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**TITLE: APPARATUS FOR CLAMPING AND CONVEYING PLATE-LIKE
WORKPIECES**

BACKGROUND OF THE INVENTION

(a) Field of the Invention:

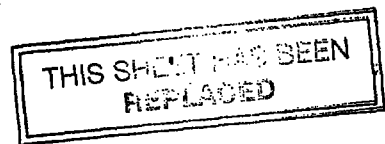
5 The present invention relates to a clamping and conveying apparatus, and more particularly to an apparatus for clamping and conveying plate-like workpieces.

(b) Description of the Prior Art:

10 In mechanical processing, especially in integrated automatic processing operations, there are various kinds of clamping and conveyance depending on the type of the workpiece. Besides, processing machinery and apparatuses are usually made to order according to the actual
15 operation and job requirements.

 In respect to conveyance, linear or cyclic conveyance is the most commonly adopted method, in which raw material or workpieces are fed in from one end of a planar surface and discharged via the other end thereof.
20 As the conveyance operation is done on the same planar surface, it is simple and does not require much equipment.

 However, for some kinds of machine work or processing operation, the workpieces have to be not only
25 conveyed on a planar surface but also lifted to different elevations, which hence requires a more



complicated conveyance system.

In processing plate-like workpieces such as integrated circuits or light emitting diodes which are likely to have residual material deposited thereon or adhered thereto, in order not to affect the product quality, it is oftentimes necessary to remove the residues. This is done by manually immersing the finished products in certain kind of chemical. Such a method is not very ineffective, and it is inefficient. The reason why this method has been adopted for years is that there is not an effective clamping and conveyance system. This problem also exists in other fields, not only in the electronics industry.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide an apparatus for clamping and conveying plate-like workpieces.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present invention will be more clearly understood from the following detailed description and the accompanying drawings, in which,

Fig. 1 is a schematic view of the apparatus of the invention;

Fig. 2 is a schematic view of a feeding device of the apparatus according to the invention;



Fig. 3 is a schematic view of the turn-over and clamping devices of the apparatus according to the invention;

Fig. 4 is a schematic view of the clamping pawl of the apparatus according to the invention; and

5 Fig. 5 is a schematic view illustrating the action of the clamping device of the apparatus according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings, the apparatus
10 according to the invention essentially comprises a feeding section 1, a loading section, a turn-over device 3, and a clamp device 4.

The feeding section 1 is located below the loading section 2 and is consisted of a feeding frame 11 mounted
15 on a feed platform 12 capable of relative sliding movement to the feeding frame 11. The feed platform 12 is in turn supported by at least a support device 13, which may be a hydraulic or pneumatic cylinder. The support device 13 displaces upwardly to push the feed
20 platform 12 to disengage from the feeding frame 11 or to lower the feed platform 12.

The support device 13 is connected to a support platform 14, which is in turn connected to a translational device 15. The translational device 15
25 may be a hydraulic or pneumatic cylinder. By means of this arrangement, the translational device 15 may cause



the support platform 14 to displace to the left or right. In addition, a plurality of containers 16 are spaced equally apart from each other above the feed platform 12. The shape of these containers 16 may vary
5 depending on the shape of the workpieces they are designed to hold. In this preferred embodiment, the containers 16 are configured to hold plate-like workpieces so that they are designed to be slanting L-shaped recesses. The feeding operation is an automatic
10 cyclic one which will be described in detail hereinbelow.

With reference to Figs. 1 and 2, a dropping device 17 is disposed at a front end of the feed platform 12 for receiving containers 16 conveyed along the loading
15 section 2 and from which workpieces deposited therein have been removed by the turn-over device 3 and dropping the containers 16 onto the feeding section 1. The dropping device 17 may be hydraulically or pneumatically actuated and is capable of upward and downward movement.
20 Additionally, a hydraulic or pneumatic lifting device 18 is disposed at a rear end of the feed platform 12 for lifting the containers 16 onto the loading section 2.

The loading section 2 mainly consists of an elongated loading platform 21 mounted across a frame and
25 its length matches that of the feed platform 12. The loading section 2 further includes a hydraulic or



pneumatic pusher 22 located above and to one side of the lifting device 18 and may advance or withdraw as controlled by the hydraulic or pneumatic actions.

5 The turn-over device 3 is shown in Fig. 3 and includes an turn-over axle 31 pivotally connected to a turn-over means 32. The turn-over means 32 is actuated by a motor which may rotate through a predetermined angle and is connected to an extendible turn-over shaft 33 at its front end. The turn-over shaft 33 is in turn
10 connected to a turn-over suction disk 34 which has disposed thereon a multiplicity of suction holes and is connected to a drawing device. Hence, when the turn-over shaft 33 is caused to extend, the suction disk 34 may adhere to a workpiece which may turn therewith.

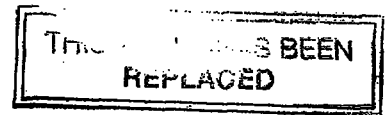
15 The clamping device 4 mainly consists of a plurality of clamping pawls 41 equally spaced apart from each other and capable of upward and downward movement, and a clamp seat 42 capable of forward and backward movement. Each clamping pawl 41 has two legs. At one
20 end of the clamp seat 42 which points towards the turn-over device 3 is provided a pin 43. The clamping pawls 41 are also provided with corresponding pawl holes 44. Therefore, when a clamping pawl 41 is lowered, the pin 43 will move forwardly to penetrate one of the pawl
25 holes 44 so that legs of the clamping pawl 41 are separated, and when the pin 43 withdraws, the legs of



the clamping pawl 41 will close up again.

Operation of the apparatus of the invention will be described by making further reference to the drawings. The lifting device 18 at the rear end of the apparatus receives an empty container 16 discharged from the feed platform 12 and displaces upwardly to the loading section 2. The empty container 16 is then pushed by the pusher 22 onto the loading platform 21. A workpiece is then automatically or manually placed inside the container 16. The suction disk 34 at the front end of the loading platform 21 will then suck up the workpiece in the container 16 nearest to it, turn it over and carry it to the clamping pawl 41. At this time, the clamping pawl 41 has been lowered and has its legs separated by the pin 43. The workpiece is placed between the legs of the clamping pawl 41 and held fast thereby once the pin 43 is withdrawn. The clamping pawl 41 together with the workpiece is then elevated to another location for subsequent processing work.

