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(54) **Device to produce electronic circuits**

Vorrichtung zur Herstellung von elektronischen Schaltungen

Dispositif pour la fabrication de circuits électroniques

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Description

FIELD OF THE INVENTION

[0001] This invention concerns a device to produce electronic circuits, particularly those comprising a base support consisting of very thin sheets of alumina and plastic materials, commonly known as "green-tape".

[0002] The device according to the invention is able to process, in a completely automatic fashion, sheets of green-tape, already cut to measure according to the final destination of the circuit or electronic plate to be produced, to perform three operations: to deposit the conductor material by means of serigraphy, the drying operation in the drying oven, and also the cooling operation. In this way the product which emerges from the device is ready for the subsequent working steps, that is to say, the assembly of several base supports to achieve multi-layer circuits, and/or the assembly of the electronic components.

BACKGROUND OF THE INVENTION

[0003] One of the techniques well-known in the production of electronic circuits is to use as a base support one or more sheets of insulating material, consisting of alumina or synthetic materials, according to the green-tape technology.

[0004] The green-tape supports are normally arranged on rectilinear guides along which they are fed in sequence, by means of a feed mechanism, from a loading station to a printing station where, by means of serigraphy, the conductor material is deposited thereon, in the form of a conductor paste, according to a pre-defined mask.

Subsequently, each base support is introduced into a drying oven, where it is kept at a temperature of at least 120°C for the time needed to make the conductor paste set, which time at present is at least ten minutes.

[0005] After the drying operation in the drying oven, the base supports are cooled in a suitable cooling chamber and then discharged from the device.

[0006] Conventional devices have the disadvantage of being very bulky, with a linear development of several tens of metres. This depends on the fact that all the steps described above occur in serial sequence, and that in the drying oven alone the line develops for more than 10 metres.

[0007] In fact, if we consider that the time needed to perform a single serigraphy operation is about 10 seconds, and that the length of each base support is several tens of centimetres, we can see that the average speed of feed of the base supports along the rectilinear guides is about 1-1.5 m/min.

[0008] Consequently, as we have seen, each base support must stay inside the drying oven for at least 10 minutes, and the development of the line inside the drying oven may be even more than 10 metres.

[0009] The state of the art includes devices with a linear-type drying oven, that is, more than 10 metres long, with consequent disadvantages from the point of view of bulk, and also devices where the drying oven develops partly upwards. In this latter type, there is a conveyor or belt system inside arranged in a coil, on which brackets are attached; on each bracket one or more base supports to be dried are rested. This second solution has the disadvantage that it is both complex and expensive, and requires that the base supports which are to be dried are handled, in order to arrange them on the brackets of the drying oven and to remove them therefrom.

[0010] EP-A-0 535 338 discloses a device to process green-tape type circuits made using thin and flexible foils of alumina in the raw state or another analogous or like material. Before starting the manufacturing process the green-tape foils are individually supported by corresponding rigid supports stacked on a container on successive vertically developing planes. Then the green-tape foils are taken one by one from the container and divided from the supports by engagement and delivery means. Each green-tape foil is then conveyed by a conveyor belt towards a printing station and a drying station to be processed.

[0011] WO-A-98/48601 discloses an apparatus for the treatment of coated printed circuit boards, wherein the printed circuit boards are firstly coated and then transferred, one at the time, in a treatment installation to be subjected to various treatment processes in succession, such as airflow treatment, drying, and cooling. More in particular, the printed circuit boards are disposed, one above the other and spaced apart from one another, into the holding elements of a pallet trolley. The treatment installation comprises a plurality of treatment zones separated from one another. The printed circuit boards are conveyed into such individual treatment zones stacked in the related pallet trolley. Each pallet trolley is moved within the treatment installation both vertically and horizontally until the entire treatment cycle is performed.

[0012] EP-A-0 578 061 discloses a device for withdrawing, superimposing and anchoring therebetween a plurality of flexible foils to realise green-tape circuits, wherein each flexible foil is temporarily supported by a corresponding rigid support. A plurality of containers is disposed along at least a rectilinear path for temporarily storing the rigid supports and the related flexible foils. In each container the rigid supports are disposed one above another guided in corresponding horizontal grooves. A single carriage is movable along a feeder conveyor to selectively withdraw each rigid supports and the related flexible foils to convey them towards a pro-alignment station. The device also comprises a removal station wherein each flexible foil is firstly separated from the rigid support and then disposed in a superimposing and anchorage station.

[0013] The present Applicant has devised and embodied the device to produce electronic circuits accord-

ing to the invention to overcome these shortcomings.

SUMMARY OF THE INVENTION

[0014] The device to produce electronic circuits according to the invention is set forth and characterized in the main claim, while the dependent claims describe other innovative characteristics of the invention.

[0015] One purpose of the invention is to achieve a device to produce electronic circuits which is simple and not cumbersome, and which, at the same time ensures high quality.

[0016] Another purpose of the invention is to achieve a device to produce electronic circuits wherein all the operations to deposit the conductor paste, and the drying and cooling steps are carried out automatically and very quickly, so as to obtain a high hourly productivity.

[0017] In accordance with this purpose, the device according to the invention, to produce electronic circuits of the type comprising at least a base support on which electrically conductive material is deposited, able to embody the conductor tracks, comprises at least a printing station able to deposit the electrically conductive material onto the base support, a drying oven and feed means to feed each base support from the printing station to the drying oven. According to one characteristic of the invention, stacking means are provided to stack the base supports one on top of the other, after they have been processed in the printing station, so that they can be introduced in vertical piles into the drying oven, and spacer means are provided to keep the base supports separate from each other when stacked.

[0018] According to one characteristic of the invention, the drying oven comprises a drying chamber inside which at least one pile of base supports is able to be inserted, and means to circulate a current of hot air in a direction transversal to the pile, so that a plurality of base supports, with the relative electronic circuits deposited thereon, can be dried simultaneously.

[0019] According to another characteristic of the invention, the drying oven is of the modular type, so that two or more modules can be placed adjacent to each other in a longitudinal direction, that is, in the direction of feed of the base supports.

[0020] According to another characteristic of the invention, downstream of the drying oven there is a cooling unit through which each pile of base supports is fed in such a manner that it can be lapped by a current of cold air, in a direction transversal to the pile, so that a plurality of base supports, with the relative electronic circuits deposited thereon, can be cooled simultaneously.

[0021] According to another characteristic of the invention, the feed means for the base supports comprise a first rectilinear guide able to guide the base supports, one in front of the other and separated by a determined pitch, from the printing station towards the stacking means, and a second rectilinear guide able to guide the piles of base supports, one in front of the other and sep-

arated by the same pitch, from the stacking means to a collection station through the drying oven.

[0022] According to another characteristic of the invention, the printing station is displaced laterally with respect to the rectilinear guide of the base supports, and transverse feed means are provided to move the base supports transversely, one at a time, from the rectilinear guide to the printing station and vice versa.

[0023] According to another characteristic of the invention, the device is able to manage advantageously other base supports of a flexible type, for example of the green-tape type. In order to do this, the spacer means comprise a rigid supporting plate for each base support, on the upper surface of which a base support is able to be rested.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] These and other characteristics of the invention will become clear from the following description of a preferential form of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

- 25 Fig. 1. is a side view of a device to produce electronic circuits according to the invention;
- Fig. 2. is a plane view of the device shown in Fig. 1;
- Fig. 3. is a plane view of a supporting plate for the base supports of the electronic circuits processed by the device shown in Fig. 1;
- 30 Fig. 4. is a side view of some plates from Fig. 3, stacked on top of each other;
- Fig. 5. is a section of an enlarged detail of Fig. 4;
- Fig. 6. is a left side view of the device in Fig. 1;
- 35 Fig. 7. is a side view of a first enlarged detail of the device in Fig. 1;
- Fig. 8. is a view from above of Fig. 7;
- Fig. 9. is a second enlarged detail of the device in Fig. 1;
- 40 Fig. 10. is a side view of the detail shown in Fig. 9;
- Fig. 11. is a transverse view of the detail shown in Fig. 9;
- Fig. 12. is a side view of Fig. 11;
- Fig. 13. is a side view of a third enlarged detail of the device in Fig. 1;
- 45 Fig. 14. is a variant of Fig. 13;
- Fig. 15. is a transverse view of a drying oven of the device in Fig. 1; and
- Fig. 16. is a transverse view of a cooling unit of the device in Fig. 1.
- 50

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

- 55 **[0025]** With reference to Figs. 1 and 2, a device 10 to produce electronic circuits according to the invention comprises a loading station 11, where a plurality of base supports 12 for electronic circuits is able to be located

to be subsequently processed, a printing station 13, a drying oven 14, a cooling unit 15 and a collection station 16, arranged aligned with each other.

[0026] Each base support 12 consists, for example, of one or more flexible sheets, very thin, in the region of several tenths of a millimetre, of insulating material, such as alumina or plastic material, obtained with the green-tape technology.

[0027] Each base support 12 is regular in shape, square or rectangular, and of a standard size for the electronics industry, usually expressed in inches, for example 4"x4", 6"x6", 8"x8" or 11"x11". It is obvious, however, that the device 10 according to the invention is also able to process base supports 12 of any other shape and size.

[0028] According to one characteristic of the invention, the base supports 12, although flexible, are able to be stacked one on top of the other.

[0029] To allow them to be stacked, each base support 12 is able to be rested on the plane surface 17 (Figs. 3 and 4) of a metal supporting plate 18, about 1 mm thick and provided with a plurality of through holes 19.

[0030] The plates 18 are kept separate from each other by cylindrical spacers 20, each provided with a central pin shaped like a truncated cone, able to couple with a corresponding cavity 22, also shaped like a truncated cone (Fig. 5), of the cylindrical spacer above, so as to achieve a precision male-female coupling. The cylindrical spacers 20 can be positioned as desired on the holes 19 of the plate 18 and some of them are able to perform the function of lateral stopper elements for the base support 12 resting on the surface 17.

[0031] The plates 18 are rigid and light, and for this reason can be stacked on top of each other in large numbers, so that piles of more than 40 base supports 12 can be achieved.

[0032] The loading station 11 comprises two horizontal guides 25 (Fig. 6), arranged transverse with respect to two rectilinear guides 26, also horizontal, along which the base supports 12, mounted on the plates 18, are able to be guided into proximity with the drying oven 14. One or more piles of plates 18, with the relative base supports 12 to be processed, are able to be arranged on the guides 25.

[0033] The loading station 11 also comprises a pick-up device 27, mounted on a stationary frame 28 and able to pick up from the pile of plates 18, the plate which is momentarily on top, in order to deposit it on the left end 26a (Fig. 2) of the rectilinear guides 26.

