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(54) **Containing apparatus for electronic parts**

Aufnahmebehälter für elektronische Teile

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Description

The present invention relates to a containing apparatus for electronic parts, and particularly to an electronic part container used in an electroplating process, whereby bending of lead wires of an electronic part may be prevented during the electroplating operation and the deposition thickness is relatively even, and what is more the apparatus is capable of being incorporated into an automatic production line so as to enhance production efficiency and prevent hazards induced by manual operation.

Referring to FIG. 1, showing a conventional containing apparatus for electronic parts used in an electroplating process, the conventional apparatus is provided with a plurality of tanks "A" and a metal piece such as tin, lead, copper, silver, and the like, serving as an anode.

Electronic parts are firstly put into a rolling barrel "C" and then the rolling barrel "C" is disposed in the electroplating apparatus as shown in FIG. 1. As shown in FIG. 2, an electrically-conducting shaft "D" is provided along the central axis of the conventional rolling barrel "C". The substantially cylindrical wall of the rolling barrel "C" is composed of a number of covers "C1" on which a plurality of apertures is formed so that the electrolyte can flow through the wall of the rolling barrel. A large quantity of electronic parts are placed in the barrel "C" to be electroplated. The rolling barrel "C" is rotatably connected to a cantilever "E" which is connected with an actuating rod "F" which is able to rotate and/or vertically translate the rolling barrel "C".

In such an apparatus, since the large quantity of electronic parts is inevitably crowded in the rolling barrel "C", a phenomenon of bending of the lead wires of an electronic part occurs during the electroplating operation. To overcome this disadvantage, the electrically-conducting shaft is provided with a plurality of electrically-conducting rings "D'" so as to avoid collisions between electronic parts in the rolling barrel. However, the bending problem still cannot be solved effectively. This is because electronic parts are randomly disposed in the rolling barrel "C" of the apparatus. Moreover, since the space inside the barrel "C" is relatively large, the chance of collision between electronic parts during the electroplating operation is very high. As a result, close to the ends of an electronic part the lead wires will suffer from being bent, and then the bent leads must be straightened manually. Consequently, human resources are wasted.

Apart from the above disadvantages, the conventional apparatus has the following disadvantages:

1. The material to be electroplated is remote from the anode. Therefore, the electroplating thickness on the electronic part will be quite non-uniform. Especially, the electroplating thickness of a low current zone will be unfavourably influenced.

With reference to FIG. 3 which is a schematic diagram of an electronic part, the reference numeral "3" is used to designate the body of the electronic part such as a resistor, a capacitor and the like. Two lead wires 31 extend outwardly longitudinally along the body 3. Due to the point discharge effect, during the electroplating process a lead wire 31 is divided into a low current density zone (L.C.D.), a medium current density zone (M.C.D.) and a high current density zone (H.C.D.).

In general, the high current density zone (H.C.D.) will be cut off after the electroplating process is finished, leaving only the low current density zone and/or a part of the medium current density zone. Therefore, electroplating quality of the low current density zone is an important factor influencing the quality of an electronic part.

For an experiment performed by the conventional apparatus, with the parameter values of:- 8K electronic parts in one barrel, an electroplating time of 10 minutes, and a current density of 26.9 mamp/cm^2 (25ASF), the result is as follows:

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
H.C.D.	Average: 14.03 μm (552.5 μinches)	83.5%
	STD. DEV (statistical error value: 4.87 μm (191.9 μinches)	0.9
	MAX. Value: 21.41μm (882.6 μinches)	85.1%
	MIN. Value: 7.77 μm (305.9 μinches)	82.3%
	Range: 14.65 μm (576.7 μinches)	2.8
	STD.DEV=standard deviation	

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
L.C.D.	Average: 6.66 μm (262.2 μinches)	86.6%

(continued)

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
	STD.DEV: 3.43 μm (135.0 μinches)	3.4
	MAX. Value: 13.18 μm (518.9 μinches)	94.3%
	MIN. Value: 0.82 μm (32.6 μinches)	82.8%
	Range: 12.35 μm (486.3 μinches)	11.5
	STD.DEV=standard deviation	

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
M.C.D.	Average: 10.41 μm (410.0 μinches)	82.3%
	STD.DEV: 7.67 μm (119.0 μinches)	1.0
	MAX. Value: 14.71μm (579.2 μinches)	83.5%
	MIN. Value: 6.56 μm (258.2 μinches)	88.9%
	Range: 8.15 μm (321.0 μinches)	2.6
	STD.DEV=standard deviation	

The above data indicate that the difference between the MAX. Value and the MIN. Value for L.C.D. is the largest, which means the quality is most variable. For H.C.D., the difference between the MAX. Value and the MIN. Value is the smallest, which means the quality in this zone is relatively stable. However, this H.C.D. will be cut off. Therefore, it is no advantage for the quality to have such a H.C.D. In view of this, it is the major object of the present invention to achieve a uniform distribution of electroplating thickness in the L.C.D.

