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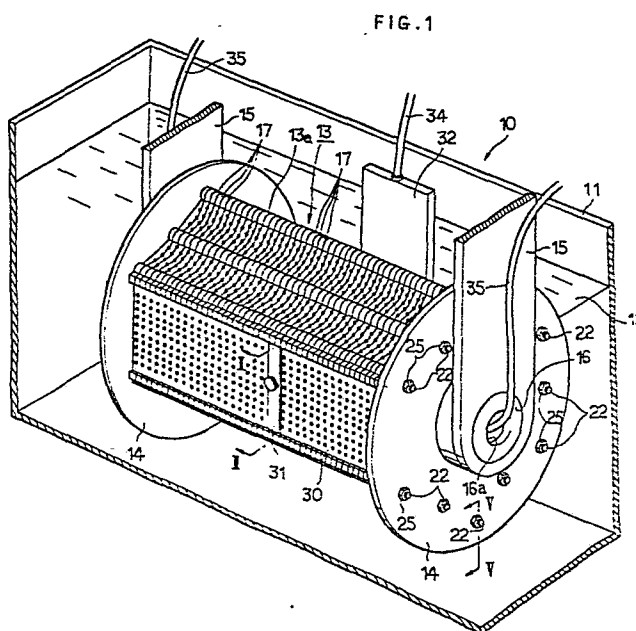
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54 A barrel assembly for a plating apparatus.

57 A barrel assembly, such as an electroplating barrel (13) according to the invention is divided into two kinds, one of which provides perforations (21) and liquid passageways (20) narrower than the diameter of said perforation to communicate between the perforations, while the other provides with liquid passage means so designed that the exterior opening (43b) is wider than the interior opening (43a), whereby, upon withdrawing the barrel from an electroplating tank containing a liquid plating solution, said solution is facilitated to flow out through said perforations and through said passage means for drainage.



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BACKGROUND OF THE INVENTION

This invention relates to a barrel assembly for a plating apparatus and particularly to a barrel assembly improved so as to facilitate a drainage from a barrel means.

5 A plating apparatus, such as an electro-chemical apparatus customarily comprises an electroplating tank and a barrel immersed in a liquid plating solution in said tank.

In the plating operation, voltage is applied across an anode plate and cathode bar, each, in turn, placed in said tank and
10 said barrel, while the barrel is rotated with "articles to be plated" loaded.

Under such circumstances said above, the barrel is provided with perforations for the solution to flow into the barrel therethrough. However, the articles often happens to be small
15 parts, such as a nut, a washer or the like, the perforations must be confined to be of smaller diameter to prevent the pieces from passing therethrough. The condition is such that upon withdrawing the barrel from the plating tank, though the solution in the barrel is almost drained through the
20 perforations, the perforations are clogged by the solution and liable to stay therein under influence of the surface tension immediately before fully drained.

This degrades the drainage performance so that the dripping condition of the solution prolongs, while the solution tends
25 to reside within the barrel with the result that the residual solution may be ultimately discarded in vain.

It is, therefore, a primary object of the invention

to provide a barrel assembly which is capable of improving a drainage performance by terminating a dripping condition of the liquid in short periods of time, and at the same time, to reduce the solution resided in the barrel means.

5 The invention substantially provides a dual means for its object, one of which is to provide liquid passageways to communicate between perforations so formed in the barrel means that the passageways are narrower than the diameter of the perforations. The other is to provide liquid passage
10 means so designed that the exterior opening is wider than the interior opening to reduce the amount of the surface tension acting in the passage means to improve the drainage performance.

15 These and other objects and novel features of the present invention will be more clearly and set forth in the following specification and accompanying drawings in which:

Figs. 1-5 show a first embodiment of the invention wherein Fig. 1 is a perspective view of a a plating machine partly broken away;

20 Fig. 2 is a longitudinal cross sectional view taken along the line II - II of Fig. 1;

Fig. 3 is a perspective view of a barrel assembly partly broken away;

Fig. 4 is an enlarged exploded view of the barrel assembly;

25 Fig. 5 is an enlarged latitudinal view taken along the line V - V of Fig. 1;

Fig. 6 is a view similar to Fig 4 according to a second

embodiment of the invention;

Fig. 7 is a side elevational view looking from the direction of arrow in Fig. 6 when a barrel means is assembled;

Fig. 8 is a view similar to Fig. 4 according to a third embodiment of the invention:

Fig. 9 is a latitudinal cross sectional view taken along the line IX - IX of Fig. 8 when a barrel means is assembled;

Fig. 10-15 show modified forms of the third embodiment pursuant to the invention inwhich:

Figs.10, 12, 14 are views similar to Fig. 4;

Figs.11, 13 are latitudinal cross sectional views each taken along the line XI - XI of Fig. 10 and XIII-XIII of Fig. 12; and Fig. 15 is also views similar to Figs. 11 and 13 taken along the line XV - XV of Fig. 14.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figs.1-5, a first embodiment of the invention will be described hereinafter.

