



**EUROPEAN PATENT APPLICATION**

Application number : **94500087.5**

Int. Cl.<sup>5</sup> : **B04B 3/00, B04B 7/18**

Date of filing : **18.05.94**

Priority : **20.05.93 ES 9301380 U**

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Date of publication of application :  
**23.11.94 Bulletin 94/47**

Designated Contracting States :  
**AT BE CH DE DK ES FR GB IT LI NL SE**

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**Improved centrifuging machine.**

The centrifuging machine comprises walls inside the tub which are gently inclined from the bottom towards the top, opening outwards, enabling the separation of phases by means of the component of the centrifugal force which is applied to the inclined surface in the upward direction, with multiple grooves which run from the lower part to the upper part thereof, the bottoms of said grooves being gently inclined outwards. The inner wall of the tub is provided with a coating of synthetic materials to form a single lining and the whole of the internal and external surfaces of the tub are provided with a coating of synthetic resin which is resistant to chemical attack.

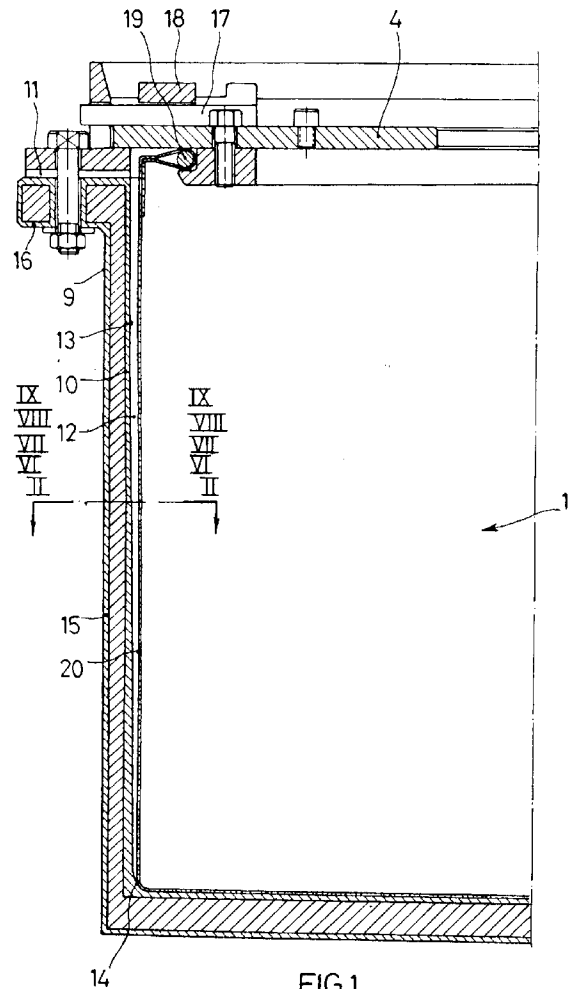


FIG.1

The present invention relates to an improved centrifuging machine which has characteristics of novelty and inventive step relative to what is currently known in the field.

### BACKGROUND OF THE INVENTION

Centrifuging machines are designed carry out the separation of solid and liquid phases, in particular in chemical processes and the like, by using the centrifugal force, and they therefore comprise a tub in which the mixture or suspension to be separated is arranged and which is subjected to a rotational speed great enough to force certain phases to separate through a piece of material which lines the wall of the tub of the centrifuge. Said walls therefore normally have multiple holes through which the phases to be separated pass to be collected in a separate compartment before proceeding outside the machine.

Among the problems which are traditionally encountered in the construction and use of centrifuging machines is to be specially mentioned the chemical attack of many of the products to be treated on the components of the centrifuge.

### DESCRIPTION OF THE INVENTION

The present invention has essentially new characteristics which enable the above mentioned problems to be solved in an efficient way. The essential characteristic of the present invention is based on the constitution of the tub walls such that the phases to be separated can leave without the need for said walls to have holes. The tub of the centrifuge which forms the object of the present invention therefore has an interior wall or walls which are provided with gently inclined grooves which open outwards from the bottom towards the top or from the top towards the bottom, such that the liquid projected against said walls by the centrifugal has a vector of force which is the component of the centrifugal force against the inclined wall, causing said liquid to ascend or descend along the walls of the tub until it is expelled in a region close to the edges or at the bottom thereof. In this way the need to provide perforations in the walls of the tub is avoided. At the same time the tub, like the other elements which come into contact with the liquids to be treated, is coated externally with a layer of synthetic material which prevents chemical attack by the products to be centrifuged. It should be noted that such a coating would be impossible in practice in the case of tubs provided with perforations.

In an alternative embodiment of the present invention the tub of the centrifuge is provided with an interior lining or casing made of a material which is highly resistant to chemical agents and which has a transverse configuration in the form of longitudinal ribs and grooves which provide the same character-

istics as described above, in that the grooves are inclined relative to the vertical such that when the centrifuging tub is in operation it gives rise to vectors of forces which automatically cause the movement of the particles to be separated. Said internal lining or casing may have any suitable shape, for example corrugated with curved corrugations, rectangular, trapezoidal or any other shape which is suitable for its operation.

The present invention also foresees an embodiment for use with centrifuges in which discharge takes place from the lower part. In this case the liquid outlet is provided in an intermediate region of the tub itself by providing two systems of grooves along the internal walls of the tub, said grooves being inclined outwards and opening at the upper edge and at the lower edge of the tub respectively and ending in a central collecting area in which there are several liquid outlets. Obviously, in this case the grooves may also be made by machining the lining or inner casing of the centrifuge tub, or they may be made by means of a fitted element of conveniently corrugated plating, as has been indicated above.

According to another aspect of the present invention, it further comprises a very secure system of simple construction for closing the lid of the tub, comprising a number of through bolts which pass through both the lid of the tub, said lid being completely coated by a resin which is highly resistant to chemical agents, and the lower ring for retaining the collecting bag, the lower part of said pins being threaded in order to fix them, whilst on the upper part, which has a truncated conical region with a rounded upper vertex for self-centring, are provided two transverse, mutually parallel cuts or grooves, with flat faces forming a narrowing, onto which fits a latch with a mouth whose shape is complementary to that of the narrowing of said bolt, said latch rotating about a vertical axis which is coupled to the lid itself.

### BRIEF DESCRIPTION OF THE DRAWINGS

In order that it be better understood, the accompanying drawings show by way of non-limiting example one practical embodiment of a centrifuge according to the present invention.

Figure 1 represents a full section of the tub which forms the object of the present invention.

Figure 2 shows a detail in section of the tub taken along the plane indicated.

Figures 3 and 4 each represent views of a device for securing the lid of the tub.

Figure 5 shows a full, simplified section of the centrifuge.

Figures 6, 7, 8 and 9 are each details of embodiment of the internal plating, in which the grooves are made, in a centrifuging tub according to the object of the present invention.

Figures 10 and 11 show schematically an elevation view with a partial section and a lower view of a centrifuging machine tub with discharge from below.

Figure 12 shows a detail in section of the centrifuging tub represented in figures 10 and 11.

Figure 13 and 14 are each sections of the tub shown in figures 10 and 12 taken along the lines shown.

Figure 15 shows a longitudinal section of the tub which is shown in figures 10-12.

Figures 16, 17 and 18 are each details of the lid closing systems provided as a preferred embodiment of the present invention.