2. After electrolyte permeates through the cover C1 into the rolling barrel "C", the flow rate of the electrolyte is lowered, namely the exchange rate between the electrolyte inside the barrel "C" and the electrolyte outside the barrel is not high. As a result, the electroplating effect is not high.

3. After the electroplating process is finished, the cover "C1" must be removed and the rolling barrel moved so as to pour the electronic parts out of the rolling barrel "C". Since there is a distance from the rolling barrel "C" to the container therebelow the lead wires, especially those of the electronic parts close to the lower level of the rolling barrel "C", will once again become bent because of the gravity induced in the pouring process.

US-A-1367567 discloses an electroplating apparatus in which a rotating cage is formed of a set of four containers of generally triangular shape with the truncated vertex of each triangle of the container nearer the axis of rotation. Workpieces can then be loosely placed in the containers and allowed to come in contact with electrolyte in the surrounding tank, by virtue of openings defining liquid-permeable walls of the containers.

SUMMARY OF THE PRESENT INVENTION

To overcome the above disadvantages, the present invention provides a containing apparatus as defined in claim 1. The plurality of spikes enhance the probability of contact between the electronic parts and the cathode. Furthermore, the electronic parts have their lead wires kept from being bent so as to eliminate the necessity of straightening bent wires. In addition, the containers are each positioned substantially tangential to the shaft so the fluidity of electrolyte is increased and hence the uniformity of the electroplating thickness is easily achieved.

The containers are preferably so spacious that the electronic parts therein will not crowd together, so the coating on the surface of the electronic part is complete, namely it is of better quality.

Having the containers substantially tangential to the shaft facilitates the circulation of the electrolyte. Therefore, the coating is evenly distributed.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be performed in various ways and one specific embodiment will be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a schematic diagram of a conventional electroplating tank;

FIG. 2 is a perspective view of a conventional rotating cage for electronic parts;
FIG. 3 is an elevational view of an electronic part;
FIG. 4 is a perspective view of a containing apparatus according to the present invention;
FIG. 5 is an exploded perspective view of a container for electronic parts, according to the present invention;
FIG. 6 is a fragmentary top view of the container for electronic parts, according to the present invention; and
FIG. 7 is a sectional view of the container for electronic parts, taken along the sectional line 7-7, wherein electronic parts are accommodated in the container.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 4-6, the containing apparatus 1 of the present invention for electronic parts mainly comprises a rotating cage 4 and a plurality of electronic part containers 2. Each of the connecting seats 42 comprises a guiding slot 45 for guiding and receiving the respective electronic part container 2 therein and a knob 43 for fixing the container 2 in the guiding slot 45. After the connection of the containers 2 with the guiding slots 45, the containers 2 are arranged in a tangential direction. The rotating cage 4 is provided with a plurality of connecting seats 42 which are substantially tangential to a rotation axis (as indicated by phantom line 41') thereof. By the provision of the connecting seats 42, the rotating cage 4 is able to receive containers 2. The connecting seat 42 is further provided with an electrically-conducting copper piece 44 which is capable of being in contact with electrically-conducting copper pieces on two ends of the container 2 so as to form a current path. During an electroplating process, the rotating cage 4 is connected to the conventional actuating rod "F" so as to move around in the tank "A".

As shown in FIG. 5, the container 2 takes the form of a thin rectangular box. The thin box 2 is provided with a plurality of baffle plates 22 which are evenly spaced so as to define a plurality of compartments 21. Spikes are provided on the side walls of each compartment 21 so as to form spiky walls 23 made of electrically-conducting material. The spiky walls 23 are connected to the electrically-conducting copper pieces 24 on the two ends of the container 2. The container 2 has a cap 25 which is able to keep electronic parts therein from dropping out. The cap 25 has a liquid-permeable screen 26 thereon and the bottom of the container 2 is also liquid-permeable. By means of the water-permeable characteristics of the container 2, the electrolyte is easily circulated.