A plating apparatus, e.g., an electro-chemical plating machine is generally designated by reference numeral 10. It includes an electroplating tank 11 containing a liquid plating solution 12 and a barrel 13 immersed in the solution 12. The barrel 13 comprises a torso portion 13a consisting annular elements as described hereinafter, and side disks 14 secured to the right and left open ends of said torso portion 13a, so that the barrel 13 is vertically movably suspended by a pair of hangers 15, each end of which is respectively pivoted to a tubular shaft 16 attached to the side disk 14.

An annular element 17 is formed by an electrically non-conductive material such as plastic to be hexagon-shaped configuration of a predetermined width and thickness, each side of which is zigzagged in a suitable manner as best seen in Fig. 4, while the both open ends of the element 17 are cut out to form semi-circular notches 18. A plurality of the annular element 17 are laminated concentrically through a thin spacer 19 to form a generally hexagonal cylindrical configuration, with a result that a liquid passageway 20 appears at the slight clearance between the abutting open ends of the elements 17, while a perforation appears at the opening created from a pair of opposed notches 18. In this way, the passageway 20 is automatically predetermined narrower than the diameter of the perforation, in which, by way of example, the former is

- 5 -

0.8(mm) in width, the latter being 4(mm) in diameter to prevent "articles to be plated" from passing therethrough. An elongated bolt 22 is driven laterally through holes 23, 24, each provided in the side disks 14 and the open end of the element 17.

Both ends of the bolt 22 is screwed by means of nuts 25, to preserve the barrel in shape. One side of the barrel 13 is opened to provide an entry and exit opening 27 for the work pieces. A pair of opposed peripheral ends of the opening 27 provide with an offset section 28 having a lengthwise channel 29. A porous hatch 30 is removably mounted on the barrel 13 to open and close the opening 27. To the hatch 30, is an arm 31 pivoted, both ends of which is fit into the channel 29 to latch the hatch 30 against removal as shown in Fig. 2.

Among an anode plate 32 and a cathode 33, the former 32 is immersed in the solution 12 through an electrical conductor cable 34, while the latter 33, being known as thief to those skilled in the art, extends into the interior of the barrel 13 by way of an electrical conductor cable 35 passing through the hollow portion 16a of the shaft 16.

With the structure thus far described, it should be apparent that an operator can apply voltage across the cables 34 and 35, and at the same time, rotate the barrel 13 by means of, e.g., an electric motor (not shown) with the work pieces loaded to start a plating operation and as a consequence, the barrel 13 agitates and tumbles the work pieces to bounce them against the cathode 33 during the plating operation.

When the plating operation is completed, the hangers 15 are lifted to withdraw the barrel 13 from the tank 11.

Subsequently the barrel 13 lifted as stated above is transferred to a certain process followed.

5 Now the attention is called to the time when the barrel 13 is withdrawn from the tank 11. At this time, the solution 12 is drained out through the perforations 21 and the passageways 20 from the barrel 13. However, when the drainage nearly comes to end, the perforation 21 is clogged by the solution 12.
10 The solution 12 staying at the perforations 21 is pulled in the direction of arrow 36 shown Fig. 5 to flow into the passageway 20 under influence of the surface tension and ultimately drips onto the tank 11. Because the passageway 20 is narrower than the diameter of the perforations.
15 This facilitates the solution 12 to pass through the perforations 21 without retaining therein to improve the drainage performance, with the result that the dripping condition of the solution 12 terminates in short periods of time to reduce the residual solution volume. As a result of experiment, the residual
20 solution volume, which conventionally has been 1300 (ml), is found to be reduced as little as 500 (ml) below half of the conventional residual volume.

25 The drainage performance, thus improved, prevents the solution 12 from dripping outside the tank 11, upon transferring the barrel 13 to the process followed.

 Futhermore, the liquid passageway 20 thus provided with the barrel 13 increases the total opening area so that an electrically

conductive effect through the opening is facilitated to improve a plating performance.

Still further, it enables to provide a barrel assembly ready in manufacturing since the passageway 20 and perforation 21 are formed by only laminating a plurality of annular elements 17.

It is noted that the shape of the perforation 21 is not limited to a circular configuration as described, it, of course, includes an elliptic configuration or the like.

Referring next to Figs. 6 and 7, a second embodiment of the invention will be described hereinafter. In the second embodiment, an annular element 37 has a saw-toothed notch 38 at the both open ends. A plurality of the annular elements 37 are laminated concentrically with a predetermined distance spaced to form a barrel 39, with the result that a perforation 40 appears at the lozenge opening between the registered notches 38, while a liquid passageway 41 appears at clearance between the apexes.

Referring to Figs. 8 and 9, a third embodiment of the invention will be described hereinafter.

In the third embodiment, instead of the notches 18, 38 of the first and second embodiment, both open ends of an annular element 42 have a tapered area (T) as seen in Figs. 8 and 9 to form a trapezoidal configuration in cross section.

