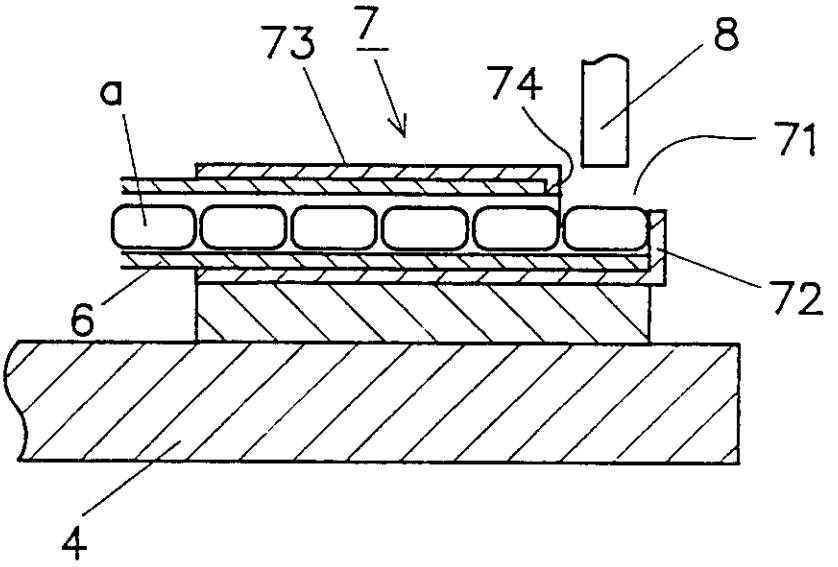


FIG.9

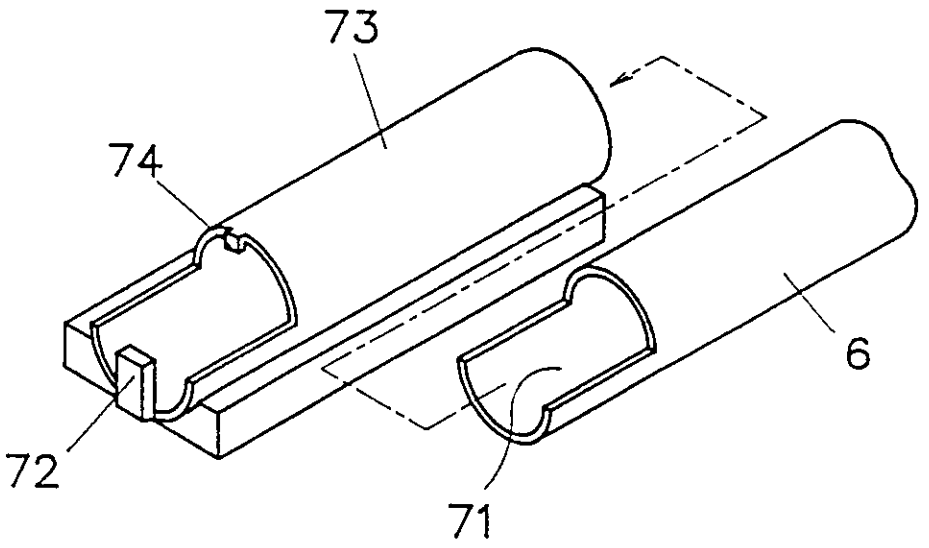


FIG.10

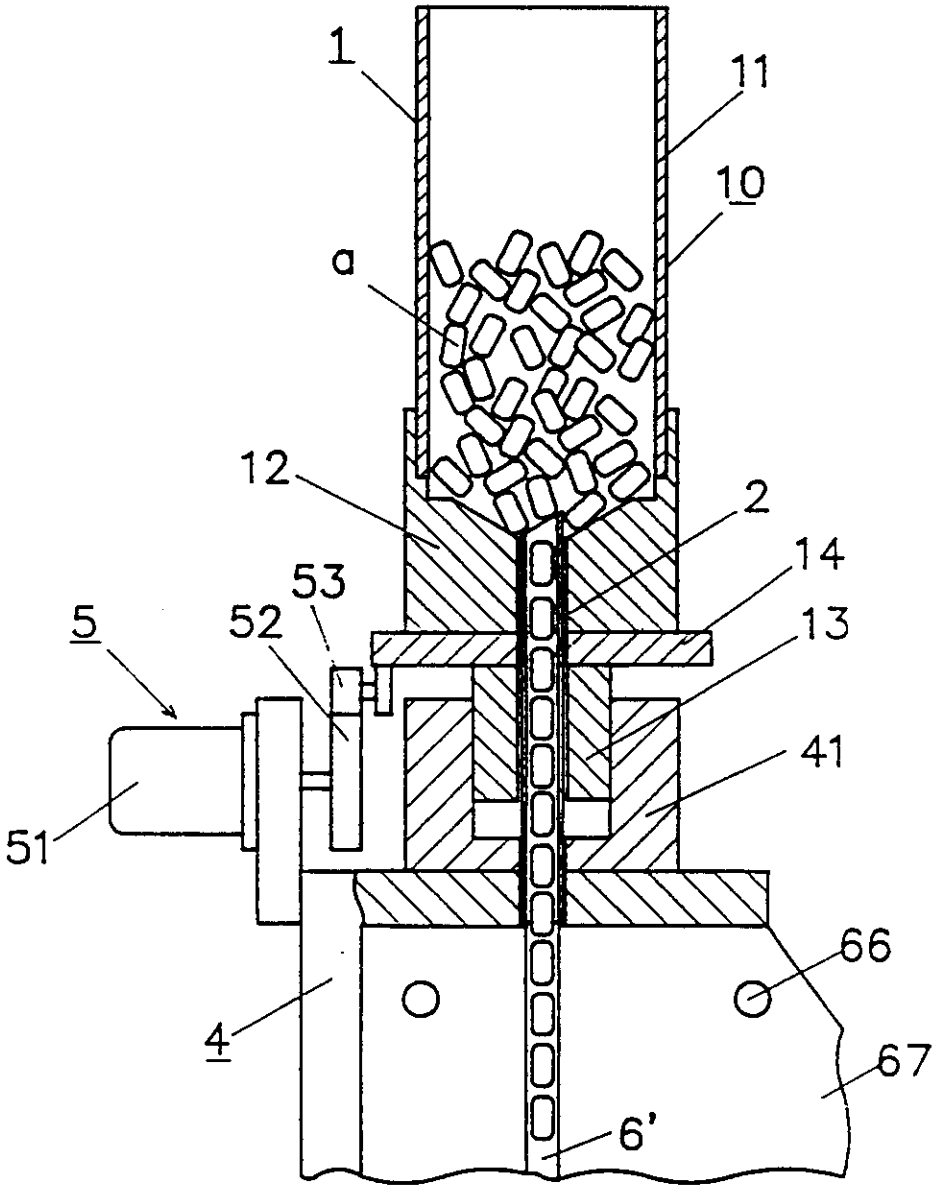


FIG.11

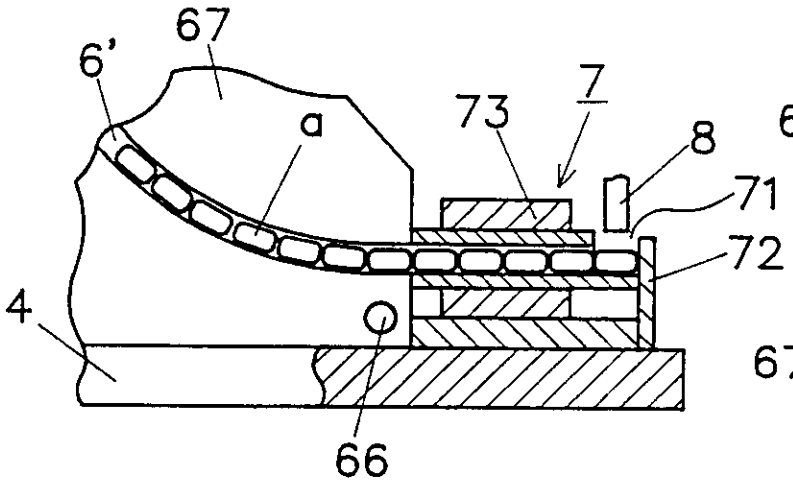


FIG.12

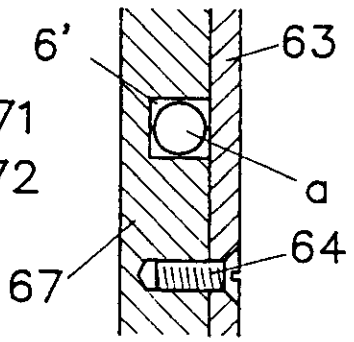


FIG.13

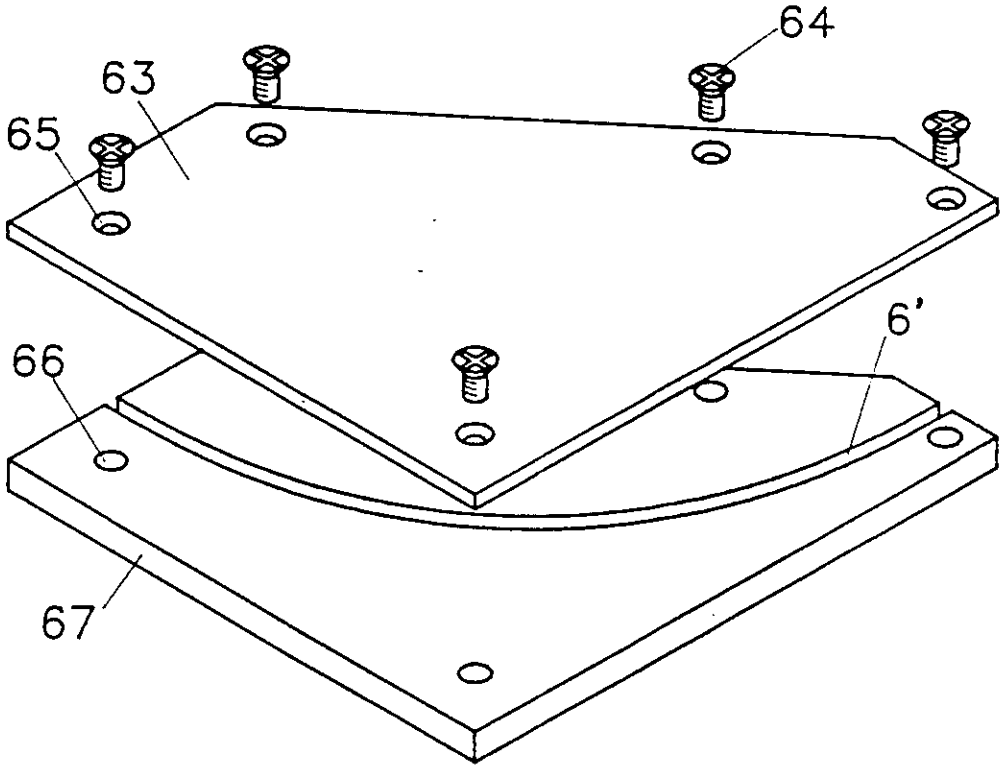


FIG.14

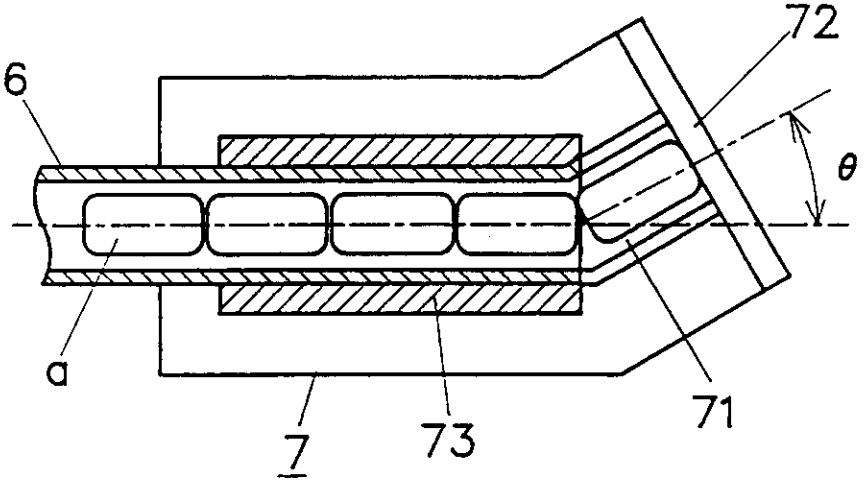


FIG.15

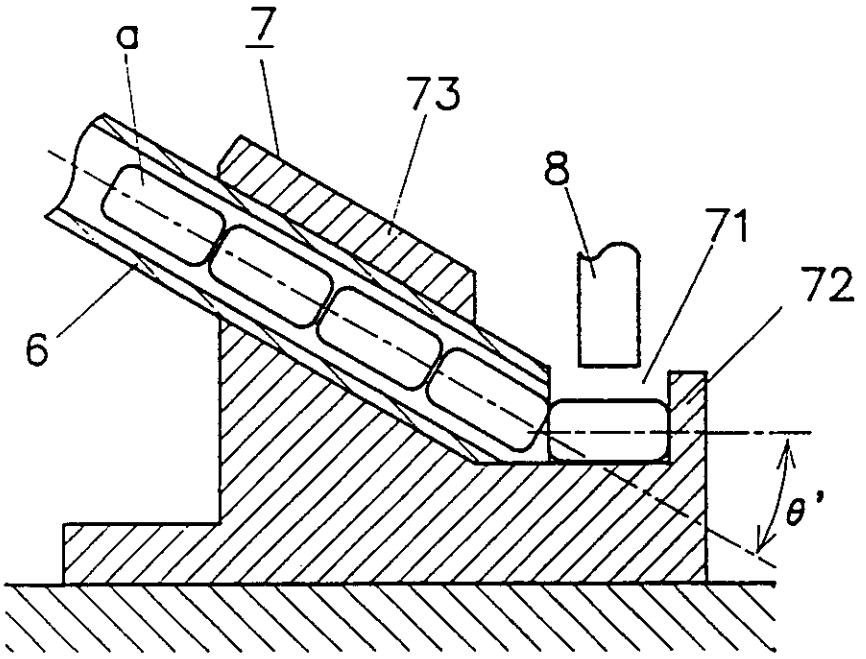


FIG.16

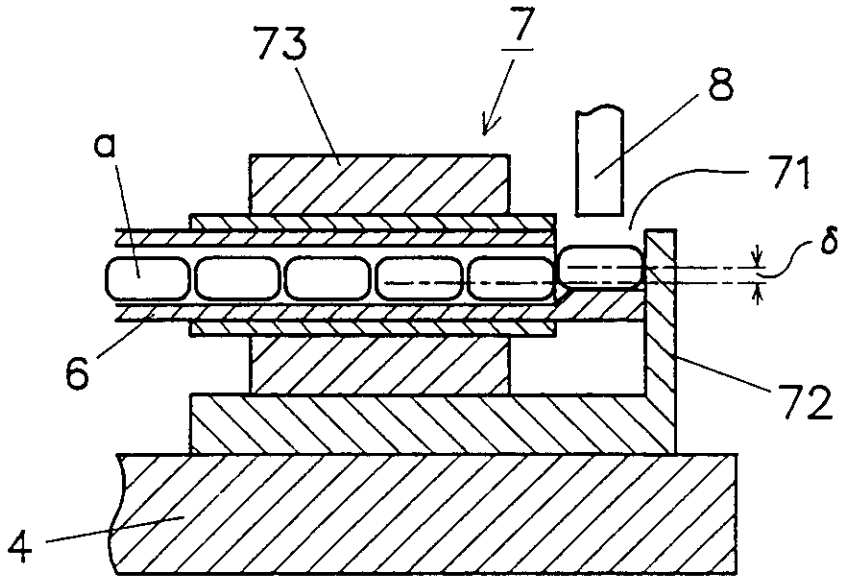


FIG.17

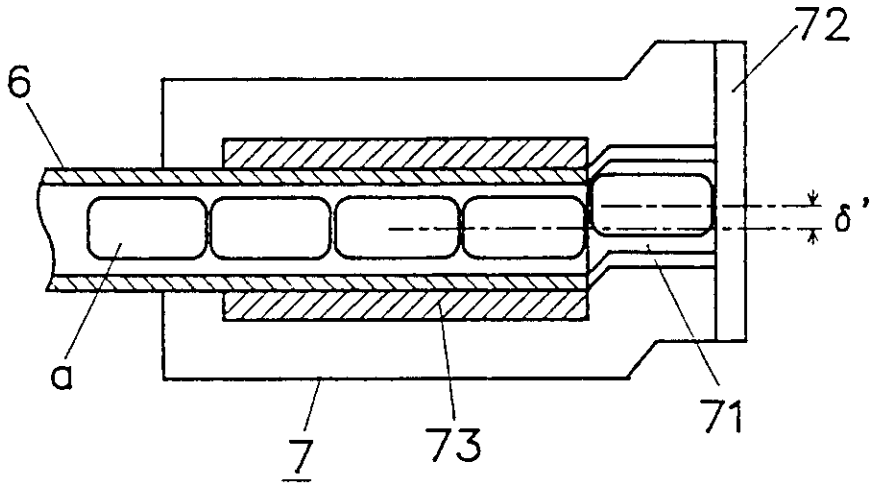


FIG.18

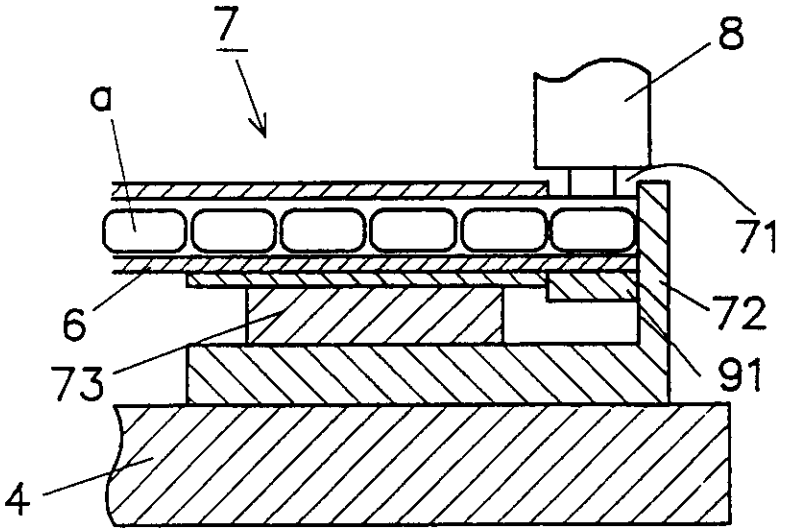


FIG.19

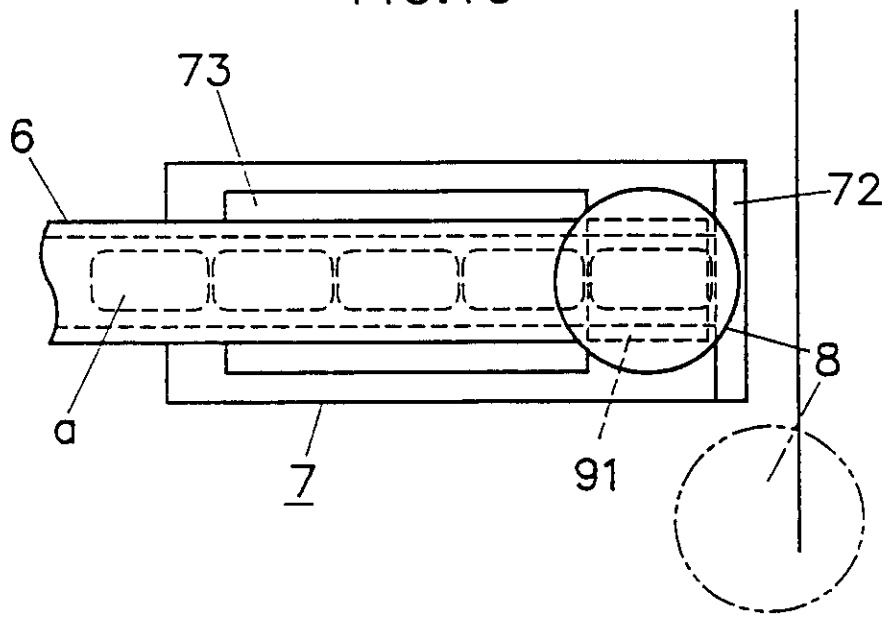


FIG.20

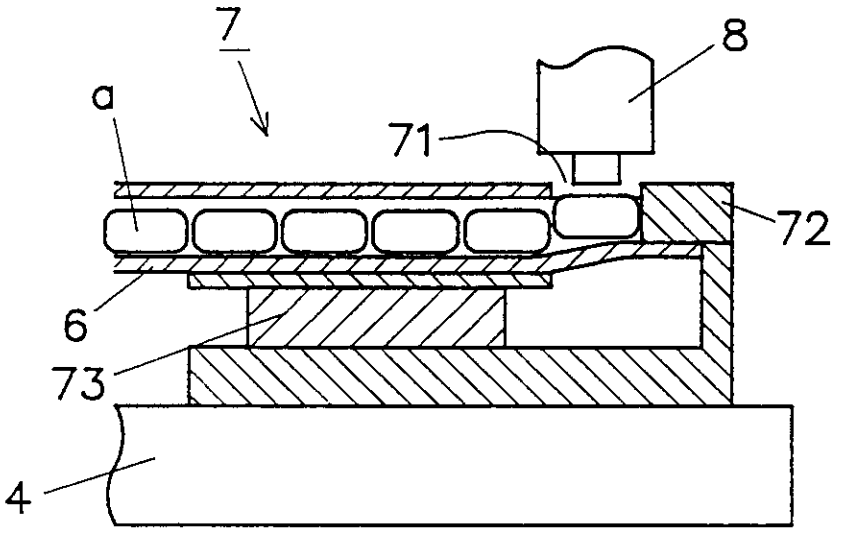


FIG.21

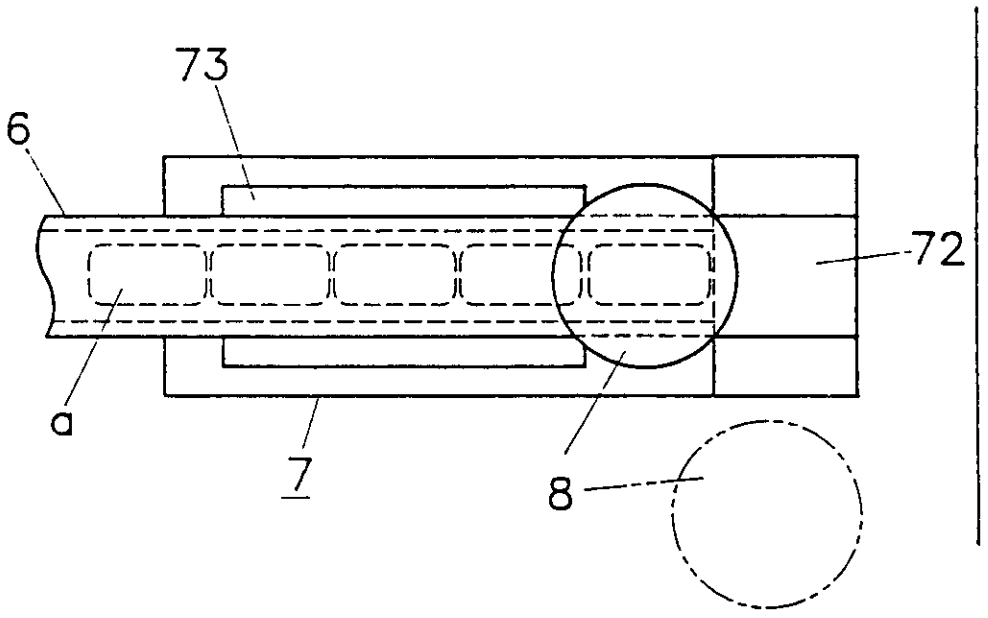


FIG.22

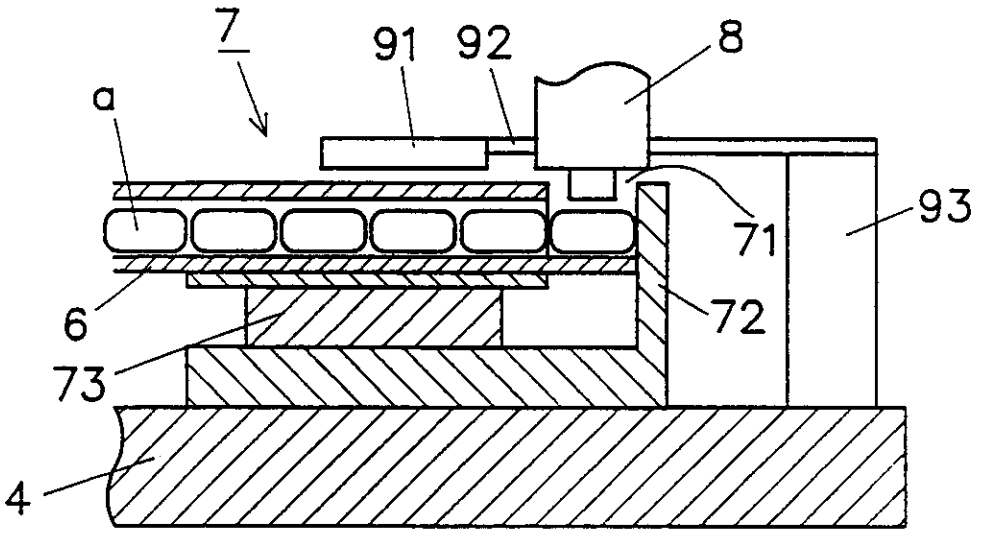


FIG.23

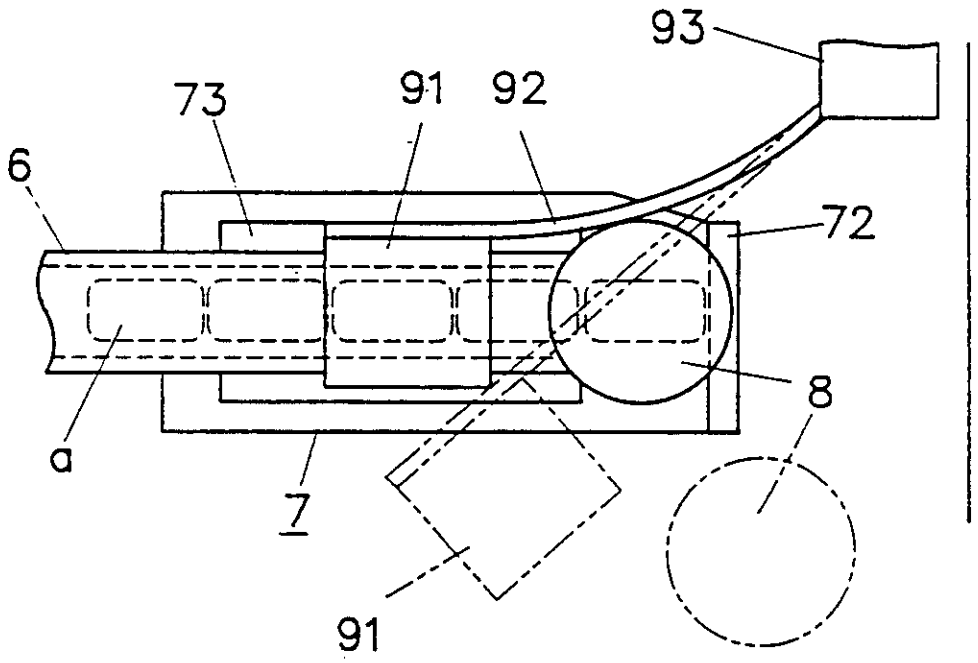


FIG.24

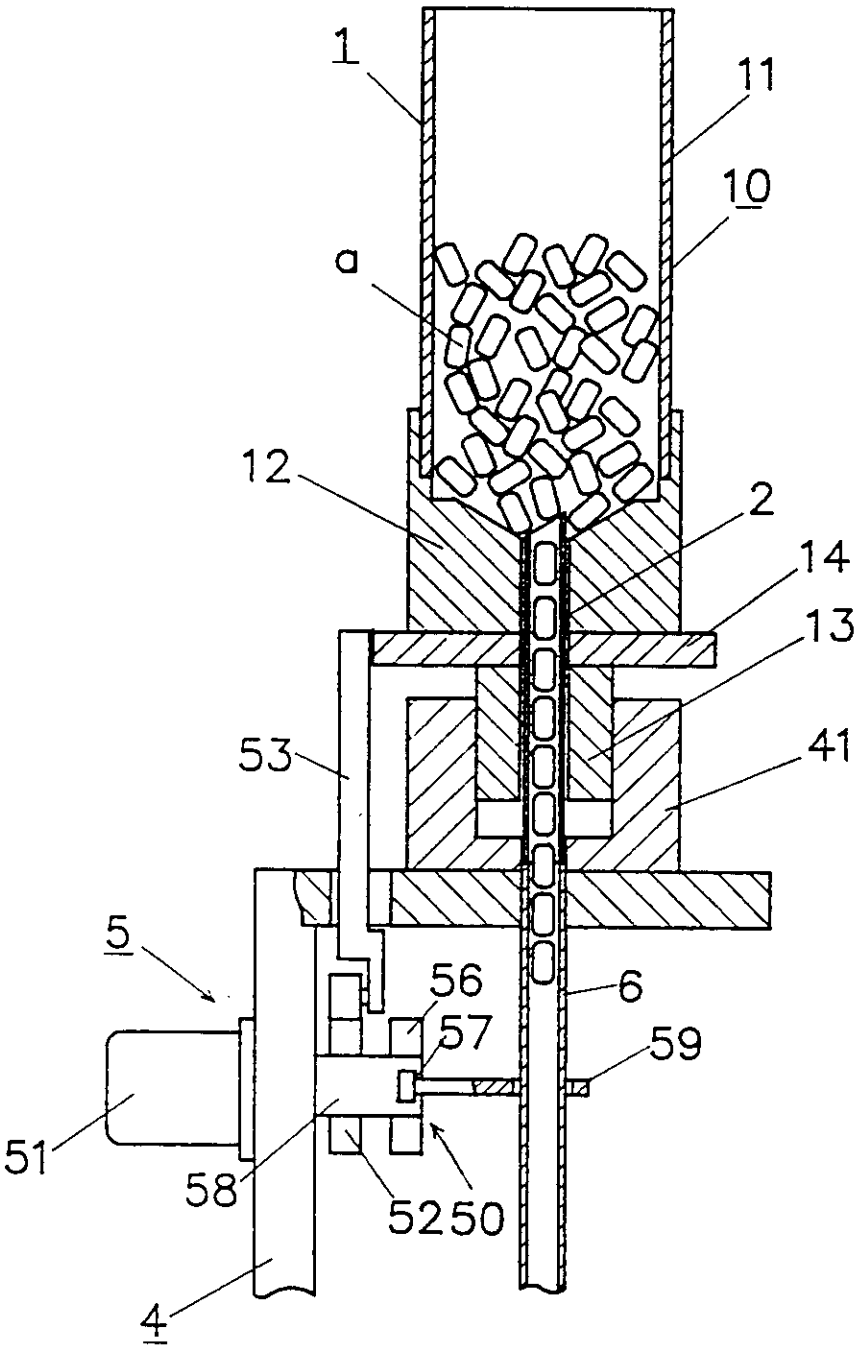
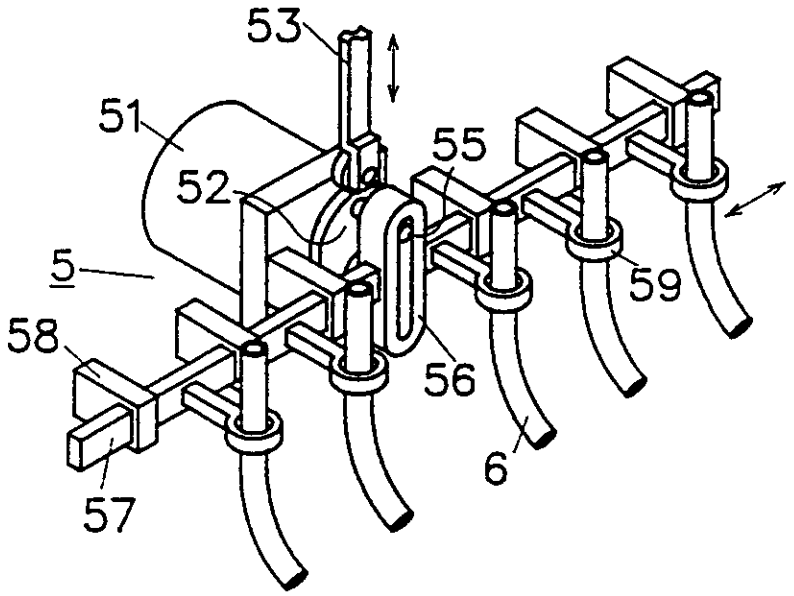


FIG.25



SPECIFICATION

PARTS SUPPLY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a parts supply device for feeding parts contained in a container in bulk and taking them out one by one.