[0034] The pick-up device 27 comprises a trolley 30, commanded by a linear motor 31 to slide horizontally on the frame 28 between a pick-up position shown by a continuous line in Fig. 6, and a release position shown by a line of dashes in Fig. 6.

[0035] A linear motor 32 is mounted on the trolley 30, able to vertically displace a lower plate 33 provided with suckers 34, connected to a pneumatic mechanism of a conventional type and not shown in the drawings. The

suckers 34 are able to adhere selectively to the plate 18 to be picked up from the pile. To be more exact, the suckers 34 cooperate with the perimeter zones of the plates 18, where the base support 12 does not rest.

[0036] The plates 18, and the base supports 12 which they carry, are fed from the loading station 11 to the printing station 13, and from the latter to the drying oven 14, by means of a metal bar 35 (Figs. 7 and 8), parallel to the guides 26 and connected to a linear motor 38 (Fig. 2), which is able to feed the metal bar 35 step-by-step, in a conventional manner, according to the technique known as "the pilgrim's progress". **[deletion(s)]**

[0037] To this purpose, both the guides 26 and the metal bar 35 are provided with hollows 36 (Figs. 7 and 8), respectively 37, able to cooperate with the cylindrical spacers 20 of the plates 18 to position them precisely and, respectively, lift them and translate them.

[0038] Each feed cycle of the metal bar 35 is able to displace all the plates 18 which are on the guides 26 by one elementary step p towards the right end 26b; this elementary step is equal to the interaxis between two adjacent plates 18.

[0039] The printing station 13 comprises a serigraphy unit 40, arranged adjacent to the guides 26 and able to deposit, in a conventional manner according to the serigraphy technique, a conductor paste on the upper surface of the base support 12, according to a pre-established pattern or mask, to thus embody the conductor tracks of the electronic circuit.

[0040] The printing station 13 also comprises a bar 41 (Figs. 9-12) arranged transverse to the guides 26, on which a sliding trolley 42 is mounted, commanded by a linear motor 43.

[0041] Two pneumatic devices 44a and 44b are mounted on the trolley 42, provided with suckers 45a, respectively 45b.

[0042] The printing station 13 also comprises a positioning and centering board 46, able to move along the horizontal axes x and y , orthogonal to each other, and to rotate on the horizontal plane with respect to the vertical axis z (rotation ϑ). The commands are imparted to the board 46 by conventional means, not shown in the drawings.

[0043] The device 44a is able to lift each base support 12 with respect to the corresponding supporting plate 18 and to deposit it on the board 46, before the serigraphy step. For this reason the suckers 45a can be positioned at any point whatsoever of the base support 12, which is not yet equipped with the conductor tracks.

[0044] The device 44b, on the contrary, is able to lift each base support 12 from the board 46, after the serigraphy step, and to deposit it on the same supporting plate 18 from which it was taken. For this reason the suckers 45b are necessarily positioned in zones of the base support 12 outside the conductor tracks which have just been deposited.

[0045] Electronic TV cameras 50 are provided in correspondence with the board 46 to optically identify de-

terminated reference points on the base support 12, called "fiducial", and to orient the board 46 in the three directions x, y and z, so that the base support 12 is exactly positioned with respect to the serigraphy unit 40.

[0046] Two rollers 47 and 48 are mounted rotatable on the board 46; a strip of paper 49, able to support the base support 12 during the serigraphy step, is wound onto said rollers 47, 48.

[0047] Below the rectilinear segment of the strip of paper 49, between the two rollers 47 and 48 there is a suction device 51 which holds the corresponding base support 12 selectively adherent to the strip 49.

[0048] Translation means of a conventional type are also provided to translate the board 46 along the axis y and move it, together with the base support 12, below the serigraphy unit 40.

[0049] Associated with the printing station 13, in correspondence with the guides 26, a weighing unit 61 is mounted, able to weigh each plate 18 and the relative base support 12 by means of an electronic scales of a conventional type, both before the conductor paste has been deposited and also afterwards, to check that the weight of material deposited corresponds exactly to the pre-set weight.

[0050] Between the printing station 13 and the drying oven 14 there is a control station 62, in which a mechanism 63, rotating around a vertical axis 64 and provided with suckers which can be selectively activated, is able to selectively remove from the line, that is, from the guides 26, one of the base supports 12, together with the relative plate 18, and take it through a rotation of 180° around the axis 64, to the control position, in front of the guides 26, where it can be subjected to a check by the workers entrusted with this task.

[0051] The device 10, in correspondence with the end 26b of the guides 26, upstream of the drying oven 14, comprises a stacking device 52 (Figs. 1, 2 and 13) for the supporting plates 18; this device 52 is able to pick up each plate 18 arriving from the printing station 13 and to stack it, one on top of the other, onto lower guides 53, identical to the guides 26 and also horizontal but arranged lower, which pass through the drying oven 14 and the cooling unit 15.

[0052] The stacking device 52 (Fig. 13) is similar to the pick-up device 27 and comprises a trolley 54 able to slide horizontally on an upper bar 55, on the command of a linear motor 56, between a stacking position and an adjacent pick-up position shown with a line of dashes in Fig. 13.

[0053] A linear motor 57 is mounted on the trolley 54, able to vertically displace a lower plate 58 provided with suckers 59, connected to a pneumatic mechanism of a conventional type and not shown in the drawings. Like the suckers 34, the suckers 59 are also able to adhere selectively to the plate 18 to be picked up from the guides 26, cooperating with the perimeter zones where the base support 12 does not rest.

[0054] The piles of plates 18 and the base supports

12 carried thereby are fed through the drying oven 14 and the cooling unit 15 by a horizontal metal bar 60; this occurs in an identical way to the step-by-step feed achieved by the metal bar 35.

[0055] To this purpose, both the guides 53 and the metal bar 60 are provided with upper hollows identical to the hollows 36 and able to cooperate with the cylindrical spacers 20 of the plates 18 which are at the bottom of each pile to position them precisely and, respectively, lift them and translate them.

[0056] Therefore, each feed cycle of the metal bar 60 is able to displace all the piles of plates 18 which are on the guides 53 by one elementary step p towards the collection station 16.

[0057] The drying oven 14, which constitutes a drying module, comprises a central drying chamber 65 (Figs. 13 and 15), substantially cubic in shape, with a length 1 equal to about double the step p between two piles of plates 18. The drying oven 14 also comprises a fan 66 (Fig. 15), made to rotate by an electric motor 67, to create a current of air in a transverse direction inside the chamber 65, a series of electric resistors 68 to heat the air to a temperature which can be regulated up to and beyond 300°C, and at least a vertical filter 69 arranged at the inlet to the central drying chamber 65.

[0058] The current of hot air passes through each pile of plates 18 horizontally; thanks to the distance between each plate 18 and the plate above, it provides to simultaneously dry all the electronic circuits deposited on the individual base supports 12.

[0059] At inlet to and at outlet from the central drying chamber 65 there are shutters 70, which can be selectively raised and lowered by means of actuators of a conventional type and not shown in the drawings, to open and respectively close the chamber 65.

[0060] The base supports 12, on which the conductor paste to form the electronic circuit has already been deposited, are able to remain for about ten minutes inside the drying oven 14. This time, however, is not fixed, and is normally established by the companies which supply the conductor paste employed.

[0061] Considering that inside the chamber 65 of the drying oven 14 there are two piles of plates 18 at the same time, with the relative base supports 12, the piles advance by one elementary step p about every 5 minutes. If we also consider that each pile can have as many as 40 plates 18, we shall see that the hourly productivity of the device 10 can reach about 480 circuits. This is high productivity, obtained with a single drying oven 14, or drying module, with a length 1 of only 540 mm, in the event that the base supports 12 are no bigger than 10"x10", or about 254x254 mm.

[0062] If we want to double the productivity of the device 10, for example with the piles of plates 18 being fed by an elementary step every two and a half minutes, to maintain the total time the plates 18 stay inside the drying oven 14 at around ten minutes, it is sufficient to install a device 10 with two identical drying ovens 14 and 114,

or drying module, adjacent to each other (Fig. 14).

[0063] To triple the productivity, it will be sufficient to put three drying ovens 14, or drying module, in series, and so on.

[0064] The cooling unit or module 15 comprises a central cooling chamber 75 (Figs. 13 and 16), also substantially cubic, with a length substantially equal to that of a drying module oven 14. The cooling unit 15 also comprises a first electric ventilator 76, emitting air, and a second electric ventilator 78, inspiring air, together able to create a current of air in a transverse direction inside the chamber 75. The cooling unit 15 also comprises a pair of vertical filters 77 arranged at the side of the central cooling chamber 75.

[0065] The supporting plates 18 and the relative base supports 12 are able to stay inside the cooling unit 15 for about ten minutes, so that they can be suitably cooled before being handled by the workers responsible for removing them.

[0066] Although the cooling units 15 can also be positioned adjacent to each other when high productivity is required, practical experiments have shown that a single cooling unit 15, thanks to the power of the electric fan 76, is sufficient to adequately cool the piles of plates 18 even when, upstream, two or more drying ovens 14 are included.

[0067] The collection station 16 comprises horizontal guides 79 (Figs. 2 and 13) arranged transverse to the guides 53 and a pick-up device 80, similar to the stacking device 52, able to pick up the plates 18 one after the other from the pile emerging from the cooling unit 15, in order to deposit them on the guides 26, in the form of other piles, so that they can subsequently be moved by the workers.

[0068] The collection device 80 comprises a trolley 81 able to slide horizontally on an upper bar 82, on the command of a linear motor 83, between a pick-up position and an adjacent collection position, not shown in the drawings.

[0069] A linear motor 84 is mounted on the trolley 81, able to vertically displace a lower plate 85 provided with suckers 86, connected with a pneumatic mechanism of a conventional type and not shown in the drawings. Like the suckers 34, the suckers 86 are also able to selectively adhere to the plate 18 which is to be picked up from the guide 53, cooperating with the perimeter zones where the base support 12 does not rest.

[0070] The device 10 (Figs. 1 and 2) also comprises, optionally, a punching station 90, where the base supports 12 are able to be punched in a conventional manner by means of a punching machine 91.

[0071] It is obvious that modifications and additions may be made to the device to produce electronic circuits as described heretofore, but these shall remain within the field and scope of this invention.