Figure 19 represents a section taken along the plane indicated.

#### DESCRIPTION OF A PREFERRED EMBODIMENT

The centrifuge which forms the object of the present invention comprises a tub 1 linked to a central axis 2 so that it can rotate by means of a conventional drive system 3, said tub being provided with an incomplete upper lid 4 and being enclosed inside a collecting casing consisting of a body in the form of a second fixed surrounding tub 5 provided with lower outlet pipes 6 and an upper closing lid 7. The liquid to be treated is fed via a pipe 8 from the upper part of the tub, since the lid 4 has a wide central opening.

According to this invention, it is essential that the side wall 9 of the tub has on its internal surface 10 a layer of synthetic resin 13 with multiple grooves 12 adopting from its bottom 14 a slight outwards inclination, that is, from the bottom to the top, in order that the liquid to be separated may run along said grooves, arriving to the upper part of the tub 9 for its removal through the outlet grooves 11.

Said layer of synthetic material coating 13 may be applied to the rest of the exposed surfaces of the tub as well as to other elements, the coating layers 15 on the outside of the tub and 16 on the upper edge regions thereof being shown in the drawings.

As has been said, the centrifuge is provided with an incomplete upper lid 4, with radial devices for securing it quickly by means of a system of wedges 17 and fixed supports 18, and is provided inside with means, which are specially integrated into the upper ring 19, for securing the filter bag 20 for eliminating the residues which remain inside the tub.

In the centrifuges of the above stated type, that is, centrifuges to be unloaded from the top, the arrangement of the grooves inside of the tub brings a marked improvement for the unloading operation, because the extraction of the loaded bag is made easier.

In the constructional embodiments shown in examples 6, 7, 8 and 9 the longitudinal grooving of the walls of the tub is made using fitted plating elements of a suitable material and which have a corrugated structure forming ribs and grooves, such that the

grooves have the characteristics described above in terms of their inclination for the evacuation of the particles to be separated. As can be seen in said drawings, the pieces of plating, represented generally by the numbers 21, 22, 23 and 24 are provided with grooves 25, 26, 27 and 28 respectively, which fit by the bottom of said grooves to the inner wall of the centrifuge tub, labelled 29, 30, 31 and 32 respectively in the embodiments shown. The collecting bag is arranged in contact with the crests or ribs of the corrugated plating, which may have different structures such as rectangular as in figure 6 with crests or ribs 33, or trapezoidal as in figure 7 with crests 34, trapezoidal with an acute-angled bottom and flat crests 35, or corrugated shapes whose crests 36 may also be curved.

The machine which forms the object of the present invention may be further provided with a lower discharge tub, as is shown in figures 10, 11 and 12. Said tub 37 is provided with lower openings 38 for eliminating the solid particles to be separated, in this case a number of holes 39 for the evacuation of the liquid being made in the side wall at an intermediate height thereof, and in this case the internal walls of the tub 37 being provided with an upper grooved area 40 and another lower grooved area 41 which start, respectively, at the upper edge and at the lower edge of the tub and which are gently inclined towards the central part in order that the liquid to be separated tends to move towards said central part where the outlet openings 39 are located, of which there can be any number. A separating ring 42 is arranged in front of the holes 39, at a sufficient distance relative to said holes, to help support the inner collecting cloth member 43.

In this embodiment the layer of material which is deposited on the side wall 37 of the centrifuging tub is removed by means of a known type of device, not shown, consisting of a scraper which can be moved axially and radially.

The collecting cloth 43 is retained above and below by means of the arrangement of retaining rings 44 each inserted into grooves in the walls of the tub.

The present invention further foresees a preferred embodiment of the system for closing the lid of the centrifuge tub, as is shown in figures 16 to 18. Said closing device comprises through bolts 45 which pass through both the lid 46 of the tub and the lower ring 47, the head or upper part of said bolts being conical and rounded 48 to improve the self-centring of the lid 46 during fitting, and the lower part 49 being threaded for fixing to a securing nut 50. The upper part of the bolt is provided with two opposing transverse cuts or grooves 51 and 51' onto which fits a flat-walled latch or fastener 52 which rotates about a fixed bolt 53 and which has a mouth 54, figure 17, that has inclined edges to improve its entrance onto the groove and a shape which is complementary thereto. The latch 52

can be easily moved laterally by means of a handle 55 in order to open and close it. After it has been closed, the safety fastenings are applied by means of the nut 50. Some of the fixed bolts 53, arranged around the circular shape of the lid, have rings 56 for engaging the tub so that it can easily be assembled and disassembled.

The improvement consisting in the multiple grooves in the internal wall of the baskets or tubs of the centrifuges may also be used in horizontal centrifuges.

As can be appreciated, the constitution of the centrifuge as has been described results in highly efficient operation, both in terms of the protection of the tub walls and the avoidance of blockages and obstructions, thereby reducing the customary and bothersome tasks of maintenance to a minimum.

### Claims

1. An improved centrifuging machine of the type which is provided with a tub that rotates about its central axis, partially open above, and which has means for receiving the products to be treated inside the tub and for enabling the desired fractions to be separated by centrifugal force, characterized in that the inner wall or walls of the tub are gently inclined from the bottom towards the top, opening outwards, enabling the separation of phases by means of the component of the centrifugal force which is applied to the inclined surface in the upward direction.
2. An improved centrifuging machine according to claim 1, characterized in that inner wall of the tub is provided with multiple grooves which run from the lower part to the upper part thereof, the bottoms of said grooves being gently inclined outwards.
3. An improved centrifuging machine according to claims 1 and 2, characterized in that inner wall of the tub is provided with a coating of synthetic materials to form a single lining.
4. An improved centrifuging machine according to the previous claims, characterized in that the inclined grooves are made in the coating of synthetic resin.
5. An improved centrifuging machine according to claim 1, characterized in that grooves are arranged on the upper part of the tub to allow the fraction separated by centrifuging to proceed to the outside.
6. An improved centrifuging machine according to

the previous claims, characterized in that the whole of the internal and external surfaces of the tub are provided with a coating of synthetic resin which is resistant to chemical attack.

7. An improved centrifuging machine according to claim 1, characterized in that the interior walls of the tub comprise a fitted element of transversely corrugated plating forming ribs and grooves designed to evacuate the particles to be separated.
8. An improved centrifuging machine according to claim 1, characterized in that two sets of grooves are provided on the walls of the centrifuge chamber, said grooves starting at the upper edge and at the lower edge respectively of said chamber and being gently inclined towards a central part of the tub itself where there are a number of outlet holes for eliminating the liquid via said intermediate part.
9. An improved centrifuging machine according to claims 1 to 6, characterized in that a number of bolts pass through both the lid of the centrifuge, which is completely coated by a resin resistant to chemical attack, as well as the lower ring for retaining the removable inner bag, the lower part of said bolts being threaded to receive a tensioning nut and the upper part being provided with transverse opposing grooves that define a narrowing, each suitable for receiving the complementary mouth of latches which rotate about axes that are fixed to the lid and parallel to said pins.