2. Prior Art:

There is known a method of packing parts such as chips, so-called taping reel method, in which method parts are arranged in a row at a given interval and subjected to a taping and wound in a roll. In the known method, when the parts are taken out one by one from such a roll, a cover of the taping is removed while the tape is drawn from the roll. Such a method of packing is laborious and costs high.

Particularly, there has been increased a demand for supplying the parts contained in the container in bulk to a printed circuit instead of the taping reel method accompanied by the miniaturization and diversification of the parts. To meet the demand, there are proposed and widely employed various parts supply devices for feeding the parts contained in the container in bulk successively in a row and supplying them to the printed circuit. However, according to these parts supply devices, there

was a prolbem that the parts supply devices per se become complex since they are provided with a complex mechanism such as an escapement mechanism, a vacuum carrier mechanism, and the like.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a parts supply device capable of feeding the parts contained in a container one by one and supplying the parts one by one to a predetermined position in the same manner as the so-called taping reel method.

It is another object of the present invention to provide a parts supply device capable of being incorporated into an automatic parts mounting device, of eliminating a complex mechanism, and of taking out the parts one by one smoothly with simple structure.

To achieve the above objects, the parts supply device according to a preferred embodiment of the present invention comprises a part supply portion for feeding parts contained in a container one by one in a row, a chute for sliding and guiding the parts fed from the parts supply portion by its own gravity, a parts takeout portion provided with a stopper at the side of the tip end of the chute and a parts takeout end opened at an upper half thereof, positioned at the space before the stopper and having a size corresponding to the length of at least one part and a part carrier portion for taking out the parts