Claims

1. Device to produce electronic circuits of the type comprising at least a flexible base support (12) on which electrically conductive material is deposited to define conductor tracks, said device comprising at least a printing station (13) able to deposit said electrically conductive material on said flexible base support (12), a drying oven (14) and first and second feeding means (35, 60) to feed each flexible base support (12) from said printing station (13) to said drying oven (14), wherein for each one of said flexible base support (12) a rigid supporting plate (18) is provided, the device being **characterized in that** stacking means (52) are provided between said printing station (13) and said drying oven (14) to stack said rigid supporting plates (18) and the associated flexible base supports (12) one on top of the other so that said flexible base supports (12) are stacked in vertical piles before its introduction into said drying oven (14), **in that** said rigid supporting plates (18) are provided with spacer elements (20) to separate of a predetermined distance said rigid supporting plates (18) when said rigid supporting plates (18) are stacked in vertical piles by said stacked means (52), and **in that** said first feeding means (35) are able to feed each flexible base support (12) from said printing station (13) to said stacking means (52), while said second feeding means (60) are able to feed said vertical piles of flexible base supports (12) from said stacking means (52) to said drying oven (14) and through said drying oven (14).
2. Device as in Claim 1, **characterized in that** said drying oven (14) comprises a drying chamber (65) inside which at least a vertical pile of said rigid supporting plates (18) and the associated flexible base supports (12) is able to be inserted, means being provided to make a current of hot air circulate in a direction transverse to said vertical pile, so that a plurality of said flexible base supports (12) can be dried simultaneously.
3. Device as in Claim 2, **characterized in that** said drying oven (14) comprises at least a vertical filter (69) arranged in correspondence with the inlet of said current of hot air into said drying chamber (65).
4. Device as in Claim 2, **characterized in that** said drying chamber (65) is able to accommodate at least two vertical piles of flexible base supports (12) arranged in a longitudinal direction, that is, orthogonal to said current of hot air.
5. Device as in Claim 1, **characterized in that** said drying oven (14) is of the modular type, each module comprising a drying chamber (65) inside which

at least one vertical pile of flexible base supports (12) is able to be inserted, two or more modules being able to be located adjacent to each other so that the drying chambers (65) of the different modules are aligned in a longitudinal direction, that is, in the direction of feeding of said flexible base supports (12).

6. Device as in Claim 1, **characterized in that** said second feeding means comprise at least a first horizontal guide (53) and a feed bar (60) able to feed simultaneously, step by step, said vertical piles of flexible base supports (12) in a longitudinal direction through said drying oven (14). 10
7. Device as in Claims 4 and 6, **characterized in that** the length (1) of said drying chamber (65) is substantially double the feed step (p) of said vertical piles of flexible base supports (12). 15
8. Device as in Claim 1, **characterized in that** downstream of said drying oven (14) there is a cooling unit (15) through which each vertical pile of said flexible base supports (12) is fed by said second feeding means in order to cool said flexible base supports (12). 20
9. Device as in Claim 8, **characterized in that** said cooling unit (15) comprises a cooling chamber (75) inside which at least one vertical pile of flexible base supports (12) is able to be inserted, means being provided to make a current of cold air circulate in a direction transverse to said vertical pile, so that a plurality of said flexible base supports (12) can be cooled simultaneously. 25
10. Device as in Claim 9, **characterized in that** said cooling unit (15) comprises at least a vertical filter (77) arranged in correspondence with the inlet of said current of cold air to said cooling chamber (75). 30
11. Device as in Claim 9, **characterized in that** said cooling unit (15) comprises at least a vertical filter (77) arranged in correspondence with the outlet of said current of cold air in said cooling chamber (75). 35
12. Device as in Claim 1, **characterized in that** said first feeding means comprise a first rectilinear guide (26) able to guide said flexible base supports (12) one in front of the other and separated from each other by a determined step (p), from a loading station (11) to said printing station (13) and thence towards said drying oven (14), **in that** said printing station (13) is laterally displaced with respect to said rectilinear guide (26), and **in that** said first feeding means further comprise a transverse feed means (41-44) to move said flexible base supports (12) transversely and one at a time from said rectilinear 40

guide (26) to said printing station (13) and vice versa.

13. Device as in Claim 12, **characterized in that** said transverse feed means (41-44) comprise a bar (41) arranged transverse to said first rectilinear guide (26) and on which a sliding trolley (42) is mounted commanded by a linear motor (43), pneumatic means (44a, 44b, 45a, 45b) being provided to selectively lift said flexible base support (12). 45
14. Device as in Claims 1 or 12, **characterized in that** said printing station (13) comprises a serigraphy unit (40) able to deposit, according to the serigraphy technique, said electrically conductive material in the form of conductor paste on the upper surface of the flexible base support (12), following a pre-determined pattern or mask in order to embody said conductor tracks. 50
15. Device as in Claim 14, **characterized in that** said printing station (13) comprises a horizontal positioning and centering board (46), able to move along the two horizontal axes (x and y), orthogonal to each other, and to rotate on the horizontal plane with respect to a vertical axis z (rotation ϑ). 55
16. Device as in Claim 13 and 15, **characterized in that** said pneumatic means comprise a first pneumatic device (44a) able to lift each flexible base support (12) with respect to said rectilinear guide (26) and to deposit it on said horizontal positioning and centering board (46) before the serigraphy step, and a second device (44b) able to lift each flexible base support (12) from said horizontal positioning and centering board (46), after the serigraphy step, and to deposit it on said rectilinear guide (26).
17. Device as in Claim 15, **characterized in that** electronic TV cameras (50) are provided in correspondence with said board (46) to optically identify determined points of reference located on said flexible base support (12) and to direct said board (46) in the three directions x, y and ϑ , so that said flexible base support (12) is exactly positioned with respect to said serigraphy unit (40).
18. Device as in Claim 15, **characterized in that** two rollers (47 and 48) are mounted rotatable on said board (46), on which rollers (47 and 48) a strip of paper (49) is wound able to support said flexible base support (12) during the serigraphy step.
19. Device as in Claim 18, **characterized in that** below the rectilinear segment of said strip of paper (49), between said two rollers (47 and 48), there is provided a suction device (51) able to hold said flexible base support (12) selectively adherent to said strip

of paper (49).

20. Device as in Claim 14, **characterized in that** a weighing unit (61) is associated with said printing station (13) to weigh each flexible base support (12) both before the conductive paste is deposited, and also afterwards, to check that the weight of the material deposited corresponds exactly to the pre-set weight.

21. Device as in Claim 12, **characterized in that** said loading station (11) comprises at least a rectilinear guide (25) arranged transverse with respect to said first rectilinear guide (26) and a pick-up device (27) able to pick up, from a vertical pile of flexible base supports (12) to be treated, the support which is momentarily on top, in order to deposit it on one end of said first rectilinear guide (26).

22. Device as in Claim 21, **characterized in that** said pick-up device (27) comprises a trolley (30), able to slide horizontally between a pick-up position and a release position, and drive means (32) associated with said trolley (30) and able to vertically displace sucker means (34) which can be selectively activated to lift and release each of said flexible base supports (12).

23. Device as in Claim 1, **characterized in that** said first feeding means comprise a first rectilinear guide (26) able to guide said flexible base supports (12), one in front of the other and separated from each other by a determined step (p), from said printing station (13) to said stacking means (52) and **in that** said second feeding means comprise a second rectilinear guide (53) able to guide said vertical piles of flexible base supports (12), one in front of the other and separated from each other by said step (p), from said stacking means (52) to a collection station (16) through said drying oven (14).

24. Device as in Claim 23, **characterized in that** said stacking means (52) comprise a trolley (54) able to slide transversely with respect to said two guides (26, 53) and drive means (57) associated with said trolley (54) and able to vertically displace sucker means (59) which can be selectively activated to lift and release each of said flexible base supports (12).

25. Device as in Claim 1, **characterized in that** said rigid supporting plate (18) comprises an upper surface (17) on which each flexible base support (12) is able to rest.

26. Device as in Claim 1, **characterized in that** said spacer elements (20) are also able to couple each rigid supporting plate (18) with the rigid supporting

plate (18) above and/or below.

27. Device as in Claim 1, **characterized in that** between said printing station (13) and said drying oven (14) there is a control station (62) comprising means (63) rotating around a vertical axis (64) and provided with suckers which can be selectively activated to selectively pick up a flexible base support (12) from said first feeding means and take it with a rotation of 180° around said vertical axis (64) to a control position so that it can be removed manually.

28. Drying oven for a device as in Claim 1, wherein for each one of said flexible base support (12) a rigid supporting plate (18) is provided, wherein said rigid supporting plates (18) are provided with spacer elements (20) to separate of a predetermined distance said rigid supporting plates (18) when said rigid supporting plates (18) are stacked in vertical piles, **characterized in that** said drying oven comprises a drying chamber (65) inside which at least a vertical pile of said rigid supporting plates (18) and the associated flexible base supports (12) are able to be introduced, stacked one on top of the other and spaced by said spacer elements (20) and **in that** feeding means (60) are provided to selectively feed said vertical pile of rigid supporting plates (18) through said drying chamber (65) along a substantially horizontal direction.

29. Drying oven as in Claim 28, **characterized in that** means are provided to circulate a current of hot air in a direction transverse to said stacked flexible base supports (12), so that a plurality of said flexible base supports (12) can be dried simultaneously.

30. Drying oven as in Claim 29, **characterized in that** said drying oven (14) comprises at least a vertical filter (69) arranged in correspondence with the inlet of said current of hot air to said drying chamber (65).