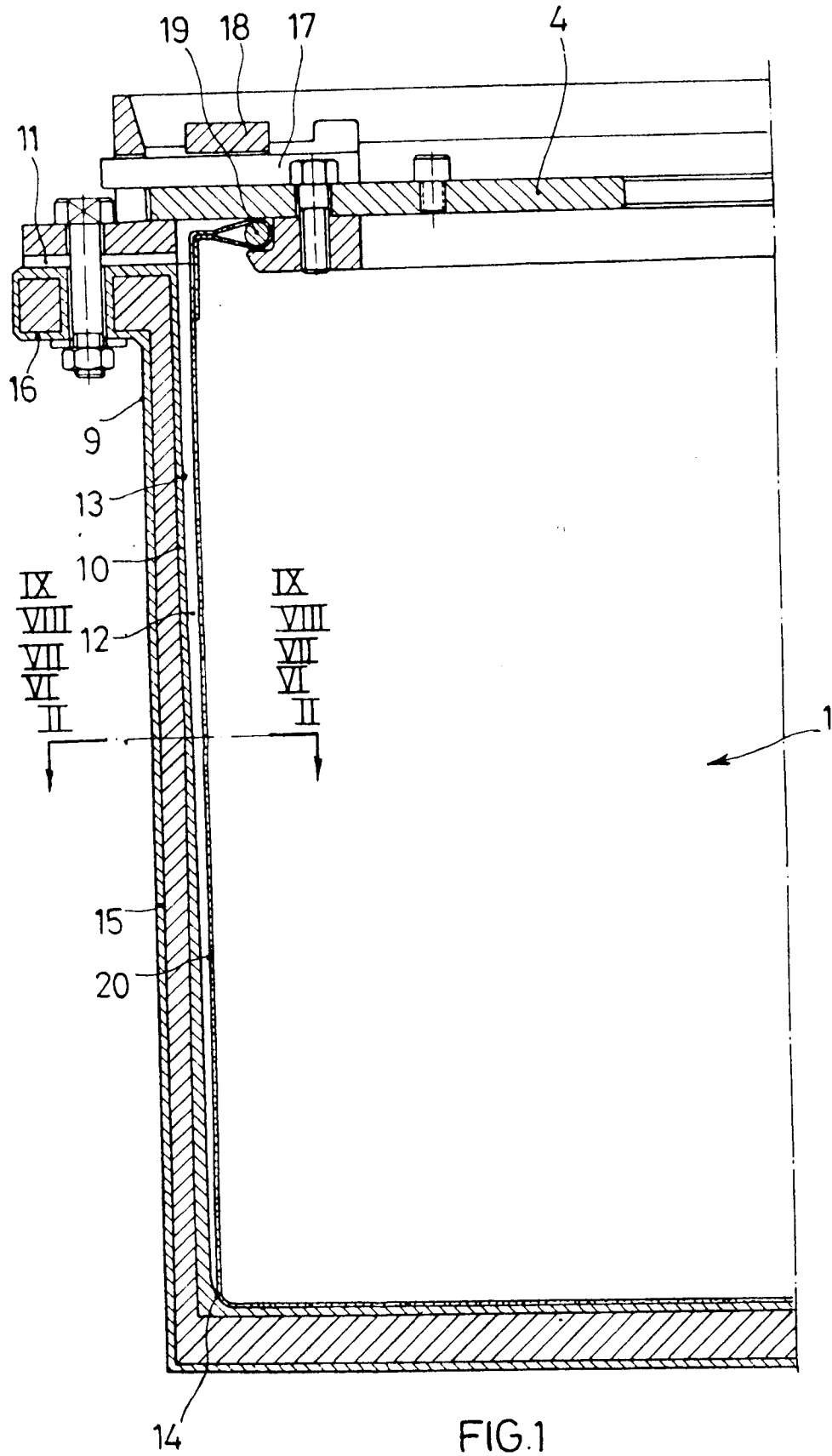


FIG.1

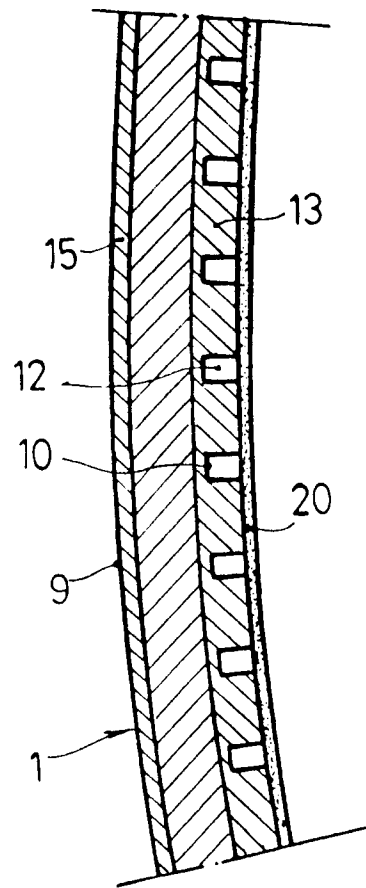


FIG. 2

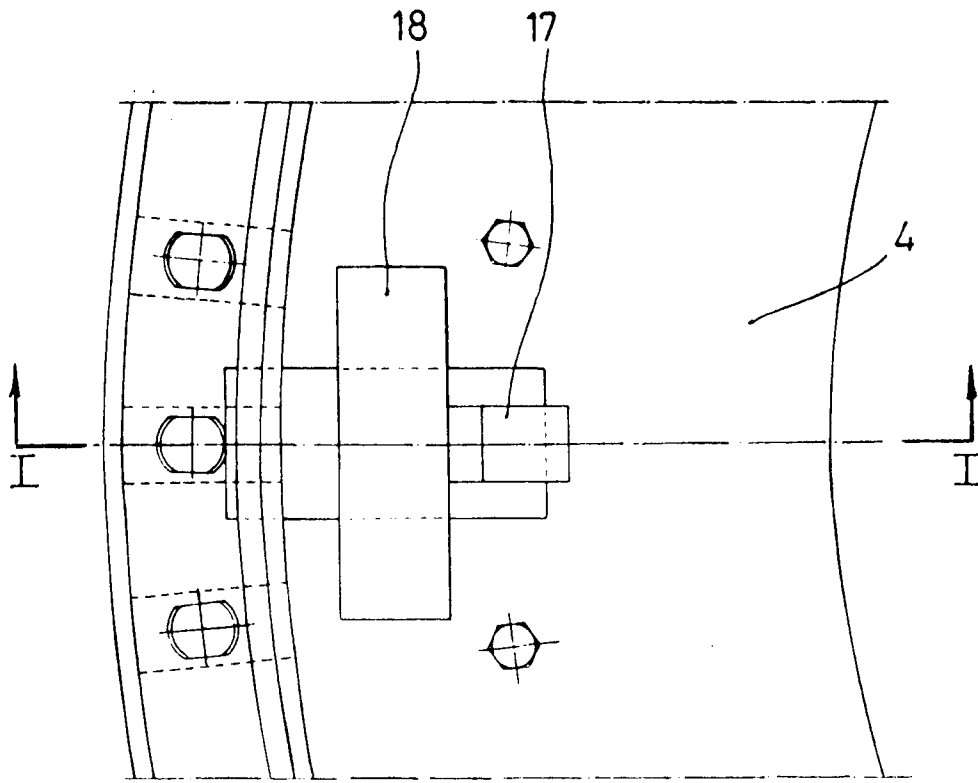


FIG. 3

