

EUROPEAN PATENT APPLICATION

Application number: **85200498.5**

Int. Cl.⁴: **B 65 D 88/06**

Date of filing: **11.04.85**

Priority: **11.04.84 IT 6736184**

Applicant: **Gianoglio, Francesco, via Caduti e Dispersi in Russia, 20, I-12035 Racconigi (Cuneo) (IT)**

Date of publication of application: **21.11.85**
Bulletin 85/47

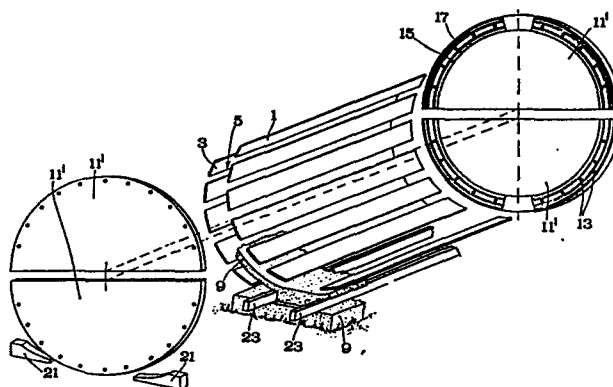
Inventor: **Gianoglio, Francesco, via Caduti e Dispersi in Russia, 20, I-12035 Racconigi (Cuneo) (IT)**

Designated Contracting States: **AT BE CH DE FR GB LI LU NL SE**

Representative: **Robba, Eugenio, Studio "INTERPATENT" via Caboto 35, I-10129 Turin (IT)**

Tank of prefabricated elements of reinforced concrete for storing liquids and purifying domestic and industrial waste water.

A tank (7) adapted for storing liquids in general and made of reinforced concrete is obtained by coupling inner and outer staves (1) and (3) in the form of rectangular laminae curved transversely with different radii of curvature and provided with appropriate inner and outer circumferential grooves (15) and (17) arranged on the inner surfaces of two substantially cylindrical heads (11), said plurality of staves (1) and (3) constituting with said two heads (11) an empty case double wall (5) or planking adapted for compacting therein the appropriately reinforced concrete (9). The heads (11) are provided with a plurality of through holes (13) adapted for insertion of the metal reinforcing and anchoring elements. Appropriate stabilizing wedges (21) and spacer elements (23) ensure the stability of the tank (7) and the correct dimensioning between the heads (11) as well as the containment of the anchoring concrete (9) and serve as a pavement. Appropriate hatches (25) are provided on the upper portion of the tank (7) which has the form of a horizontal cylindroid solid.



"Tank of prefabricated elements of reinforced concrete
for storing liquids and purifying domestic and industrial
waste water"

The present invention relates to a tank of prefabricated elements of reinforced concrete for storing liquids and purifying domestic and industrial waste water.

5 It is known that at present the waste water purification plants are constituted by recipients, generally two, which are constructed in situ or prefabricated. Among the smaller ones prefabrication in a vertical cylindrical form is most widespread.

10 However, for uses of a considerable size - real basins - the form is generally with a circular or polygonal base and with vertical walls and normally upwardly open.

15 The waste water flows into the first one of the two containers forming the plant and undergoes therein - by means of oxygenation apparatus - an aerobic digestion process.

After a predetermined residence time, the digested waste water flows into the second container in which sedimentation of the sludge takes place.

20 It is not considered necessary to enlarge further on this argument as it departs from the field of the invention.

However, it is considered necessary to point out the necessity for each plant to dimension the containers in

proportion to the use, the necessity to carry out the purification process in the best possible manner, and finally the necessity to reduce the construction and running costs.

With regard to the plants of modest size, the commercially available products (IMHOFF pits and the like) meet
5 the requirements from an economical aspect, but this is only the case if the dimension with regard to height for the structures above ground and with regard to depth for those that are buried is very small, otherwise one resorts
10 to the construction of reinforced concrete basins constructed in situ with a larger base area.

However, from the technical point of view, the vertical arrangement of the products in the above plants, whether they be prefabricated or not, does not represent
15 the best solution with regard to the process of complete and homogeneous oxygenation of the entire contents as - due to the dynamics of expansion of the air in the liquids in relation to the form of the container - quiet areas are produced in the liquid mass (flu) which the currents pro-
20 duced by the insufflated air do not easily reach.

This causes an irregular digestion of the "flu" or at least a delay in the cycle.

It is the object of the present invention to eliminate the above drawbacks by providing a tank which, due to the
25 dynamic relation between the insufflated air and the container, permits to accelerate the digestive phase with a consequent reduced necessity of capacity of the container and further permits to prefabricate purification plants capable of fulfilling various uses by reducing the dimensions of the container, the completion work in situ as well
30 as the time for their execution and the resulting costs.

It is further to be noted that the tank according to the invention is easy to transport to the place of installation as the component elements are of relatively small dimensions and weight.