one by one and carries the parts to a destination.

It is possible to feed the parts from the parts supply portion to the parts carrier portion owing to an automatic fall of the parts in the chute. The parts guided by the chute and fed to the parts carrier portion are stopped by the stopper of the parts takeout portion. Inasmuch as the parts takeout portion has an opening at the portion corresponding to the position where the leading part is located, the leading part can be taken out upward from the opening of the parts takeout portion. The thus taken out leading part can be carried to the destination by the parts carrier portion. When the leading part is taken out, the parts in the chute are respectively fed forward for the interval corresponding to the length of one part and the sucseeding leading part is stopped by the stopper. The parts are taken out one by one from the parts takeout portion by the repetition of these motions.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1(a) is a longitudinally cross-sectional view showing a portion adjacent to a parts supply portion and Fig. 1(b) is a longitudinally cross-sectional view showing a parts takeout portion;

Fig. 2 is a perspective view showing an entire arrangement of a parts supply device according to a preferred embodiment of the present invention;

Fig. 3 is a side elevational view, cut away a part, of the parts supply device in Fig. 2;

Fig. 4 is a side elevational view showing a chute in a first modified example;

Fig. 5 is a side elevational view showing a chute in a second modified example;

Fig. 6 is a cross-sectional view of the chute in Fig. 5;

Fig. 7 is a longitudinally cross-sectional side elevational view showing a parts supply portion according to a first modified example;

Fig. 8 is a longitudinally cross-sectional side elevational view showing a parts takeout portion according to a first modified example;

Fig. 9 is a an exploded perspective view of the parts takeout portion in Fig. 8;

Fig. 10 is a longitudinally cross-sectional side elevational view showing a parts supply portion according to a second modified example;