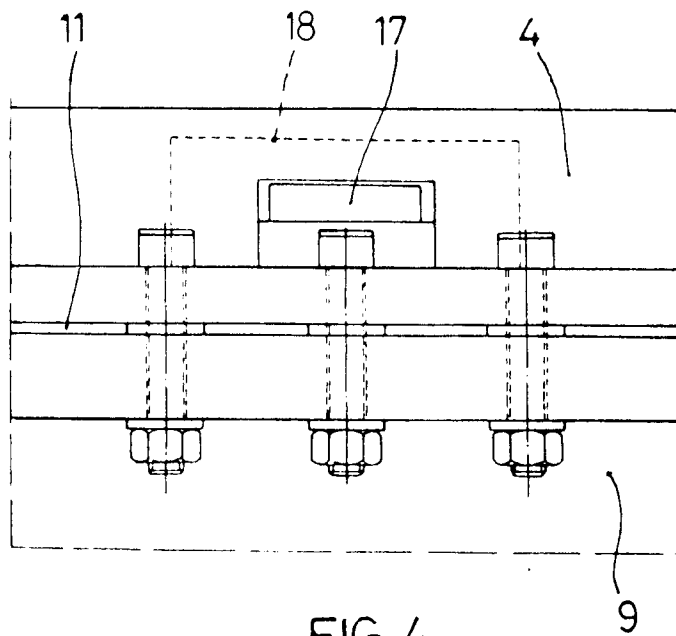


FIG. 4

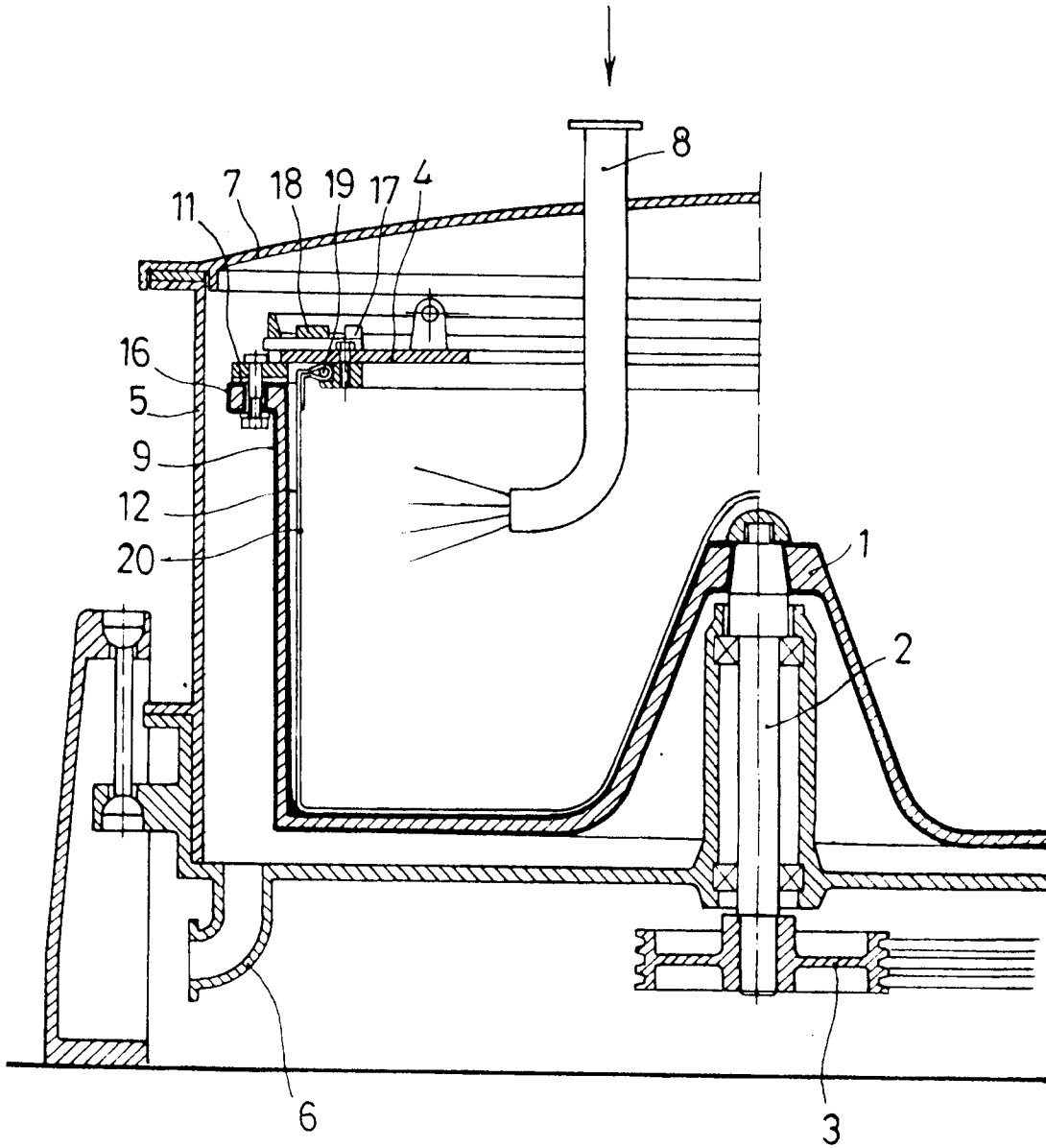


FIG. 5

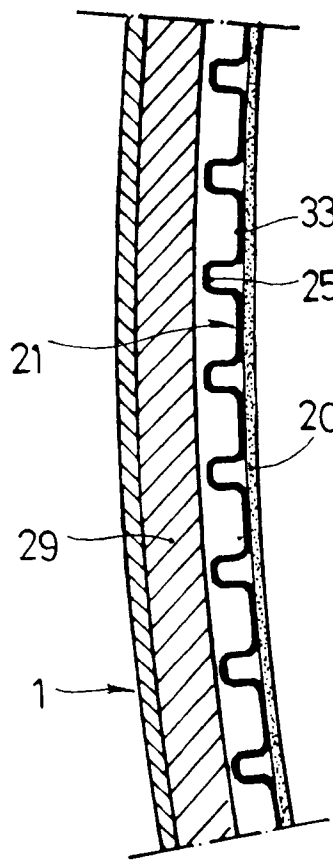


FIG. 6