Patentansprüche

1. Vorrichtung zur Herstellung von elektronischen Schaltungen mit einem Aufbau, der wenigstens einen flexiblen Basisträger (12) aufweist, auf dem elektrisch leitendes Material zur Bildung von Leiterbahnen abgeschieden ist, wobei die Vorrichtung

- wenigstens eine Bedruckungsstation (13) zum Abscheiden des elektrisch leitenden Materials auf dem flexiblen Basisträger (12),
- einen Trocknungsofen (14) und
- eine erste und eine zweite Transporteinrichtung (35, 60) zum Transportieren des flexiblen Basisträgers (12) aus der Bedruckungsstation (13) in den Trocknungsofen (14) aufweist,

- wobei für jeden flexiblen Basisträger (12) eine starre Trägerplatte (18) vorgesehen ist,

dadurch gekennzeichnet,

- **dass** zwischen der Bedruckungsstation (13) und dem Trocknungssofen (14) eine Stapeleinrichtung (52) für ein solches Aufeinanderstapeln der starren Trägerplatten (18) und der zugehörigen flexiblen Basisträger (12) vorgesehen ist, dass die flexiblen Basisträger (12) vor ihrem Einführen in den Trocknungssofen (14) in vertikalen Säulen gestapelt sind,
 - **dass** die starren Trägerplatten (18) mit Distanzelementen (20) versehen sind, um die starren Trägerplatten (18) mit einem vorgegebenen Abstand zu trennen, wenn sie durch die Stapeleinrichtung (52) zu vertikalen Säulen gestapelt werden, und
 - **dass** die erste Transporteinrichtung (35) jeden flexiblen Basisträger (12) von der Bedruckungsstation (13) zur Stapeleinrichtung (42) und die zweite Transporteinrichtung (60) die vertikalen Säulen der flexiblen Basisträger (12) von der Stapeleinrichtung (52) zum Trocknungssofen (14) und durch den Trocknungssofen (14) transportieren kann.
2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Trocknungssofen (14) eine Trocknungskammer (65) aufweist, in die wenigstens eine vertikale Säule von starren Trägerplatten (18) und den zugeordneten flexiblen Basisträgern (12) einsetzbar ist, wobei Einrichtungen zum Zirkulierenlassen eines Heißluftstroms in eine Richtung quer zu der vertikalen Säule vorgesehen sind, so dass eine Vielzahl der flexiblen Basisträger (12) gleichzeitig getrocknet werden kann.
 3. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der Trocknungssofen (14) wenigstens einen vertikalen Filter (69) aufweist, der dem Einlass des Heißluftstroms in die Trocknungskammer (65) zugeordnet ist.
 4. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** die Trocknungskammer (65) wenigstens zwei vertikale Säulen von flexiblen Basisträgern (12) aufnehmen kann, die in einer Längsrichtung, d.h. senkrecht zum Heißluftstrom, angeordnet sind.
 5. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Trocknungssofen (14) modulförmig gebaut ist, wobei jedes Modul eine Trocknungskammer (65) aufweist, in der wenigstens eine vertikale Säule von flexiblen Basisträgern (12) einsetzbar ist, und zwei oder mehr Module angrenzend an-

einander so positionierbar sind, dass die Trocknungskammern (65) der verschiedenen Module in einer Längsrichtung ausgerichtet sind, d.h. in der Transportrichtung der flexiblen Basisträger (12).

6. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die zweite Transporteinrichtung wenigstens eine erste horizontale Führung (53) und eine Transportstange (60) für den gleichzeitigen schrittweisen Transport der vertikalen Säulen von flexiblen Basisträgern (12) in eine Längsrichtung durch den Trocknungssofen (14) aufweist.
7. Vorrichtung nach Anspruch 4 und 6, **dadurch gekennzeichnet, dass** die Länge (l) der Trocknungskammer (65) im Wesentlichen das Doppelte des Transportschritts (p) der vertikalen Säulen der flexiblen Basisträger (12) beträgt.
8. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** stromab von dem Trocknungssofen (14) eine Kühleinheit (15) vorgesehen ist, durch welche jede vertikale Säule der flexiblen Basisträger (12) von der zweiten Transporteinrichtung transportiert wird, um die flexiblen Basisträger (12) abzukühlen.
9. Vorrichtung nach Anspruch 8, **dadurch gekennzeichnet, dass** die Kühleinheit (15) eine Kühlkammer (75) aufweist, in die wenigstens eine vertikale Säule der flexiblen Basisträger (12) einsetzbar ist, wobei Einrichtungen zum Umlaufenlassen eines Kühlluftstroms in einer Richtung quer zur vertikalen Säule vorgesehen sind, so dass eine Vielzahl der flexiblen Basisträger (12) gleichzeitig abgekühlt werden kann.
10. Vorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** die Kühleinheit (15) wenigstens einen vertikalen Filter (77) aufweist, der in Übereinstimmung mit dem Einlass des Kühlluftstroms zu der Kühlkammer (75) angeordnet ist.
11. Vorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** die Kühleinheit (15) wenigstens einen vertikalen Filter (77) aufweist, der dem Auslass des Kühlluftstroms in der Kühlkammer (75) zugeordnet ist.
12. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet,**
 - **dass** die erste Transporteinrichtung eine erste Geradföhrung (26) zum Führen der flexiblen Basisträger (12) einer vor dem anderen und um einen vorgegebenen Schritt (p) getrennt voneinander von einer Beladestation (11) zu der Bedruckungsstation (13) und von da zu dem

- Trocknungsöfen (14) aufweist,
- **dass** die Bedruckungsstation (13) bezüglich der Geradföhrung (26) seitlich versetzt ist, und
 - **dass** die erste Transporteinrichtung weiterhin eine Quertransporteinrichtung (41 bis 44) zum Bewegen der flexiblen Basisträger (12) quer und immer einer von der Geradföhrung (26) aus zu der Bedruckungsstation (13) und umgekehrt aufweist.
13. Vorrichtung nach Anspruch 12, **dadurch gekennzeichnet, dass** die Quertransporteinrichtung (41 bis 44) eine Stange (41) aufweist, die quer zu der ersten Geradföhrung (26) angeordnet ist und auf der ein gleitend verschiebbarer Wagen (42) angebracht ist, der von einem Linearmotor (43) gesteuert wird, wobei pneumatische Einrichtungen (44a, 44b, 45a, 45b) zum selektiven Anheben der flexiblen Basisträger (12) vorgesehen sind.
14. Vorrichtung nach Anspruch 1 oder 12, **dadurch gekennzeichnet, dass** die Bedruckungsstation (13) eine Siebdruckeinheit (40) zum Abscheiden des elektrisch leitenden Materials in Form einer Leiterpaste auf der Oberseite des flexiblen Basisträgers (12) nach dem Siebdruckverfahren entsprechend einem vorgegebenen Muster oder einer vorgegebenen Maske zur Ausgestaltung der Leiterbahnen aufweist.
15. Vorrichtung nach Anspruch 14, **dadurch gekennzeichnet, dass** die Bedruckungsstation (13) eine horizontale Positionier- und Zentrierplatte (46) für zueinander senkrechte Bewegungen längs der beiden horizontalen Achsen (x und y) und für ein Drehen auf der horizontalen Ebene bezüglich einer vertikalen Achse z (Rotation ϑ) aufweist.
16. Vorrichtung nach Anspruch 13 und 15, **dadurch gekennzeichnet, dass** die pneumatischen Einrichtungen eine erste pneumatische Vorrichtung (44a) zum Anheben jedes flexiblen Basisträgers (12) bezüglich der Geradföhrung (26) und für sein Ablegen auf der horizontalen Positionier- und Zentrierplatte (46) vor dem Siebdruckschritt und eine zweite Vorrichtung (44b) zum Abheben jedes flexiblen Basisträgers (12) von der horizontalen Positionier- und Zentrierplatte (46) nach dem Siebdruckschritt und für sein Ablegen auf der Geradföhrung (26) aufweist.
17. Vorrichtung nach Anspruch 15, **dadurch gekennzeichnet, dass** elektronische TV-Kameras (50) in Zuordnung zu der Platte (46) für eine optische Identifizierung vorgegebener, sich auf dem flexiblen Basisträger (12) befindlicher Bezugspunkte und zum Ausrichten der Platte (46) in den drei Richtungen (x, y und ϑ) vorgesehen sind, so dass der flexible Basisträger (12) bezüglich der Siebdruckeinheit (40) genau positioniert ist.
18. Vorrichtung nach Anspruch 15, **dadurch gekennzeichnet, dass** auf der Platte (46) zwei Rollen (47 und 48) drehbar angebracht sind, auf die ein Papierstreifen (49) zum Halten des flexiblen Basisträgers (12) während des Siebdruckschritts gewickelt ist.
19. Vorrichtung nach Anspruch 18, **dadurch gekennzeichnet, dass** unter dem Geradsegment des Papierstreifens (49) zwischen den beiden Rollen (47 und 48) eine Saugvorrichtung (49) zum Halten des flexiblen Basisträgers (12) mit selektiver Haftung an dem Papierstreifen (49) vorgesehen ist.
20. Vorrichtung nach Anspruch 14, **dadurch gekennzeichnet, dass** der Bedruckungsstation (13) eine Wiegeeinheit (61) zum Wiegen jedes flexiblen Basisträgers (12) sowohl vor dem Abscheiden der Leiterpaste als auch danach zugeordnet ist, um zu prüfen, ob das Gewicht des abgeschiedenen Materials genau dem Sollgewicht entspricht.
21. Vorrichtung nach Anspruch 12, **dadurch gekennzeichnet, dass** die Beladestation (11) wenigstens eine Geradföhrung (25), die quer bezüglich der ersten Geradföhrung (26) angeordnet ist, und eine Aufnahmevorrichtung (27) zum Aufnehmen des sich momentan oben befindlichen Trägers von einem vertikalen Stapel der zu behandelnden flexiblen Basisträger (12) aufweist, um ihn an einem Ende der ersten Geradföhrung (26) abzusetzen.
22. Vorrichtung nach Anspruch 21, **dadurch gekennzeichnet, dass** die Aufnahmevorrichtung (27) einen horizontal zwischen einer Aufnahmeposition und einer Abgabeposition verschiebbaren Wagen (30) sowie dem Wagen zugeordnete Antriebseinrichtungen (32) zum vertikalen Verschieben von Saugereinrichtungen (34) aufweist, die zum Abheben und Abgeben jedes der flexiblen Basisträger (12) selektiv aktivierbar sind.
23. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet,**
- **dass** die erste Transporteinrichtung eine erste Geradföhrung (26) zum Föhren der flexiblen Basisträger (12) einer vor dem anderen und um einen vorgegebenen Schritt (p) voneinander getrennt von der Trocknungsstation (13) zu der Stapeleinrichtung (52) aufweist, und
 - **dass** die zweite Transporteinrichtung eine zweite Geradföhrung (53) zum Föhren der vertikalen Säulen der flexiblen Basisträger (12) eine vor der anderen und um den Schritt (p) von-

einander getrennt von der Stapeleinrichtung (52) zu einer Sammelstation (16) durch den Trocknungssofen (14) hindurch aufweist.

24. Vorrichtung nach Anspruch 23, **dadurch gekennzeichnet, dass** die Stapeleinrichtung (52) einen Wagen (54) für eine Querverschiebung bezüglich der beiden Führungen (26, 53) und dem Wagen (54) zugeordnete Antriebseinrichtungen (57) zum vertikalen Verschieben von Saugereinrichtungen (59) aufweist, die zum Abheben und Abgeben jedes der flexiblen Basisträger (12) selektiv aktivierbar sind.

25. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die starre Trägerplatte (18) eine obere Fläche (17) aufweist, auf der jeder flexible Basisträger (12) liegen kann.

26. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Distanzelemente (20) auch in der Lage sind, jede starre Trägerplatte (18) mit der darüber und/oder darunter befindlichen starren Trägerplatte (18) zu koppeln.

27. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** zwischen der Bedruckungsstation (13) und dem Trocknungssofen (14) eine Kontrollstation (62) mit einer Einrichtung (63) vorgesehen ist, die sich um eine vertikale Achse (64) dreht und mit Saugern versehen ist, die selektiv aktivierbar sind, um selektiv einen flexiblen Basisträger (12) von der ersten Transporteinrichtung aufzunehmen und ihn bei einer Drehung von 180° um die vertikale Achse (64) in eine Kontrollposition mitzunehmen, so dass er von Hand entfernt werden kann.

28. Trocknungssofen für eine Vorrichtung nach Anspruch 1, bei welchem

- für jeden flexiblen Basisträger (12) eine starre Trägerplatte (18) vorgesehen ist, und
- die starren Trägerplatten mit Distanzelementen (20) vorgesehen sind, um die starren Trägerplatten (18) mit einem vorgegebenen Abstand zu trennen, wenn die starren Trägerplatten (18) in vertikalen Säulen gestapelt werden,

dadurch gekennzeichnet,

- **dass** der Trocknungssofen eine Trocknungskammer (65) aufweist, in die wenigstens eine vertikale Säule aus starren Trägerplatten (18) und den zugeordneten flexiblen Basisträgern (12) einer auf dem anderen gestapelt und durch die Distanzelemente (20) beabstandet einführbar ist, und
- **dass** Transporteinrichtungen (60) zum selekti-

ven Transportieren des vertikalen Stapels aus starren Trägerplatten (18) durch die Trocknungskammer (65) längs einer im Wesentlichen horizontalen Richtung vorgesehen sind.

29. Trocknungssofen nach Anspruch 28, **dadurch gekennzeichnet, dass** Einrichtungen zum Umwälzen eines Heißluftstroms in einer Richtung quer zu den gestapelten flexiblen Basisträgern (12) vorgesehen sind, so dass eine Vielzahl der flexiblen Basisträger (12) gleichzeitig getrocknet werden kann.

30. Trocknungssofen nach Anspruch 29, **dadurch gekennzeichnet, dass** der Trocknungssofen (14) wenigstens einen vertikalen Filter (69) aufweist, der dem Einlass des Heißluftstroms in die Trocknungskammer (65) zugeordnet ist.

Revendications

1. Dispositif pour fabriquer les circuits électroniques du type comprenant au moins un support de base souple (12) sur lequel le matériau électriquement conducteur est déposé pour définir des pistes conductrices, ledit dispositif comprenant au moins une station d'impression (13) capable de déposer ledit matériau électriquement conducteur sur ledit support de base souple (12), une étuve (14) et des premiers et deuxième moyens d'approvisionnement (35, 60) pour approvisionner chaque support de base souple (12) de ladite station d'impression (13) à ladite étuve (14), où pour chacun desdits supports de base souples (12) une plaque de maintien rigide (18) est prévue, le dispositif étant **caractérisé en ce que** les moyens d'empilement (52) sont prévus entre ladite station d'impression (13) et ladite étuve (14) pour empiler lesdites plaques de maintien rigides (18) et les supports de base souples associés (12) l'un sur l'autre de sorte que lesdits supports de base souples (12) soient empilés en piles verticales avant leur introduction dans ladite étuve (14), **en ce que** lesdites plaques de maintien rigides (18) sont équipées d'entretoises (20) pour séparer d'une distance prédéterminée lesdites plaques de maintien rigides (18) quand lesdites plaques de maintien rigides (18) sont empilées en piles verticales par lesdits moyens d'empilement (52), et **en ce que** lesdits premiers moyens d'approvisionnement (35) peuvent approvisionner chaque support de base souple (12) de ladite station d'impression (13) vers lesdits moyens d'empilement (52), alors que lesdits deuxièmes moyens d'approvisionnement (60) peuvent approvisionner lesdites piles verticales de supports souples de base (12) desdits moyens d'empilement (52) vers ladite étuve (14) et au travers de ladite étuve (14).

2. Dispositif selon la revendication 1, **caractérisé en ce que** ladite étuve (14) comprend une chambre de séchage (65) à l'intérieur de laquelle au moins une pile verticale desdites plaques de maintien rigides (18) et les supports de base souples associés (12) peuvent être introduits, des moyens étant prévus pour faire circuler un courant d'air chaud dans une direction transversale à ladite pile verticale, de sorte qu'une pluralité desdits supports de base souples (12) puisse être séchée simultanément. 5 10
3. Dispositif selon la revendication 2, **caractérisé en ce que** ladite étuve (14) comprend au moins un filtre vertical (69) disposé en relation avec l'admission dudit courant d'air chaud dans ladite chambre de séchage (65). 15
4. Dispositif selon la revendication 2, **caractérisé en ce que** ladite chambre de séchage (65) peut accueillir au moins deux piles verticales de supports de base souples (12) disposés longitudinalement, c'est-à-dire, orthogonalement audit courant d'air chaud. 20
5. Dispositif selon la revendication 1, **caractérisé en ce que** ladite étuve (14) est de type modulaire, chaque module comprenant une chambre de séchage (65) à l'intérieur de laquelle au moins une pile verticale de supports de base souples (12) peut être introduite, deux modules ou davantage pouvant être installés l'un à côté de l'autre de sorte que les chambres de séchage (65) des différents modules soient alignées dans une direction longitudinale, c'est-à-dire, dans la direction de l'approvisionnement desdits supports de base souples (12). 25 30 35
6. Dispositif selon la revendication 1, **caractérisé en ce que** lesdits seconds moyens d'approvisionnement comprennent au moins un premier guide horizontal (53) et une barre d'approvisionnement (60) capable d'approvisionner simultanément, étape par étape, lesdites piles verticales des supports de base souples (12) dans une direction longitudinale au travers de ladite étuve (14). 40 45
7. Dispositif selon les revendications 4 et 6, **caractérisé en ce que** la longueur (1) de ladite chambre de séchage (65) est essentiellement le double du pas d'approvisionnement (p) desdites piles verticales des supports de base souples (12). 50
8. Dispositif selon la revendication 1, **caractérisé en ce qu'en** aval de ladite étuve (14) est située une unité de refroidissement (15) au travers de laquelle chaque pile verticale desdits supports de base souples (12) est approvisionnée par lesdits deuxièmes moyens d'approvisionnement afin de refroidir lesdits supports de base souples (12). 55
9. Dispositif selon la revendication 8, **caractérisé en ce que** ladite unité de refroidissement (15) comprend une chambre froide (75) à l'intérieur de laquelle au moins une pile verticale de supports de base souples (12) peut être introduite, des moyens sont prévus pour créer un courant d'air froid circulant dans une direction transversale à ladite pile verticale, de sorte qu'une pluralité desdits supports de base souples (12) puisse être refroidie simultanément.
10. Dispositif selon la revendication 9, **caractérisé en ce que** ladite unité de refroidissement (15) comprend au moins un filtre vertical (77) disposé en correspondance avec l'admission dudit courant d'air froid de ladite chambre froide (75).
11. Dispositif selon la revendication 9, **caractérisé en ce que** ladite unité de refroidissement (15) comprend au moins un filtre vertical (77) disposé en correspondance avec la sortie dudit courant d'air froid de ladite chambre froide (75).
12. Dispositif selon la revendication 1, **caractérisé en ce que** lesdits premiers moyens d'approvisionnement comprennent un premier guide rectiligne (26) capable de guider lesdits supports de base souples (12) l'un devant l'autre et séparément l'un de l'autre par un pas déterminé (p), d'une station de chargement (11) à ladite station d'impression (13) et de là vers ladite étuve (14), **en ce que** ladite station d'impression (13) est latéralement déplacée en relation avec ledit guide rectiligne (26), et **en ce que** lesdits premiers moyens d'approvisionnement comprennent en outre des moyens d'approvisionnement transverses (41-44) afin de déplacer lesdits supports de base souples (12) transversalement et un par un dudit guide rectiligne (26) vers ladite station d'impression (13) et vice-versa.
13. Dispositif selon la revendication 12, **caractérisé en ce que** lesdits moyens d'approvisionnement transverses (41-44) comprennent une barre (41) disposée transversalement audit premier guide rectiligne (26) et sur lequel un chariot coulissant (42) est monté, entraîné par un moteur linéaire (43), des moyens pneumatiques (44a, 44b, 45a, 45b) étant prévus pour soulever sélectivement ledit support de base souple (12).
14. Dispositif selon les revendications 1 ou 12, **caractérisé en ce que** ladite station d'impression (13) comprend un ensemble de sérigraphie (40) capable de déposer, selon la technique de sérigraphie, ledit produit électriquement conducteur sous forme de pâte conductrice sur la surface supérieure du support de base souple (12), selon un motif ou un masque prédéterminé afin de réaliser lesdites pistes

conductrices.