After the workpiece is sucked away from the container 16 by the suction disk 34, the thus emptied container 16 is received by the dropping device 17 which displaces downwardly to deposit the container 16 onto the feed platform 12. The support device 13 then urges upwardly so that the translational device 15 displaces forwardly causing an empty container 16 at the rear end



of the feed platform 12 to be discharged onto the lifting device 18, and the container 16 is then lifted to the loading section 1 for receiving a workpiece. The above-described operation may also be programmed and automated.

In the present invention, the arrangement of a feeding section 1 and a loading section 2 disposed at different elevations facilitate conveyance of workpieces from a lower position to an upper position. The lateral displacement of the loading section 2 and the turn-over device 3 as well as the picking and lowering actions of the turn-over device 3 enable the invention to be employed in various processing operations such as coating, paint spraying, electrolysis, washing, immersion, etc. In addition, the invention does not occupy space and may be automated to save labor.

Although the present invention has been illustrated and described with reference to the preferred embodiment thereof, it should be understood that it is in no way limited to the details of such embodiment but is capable of numerous modifications within the scope of the appended claims.



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What is claimed is:

1. An apparatus for clamping and conveying plate-like workpieces comprising:

5 a feeding section consisting of a feeding frame mounted on a movable feed platform and at least one supporting device disposed therebelow for supporting or urging upwardly against said feeding frame so that said feed platform may disengage from said feeding frame, said supporting device having a rear end thereof connected to
10 a support platform which is in turn connected to a translational device, said feed platform having disposed thereon a multiplicity of containers spaced equally apart from each other, a dropping device capable of upward and downward displacement being disposed at a
15 front end of said feeding section, and a lifting device capable of upward and downward displacement being disposed at a rear end of said feeding section;
a loading section consisting of an elongated load platform mounted across a frame and located right above
20 said feeding section, said load platform having a length equivalent to that of said feed platform, said loading section further having a pusher located at a rear end thereof to one side of said lifting device;
a turn-over device consisting of a turn-over axle
25 pivotally connected to a turn-over means which is actuated by a motor capable of rotating through a

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predetermined angle, said turn-over means having an extendible turn-over shaft disposed at a front end thereof, said turn-over shaft being connected to a turn-over suction disk having a multiplicity of suction holes and connected to a drawing device; and

5 a clamping device consisting of a multiplicity of clamping pawls spaced equally apart from each other in a row and capable of upward and downward displacement, and a clamp seat capable of forward and backward

10 displacement, said clamp seat having one end thereof pointing towards said turn-over device, said end being provided with a multiplicity of pins matching said clamping pawls in number, said clamping pawls each having a plurality of pawl holes for passage of said

15 pins; wherein

an empty container discharged from said feed platform is lifted up to said loading section and is pushed by said pusher along said load platform for receiving a workpiece which is then sucked away from said container

20 by said suction disk of said turn-over device and is held by said clamping device, and said container is received onto said dropping device which deposits said container back onto said feed platform.

2. An apparatus as claimed in Claim 1, wherein

25 operations of said apparatus may be programmed and

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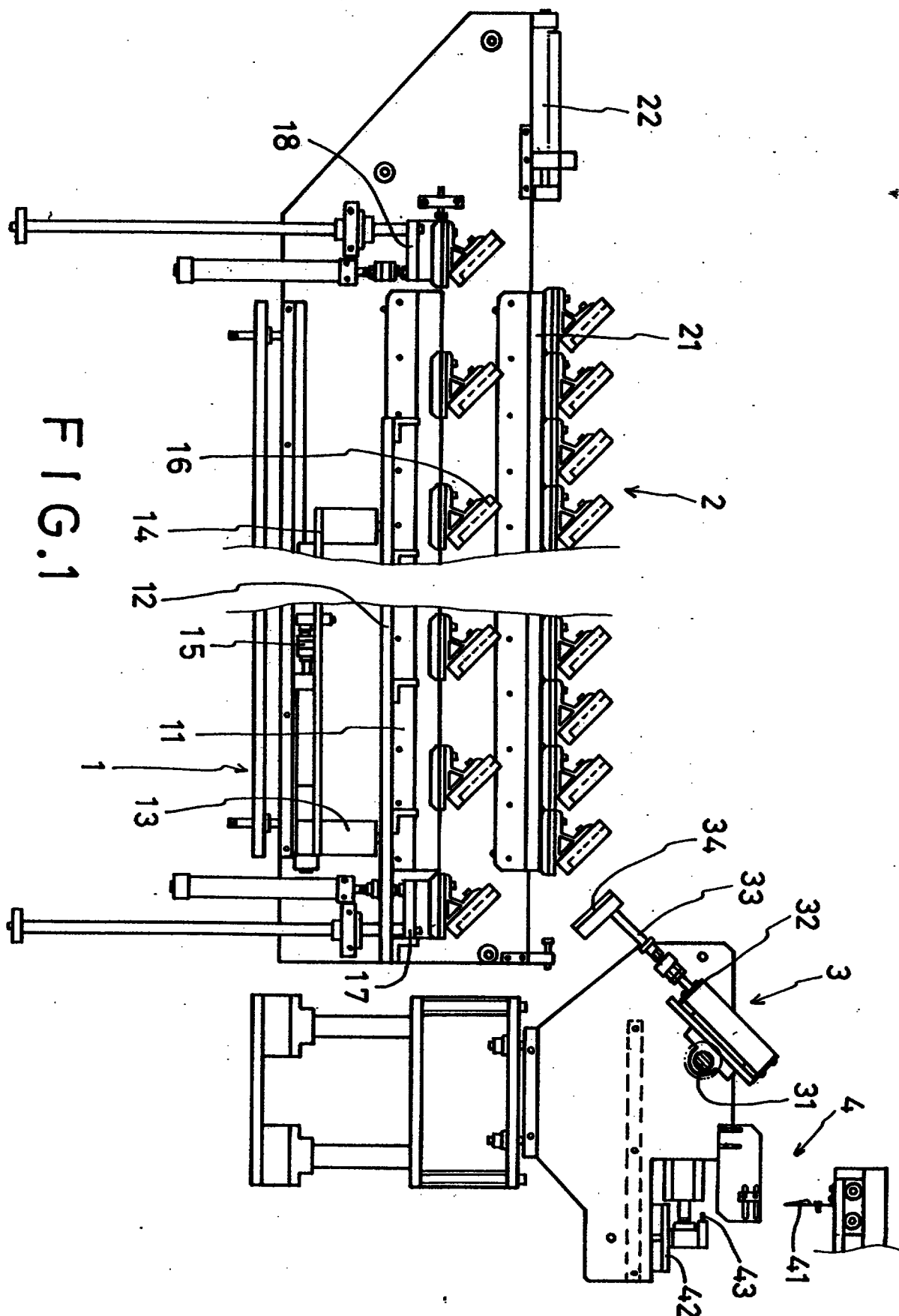
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automated.