In this condition, a liquid passage means 43 created between the abutting annular elements 42 is progressively divergent from the interior opening 43a to the exterior opening 43b.

With the structure thus far described, when the liquid level in the barrel lowers to an extent that the passage means 43 may be clogged by the solution 12 in the event of withdrawing the barrel from the tank 11, the solution 12, though temporarily stays only at the interior opening 43a, passes readily therethrough owing to the outwardly divergent passage means 43 and the small amount of the surface tension working in the thin peripheral end of the interior opening 43a. This facilitates the solution 12 to drain out through the passage means 43 to improve the drainage performance, with the result that the dripping condition of the solution terminates in short periods of time to reduce the residual solution volume in the barrel.

On the other hand, the liquid plating solution 12 just stays only at the interior opening 43a region without remaining at the full passage means 43 as aforementioned even when the draining process is finished. In this sense, the total liquid volume resided in the barrel is reduced.

By the way, assuming that the annular element 42 may be or originally determined thin to reduce the residual liquid volume, the problem that the whole strength becomes weak will arise. So the element 42 is after all required to have a predetermined thickness to preserve a desired strength.

Yet further, the outwardly divergent passage means 43 prevents itself from being plugged by the articles to be plated.

Referring to Figs. 10-15, as a modified form of the third embodiment of the invention, will three examples be described

hereinafter.

As a first modified form, a tapered area 44 may be formed intermittently in an annular element 45 as shown in Fig. 10 in opposition to the overall tapered area (T) of the third embodiment. The rectangular portion 45a remains serves to agitate the liquid plating solution 12 during the plating operation. Note that the cornered area of said rectangular portion 45a may be, of course, rounded.

Next, as a second modified form, either of two open ends of an annular element 46 may have a tapered area 46a shown in Figs. 12 and 13.

And last, as a third modified form, an annular element 47 may be formed L-shaped in cross-section as shown in Figs. 14 and 15 so that an interior opening 48 may appear at the clearance between the horizontal segment 48a of the element 47 and other element 47.

According to the invention, the liquid in a barrel is facilitated to pass through a perforation under influence of the surface tension without lingering therein to improve a drainage performance upon withdrawing the barrel from a plating tank 11 as particularly stated in the first embodiment. This enables to terminate the dripping condition of the liquid in short periods of time to reduce the residual liquid volume in the barrel.

On the other hand, as hereinbefore stated especially in the third embodiment, a liquid passage means is so designed that the interior opening is narrower than the exterior opening.

The liquid, though stays only at the interior opening temporarily, is facilitated to pass through the interior opening without lingering therein to improve a drainage performance upon withdrawing the barrel from the tank, since the amount of the surface tension working in the interior opening is small. This also enables to terminate the dripping condition of the liquid in short periods of time to reduce the residual liquid volume in the barrel, together with the fact that the liquid stays only at the interior opening when the drainage is finished.

As is apparent from the foregoing examples, the improved drainage performance reduces the liquid volume resided in the barrel and prevent the liquid from being discarded in vain. This contributes to solution-saving.

It will be appreciated that a barrel is comprised of annular elements in each embodiment of the invention, the construction, however, is not limited to this, a barrel may be comprises of a wooden board. Furthermore a barrel may be oscillably mounted, not being limited to be rotatably mounted.

Although various minor structural modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent hereon all such modifications as reasonably and properly come within the scope of our contribution to the art.

What is claimed is:

1. A barrel assembly for a plating apparatus comprising;
a barrel means disposed in a liquid plating solution,
a perforation provided with the circumferential wall of
said barrel means,
a liquid passageway provided with said barrel means to
communicate between said perforations so that said passageway may
be narrower than the diameter of said perforation.

2. A barrel assembly for a plating apparatus of claim 1
in which;

said barrel means comprising a plurality of annular
elements having a notch means forming a part of said perforation
and said annular elements are concentrically connected respectively
with a predetermined distance spaced so that said liquid passage-
way may be developed between the abutting annular elements.

3. In a barrel assembly for a plating apparatus comprising
of a barrel means having a liquid passage means, and disposed
in a liquid plating solution; it is characterized in that
the exterior opening of said liquid passage means is wider than

the interior opening.

5

4. A barrel assembly for a plating apparatus of claim 3 in which; said liquid passage means is progressively divergent from the interior opening to the exterior opening.

10

5. A barrel assembly for a plating apparatus of claim 3 in which; said barrel means comprising a plurality of annular elements, each connected concentrically with a predetermined distance spaced so that a liquid passage means may be created between the abutting annular elements.

20

6. A barrel assembly for a plating apparatus of claim 5 in which; said liquid passage means is progressively divergent from the interior opening to the exterior opening.