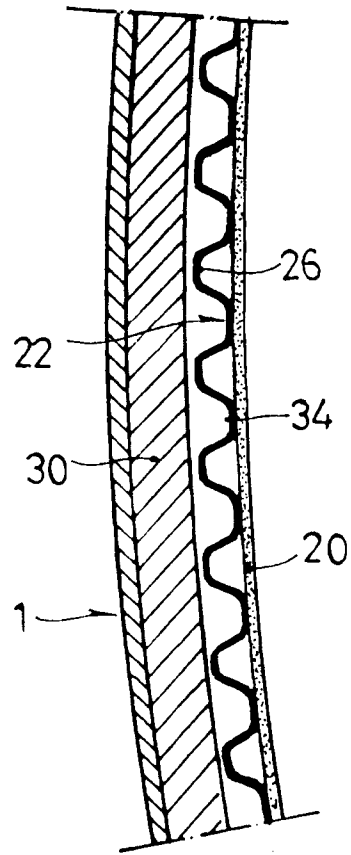


FIG. 7

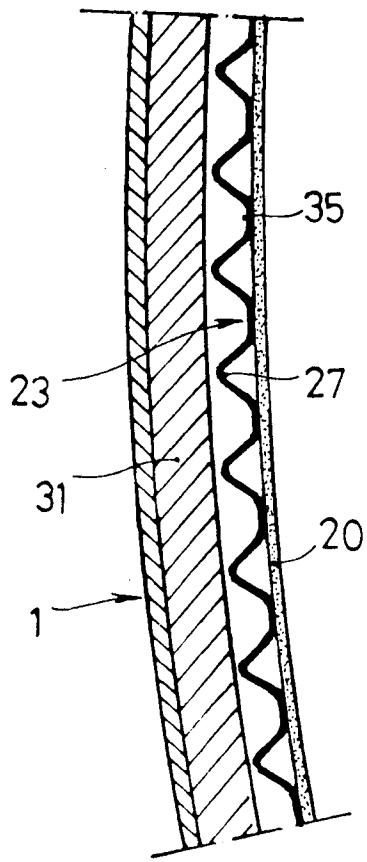


FIG. 8

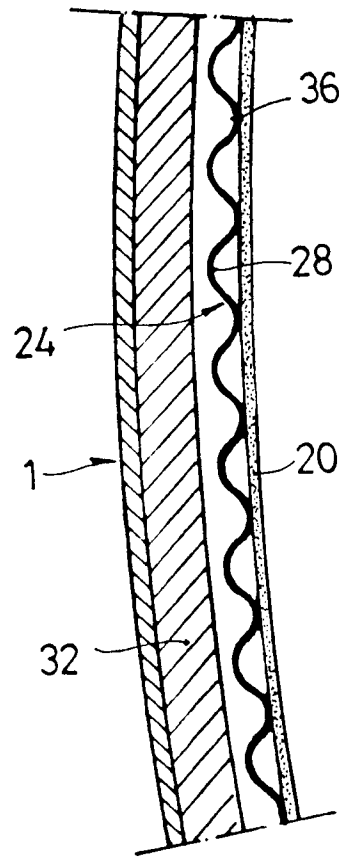


FIG. 9

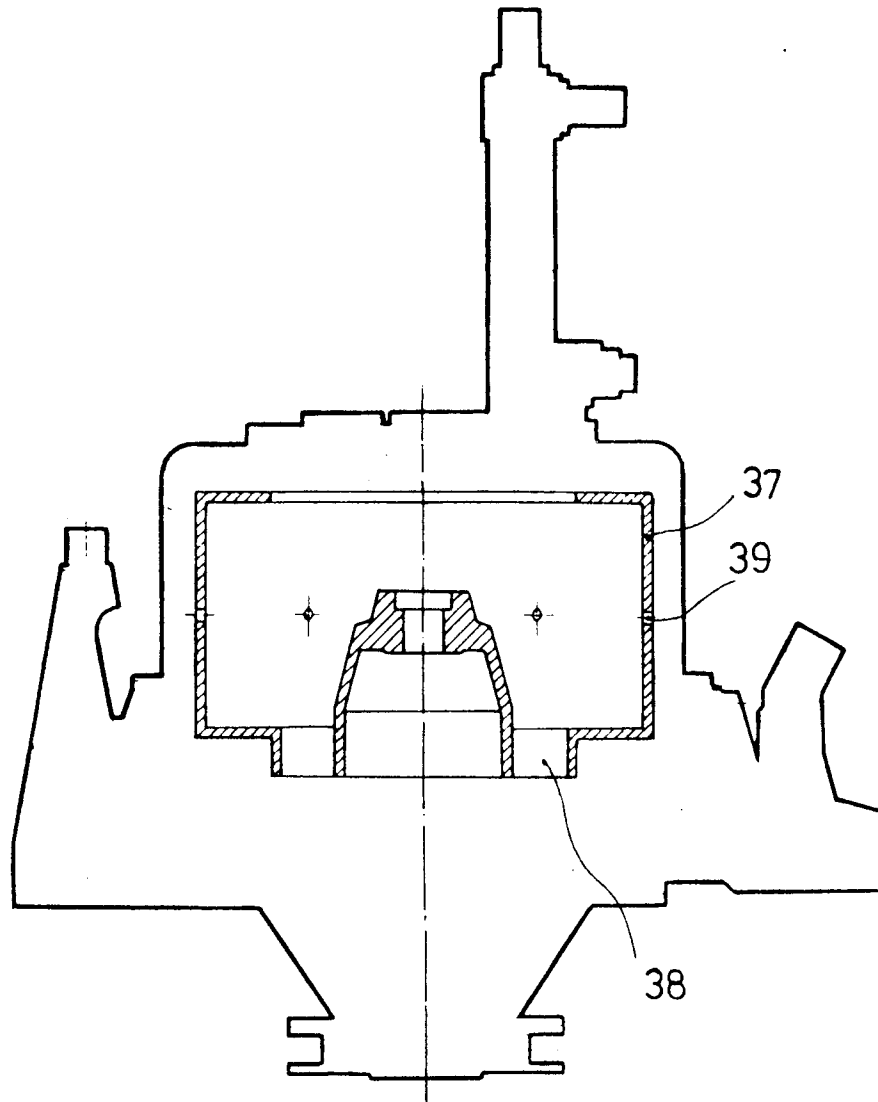