As shown in FIG. 7, the orientation of each electronic part 3 is perpendicular to the spiky walls such that the lead wires of each electronic part are able to contact with the spiky walls 23. Since the orientation of every electronic part 3 is the same, and no collision with another occurs, the lead wires 31 of the electronic parts 3 will be almost clear of risk of being bent. Furthermore, the probability of contact between the electronic parts and the cathode is greatly increased.

Summing up the above, the electroplating apparatus of the present invention is able to achieve the following advantages:

1. The probability of lead wire bending is greatly reduced. Since the orientations of electronic parts are the same, the electronic parts are not crowded together and hence the lead wires are securely kept straight.
2. The coating on the surface of the electronic part is more uniform. Since the current in the present invention is well-distributed, the electroplating apparatus of the present invention is capable of providing an even and high current density to the electronic part, especially to zone L.C.D. thereof. Furthermore, the coating thickness of zone H.C.D. produced by the conventional method is reduced by the design of the spiky walls so as to achieve a more evenly distributed coating along the entire lead wires. Particularly, for the zone L.C.D. which in application is used as an effective welding zone, the present invention is capable of greatly increasing the weldability of an electronic part (according to the test method of MIL-STD-208 METHOD 202F).
3. The orientations of the thin boxes are such that the circulation of the electrolyte flowing through the screen is easily achieved. Meanwhile, the electrolyte circulation inside the thin box is comparatively ameliorated. Therefore, the coating thickness and the uniformity thereof are well under control.
4. The body 1 is made according to standard specifications so as to facilitate the automatic loading, transporting and unloading.

To demonstrate the quality of electronic parts, an experiment is performed using the same parameter values as the conventional ones except that the quantity of electronic parts is 4K per barrel. The following is the result:

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
H.C.D.	Average: 11.43 μm (450.5 μinches) STD. DEV (statistical error value: 6.99 μm (275 μinches)	88.6% 3.3

(continued)

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
	MAX. Value: 30.48 μm (1200 μinches) MIN. Value: 5.08 μm (200 μinches) Range: 24.9 μm (980 μinches) STD.DEV=standard deviation	93.8% 80.9% 12.9

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
M.C.D.	Average: 12.14 μm (478 μinches) STD.DEV: 4.32 μm (170 μinches) MAX. Value: 23.37 μm (920 μinches) MIN. Value: 5.72 μm (225 μinches) Range: 17.78 μm (700 μinches) STD.DEV=standard deviation	84.2% 1.1 86.4% 82.2% 4.2

	Thickness	Alloy proportion (percentage of tin in a tin-lead alloy)
L.C.D.	Average: 10.29 μm (405 μinches) STD.DEV: 3.81 μm (150 μinches) MAX. Value: 18.8 μm (740 μinches) MIN. Value: 3.81μm (150 μinches) Range: 15.24 μm (600 μinches) STD.DEV=standard deviation	86.4% 1.5 90.01% 83.2% 6.8

As indicated by the above data, the present invention makes the thickness of the zone L.C.D. and that of the H. C.D. zone almost equal. Therefore, the quality of the electronic part can be improved.

Claims

1. A containing apparatus for electronic parts (3) used in an electroplating process which is disposed in a tank (A) comprising:-

a rotating cage (4) capable of moving around in the tank and having a plurality of connecting seats (42), each of said connecting seats having thereon an electrically-conducting piece (44) and being tangent to a central axis (41') of said rotating cage; and
a plurality of containers (2) each having a respective electrically-conducting piece (24) provided on the two ends of said container to contact said electrically-conducting piece (44) of said rotating cage (4) when each of said containers (2) is received in a respective said connecting seat (42), each said container having a thin box having each end provided with an electrically-conducting copper piece and a screen provided thereon as a cap, and being received in said rotating cage, the bottom of said box including a bottom screen (26);

characterized in that :
said thin box has a plurality of baffle plates (22) which are so placed that a plurality of compartments (21) are formed therein, and in that each of said compartments has two side walls which are provided with a plurality of electrically-conducting spikes (23) so as to form an electrically-conducting spiky wall on each of said ends, each of said spiky walls being respectively in contact with each of said electrically-conducting copper pieces (24) of said box.

2. A container as claimed in claim 1, wherein said rotating cage has a plurality of guiding slots (45), each capable of receiving a said container and provided with a said electrically-conducting piece (44)of copper, and wherein a knob is provided at the open end of said guiding slots.