25

FIG. 1

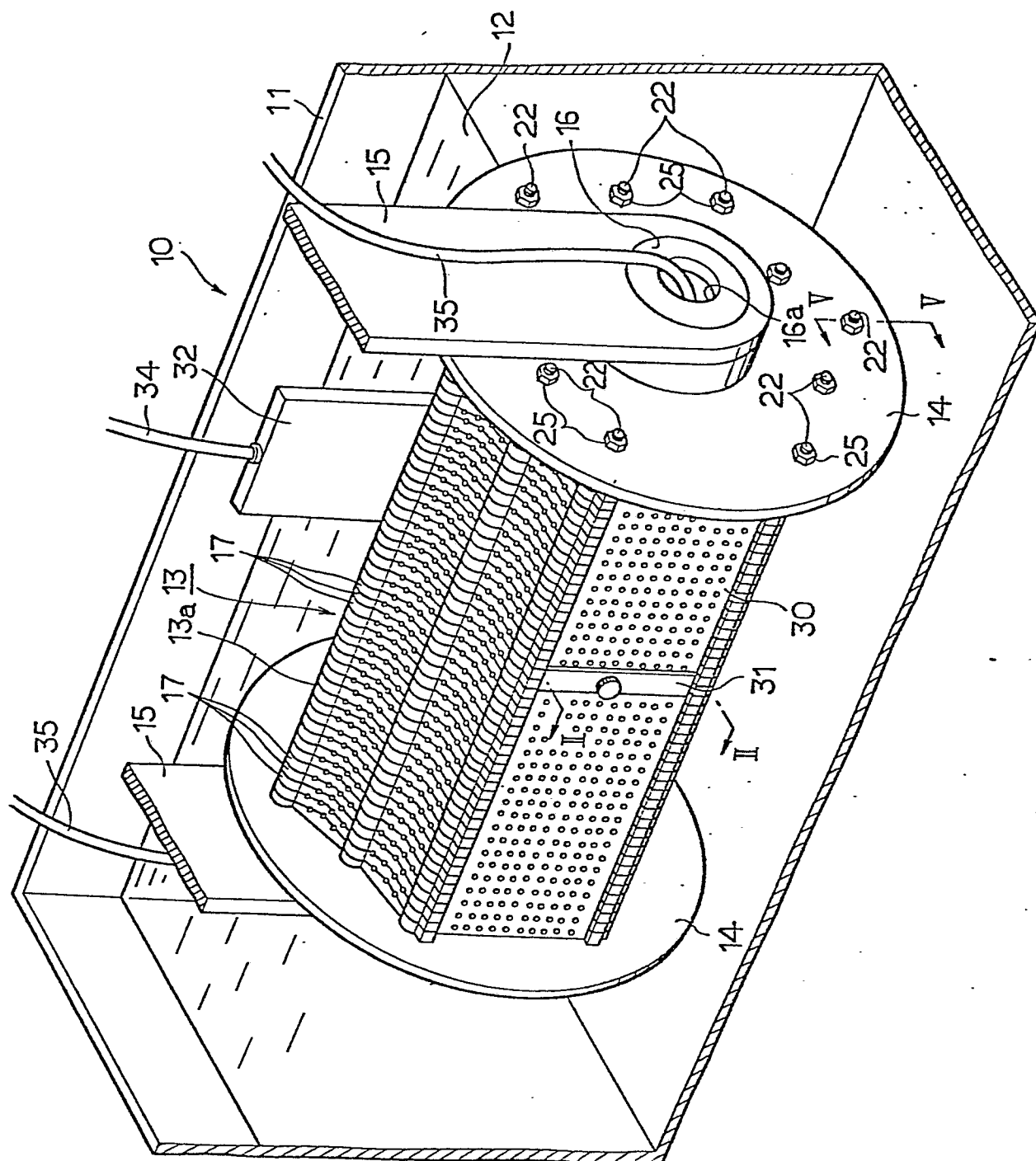


FIG. 2

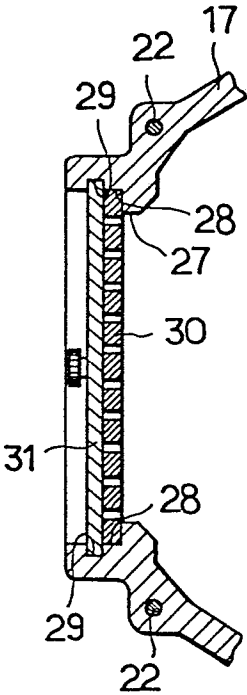


FIG. 3

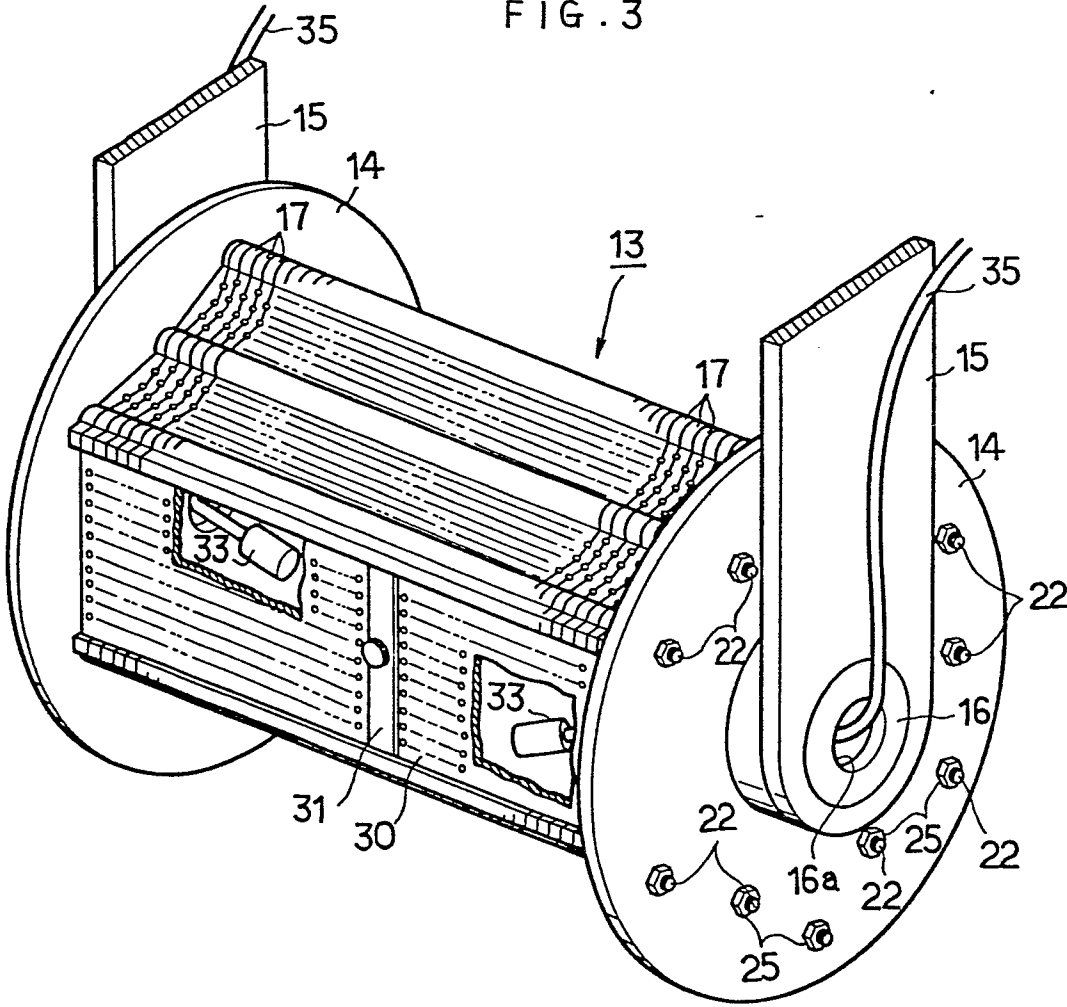


FIG. 4

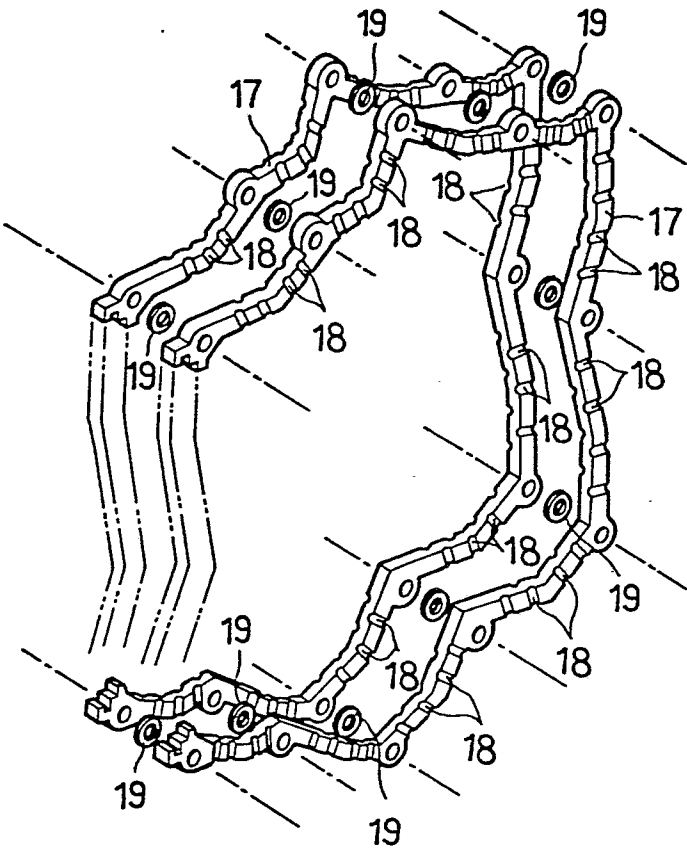


FIG. 5

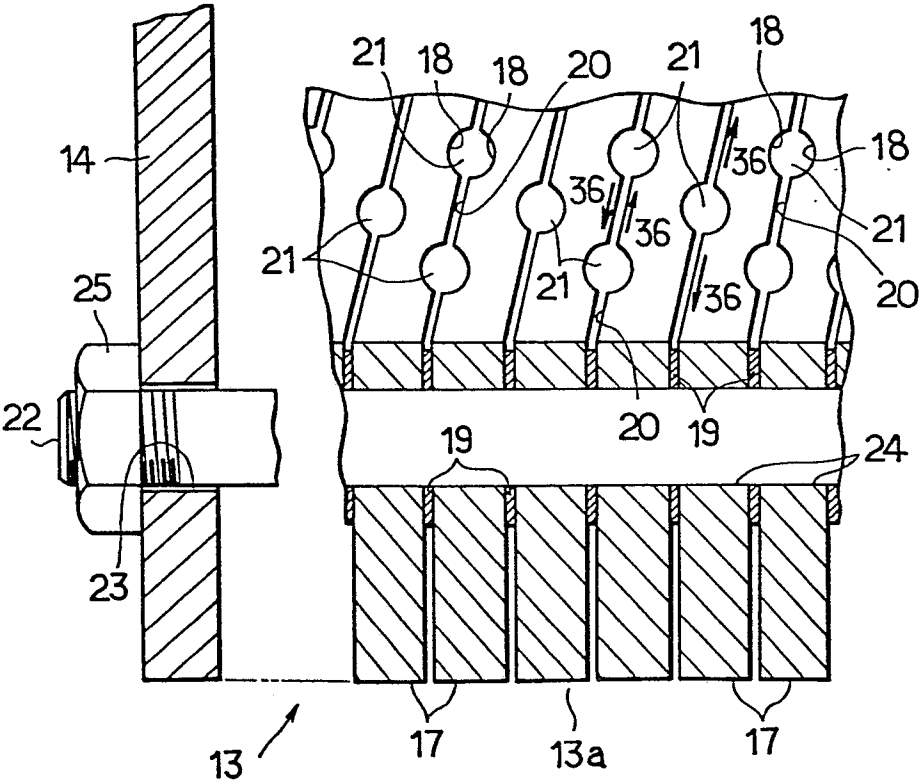


FIG. 6