FIG. 10

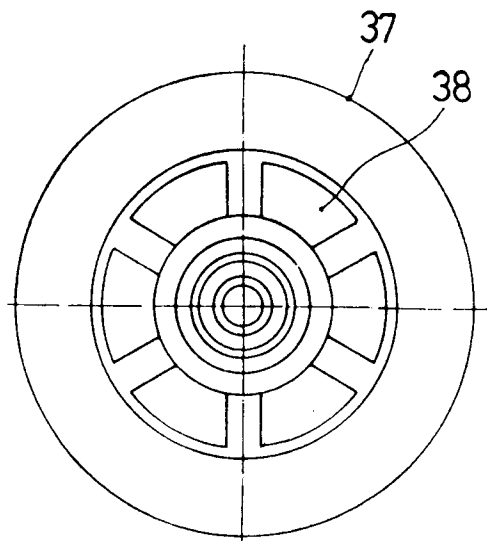


FIG. 11

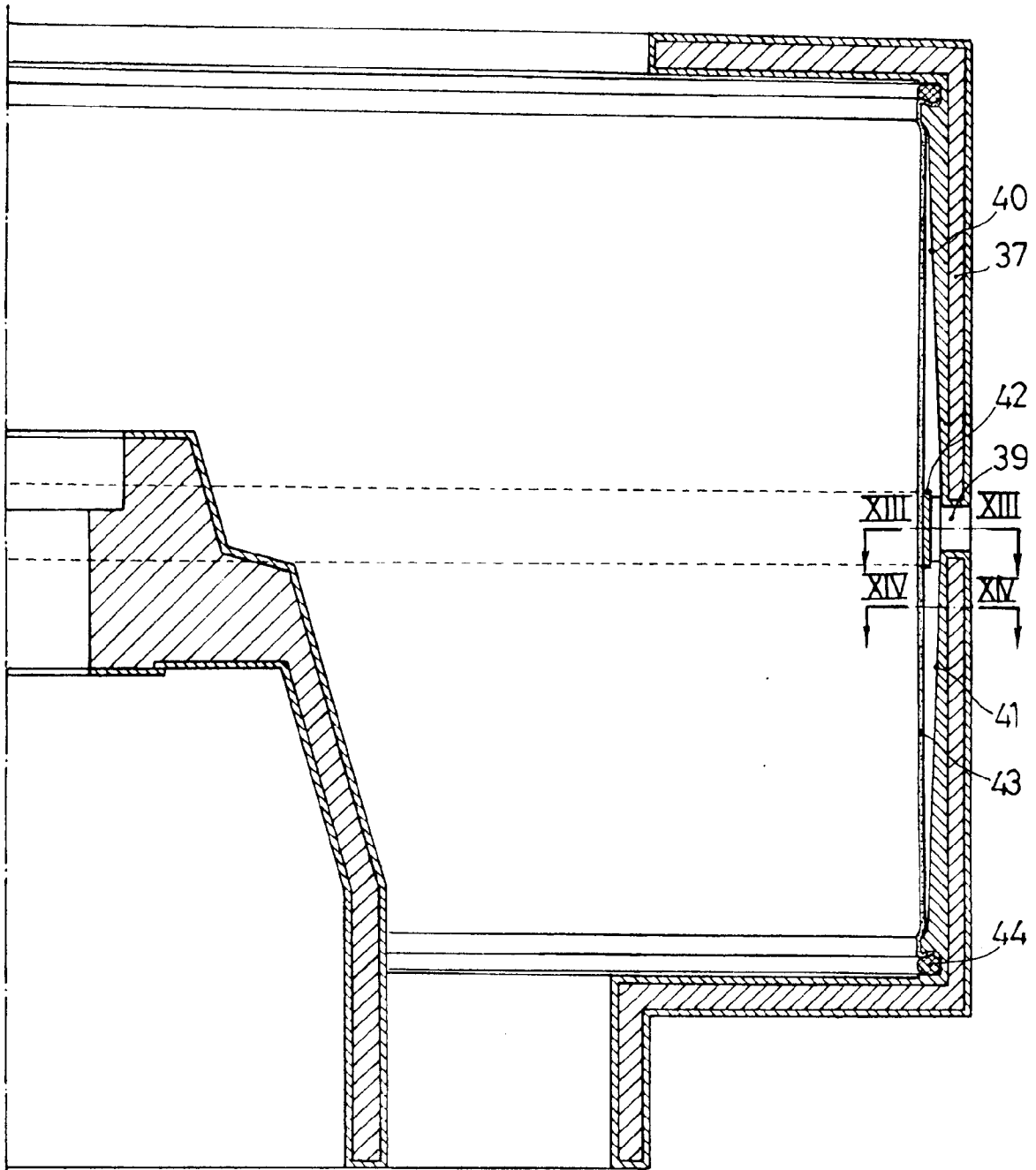


FIG. 12

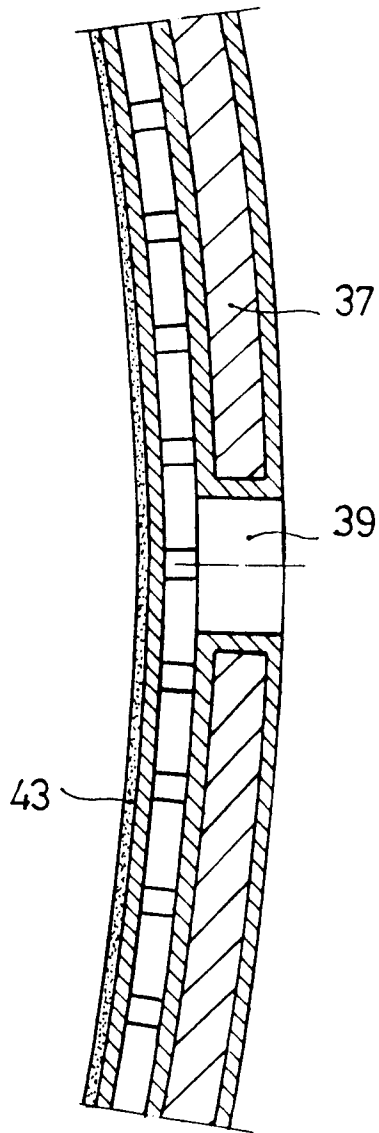