3. A container as claimed in claim 1 or 2, wherein each spike (23) of said spiky walls is in the shape of a pyramid, and said spikes are not in contact with one another.

Patentansprüche

1. Eine Aufnahmevorrichtung für elektronische Teile (3), wobei die Aufnahmevorrichtung bei einem Elektroplattierverfahren verwendet wird und in einem Tank (A) angeordnet ist, aufweisend:

einen drehbaren Käfig (4), der dazu befähigt ist, sich in dem Tank herumzubewegen, und eine Mehrzahl von Verbindungssitzen (42) aufweist, wobei jeder der genannten Verbindungssitze an ihm ein elektrisch leitendes Teil (44) aufweist und in Bezug auf eine mittlere Achse (41') des genannten drehbaren Käfigs tangential ist; und

eine Mehrzahl von Behältern (2), von denen jeder ein entsprechendes elektrisch leitendes Teil (24) aufweist, das an den zwei Enden des genannten Behälters vorgesehen ist, um das genannte elektrisch leitende Teil (44) des genannten drehbaren Käfigs (4) zu berühren, wenn jeder der genannten Behälter (2) in einem entsprechenden, genannten Verbindungssitz (42) aufgenommen ist, wobei jeder genannte Behälter einen dünnen Kasten, bei dem jedes Ende mit einem elektrisch leitenden Kupferstück versehen ist, und ein Sieb aufweist, das an ihm als eine Abdeckung vorgesehen ist, wobei jeder genannte Behälter in dem genannten drehbaren Käfig aufgenommen ist und wobei der Boden des genannten Kastens ein Bodensieb (26) aufweist;

dadurch gekennzeichnet, daß
der genannte dünne Kasten eine Mehrzahl von Scheidewänden (22) aufweist, welche so angeordnet sind, daß eine Mehrzahl von Abteilen (21) hierin gebildet ist, und daß jedes der genannten Abteile zwei Seitenwände aufweist, welche mit einer Mehrzahl von elektrisch leitenden Spitzen (23) versehen sind, so daß eine elektrisch leitende, Spitzen aufweisende Wand an jedem der genannten Enden gebildet ist, wobei jede der genannten, Spitzen aufweisenden Wände in Berührung mit jedem der genannten, elektrisch leitenden Kupferstücke (24) des genannten Kastens ist.

2. Eine Aufnahmevorrichtung, wie in Anspruch 1 beansprucht, bei welcher der genannte drehbare Käfig eine Mehrzahl von Führungsschlitzen (45) aufweist, von denen jeder dazu befähigt ist, einen genannten Behälter aufzunehmen, und mit einem genannten elektrisch leitenden Stück (44) aus Kupfer versehen ist, und bei welcher an dem offenen Ende der genannten Führungsschlitze ein Knopf vorgesehen ist.

3. Eine Aufnahmevorrichtung, wie in Anspruch 1 oder 2 beansprucht, bei welcher jede Spitze (23) der genannten, Spitzen aufweisenden Wände in der Gestalt einer Pyramide ist und die genannten Spitzen nicht in Berührung miteinander sind.

Revendications

1. Équipement pour contenir des composants électroniques (3) utilisé dans un processus de galvanoplastie, qui est disposé dans une cuve (A), comprenant :

- une cage tournante (4) propre à tourner dans la cuve et ayant une multiplicité de sièges de raccordement (42), chacun desdits sièges de raccordement ayant sur lui une pièce électriquement conductrice (44) et étant tangent à un axe central (41') de ladite cage tournante ; et
- une multiplicité de récipients (2) ayant chacun une pièce conductrice de l'électricité (24) prévue sur les deux extrémités dudit récipient pour être en contact avec ladite pièce électriquement conductrice (44) de ladite cage tournante (4), lorsque chacun desdits récipients (2) est reçu dans l'un desdits sièges de raccordement respectifs (42), chacun desdits récipients étant un mince bac ayant chaque extrémité équipée d'une pièce de cuivre électriquement conductrice et ayant chacun une fine grille prévue sur lui comme chapeau, et étant reçu dans ladite cage tournante, le fond de ladite cage comprenant une fine grille de fond (26) ;

caractérisé en ce que :

ledit mince bac a une multiplicité de chicanes (22) qui sont disposées de telle sorte qu'une multiplicité de compartiments (21) y sont formés, et en ce que chacun desdits compartiments a deux parois latérales qui sont équipées d'une multiplicité de dents électriquement conductrices (23) de façon à former une paroi crénelée conductrice de l'électricité sur chacune desdites extrémités, chacune desdites parois crenelée étant respectivement en contact avec chacune desdites pièces de cuivre électriquement conductrices (24) dudit bac.