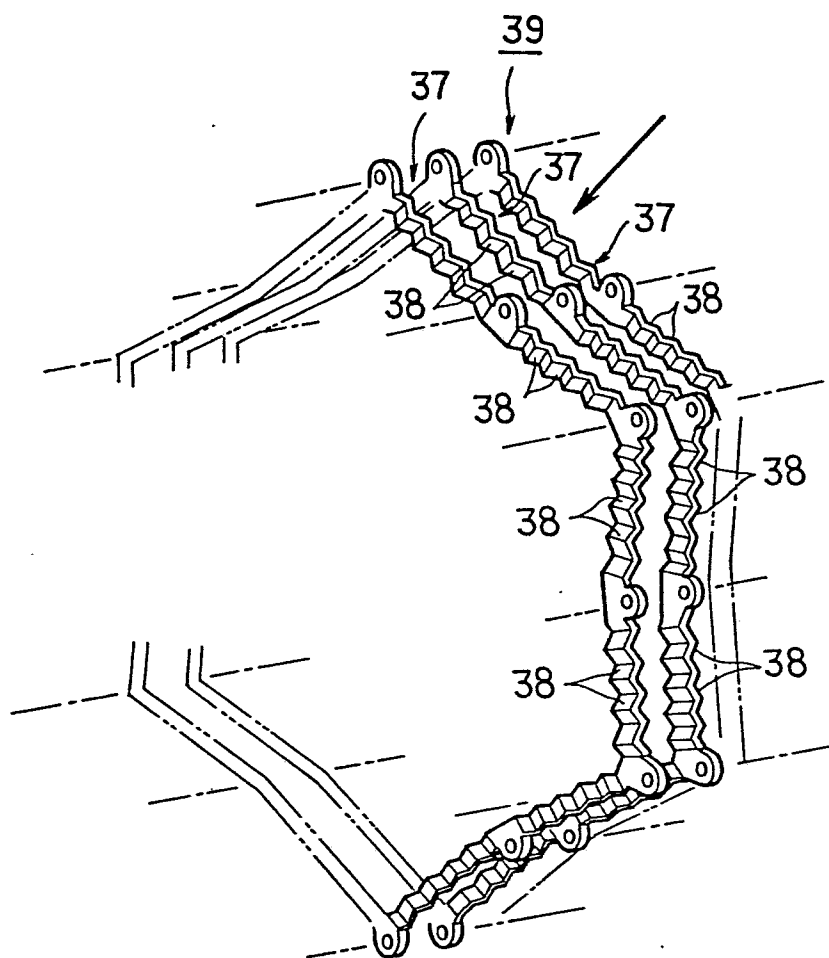


FIG. 7

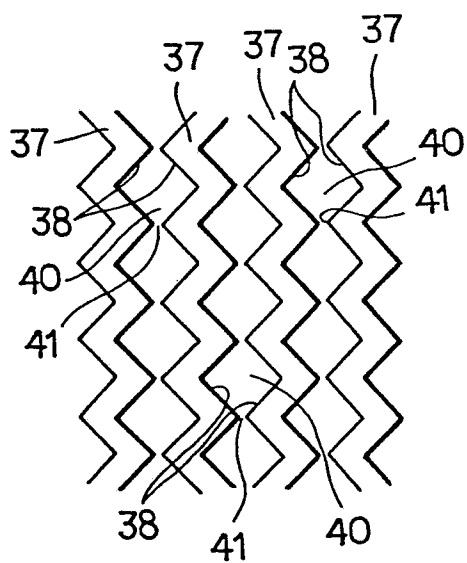


FIG. 8

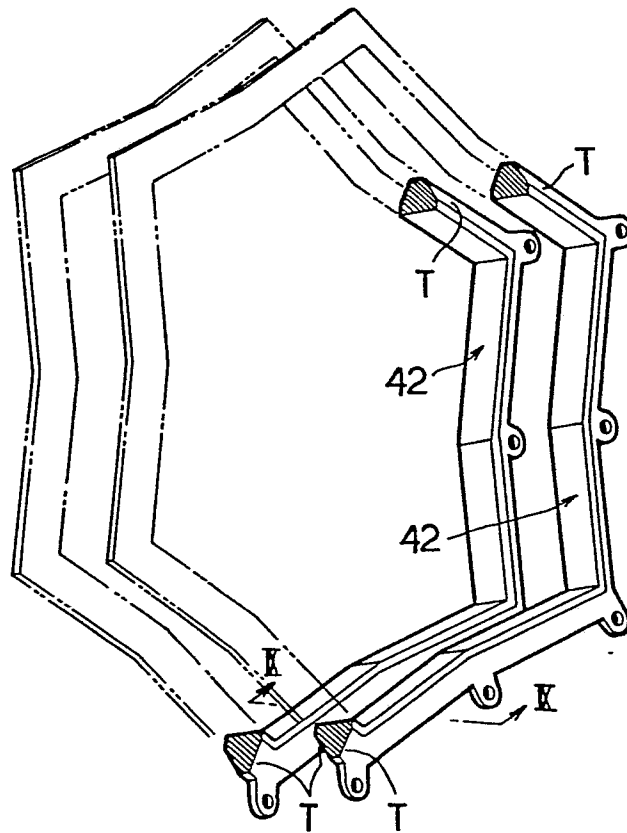


FIG. 9

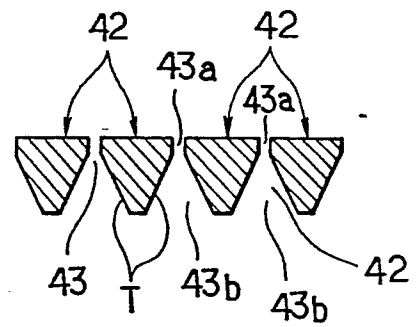


FIG. 10

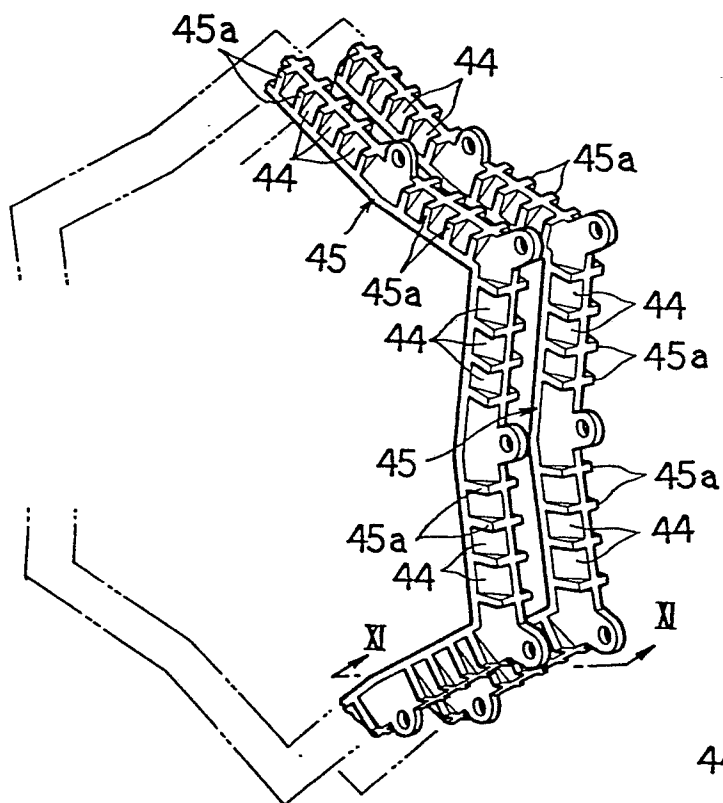


FIG. 11

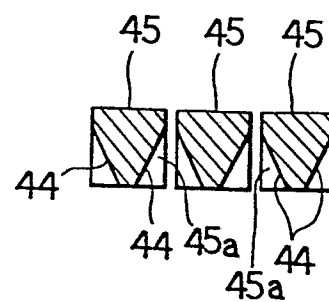