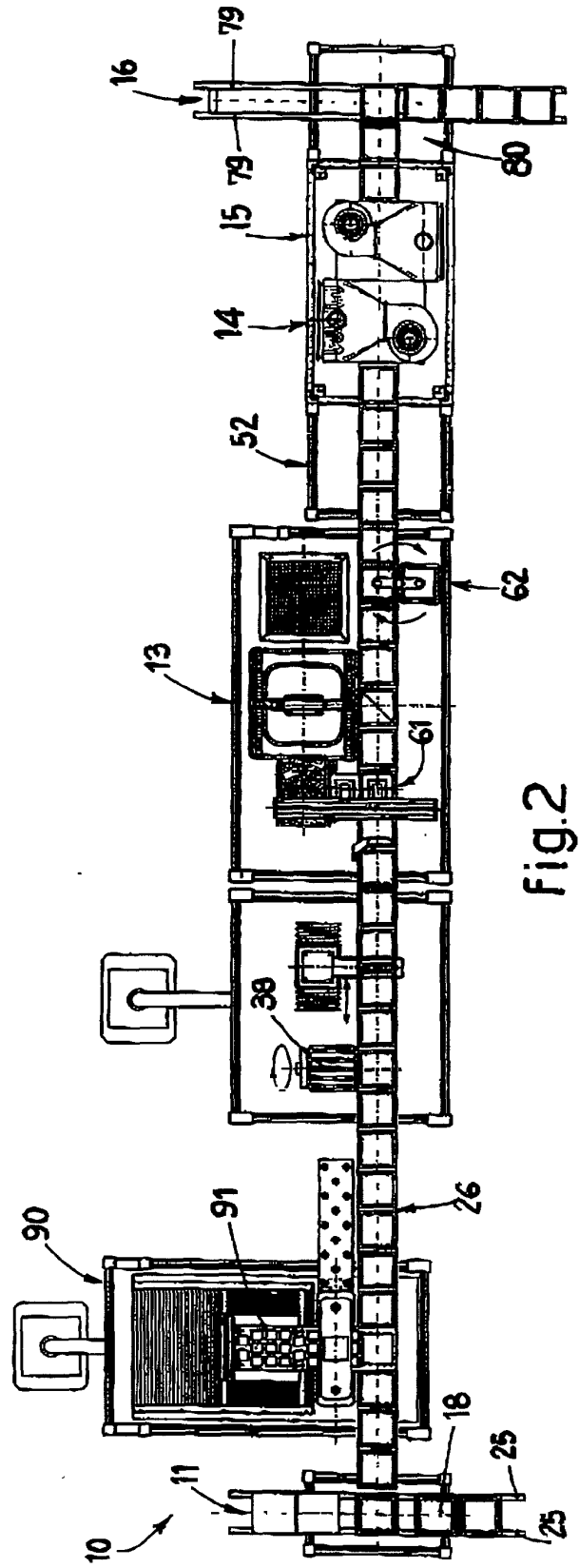
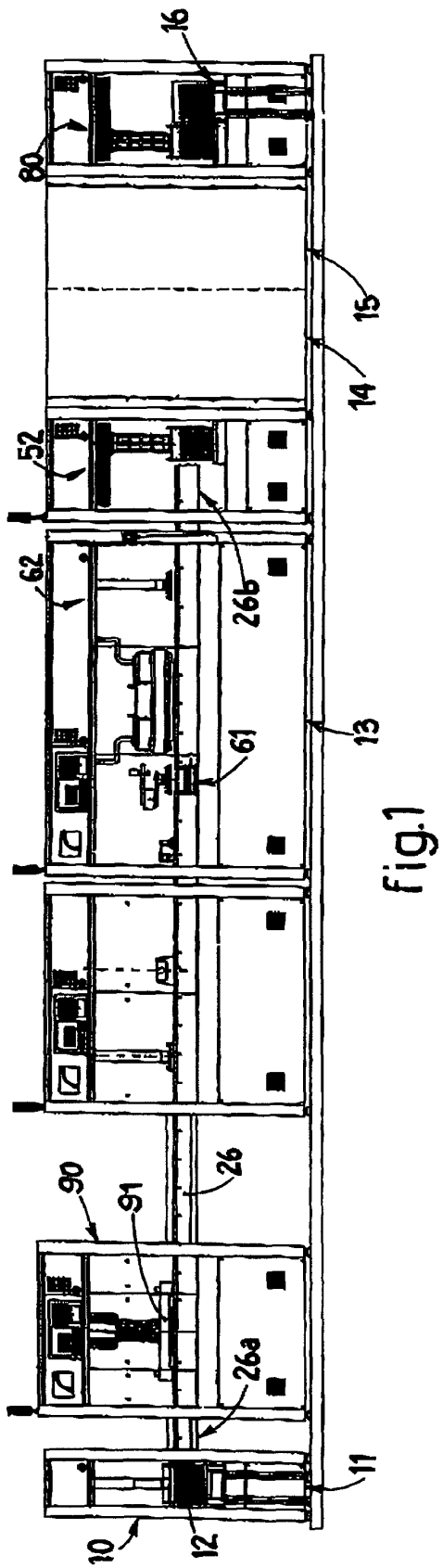
15. Dispositif selon la revendication 14, **caractérisé en ce que** ladite station d'impression (13) comprend un plateau horizontal de positionnement et de centrage (46), capable se déplacer le long des deux axes horizontaux (x et y), orthogonaux entre eux, et de tourner dans le plan horizontal suivant un axe vertical z (rotation θ). 5
16. Dispositif selon la revendication 13 et 15, **caractérisé en ce que** lesdits moyens pneumatiques comportent un premier dispositif pneumatique (44a) capable de soulever chaque support de base souple (12) en relation ledit guide rectiligne (26) et de le déposer sur ledit plateau horizontal de positionnement et de centrage (46) avant l'étape de sérigraphie, et un deuxième dispositif (44b) capable de soulever chaque support de base souple (12) dudit plateau horizontal de positionnement et de centrage (46), après l'étape de sérigraphie, et de le déposer sur ledit guide rectiligne (26). 10
17. Dispositif selon la revendication 15, **caractérisé en ce que** les caméras électroniques TV (50) sont prévues en relation avec ledit plateau (46) pour identifier optiquement les points déterminés de référence localisés sur ledit support de base souple (12) et pour diriger ledit plateau (46) dans les trois directions x, y et θ , de sorte que ledit support de base souple (12) soit exactement positionné par rapport audit ensemble de sérigraphie (40). 15
18. Dispositif selon la revendication 15, **caractérisé en ce que** deux rouleaux (47 et 48) sont montés rotatifs sur ledit plateau (46), sur lesquels rouleaux (47 et 48) une bande de papier (49) est enroulée afin de soutenir ledit support de base souple (12) pendant l'étape de sérigraphie. 20
19. Dispositif selon la revendication 18, **caractérisé en ce que** sous le segment rectiligne de ladite bande du papier (49), entre lesdits deux rouleaux (47 et 48), un dispositif d'aspiration (51) est prévu, capable de maintenir ledit support de base souple (12) sélectivement par adhérence sur ladite bande du papier (49). 25
20. Dispositif selon la revendication 14, **caractérisé en ce qu'un** ensemble de pesée (61) est associé à ladite station d'impression (13) pour peser chaque support de base souple (12) avant que la pâte conductrice ne soit déposée, et également après, pour vérifier que la masse de produit déposé correspond exactement à la masse prédéfinie. 30
21. Dispositif selon la revendication 12, **caractérisé en ce que** ladite station de chargement (11) comprend 35

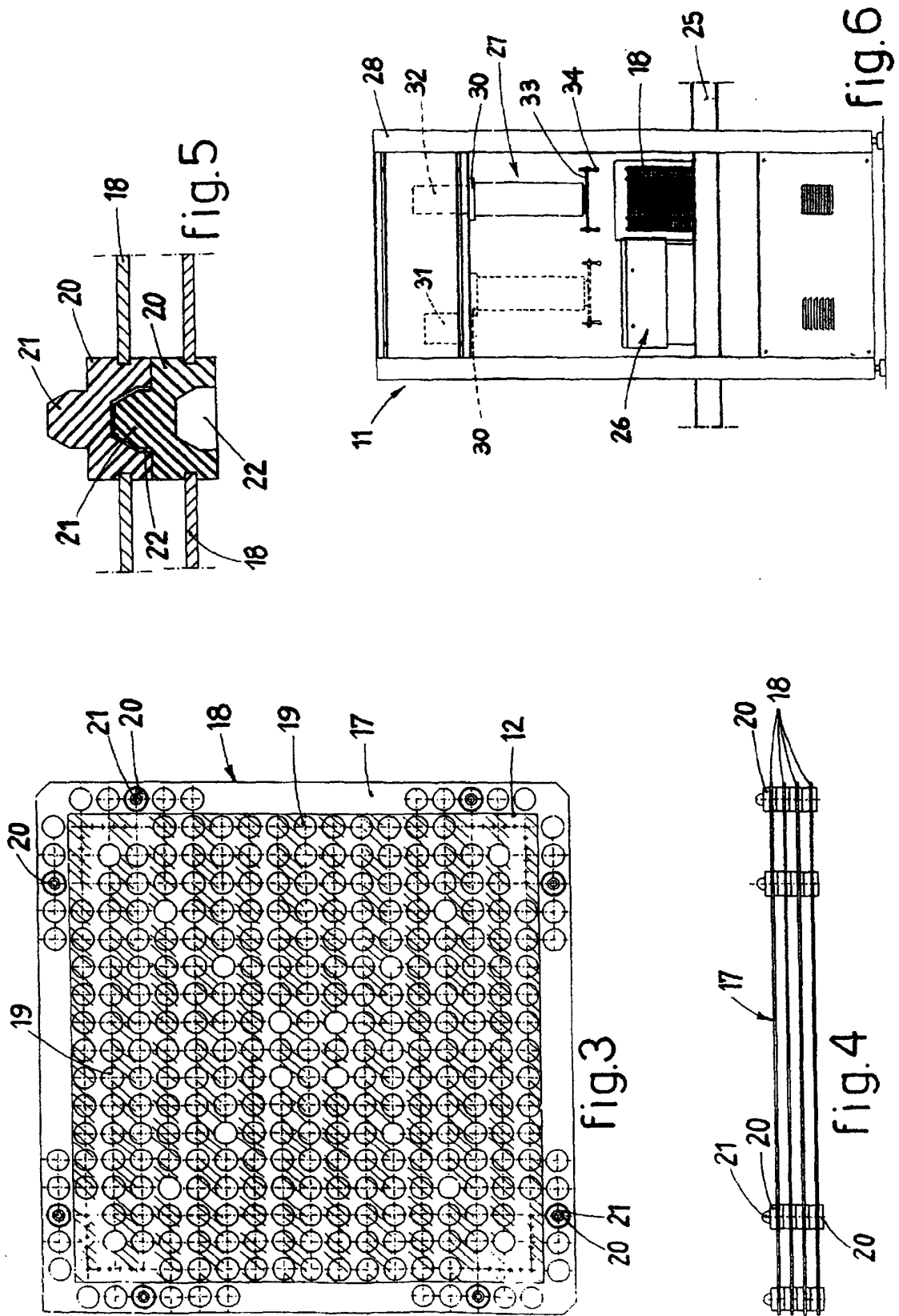
au moins un guide rectiligne (25) disposé transversalement en relation avec ledit premier guide rectiligne (26) et un dispositif de préhension (27) capable de prélever, d'une pile verticale de supports de base souples (12) à traiter, le support qui est momentanément sur le sommet, afin de le déposer sur une extrémité dudit premier guide rectiligne (26).