FIG. 13

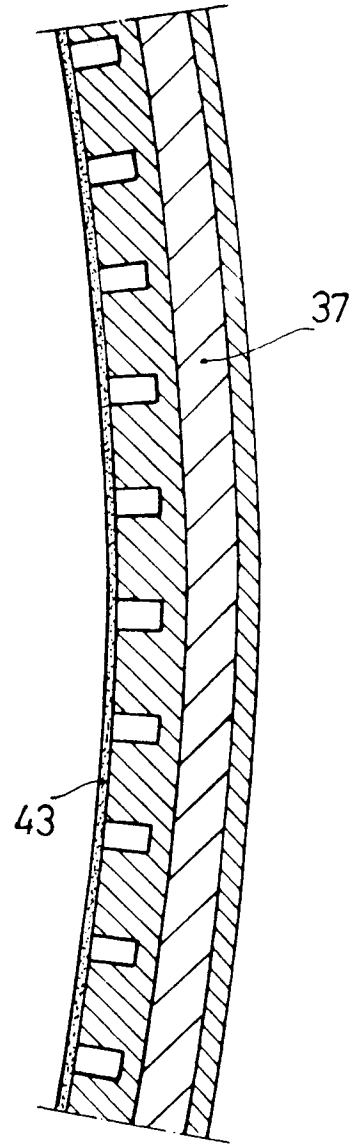


FIG. 14

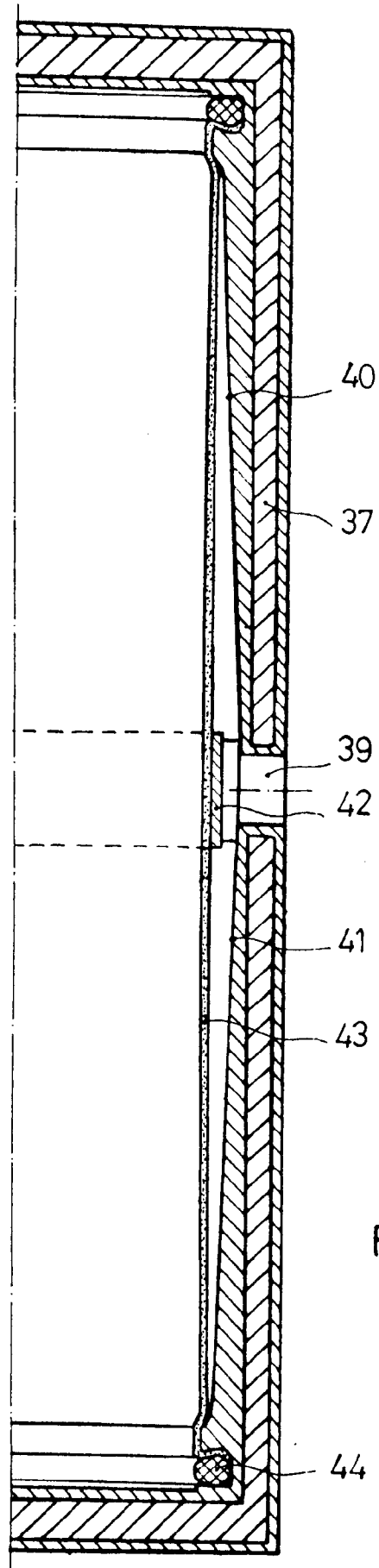


FIG.15

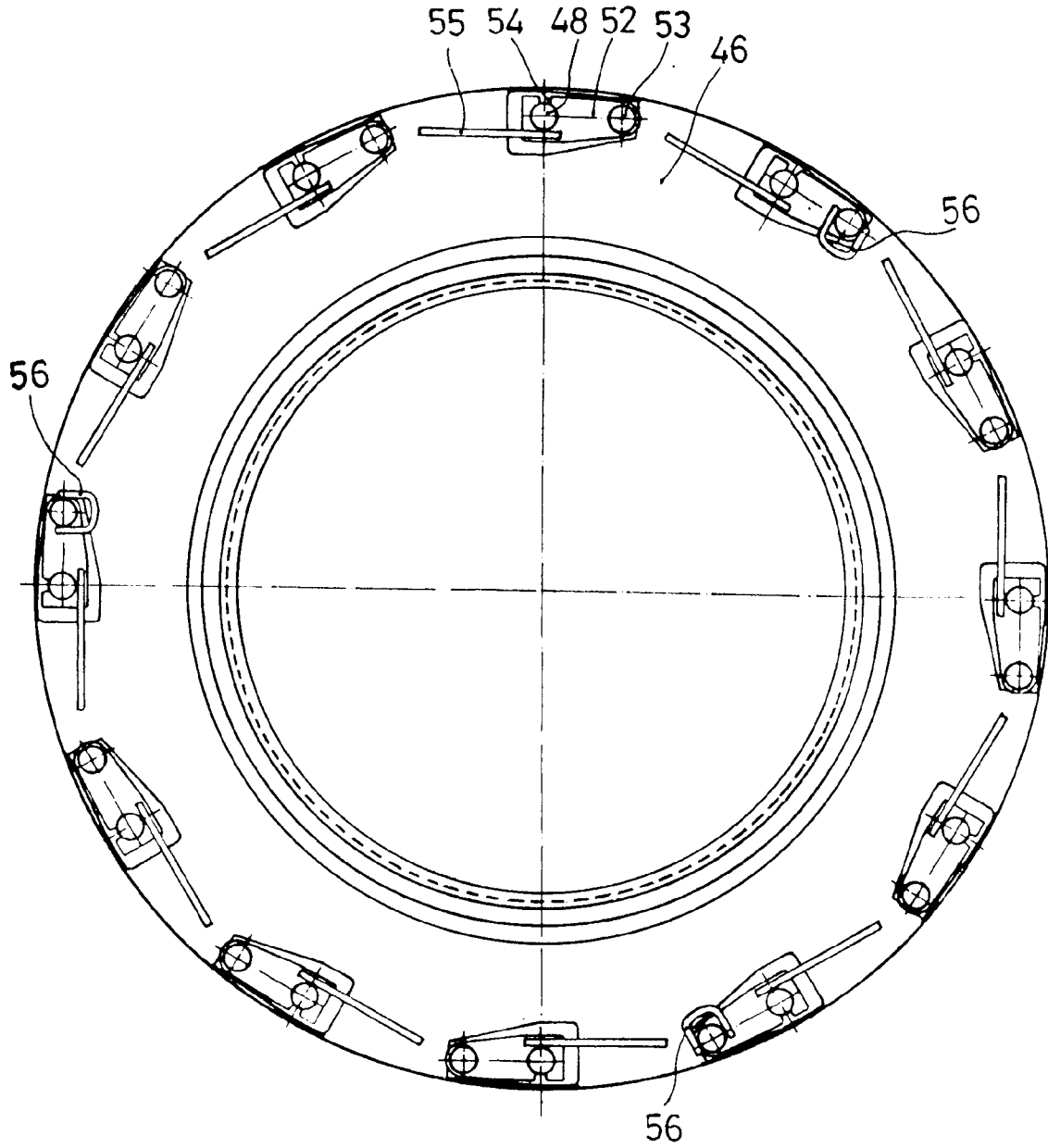