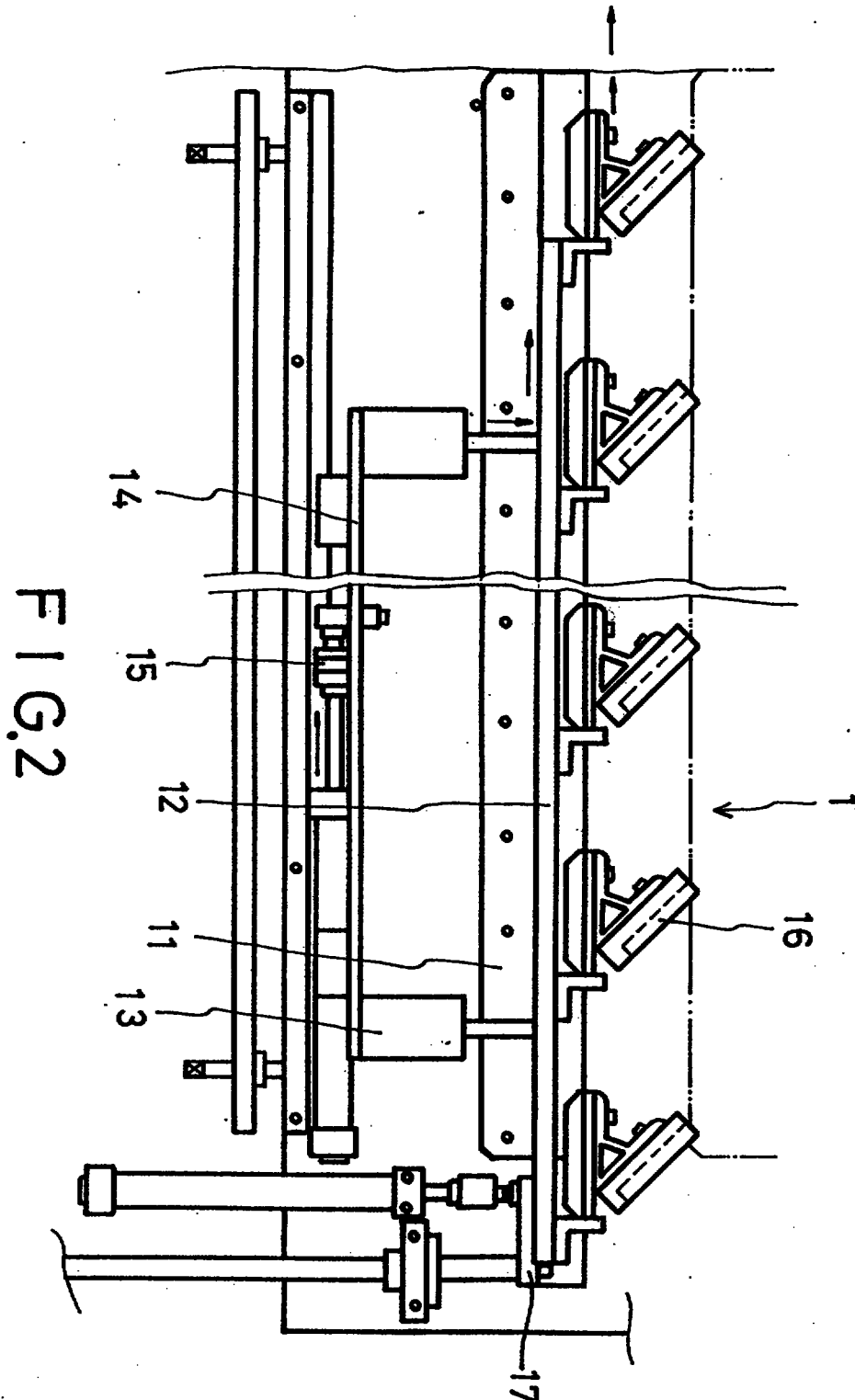
3. An apparatus as claimed in Claim 1, wherein said supporting device, said translational device, said dropping device, said lifting device, said pusher and
5 said turn-over device may be hydraulically or pneumatically actuated.