FIG. 12

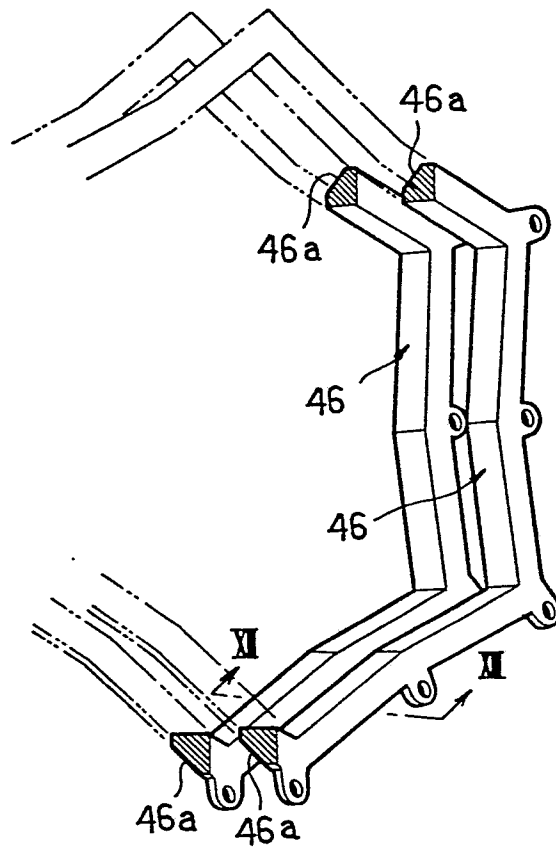


FIG. 13

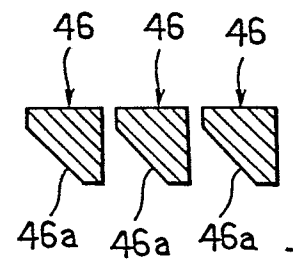


FIG. 14

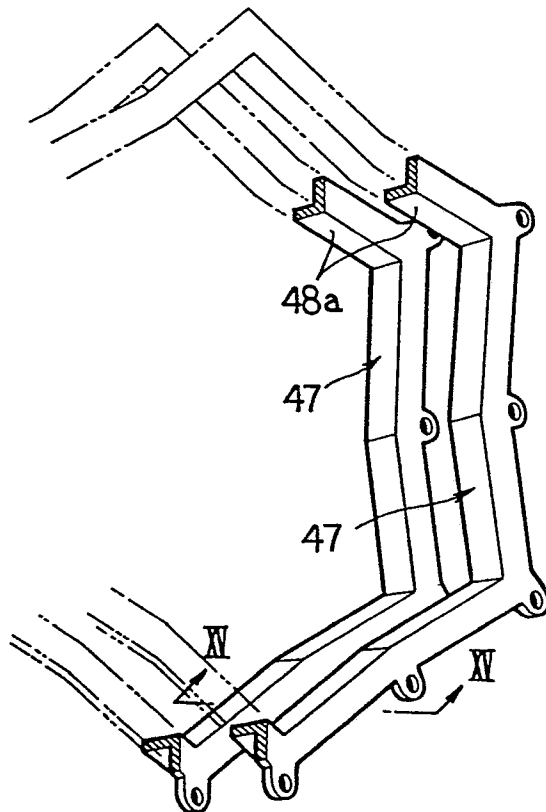
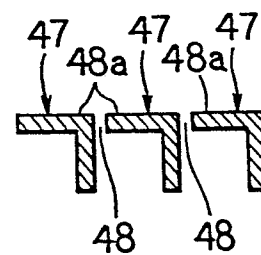


FIG. 15





European Patent
Office

EUROPEAN SEARCH REPORT

0048576

Application number

EP 81 30 4172

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 3 582 492 (GILL)</u> * figures 4,5,6 * --	1	C 25 D 17/20
A	<u>DE - C - 882 937 (BOSCH)</u> * figure 3 * --		
A	<u>DE - B - 1 119 623 (LINNHOF)</u> * figure 1 * -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.)
			C 25 D 17/20 C 23 G 3/00
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
☒ The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search The Hague		Date of completion of the search 14-12-1981	Examiner NGUYEN THE NGHIEP