Fig. 11 is a longitudinally cross-sectional side elevational view showing a parts takeout portion according a second modified example;

Fig. 12 is a cross-sectional view of a plate forming a chute in the second modified example;

Fig. 13 is an exploded perspective view of the plate forming the chute in Fig. 12;

Fig. 14 is a cross-sectional plan view showing a

takeout portion according to a third modified example;

Fig. 15 is a longitudinally cross-sectional plan view showing a takeout portion according to a fourth modified example;

Fig. 16 is a longitudinally cross-sectional plan view showing a takeout portion according to a fifth modified example;

Fig. 17 is a cross-sectional plan view showing a takeout portion according to a sixth modified example;

Fig. 18 is a longitudinally cross-sectional plan view showing a takeout portion according to a seventh modified example;

Fig. 19 is a plan view showing a takeout portion according to a eighth modified example;

Fig. 20 is a longitudinally cross-sectional plan view showing a takeout portion according to a ninth modified example;

Fig. 21 is a plan view showing a takeout portion according to a tenth modified example;

Fig. 22 is a longitudinally cross-sectional plan view showing a takeout portion according to an eleventh modified example;

Fig. 23 is a plan view showing a takeout portion according to a twelfth modified example;

Fig. 24 is a longitudinally cross-sectional plan view showing a takeout portion according to a thirteenth modified example; and

Fig. 25 is a perspective view showing an oscillating mechanism in Fig. 24.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A parts supply device according to a preferred embodiement of the present invention will be descried with reference to Figs. 1 to 25.

As illustrated in Figs. 1 to 3, a parts supply device comprises a parts suply portion 1 attached to a base 4 at the upper portion thereof, a parts carrier portion 7 attached to the base 4 at the lower portion thereof and a chute 6 connected to both the parts supply portion and the parts carrier portion 7.

The base 4 comprises, as illustrated in Figs. 2 and 3, two members 42 and 43 having respectively L-shapes viewed in side. There are arranged a plurality of long holes 45 in the width direction of the upper member 42 and at the portion adjacent to the lower portion of the upper member 42. There are provided screw holes 47 at the portion adjacent to the upper portion of the lower member 43. Bolts 46 screwed from the side of the long holes 45 are fastened so that both the upper and lower members 42 and 43 are vertically connected to each other, thereby assembling the base 4 having a U-shape viewed in side. The height of base 4, i.e. the height of the upper member 42 can be variably adjusted to an extent of the length of the long hole 45.

There is provided a guide member 41 on the upper member 42 in which the guide member 41 has a recessed portion opened upward as illustrated in Fig. 1. The guide member 41 is attached to the upper member 42 by bolts 49 which were screwed into the long holes 48. Accordingly, the guide member 41 can be variably attached to the long hole 48 to the extent of the lateral size of the long hole 48. There is provided a supply pipe 2 protruded from the center of the guide member 41 and having an upper end opened aslant.

The parts supply portion 1 comprises a container 10 composed of a base member 12 and a cylindrical member 11 protruded from the circumference of the base member 12 having a through hole opened longitudinally at the center of the base member 12. Furthermore, a bottom surface of the container 10 formed by an upper surface of the base member 12 is inclined toward the center at which the through hole is provided to form a funnel-shape. The base member 12 is fixed to a frame 14. According to the embodiment as illustrated in Fig. 2, a plurality of parts supply portions 1, 1, ... are attached to one frame 14 and arranged in a row. A slide member 13 is protruded from the bottom surface of the frame 14 and slidably engaged in the guide member 41. The slide member 13 has a through hole at a center thereof extending to the through hole of the base member 12 so that the supply pipe 2 penetrates the through holes of the base member 12 and the slide

member 13 and the upper end of the supply pipe 2 is protruded into the container 10.

There is provided a driving mechanism 5 on the base 4 for driving vertically the container 10 while the engagement between the slide member 13 and the guide member 41 serve as a guide member. A cam 52 rotatable by a motor 51 attached to the frame 4 is brought into contact with a driven roller 53 supported by the frame 14 wherein the frame 14 is vertically moved by the motor 51. As a result, the container 10 is vertically moved so that the supply pipe 2 is vertically moved relative to the container 10. An electric motor or pneumatic motor is employed as the motor 51.

An upper end of the pipe-shaped chute 6 made of a flexible elastic member is connected to a lower end of the supply pipe 2. The chute 6 has a lower end connected to the parts takeout portion 7 provided at the upper portion of the lower member 43. The parts takeout portion 7 has a holding member 73 for fixing the lower end of the chute 6 and a stopper 72. The holding member 73 is attached to the upper portion of the bottom peace of the base 4 and keeping the tip end of the chute 6 horizontal. The stopper 72 is spaced from the tip end of the holding member 73 and brought into contact with the tip end of the chute 6. The end of the chute 6 forms a parts takeout end 71 having an opening at the upper half portion thereof extending the length of one piece of the part. There is

disposed an attraction nozzle 8 over the parts takeout end for attracting one of the parts a, taking out the part a and carrying out the part a to the destination. The attraction nozzle is of a vacuum device. However, the part a can be clamped at both sides thereof by a so-called hand type chuck.

The chute 7 extending from the parts supply portion 1 to the parts takeout portion 7 is curved to form a quadratic curve at orthogonal coordinates.

As mentioned above, according to the preferred embodiment, the parts supply portion each can move horizontally relative to the upper member 42 of the base 4 while the upper member 42 of the base 4 can be vertically telescopically movable relative to the lower member 43 fixed the parts takeout portion 7 thereto. In such an arrangement, the quadratic curve drawn by the chute 6 can be adjustably varied by adjusting the fixing position of the parts supply portion 1 relative to the parts takeout portion 7 to always satisfy the aforementioned inequality. Furthermore, inasmuch as the chute 6 is formed of the elastic pipe according to the preferred embodiment, the chute 6 can absorb the vibration caused by the driving of the parts supply portion 1 by the driving means so that the quadratic curve can be maintained.

According to the parts supply apparatus, the upper end of the supply pipe to is vertically reciprocally and relatively moved in the container 10 by the vertical

movement of the container 10. When the upper end of the supply pipe 2 is moved upward from the bottom of the container 10, the parts a, a, ... in the container 10 are collapsed while when the upper end of the supply pipe 2 is lowered, the parts a, a ... enter the supply pipe 2 one by one from the opening. The parts a, a, ... are fed to the chute 6 by the gravity thereof and successively delivered to the parts takeout portion 7 while they are arranged in a row.

The leading part a in the chute 6 strikes against the stopper 72 of the parts takeout portion 7 and stopped thereby. The portion where the leading part a thus stopped by the stopper 72 forms the parts takeout end 71 having the opening opened at the upper half portion thereof. The leading part a is attracted by the attraction nozzle 8 at the parts taking up portion 71 and retained thereby and thereafter taking out. By the repetition of this motion, the parts a, a ... are fed one by one downward in the chute 6. The part a taken out by the attraction nozzle from the parts takeout end 71 is carried to a desired position, i.e., a given position of a printed circuit and mounted thereon.

The supply pipe 2 and the chute 6 can be integrated with each other or the container 10 of the parts supply portion 1 may be a detachable case type. Furtheremore, the parts supply portion 1 may be arranged in a prularity of rows and the height and the horizontal position thereof

may be adjusted by a simple screw mechanism and the like.

First Modification (Figs. 4 and 9):

A parts suppy device according to a first modification will be described with reference to Figs. 4 and 5.