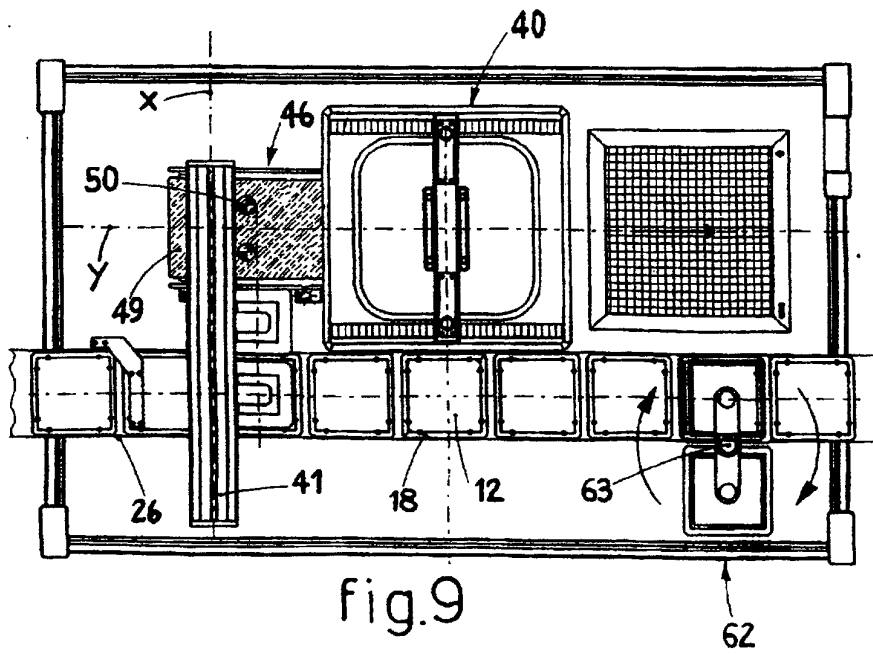
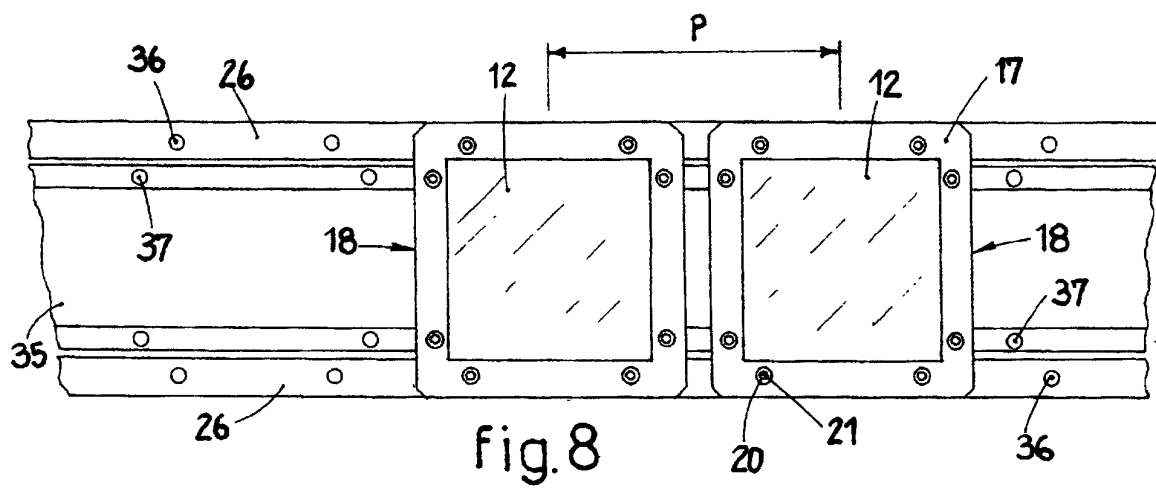
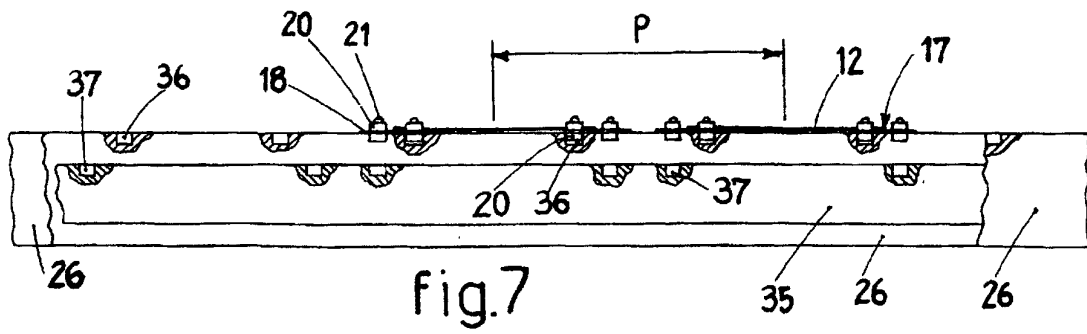
22. Dispositif selon la revendication 21, **caractérisé en ce que** ledit dispositif de préhension (27) comprend un chariot (30), capable de glisser horizontalement entre une position de préhension et une position de déposition, et des moyens d'entraînement (32) associés audit chariot (30) et capables de déplacer verticalement des moyens d'aspiration (34) qui peuvent être sélectivement activés pour soulever et déposer chacun desdits supports souples de base (12). 40
23. Dispositif selon la revendication 1, **caractérisé en ce que** lesdits premiers moyens d'approvisionnement comprennent un premier guide rectiligne (26) capable de guider lesdits supports de base souples (12), l'un devant l'autre et séparément l'un de l'autre par un pas déterminé (p), de ladite station d'impression (13) aux dits moyens d'empilement (52) et **en ce que** lesdits deuxièmes moyens d'approvisionnement comprennent un second guide rectiligne (53) capable de guider lesdites piles verticales des supports souples de base (12), l'une devant l'autre et séparément l'une de l'autre par ledit pas (p), desdits moyens d'empilement (52) à une station d'assemblage (16) au travers de ladite étuve (14). 45
24. Dispositif selon la revendication 23, **caractérisé en ce que** lesdits moyens d'empilement (52) comprennent un chariot (54) capable de glisser transversalement en relation avec lesdits deux guides (26, 53) et des moyens d'entraînement (57) associés audit chariot (54) et capables de déplacer verticalement des moyens d'aspiration (59) qui peuvent être sélectivement activés pour soulever et relâcher chacun desdits supports souples de base (12). 50
25. Dispositif selon la revendication 1, **caractérisé en ce que** ladite plaque de maintien rigide (18) comporte une surface supérieure (17) sur laquelle chaque support de base souple (12) peut reposer. 55
26. Dispositif selon la revendication 1, **caractérisé en ce que** lesdits éléments d'entretoise (20) peuvent également coupler chaque plaque de maintien rigide (18) avec la plaque de maintien rigide (18) située au-dessus et/ou en dessous.
27. Dispositif selon la revendication 1, **caractérisé en ce qu'entre** ladite station d'impression (13) et ladite étuve (14) une station de commande (62) est située

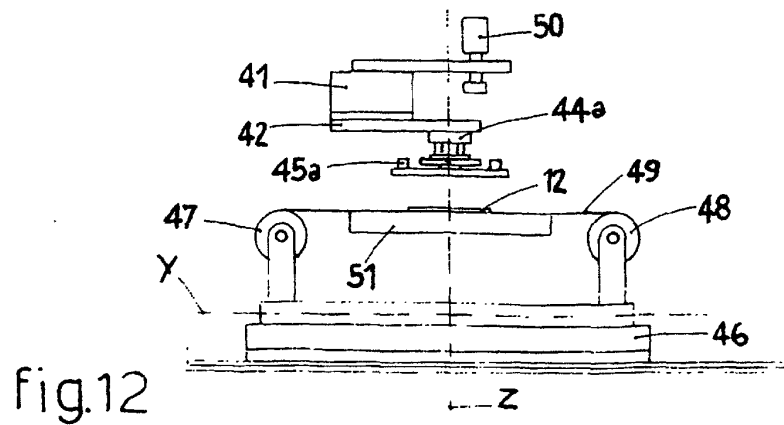
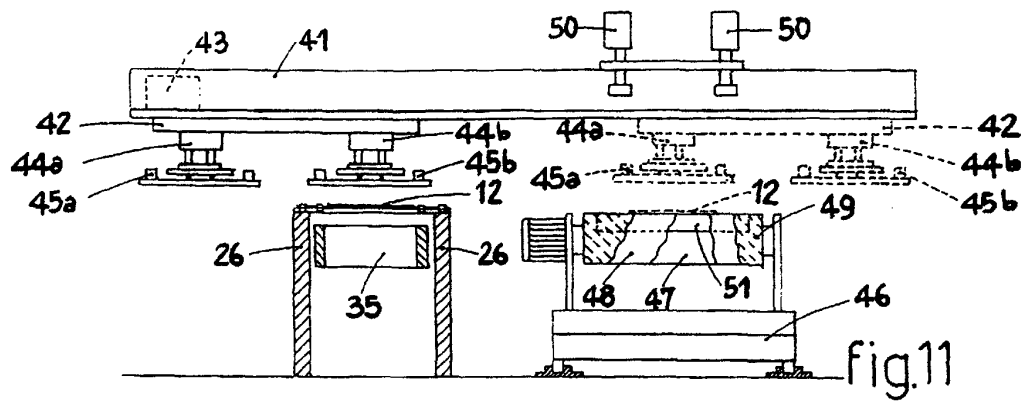
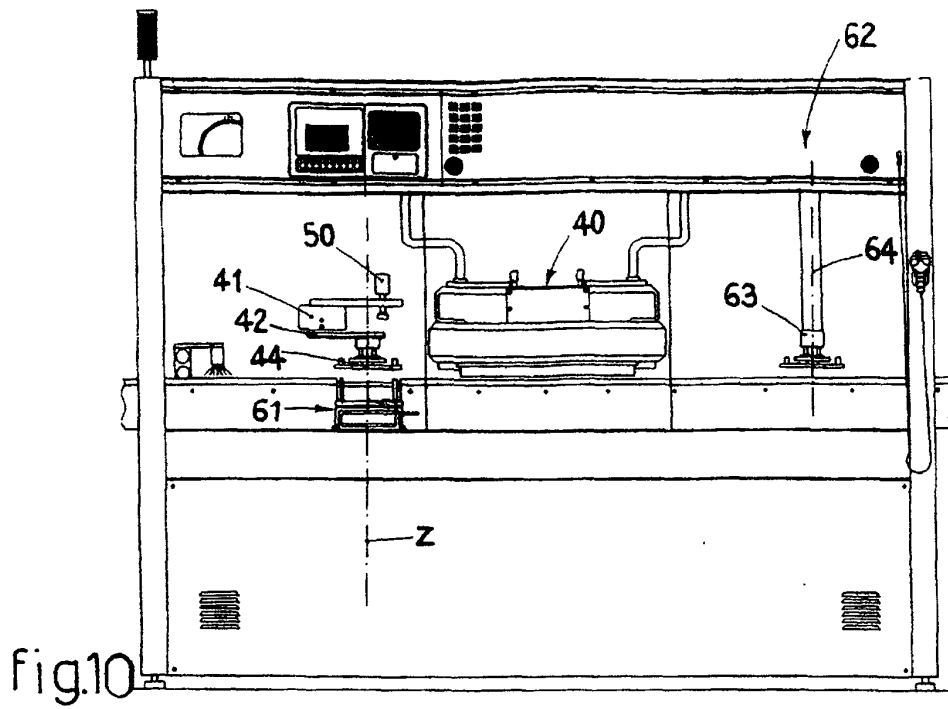
comprenant des moyens de rotation (63) autour d'un axe vertical (64) et équipée de ventouses qui peuvent être sélectivement activées pour prélever sélectivement un support de base souple (12) desdits premiers moyens d'approvisionnement et pour le faire pivoter de 180° autour dudit axe vertical (64) dans une position de contrôle de sorte qu'il puisse être ôté manuellement.