2. Récipient selon la revendication 1, dans lequel ladite cage tournante a une multiplicité de fentes de guidage (45), chacune pouvant recevoir l'un desdits récipients et étant équipée d'une desdites pièces de cuivre électriquement conductrices (44) et dans lequel un bouton est prévu au niveau de l'extrémité ouverte desdites fentes de guidage.

3. Récipient selon la revendication 1 ou la revendication 2, dans lequel chaque dent (23) desdites parois crénelées a la forme d'une pyramide, et lesdites dents ne sont pas en contact les unes avec les autres.

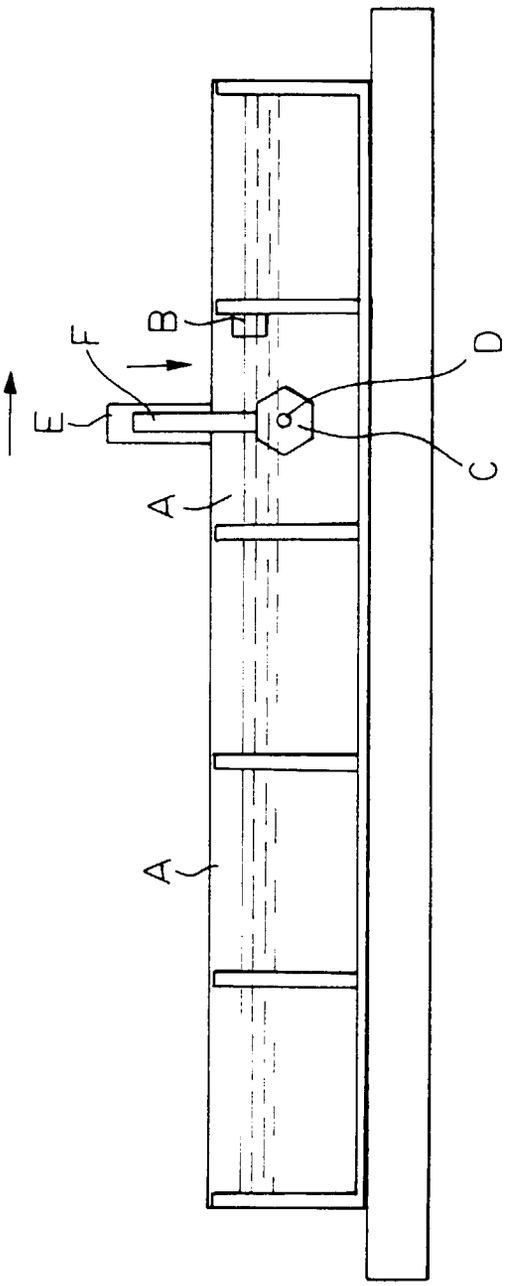


FIG. 1

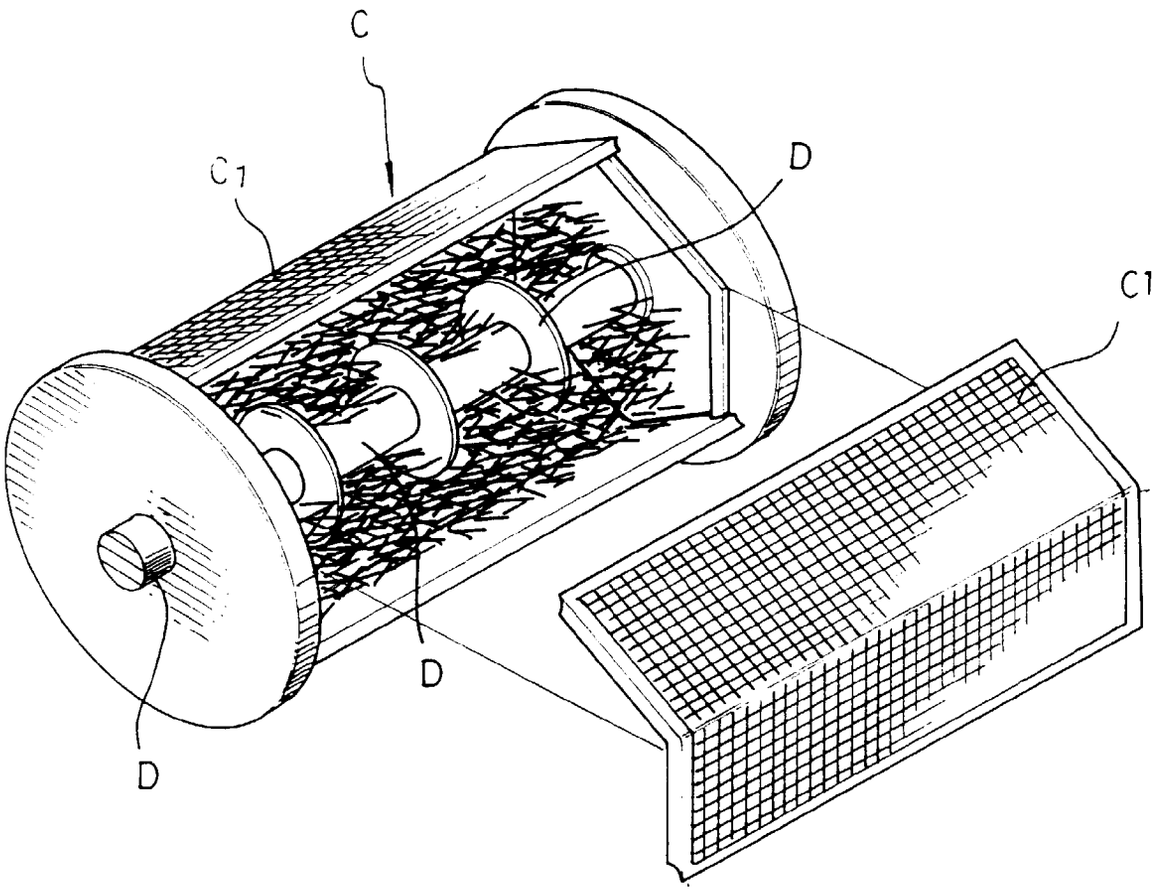


FIG. 2



FIG. 3

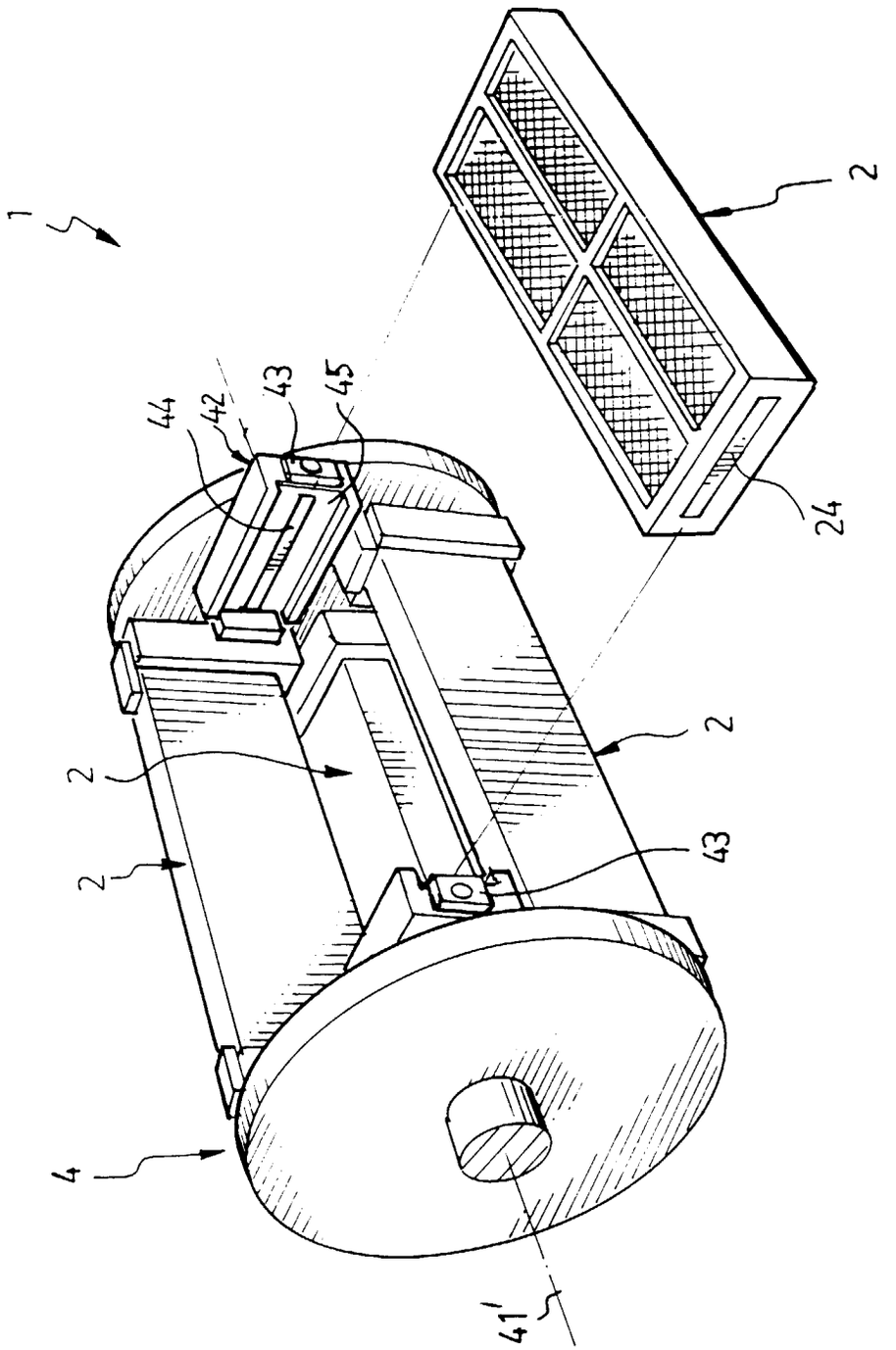


FIG. 4

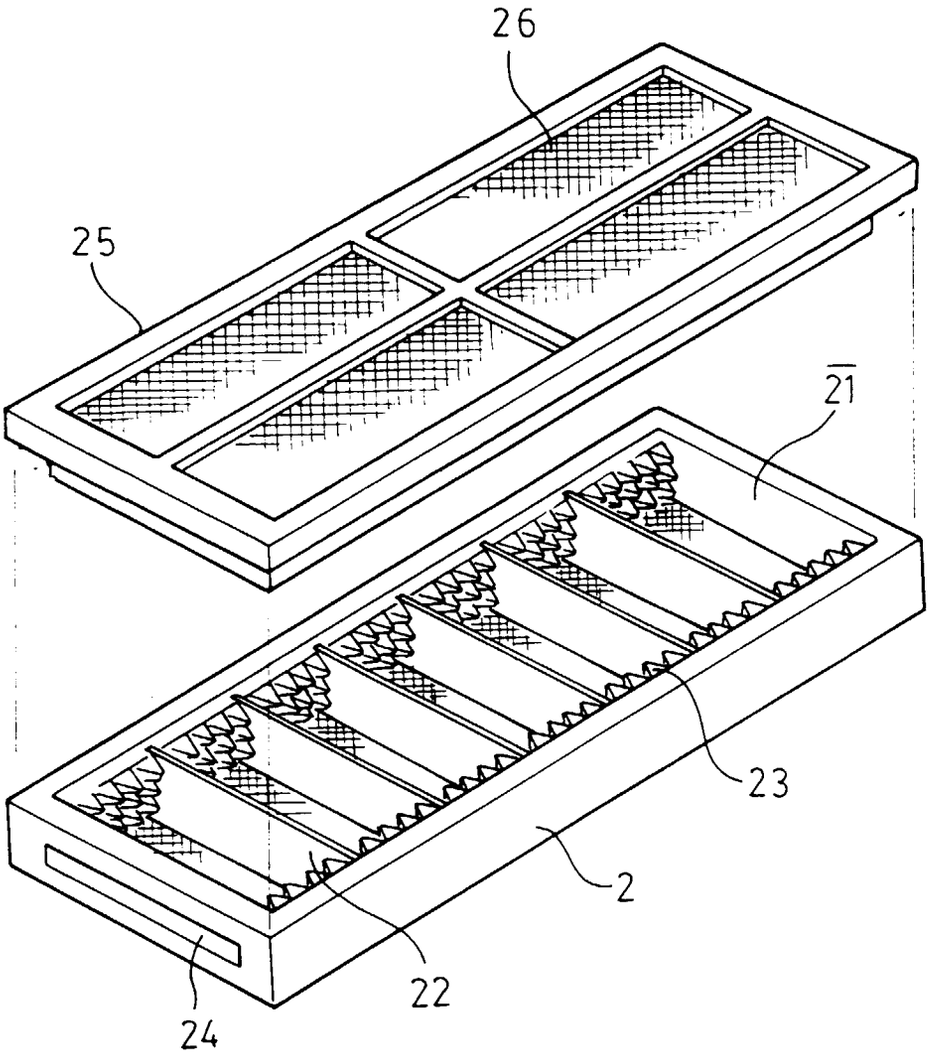


FIG. 5.