The chute 6 has a linear portion 61 at the portion extending from the container 10 to the parts carrier portion 7. The linear portion 61 of the chute 6 in Fig. 5 is positioned close to the parts takeout portion 7. According to this modification, provided that the parts a, a ... are square, each of the parts at the posture as illustrated in an immaginary line in Fig. 6 to the posture as illustrated in a solid line where the flat both sides thereof are directed vertically, i.e., the most stable posture in the linear portion 61. Accordingly, these parts can be arranged in a given posture. The parts a, a by the succeeding parts a, a ... and fed toward the parts takeout portion 7 while they are postured as they are. Each of the parts a, a, ... can be taken out one by one at the parts takeout portion 7 at the state where they are postured in a given positioned.

According to the first modification as illustrated in Fig. 4, the linear portion 61 is formed at the substantially central portion between the parts supply portion 1 and the parts takeout portion 7 at the inclination close to the horizontal posture. According to the embodiment as illustrated in Fig. 5, the linear

portion 61 is formed at the portion close to the parts takeout portion 7 with a given inclination.

The chute 6 according to the embodiment as illustrated in Fig. 7 has one end detachably attached to the parts supply portion 1. More in detail, the chute 6 is connected to the supply pipe 2 in the manner that the upper end of the chute 6 is connected to the lower end of the supply pipe 2 by screwing a screw type joint 62 into a ceiling member 42 of the base 4. Accordingly, the chute 6 can be detached from the parts supply portion 1 by removing the ceiling portion 42 from the joint 62. The chute 6 and the supply pipe 2 may be not separable but integrated with each other and the upper end of the chute 6 may slidably inserted into the container 10.

According to the embodiment as illustrated in Figs. 8 and 9, the chute 6 is detachably attached to the parts takeout portion 7 at the other end thereof. The parts takeout portion 7 has the holding member 73 into which the lower end of the chute 6 inserts. The holding portion 73 is provided on the base 4. The holding member 73 is, as illustrated in Fig. 8, formed of a cylindrical body having the end portion which is opened at the upper half portion thereof and has the length slightly longer than the length of one part a. The stopper 74 protrudes from the upper end of the opened half portion of the holding member 73 in the direction of the center of the holding member 73 while the stopper 72 protrudes from the lower end thereof. The

holding member 73 has an inner diameter same as an outer diameter of the chute 6 whereby the chute 6 is tightly engaged in the holding member 73 to some extent. The chute 6 engaged in the holding member 73 has a tip portion having an opening opened at the half portion thereof and extending to the length slightly longer than the length of one part a. When the tip end of the chute 6 is, as illustrated in Fig. 7, engaged deep in the holding member 73, the tip end of the chute 6 strikes against the stoppers 74 and 72 at the upper and lower end surfaces thereof and stopped thereby so that the openings of both the holding member 73 and the chute 6 accord with each other. The opening forms the parts takeout portion 71 for taking out the leading part a and the attraction nozzle 8 is disposed thereover for attracting and taking out the leading part a. The lower stopper 72 is raised to the height higher than the center of the end surface of the chute 6 and serves as a stopper for stopping the leading part a in the chute 6 at the parts takeout end 71.

The chute 6 is attached to the parts supply portion 1 and the parts carrier portion 7 with ease or removed therefrom so that the chute 6 can be replaced by another depending on the kind of parts to be supplied thereto, thereby coping with the carrier of the variety of parts.

Second Modification (Figs. 10 to 13):

According to the preferred embodiment and modified examples set forth above, the chute 6 is formed of a pipe.

However, second modified example as illusrated in Figs. 10 to 13 has a chute 6' formed by a groove. The groove formed in a plate 67 is covered by a transparent plate 63 which is overlaid on the a plate 67. The transparent plate 63 is joined with the plate 67 by screwing screws 64 through holes 65 provided at the transparent plate 63 into screw holes 66 provided at the plate 67. Fig. 10 shows an upper portion of the chute 6', i.e. the side of the parts supply portion 1 while Fig. 11 shows a lower portion of the chute 6', i.e. the side of the parts takeout portion.

When the groove formed in the plate 67 is covered by the transparent plate 63 overlaid thereto for forming the chute 6', the state of arrangement of the electronic parts a, a ... in the chute 6' can be confirmed with ease. In case the electronic parts a, a ... are clogged in the chute 6', the electronic parts can be removed with ease by removing the transparent plate 63 from the plate 67. In case that dust is accumulated in the chute 6', the accumulated dust can be removed with ease in the same manner. Since the chute 6' is formed of the groove in the plate 67, it is possible to form the chute 6' with a precise track without causing the variation of the track as made in the chute formed of the pipe.

Third and Fourth Modifications (Figs. 14 and 15):

Parts takeout portions of the parts supply device according to third and fourth modifications will be described with reference to Figs. 14 and 15.

The parts takeout end 71 in front of the stopper 72 has a central aixs which is inclined relative to the extending line of the parts feeding path. With such an arrangement, the gravity of the part succeeding to the leading part influences aslant the leading part so that the gravity is decomposed which involves the reduction of the frictional force generated between the leading part and the succeeding part. Accordingly, it is possible to prevent the succeeding part from being drawn out from the parts feeding path and taken out together with the leading part when the leading part is taken out.

According to the third modification as illustrted in Fig. 14, the parts takeout end 71 is bent horizontally relative to the extending line of the parts feeding path in front of the parts takeout end 71. The bending angle is preferable to be 10 to 45° relative to the horizontal direction.

According to the fourth modification as illustrated in Fig. 15, the parts takeout end 71 is bent vertically relative to the extendng line of the parts feeding path in front of the parts takeout end 71. The angle between the extending line of the parts feeding path and the horizontal line is set to be while the parts take out end 71 is kept horizontal. The angle is preferable to be 5 to 45° in the vertical direction.

Fifth and Sixth Embodiment (Figs. 16 and 17):

Parts takeout portions of the parts supply device

according to fifth and sixth modifications will be described with reference to Figs. 6 and 17.

The parts takeout end 71 has a central axis slightly displaced from the extending line of the parts feeding path in front of the parts takeout end 71. In these modifications, since the gravity of the part succeeding to the leading part is decomposed it is possible to reduce the frictional force generated between the leading part and the succeeding part.

The parts takeout portion in Fig. 16 has a difference in level between the takeout end 71 and the parts feeding path in front of the takeout end 71 whereby the central axis of the parts takeout end 71 and the central axis of the end portion of the chute 6 are displaced in vertical relationship. The amount of displacement is denoted at in Fig. 16. Although the parts takeout end 71 is higher than the height of the chute 6 in Fig. 16, the parts takeout end 71 can be lower than the height of the chute 6.

In the sixth modification in Fig. 17, the central axis of the parts takeout end 71 is displaced horizontally from the central axis of the end portion of the chute 6 forming the parts feeding path. The amount of displacement is denoted at in Fig. 17.

Seventh and Eighth Modification (Figs. 18 and 19):

Parts takeout portions of the parts supply device according to seventh and eighth modifications will be described with reference to Figs. 18 and 19.

A magnet 91 is provided at the portion just under the parts takeout end 71. In case that the electronic parts provided with electrodes are made of magnetic members such as nickel which are liable to be influenced by the magnetic force, the electronic part a is pressed by the magnetic force of the magnet 91 so that the electronic part a is hardly dropped from the part takeout end 71.