28. Etuve pour un dispositif selon la revendication 1, dans laquelle pour chacun desdits supports de base souple (12) une plaque de maintien rigide (18) est prévue, où lesdites plaques de maintien rigides (18) sont équipées d'éléments d'entretoise (20) pour séparer d'une distance prédéterminée lesdites plaques de maintien rigides (18) quand lesdites plaques de maintien rigides (18) sont empilées en piles verticales, **caractérisée en ce que** ladite étuve comprend une chambre de séchage (65) à l'intérieur de laquelle au moins une pile verticale desdites plaques de maintien rigides (18) et les supports de base souples correspondants (12) peuvent être introduits, empilé l'un sur l'autre et espacés par lesdits éléments d'entretoise (20) et **en ce que** des moyens d'approvisionnement (60) sont prévus pour approvisionner sélectivement ladite pile verticale de plaques de maintien rigides (18) au travers de ladite chambre de séchage (65) le long d'une direction essentiellement horizontale.
29. Etuve selon la revendication 28, **caractérisée en ce que** des moyens sont prévus pour faire circuler un courant d'air chaud dans une direction transversale aux dits supports de base souples empilés (12), de sorte qu'une pluralité desdits supports de base souples (12) puisse être séchée simultanément.
30. Etuve selon la revendication 29, **caractérisée en ce que** ladite étuve (14) comprend au moins un filtre vertical (69) disposé en relation avec l'admission dudit courant d'air chaud de ladite chambre de séchage (65).









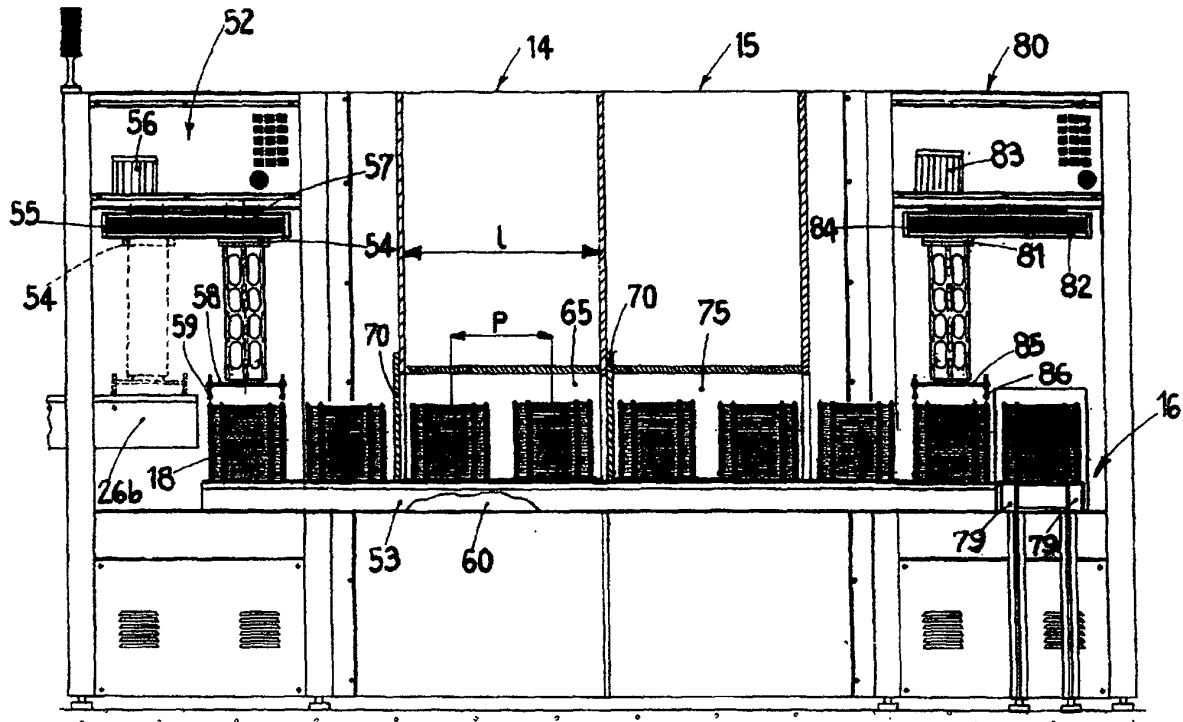


fig.13

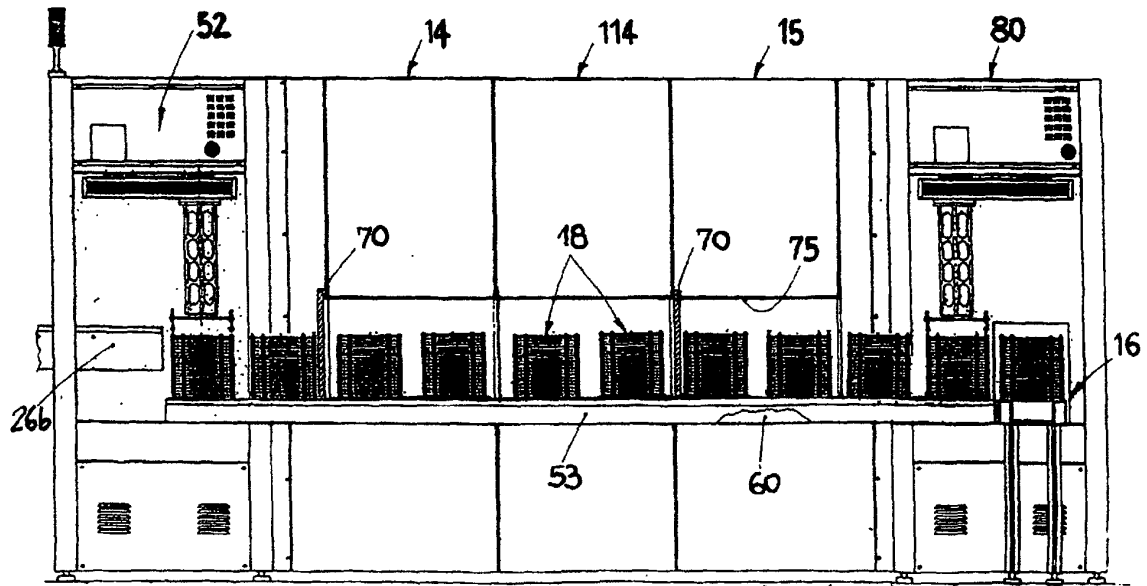


fig.14

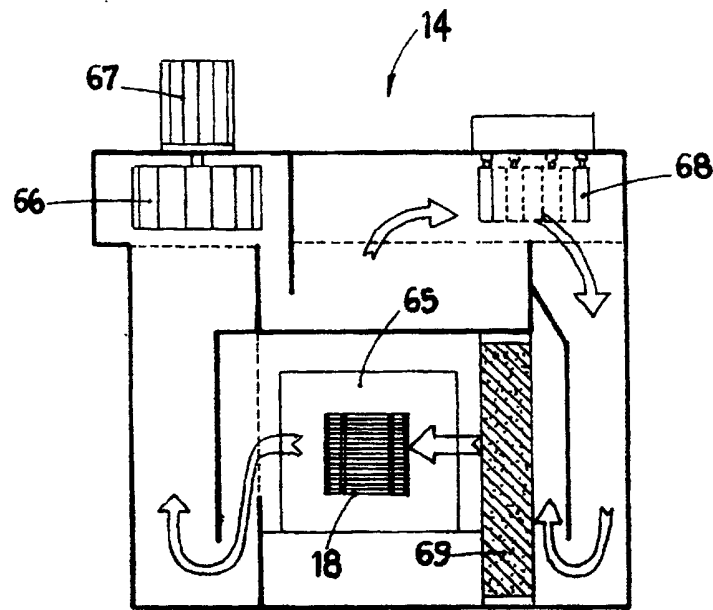


fig.15

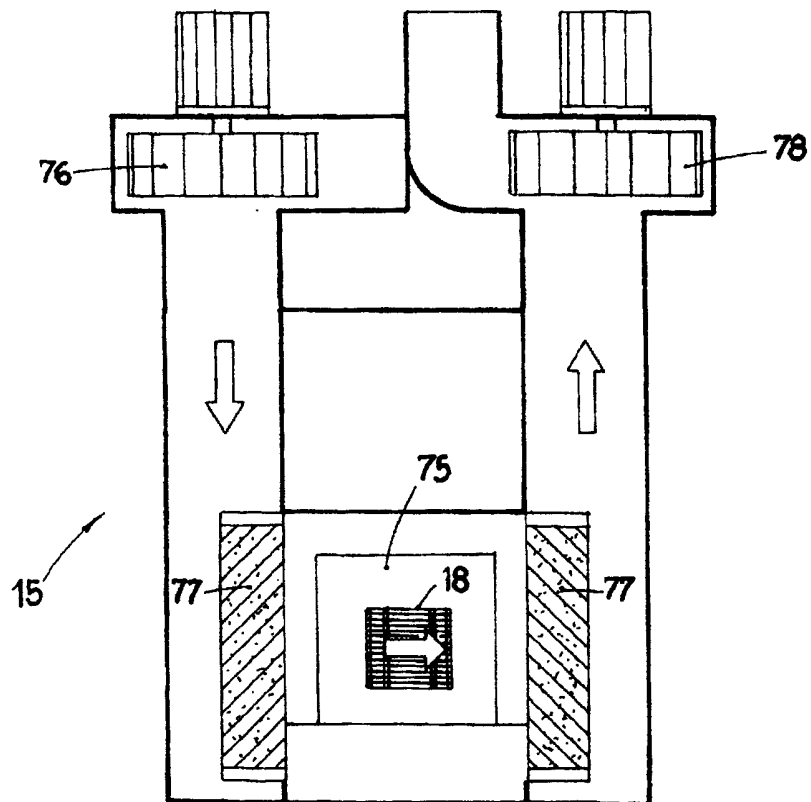


fig.16