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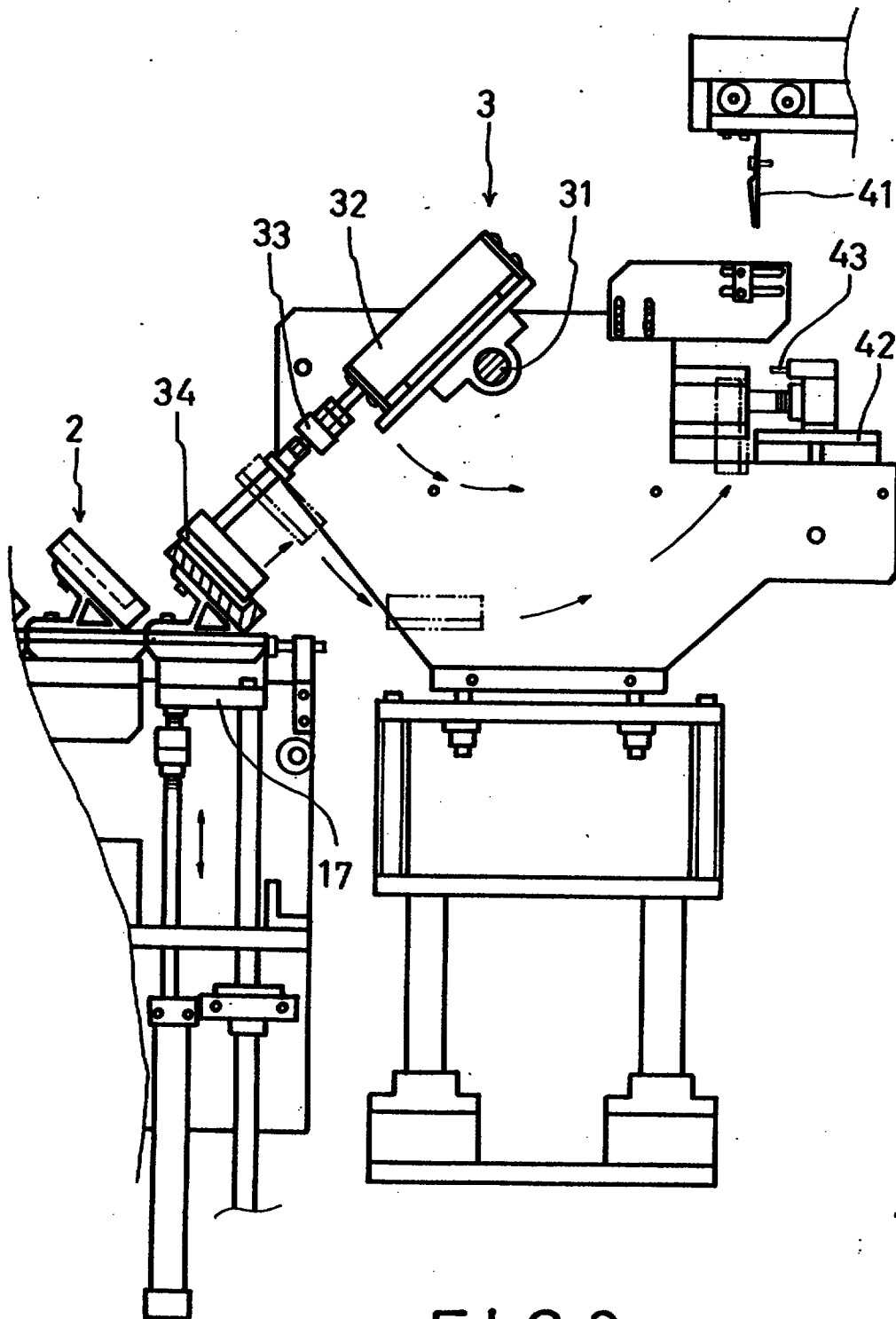
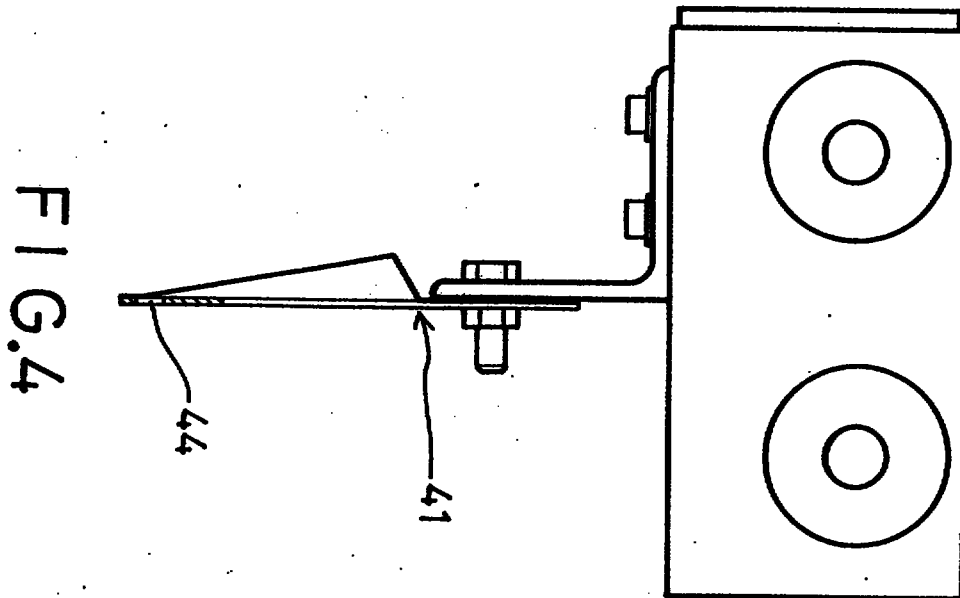
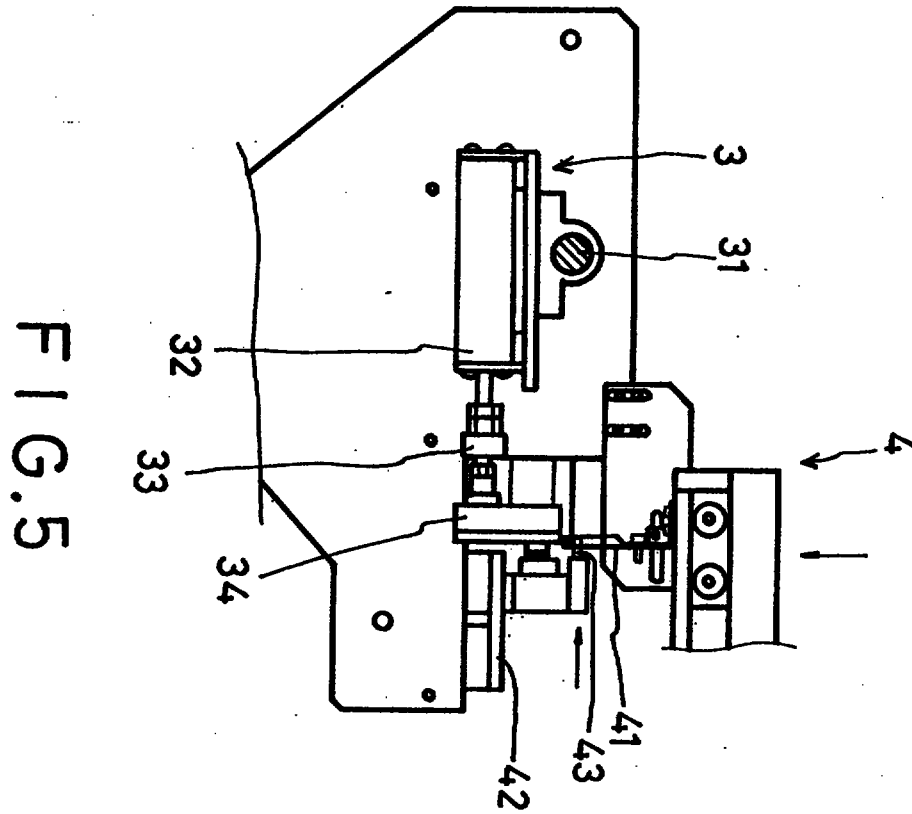