FIG.16

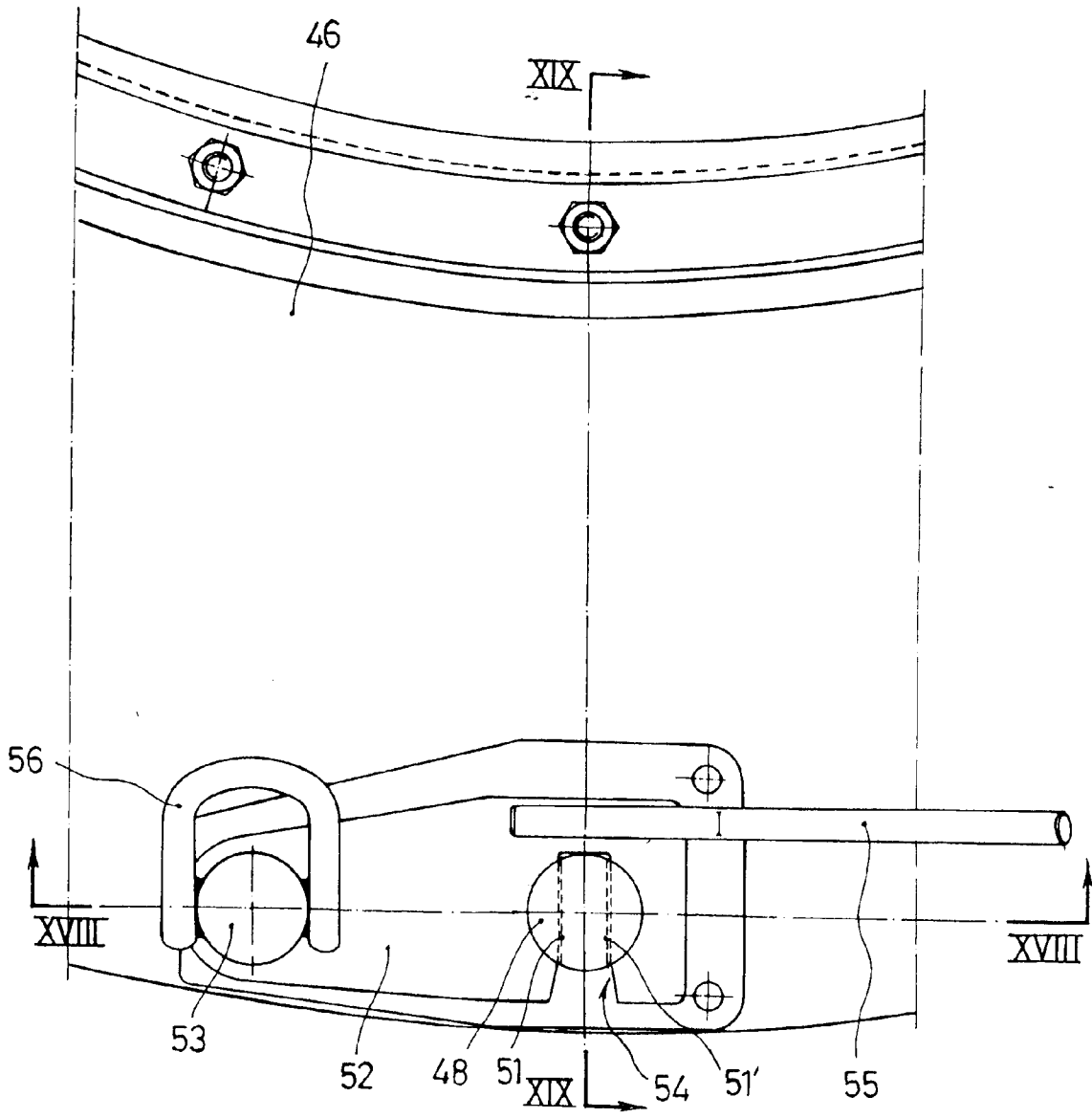


FIG. 17

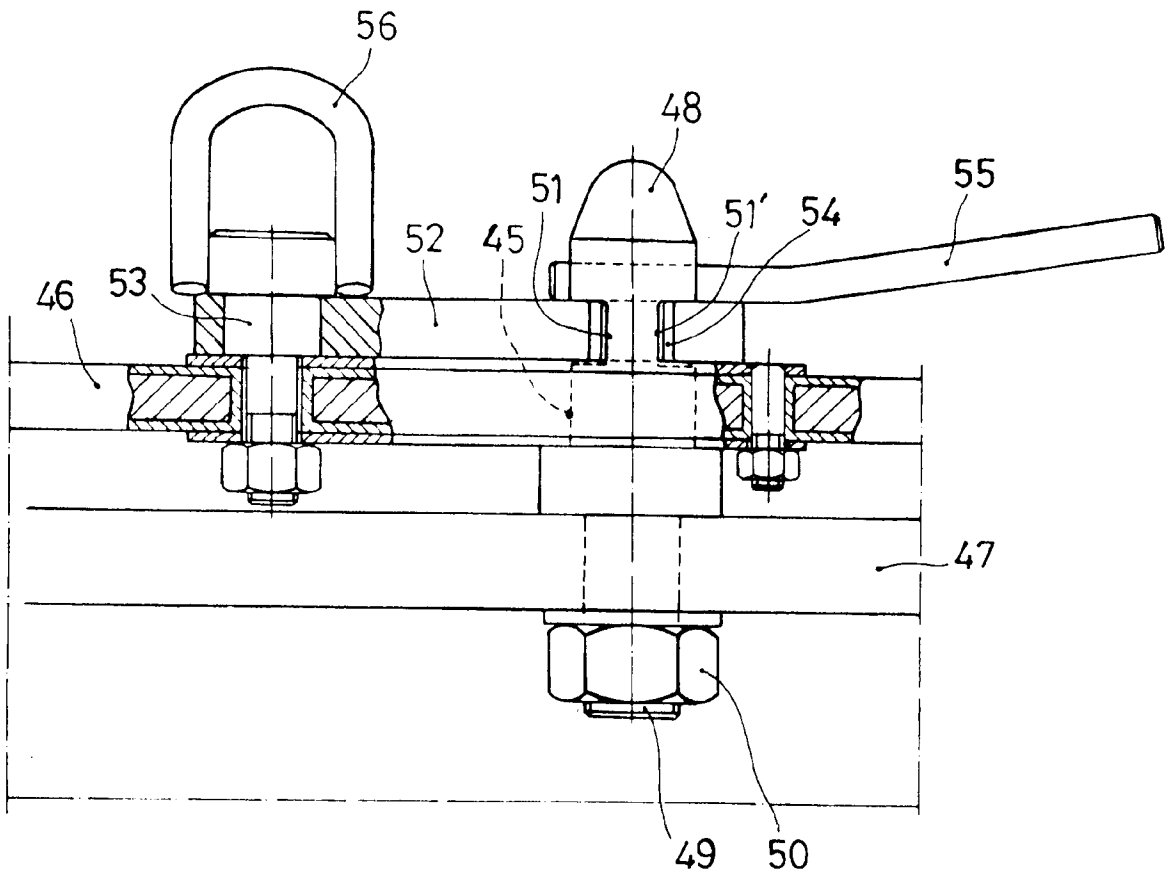


FIG.18

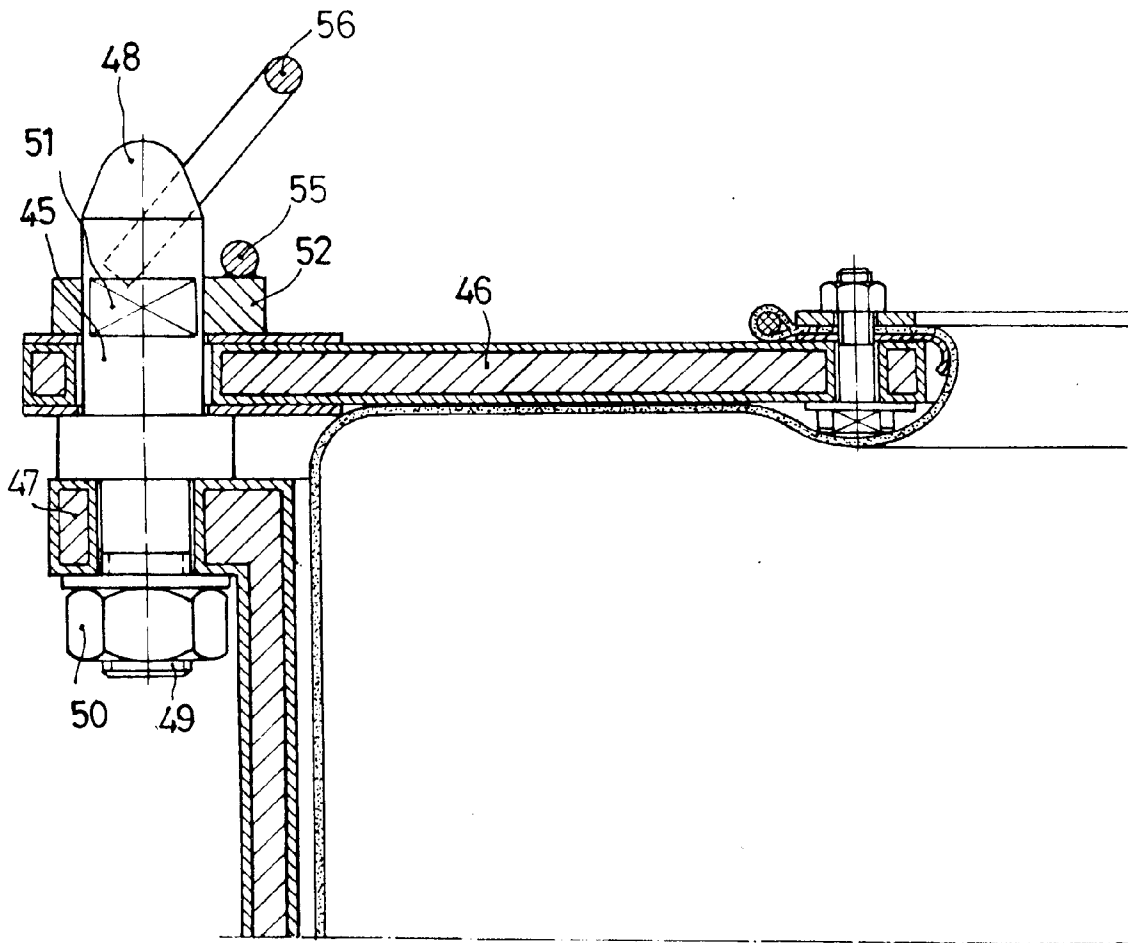


FIG.19