Ninth and Tenth Modifications (Figs. 20 and 21):

In parts takeout portions of ninth and tenth modifications, the stopper 72 per se is made of a magnet as illustrated in Figs. 20 and 21. The chip a having circuits thereon provided with terminals stopped by the stopper 72 is attracted by the stopper 72 at one end terminal thereof and pressed thereby. As illustrated in Fig. 20, there is formed an inclination of about 5^{o} in the parts takeout end 71 and the chip a is attracted by the attraction nozzle 8 at the portion which is higher than the portion where the succeeding chip a is positioned. In such a manner, i.e., since the stopper 72 is formed of the magnet and the parts takeout end 71 has the inclination, the chip a is completely attracted by the attraction nozzle 8 without fail.

Eleventh and Twelfth Modification (Figs. 22 and 23):

Parts takeout portions according to eleventh and twelfth modified examples will be described with reference to Figs. 22 and 23.

A magnet 91 is disposed in front of the parts takeout

end 71. The magnet 91 is attached to a tip end of an elastic arm 92 which is attached to a fixing table 93 protruded from the frame 4 at the base end thereof. When the arm 92 is in a free state, the arm 92 extends straight so that the magnet 91 provided thereto is displaced from the chute 6. However, when the attraction nozzle 8 comes over the parts takeout end 71 of the parts takeout portion 7, the arm 92 is pushed thereby and vent so that the magnet 91 is positioned just over the end portion of the chute 6. When the attraction nozzle 8 is moved as illustrated in two dotted chain lines in Fig. 23, the arm 92 is recovered straight by its own elasticity so that the magnet 91 provided at the tip end thereof is displaced again from the chute 6.

In case that both the electrodes of the electronic parts a are formed of magnetic members such as nickel and the like, the magnetic force of the magnet 91 influences the part a when the magnet 91 comes just over the end portion of the chute 6 so that the part a is refrained from moving in the chute 6. Therefore, the leading electronic part a is attracted and held by the attraction nozzle 8 without being influenced by the electronic parts a, a ... arranged in the chute 6 and can be taken out from the parts takeout end 71. When the magnet 91 is displaced from the end portion of the chute 6, the magnet force which influenced the electronic part a is removed so that the electronic part a is fed toward the parts takeout end

71 owing to the grvaity of the succeeding parts to the extent corresponding to the length of one part.

Thirteenth and Fourteenth Modifications (Figs. 24 and 25):

Parts takeout portions according to thirteenth and fourteenth modified examples will be described with reference to Figs. 24 and 25.

The pipe shaped chute 6 is oscillated by the actuation of the motor 51 through an oscillating mechanism 50 composed of a yoke mechanism. That is, as illustrated in Fig. 25, a protrusion 55 protruded from a plate surface of a cam 52 is engaged in a slider 56 having a long track in the vertical direction thereof. A rod 57 is protruded from both sides of the slider 56 and is supported by brackets 58, 58 ... protruded respectively from the frame 4 so as to slide in the longitudinary direction thereof. Accordingly, both the slider 56 and the rod 57 are respectively reciprocated in the longitudinal direction of the rod 57 accompanied by the rotation of the cam 52 by the motor 51. Arms 59, 59... are protruded from the rod 57 and the flexible pipe shaped chutes 6, 6 ... are passed through and attached to each of the arms 59, 59 ... As a result, the chute 6 is reciprocated by the rotation of the motor 51 so that the oscillation is given to the chute 6. When the chutes 6 are oscillated, it is possible to prevent the electronic parts a, a ... from being stayed or clogged in the chute 6 so that the electronic parts a, a

As mentioned in detail above, it is possible to smoothly supply the parts using the gravity thereof without employing a complex mechanism. It is also possible to take out the thus fed parts one by one and carry it to the destination.

The parts supply device of the present invention may further comprise a hopper and/or a parts discharge pipe as described in simultaneously-filed, co-pending U.K. Patent Application No. 9111329.0, the disclosure of which is incorporated herein by reference.

CLAIMS:

1. A parts supply device comprising a parts supply means for feeding parts contained in bulk in a container, a chute for sliding and guiding the parts fed from the parts supply means and gravitationally arranged in a row, a parts takeout means with a stopper provided at the tip end of the chute and a parts takeout end provided in front of the stopper, the parts takeout end having an open upper half portion and having a size corresponding to the length of at least one part, and a parts carrier means for taking out the parts one by one from the parts takeout means and carrying the parts to a destination.

2. A parts supply device according to Claim 1, wherein the chute has a linear portion at the parts takeout end thereof.

3. A parts supply device according to Claim 1, wherein the chute is formed of a flexible pipe.

4. A parts supply device according to Claim 3, wherein the chute is detachably attached to the parts supply means at the one end thereof and the parts takeout means at the other end thereof.

5. A parts supply device according to Claim 3, wherein the track of the chute is variable by adjusting the position of the parts takeout means relative to the parts supply means.

6. A parts supply device according to Claim 3, which further includes an oscillating mechanism for oscillating the chute.

7. A parts supply device according to Claim 1, wherein the chute is formed of a groove in a plate, covered by a transparent plate.

8. A parts supply device according to Claim 1, wherein the parts takeout end just in front of the stopper is curved relative to an extending line of a parts feeding path leading to the parts takeout end.

9. A parts supply device according to Claim 1, wherein the parts takeout end just in front of the stopper of the parts takeout portion is laterally displaced relative to an extending line of a parts feeding path leading to the parts takeout end.

10. A parts supply device according to Claim 1, wherein the parts takeout end just in front of the stopper of the parts takeout means is longitudinally displaced relative to an extending line of the parts feeding path leading to the parts takeout end.

11. A parts supply device according to Claim 1, wherein the parts takeout means has a magnet for attracting each part, made of a magnetic material, which is stopped by the stopper.

12. A parts supply device according to Claim 1, wherein the parts takeout means has a magnet for attracting each part made of a magnetic material which reaches the parts stopped by the stopper.

13. A parts supply device comprising a parts supply means comprising a container for storing a plurality of parts, a parts takeout means comprising a stopper adjacent an upwardly facing removal aperture, which aperture is at

least the length of one of the parts, a chute connecting the parts supply means with the parts takeout means for delivering individual parts to the removal aperture and part carrier means for removing a part from the removal aperture.

14. A parts supply device according to any one of Claims 1 to 13, wherein the container comprises a hopper having a delivery aperture in the bottom surface thereof and a partition, partially partitioning the inside of the hopper so that, in use, the pressure exerted on parts adjacent the delivery aperture by parts contained in other portions of the hopper is reduced.

15. A parts supply device according to any one of Claims 1 to 14, wherein the chute comprises a parts discharge pipe having a projection extending from the upper edge thereof.

16. A parts supply device according to Claim 15, wherein the projection has a flat inner side.

17. A parts supply device according to Claim 15, wherein the projection has a curved inner side.

18. A method of supplying an individual part using a device according to any one of Claims 1 to 17, which method comprises storing a plurality of parts in the container, causing an individual part to move, under the influence of gravity, along the chute to the removal aperture and removing the part from the removal aperture with the part carrier means.

19. A method of supplying individual parts substantially as hereinbefore described with reference to the accompanying drawings.

20. A parts supply device substantially as hereinbefore described with reference to, and as shown in, Figures 1 to 3, or 4 or 5 and 6, or 7, or 8 and 9 or 10 to 13, or 14, or 15, or 16, or 17, or 18 and 19, or 20 and 21, or 22 and 23, or 24 and 25.

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