FIG. 3



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ABSTRACT

An apparatus for clamping and conveying plate-like workpieces includes a feeding section consisting of a feeding frame mounted on a movable feed platform and at least one supporting device disposed therebelow for supporting or urging upwardly against the feeding frame, the supporting device being connected to a support platform which is in turn connected to a translational device, the feed platform having disposed thereon a multiplicity of containers, a dropping device and a lifting device being respectively disposed at both sides of the feeding section; a loading section consisting of an elongated load platform mounted across a frame and located right above the feeding section, the load platform equaling to the feed platform in length and having a pusher located to one side of the lifting device; a turn-over device consisting of an axle pivotally connected to a turn-over means which is actuated by a motor capable of rotating through a predetermined angle, the turn-over means having an extendible shaft disposed at a front end thereof, the shaft being connected to a suction disk having suction holes and being connected to a drawing device; and a clamping device consisting of a multiplicity of clamping pawls spaced equally apart from each other in a row and capable of upward and downward displacement, and a clamp



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seat capable of forward and backward displacement, the clamp seat having one end thereof provided with a multiplicity of pins which penetrate holes in the clamp pawls.

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REPLACEMENT SHEET
Date :...29 MAR 1996

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In respect to conveyance, linear or cyclic conveyance is the most commonly adopted method, in which raw material or workpieces are fed in from one end of a planar surface and discharged via the other end thereof. As the conveyance operation is done on the same planar surface, it is simple and does not require much equipment.

However, for some kinds of machine work or processing operation, the workpieces have to be not only conveyed on a planar surface but also lifted to different elevations, which hence requires a more

complicated conveyance system.

In processing plate-like workpieces such as integrated circuits or light emitting diodes which are likely to have residual material deposited thereon or adhered thereto, in order not to affect the product quality, it is oftentimes necessary to remove the residues. This is done by manually immersing the finished products in certain kind of chemical. Such a method is not very ineffective, and it is inefficient. The reason why this method has been adopted for years is that there is not an effective clamping and conveyance system. This problem also exists in other fields, not only in the electronics industry.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide an apparatus for clamping and conveying plate-like workpieces.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present invention will be more clearly understood from the following detailed description and the accompanying drawings, in which,

Fig. 1 is a schematic view of the apparatus of the invention;

Fig. 2 is a schematic view of a feeding device of the apparatus according to the invention;

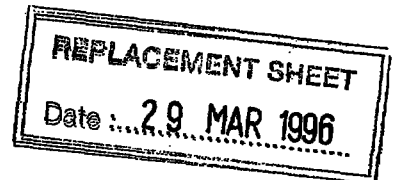
Fig. 3 is a schematic view of the turn-over and clamping devices of the apparatus according to the invention; Fig. 4 is a schematic view of the clamping pawl of the apparatus according to the invention; and Fig. 5 is a schematic view illustrating the action of the clamping device of the apparatus according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings, the apparatus according to the invention essentially comprises a feeding section 1, a loading section, a turn-over device 3, and a clamp device 4.

The feeding section 1 is located below the loading section 2 and is consisted of a feeding frame 11 mounted on a feed platform 12 capable of relative sliding movement to the feeding frame 11. The feed platform 12 is in turn supported by at least a support device 13, which may be a hydraulic or pneumatic cylinder. The support device 13 displaces upwardly to push the feed platform 12 to disengage from the feeding frame 11 or to lower the feed platform 12.

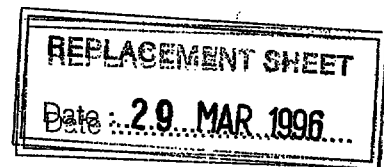
The support device 13 is connected to a support platform 14, which is in turn connected to a translational device 15. The translational device 15 may be a hydraulic or pneumatic cylinder. By means of this arrangement, the translational device 15 may cause



the support platform 14 to displace to the left or right. In addition, a plurality of containers 16 are spaced equally apart from each other above the feed platform 12. The shape of these containers 16 may vary depending on the shape of the workpieces they are designed to hold. In this preferred embodiment, the containers 16 are configured to hold plate-like workpieces so that they are designed to be slanting L-shaped recesses. The feeding operation is an automatic cyclic one which will be described in detail hereinbelow.

With reference to Figs. 1 and 2, a dropping device 17 is disposed at a front end of the feed platform 12 for receiving containers 16 conveyed along the loading section 2 and from which workpieces deposited therein have been removed by the turn-over device 3 and dropping the containers 16 onto the feeding section 1. The dropping device 17 may be hydraulically or pneumatically actuated and is capable of upward and downward movement. Additionally, a hydraulic or pneumatic lifting device 18 is disposed at a rear end of the feed platform 12 for lifting the containers 16 onto the loading section 2.

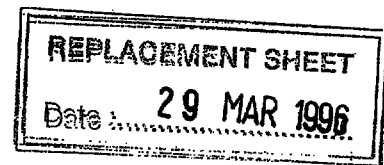
The loading section 2 mainly consists of an elongated loading platform 21 mounted across a frame and its length matches that of the feed platform 12. The loading section 2 further includes a hydraulic or



pneumatic pusher 22 located above and to one side of the lifting device 18 and may advance or withdraw as controlled by the hydraulic or pneumatic actions.

The turn-over device 3 is shown in Fig. 3 and includes an turn-over axle 31 pivotally connected to a turn-over means 32. The turn-over means 32 is actuated by a motor which may rotate through a predetermined angle and is connected to an extendible turn-over shaft 33 at its front end. The turn-over shaft 33 is in turn connected to a turn-over suction disk 34 which has disposed thereon a multiplicity of suction holes and is connected to a drawing device. Hence, when the turn-over shaft 33 is caused to extend, the suction disk 34 may adhere to a workpiece which may turn therewith.