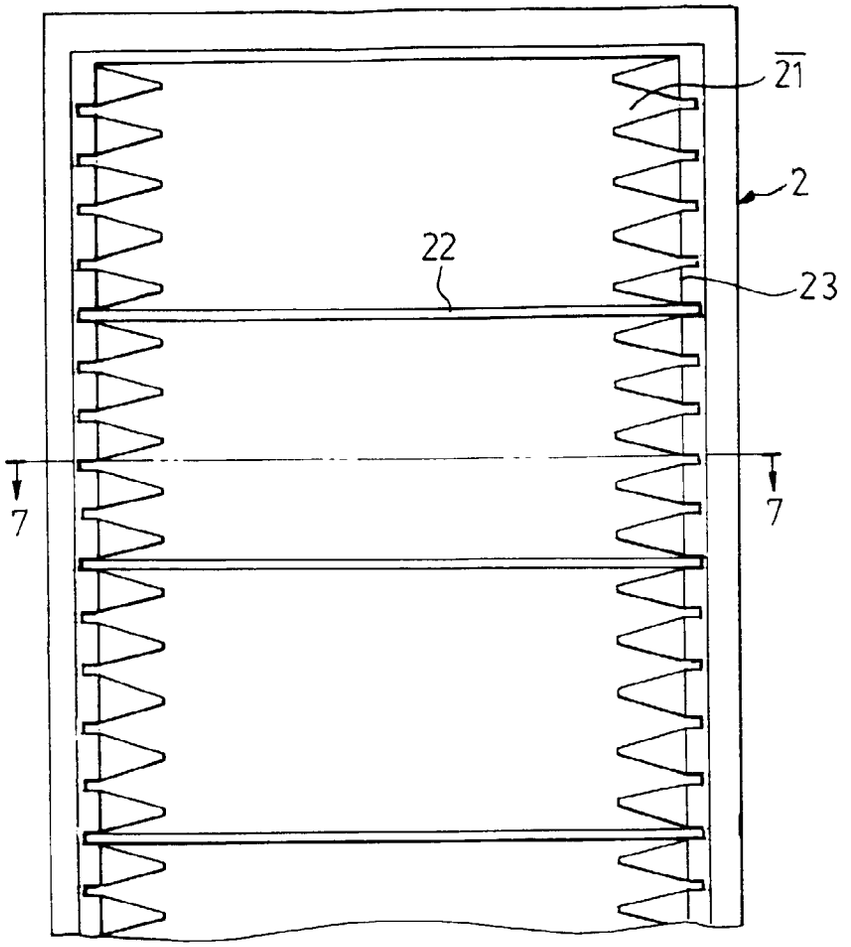


FIG. 6

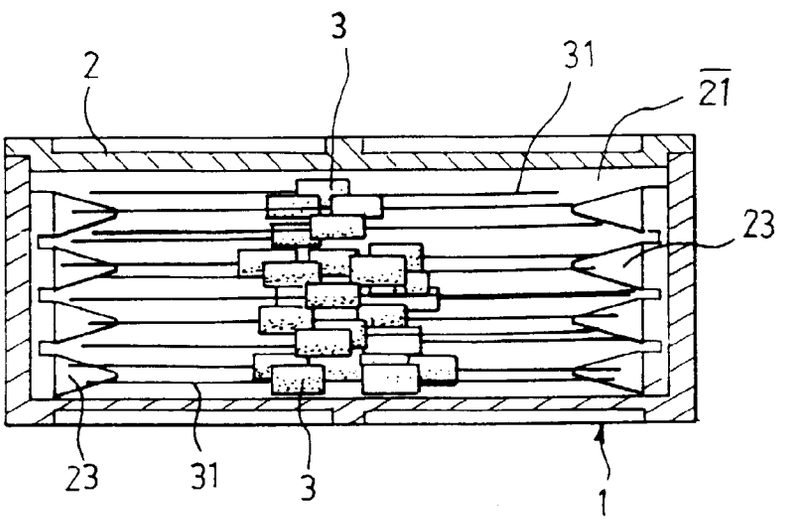


FIG. 7