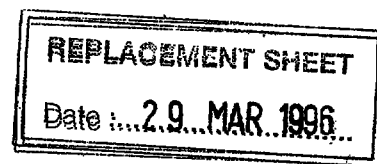
The clamping device 4 mainly consists of a plurality of clamping pawls 41 equally spaced apart from each other and capable of upward and downward movement, and a clamp seat 42 capable of forward and backward movement. Each clamping pawl 41 has two legs. At one end of the clamp seat 42 which points towards the turn-over device 3 is provided a pin 43. The clamping pawls 41 are also provided with corresponding pawl holes 44. Therefore, when a clamping pawl 41 is lowered, the pin 43 will move forwardly to penetrate one of the pawl holes 44 so that legs of the clamping pawl 41 are separated, and when the pin 43 withdraws, the legs of



the clamping pawl 41 will close up again.

Operation of the apparatus of the invention will be described by making further reference to the drawings. The lifting device 18 at the rear end of the apparatus, receives an empty container 16 discharged from the feed platform 12 and displaces upwardly to the loading section 2. The empty container 16 is then pushed by the pusher 22 onto the loading platform 21. A workpiece is then automatically or manually placed inside the container 16. The suction disk 34 at the front end of the loading platform 21 will then suck up the workpiece in the container 16 nearest to it, turn it over and carry it to the clamping pawl 41. At this time, the clamping pawl 41 has been lowered and has its legs separated by the pin 43. The workpiece is placed between the legs of the clamping pawl 41 and held fast thereby once the pin 43 is withdrawn. The clamping pawl 41 together with the workpiece is then elevated to another location for subsequent processing work.

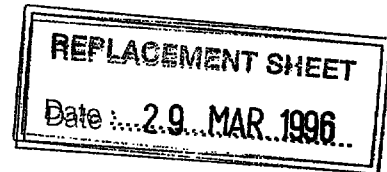
After the workpiece is sucked away from the container 16 by the suction disk 34, the thus emptied container 16 is received by the dropping device 17 which displaces downwardly to deposit the container 16 onto the feed platform 12. The support device 13 then urges upwardly so that the translational device 15 displaces forwardly causing an empty container 16 at the rear end



of the feed platform 12 to be discharged onto the lifting device 18, and the container 16 is then lifted to the loading section 1 for receiving a workpiece. The above-described operation may also be programmed and automated.

In the present invention, the arrangement of a feeding section 1 and a loading section 2 disposed at different elevations facilitate conveyance of workpieces from a lower position to an upper position. The lateral displacement of the loading section 2 and the turn-over device 3 as well as the picking and lowering actions of the turn-over device 3 enable the invention to be employed in various processing operations such as coating, paint spraying, electrolysis, washing, immersion, etc. In addition, the invention does not occupy space and may be automated to save labor.

Although the present invention has been illustrated and described with reference to the preferred embodiment thereof, it should be understood that it is in no way limited to the details of such embodiment but is capable of numerous modifications within the scope of the appended claims.



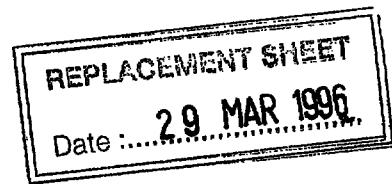
What is claimed is:

1. An apparatus for clamping and conveying plate-like workpieces comprising:

a feeding section consisting of a feeding frame mounted on a movable feed platform and at least one supporting device disposed therebelow for supporting or urging upwardly against said feeding frame so that said feed platform may disengage from said feeding frame, said supporting device having a rear end thereof connected to a support platform which is in turn connected to a translational device, said feed platform having disposed thereon a multiplicity of containers spaced equally apart from each other, a dropping device capable of upward and downward displacement being disposed at a front end of said feeding section, and a lifting device capable of upward and downward displacement being disposed at a rear end of said feeding section;

a loading section consisting of an elongated load platform mounted across a frame and located right above said feeding section, said load platform having a length equivalent to that of said feed platform, said loading section further having a pusher located at a rear end thereof to one side of said lifting device;

a turn-over device consisting of a turn-over axle pivotally connected to a turn-over means which is actuated by a motor capable of rotating through a

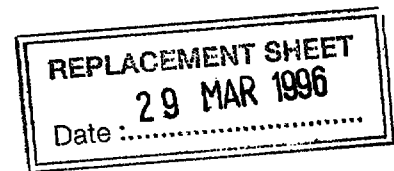


predetermined angle, said turn-over means having an extendible turn-over shaft disposed at a front end thereof, said turn-over shaft being connected to a turn-over suction disk having a multiplicity of suction holes and connected to a drawing device; and

a clamping device consisting of a multiplicity of clamping pawls spaced equally apart from each other in a row and capable of upward and downward displacement, and a clamp seat capable of forward and backward displacement, said clamp seat having one end thereof pointing towards said turn-over device, said end being provided with a multiplicity of pins matching said clamping pawls in number, said clamping pawls each having a plurality of pawl holes for passage of said pins; wherein

an empty container discharged from said feed platform is lifted up to said loading section and is pushed by said pusher along said load platform for receiving a workpiece which is then sucked away from said container by said suction disk of said turn-over device and is held by said clamping device, and said container is received onto said dropping device which deposits said container back onto said feed platform.

2. An apparatus as claimed in Claim 1, wherein operations of said apparatus may be programmed and



automated.

3. An apparatus as claimed in Claim 1, wherein said supporting device, said translational device, said dropping device, said lifting device, said pusher and said turn-over device may be hydraulically or pneumatically actuated.

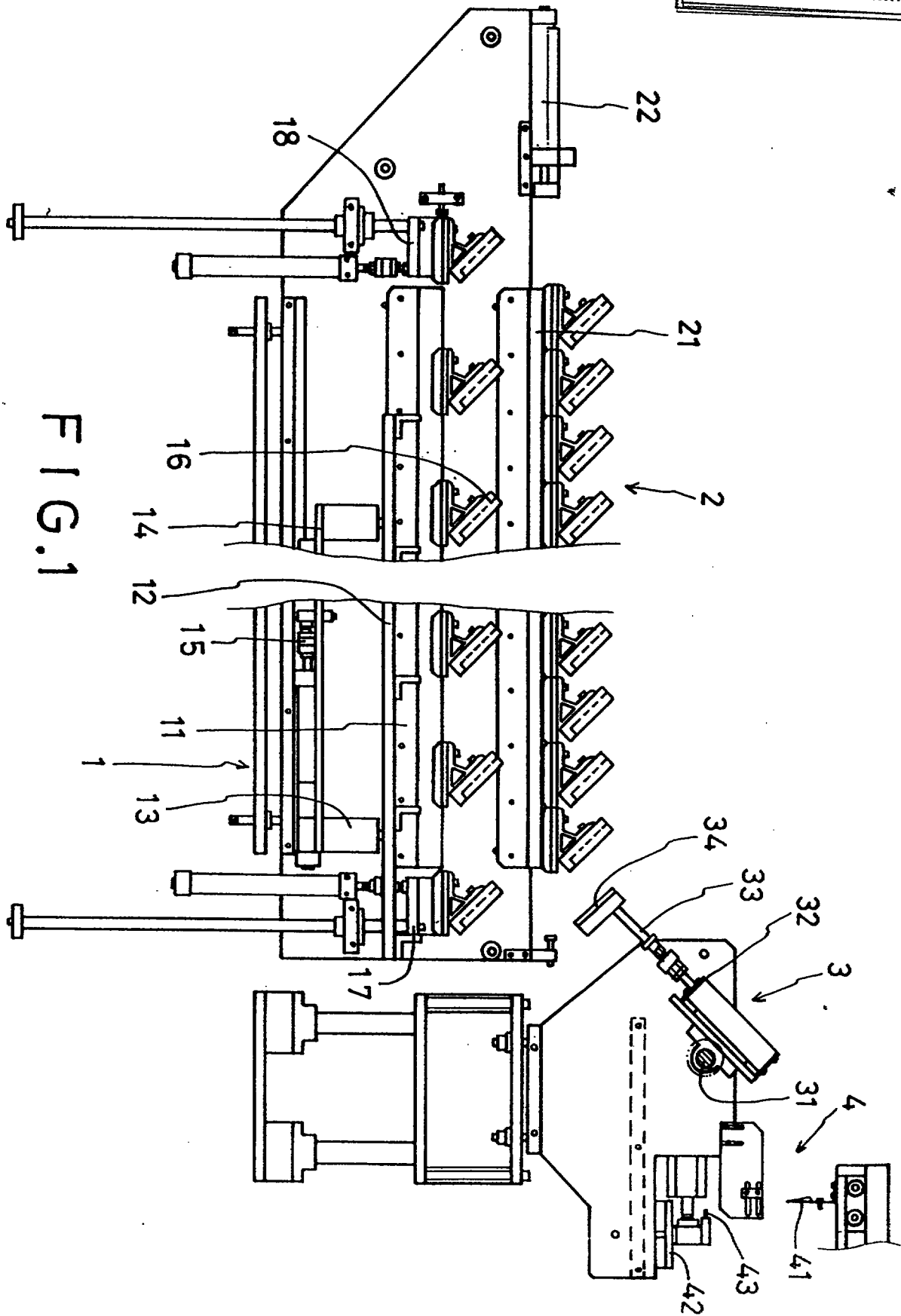


FIG. 1

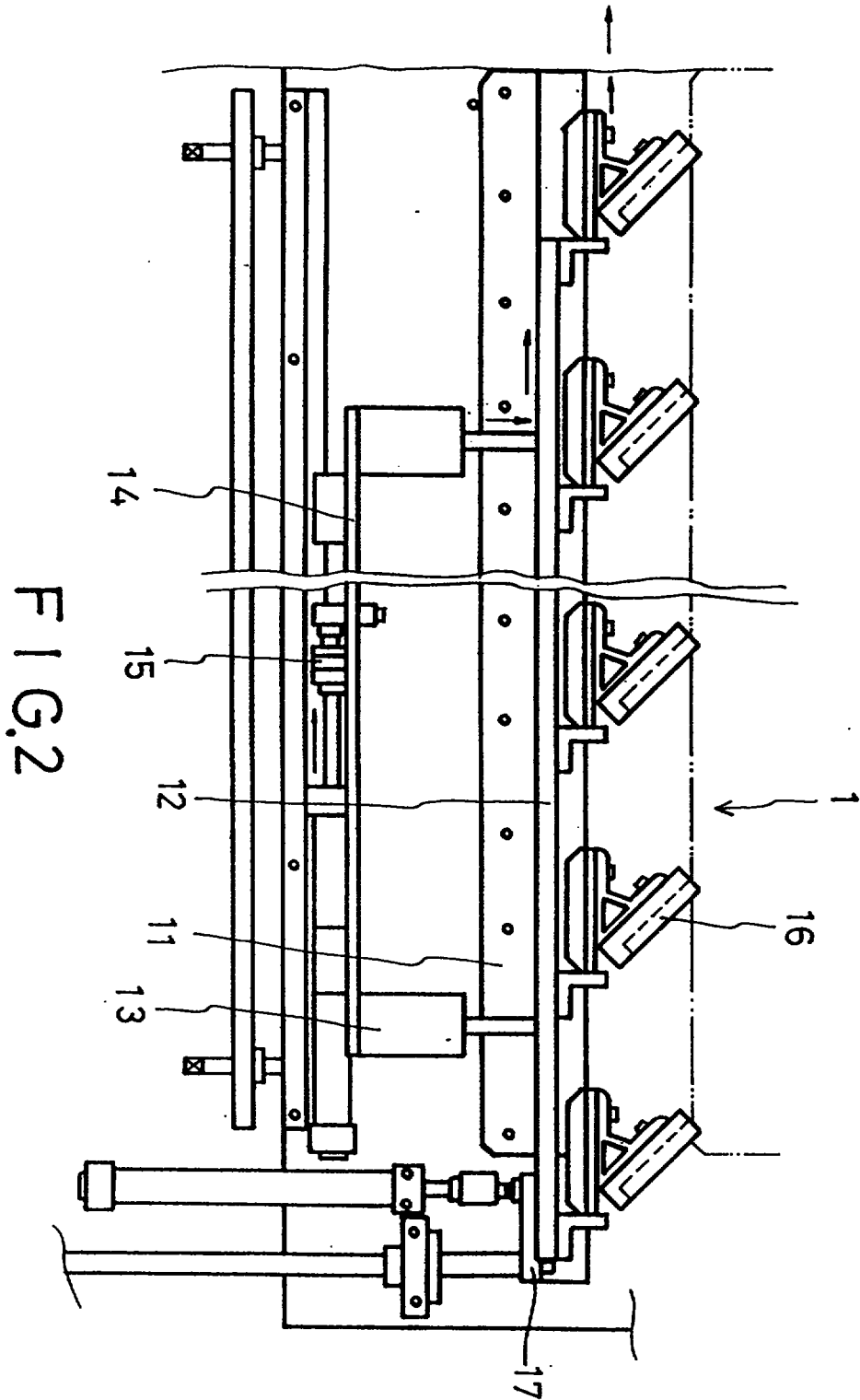




FIG.5

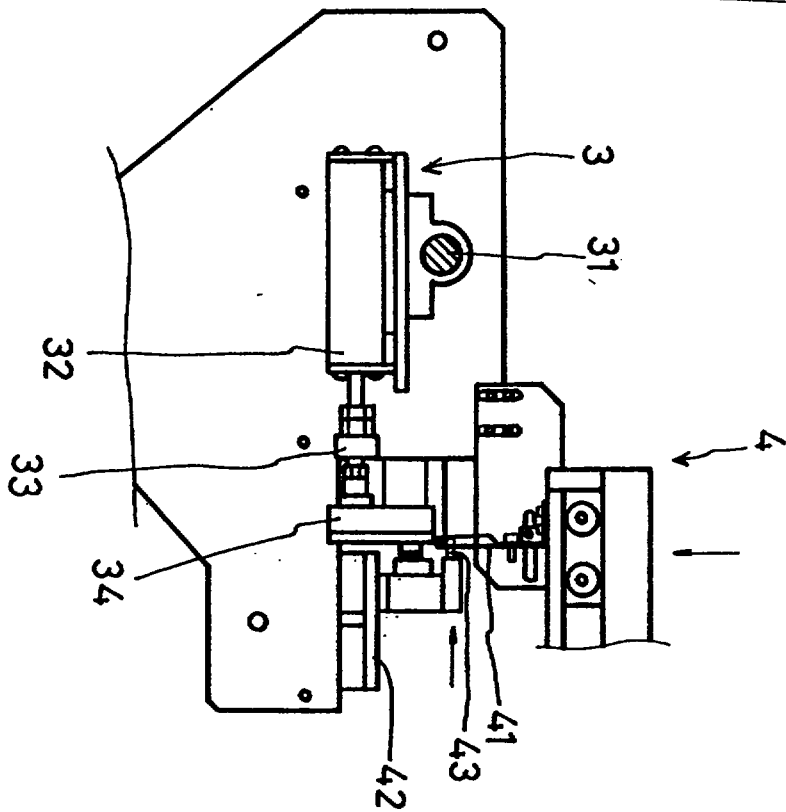
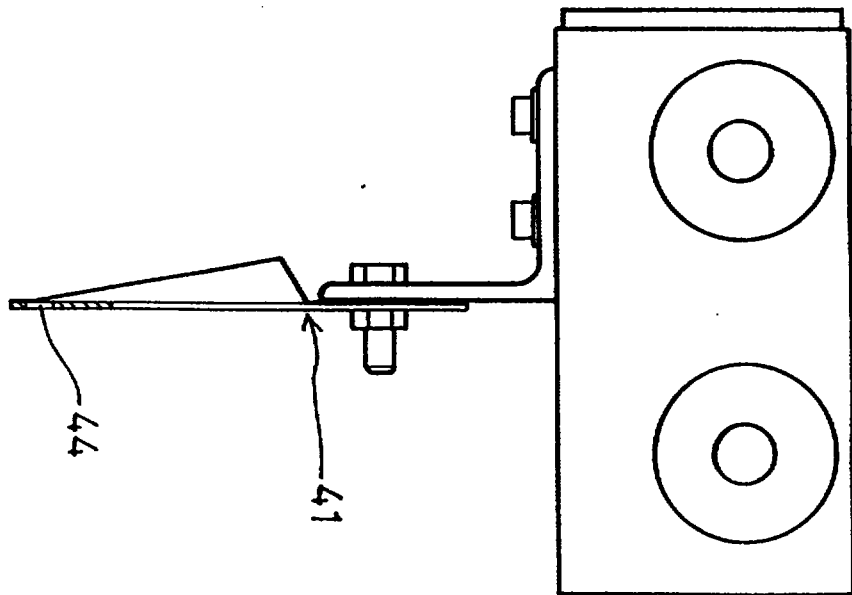


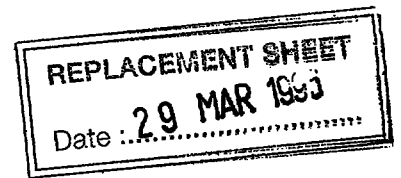
FIG.4



APPARATUS FOR CLAMPING AND CONVEYING PLATE-LIKE WORKPIECES

ABSTRACT

An apparatus for clamping and conveying plate-like workpieces includes a feeding section consisting of a feeding frame mounted on a movable feed platform and at least one supporting device disposed therebelow for supporting or urging upwardly against the feeding frame, the supporting device being connected to a support platform which is in turn connected to a translational device, the feed platform having disposed thereon a multiplicity of containers, a dropping device and a lifting device being respectively disposed at both sides of the feeding section; a loading section consisting of an elongated load platform mounted across a frame and located right above the feeding section, the load platform equaling to the feed platform in length and having a pusher located to one side of the lifting device; a turn-over device consisting of an axle pivotally connected to a turn-over means which is actuated by a motor capable of rotating through a predetermined angle, the turn-over means having an extendible shaft disposed at a front end thereof, the shaft being connected to a suction disk having suction holes and being connected to a drawing device; and a clamping device consisting of a multiplicity of clamping pawls spaced equally apart from each other in a row and capable of upward and downward displacement.



seat capable of forward and backward displacement, the clamp seat having one end thereof provided with a multiplicity of pins which penetrate holes in the clamp pawls.

FIGURE 1

67-10000