5 The main characteristic of the tank according to the invention, which has the form of a cylindroid solid having an horizontal axis is constituted by a plurality of pre-fabricated modular elements of reinforced concrete such as:

10 - the staves forming, when assembled, the empty case double side wall or planking consisting of two groups of rectangular battens slightly curved relative to their transverse profile with two different radii of curvature and adapted to form the inner surface and the outer surface, respectively, of the above-mentioned double side wall, the
15 concrete being compacted in situ into said empty case double side wall;

20 - the heads each formed of two superimposed semicircular monolithic portions of reinforced concrete with through holes and inner and outer circumferential grooves on at least one of the side surfaces, the staves being inserted in said grooves to delimit a peripheral circular crown of the head in which the above-mentioned holes are provided for insertion therein of metal anchoring elements between the head and side wall which are subsequently locked by the
25 filling concrete;

 - the stabilizing wedges at least two of which are provided for each head to ensure stability of the tank during its installation;

30 - the spacer elements which are provided in a number of at least two and have a length identical to the distance between the heads and have the function of spacers between

the heads and jet containers during casting as well as casings for containing the concrete compacted during casting, said concrete serving as an anchoring plinth and pavement;

5 - the elements for forming the hatches.

A further basic characteristic of the invention consists in that the tank is upwardly provided with apertures of the required width and length, which are obtained by insertion, into the longitudinal aperture
10 of the tank, of small beams in the form of spaced segments of a circular crown between which appropriate frames adapted to carry grid structures are inserted, said small beams, frames and grids constituting the hatches of the tank.

15 A further characteristic of the present invention consists in that, for the purpose of adding to the modular container described above further modular containers to meet the intended capacity requirements of the plant, one of the heads of said modular container is
20 provided with two surfaces, i.e. with the grooves for the insertion of the staves and the anchoring holes on both surfaces, said head being hollow instead of blind so as to form an intermediate ring for connection of at least two modular elements.

25 It is to be noted that the connection of several simple or double modular elements permits the present tank to be used not only as an actual tank but also as a wall of an upwardly open polygonal basin; for this purpose, it is sufficient to adjust the length of the
30 staves and use hollow instead of blind heads to form with said elements a regular polygon.

The invention will now be described in detail with particular reference to the accompanying drawings provided by way of a non-limitative example and showing some embodiments of the invention, and in which:

5 - Fig. 1 is a perspective view of a modular tank;
 - Fig. 2 is an exploded perspective view of the tank of Fig.1, from which some staves have been removed for reasons of clarity;

10 - Figs. 3, 4 and 5 are perspective views of the small beams, frames and grid elements, respectively, forming the hatches;

 - Fig. 6 is a perspective view of a compound tank made up of three modular tanks;

15 - Fig. 7 is a transverse section of the double-faced connection ring adapted to connect two modular elements to each other;

 - Fig. 8 is a variation of Fig. 7 wherein the ring is obtained by back-to-back connection of two simple rings;

20 - Fig. 9 is a top view of a polygonal composition of simple modular elements adapted to form a wall of an upwardly open containment basin;

 - Fig. 10 is a variation of Fig. 9 wherein double modular elements are used for the sides;

25 - Fig. 11 is an exploded partial view of an intermediate ring to which a prefabricated fixing element is coupled.

30 As is evident from the Figures, the present tank for storing liquids and purification of domestic and industrial waste water is substantially constituted by a plurality of modular elements prefabricated of rein-

forced concrete and adapted to be assembled to constitute the present tank in the desired manner.

Said prefabricated elements substantially are:

the staves 1 and 3 adapted to form, when assembled,
5 the empty case double side wall 5 or planking of the tank 7, the staves being formed of two groups of rectangular battens 1 and 3 slightly curved relative to their transverse profile with two different radii of curvature and adapted to form the inner surface and the outer surface,
10 respectively, of the above-mentioned double side wall 5, the concrete 9 being compacted in situ into said empty case wall;

the heads 11 each formed of two superimposed semi-circular monolithic portions 11' of reinforced concrete
15 with through holes 13 and grooves 15 and 17 on at least one of the side surfaces, the staves 1 and 3 being inserted in said grooves 15 and 17 to delimit a peripheral circular crown of the head in which the abovementioned holes 13 are arranged for insertion therein of metal an-
20 choring elements between the head 11 and side wall 5 which are subsequently locked by the filling concrete 9;

the stabilizing wedges 21 at least two of which are provided for each head to ensure stability of the tank 7 during its installation;

25 the spacer elements 23 which are provided in a number of at least two and have a length identical to the distance between the heads 11 and have the function of spacers between said heads 11 and the jet containers during casting as well as casing for containing the con-
30 crete 9 compacted during casting, said concrete serving as an anchoring plinth and pavement;

the elements for forming the hatches 25.

The present tank 7 is upwardly provided with appropriate apertures 25 of the required width and length, which are obtained by insertion, into the longitudinal
5 aperture of the tank, of appropriate prefabricated elements such as small beams 27 which are spaced from one another and arranged in the form of a circular crown and between which appropriate frames 29 in turn adapted to carry grid structure 31 are inserted, said small beams,
10 frames and grids constituting the above-mentioned hatches.

When particular capacity requirements have to be met, the present modular tank 7 can be modularly assembled with other elements to compose a compound tank 33 adapted to reach the desired capacity value (see Fig. 6). For this
15 purpose, it is sufficient to replace one of the heads 11 of the modular element 7 described above by an annular double head 35 in the peripheral portion of which the grooves 15 and 17 for insertion of the staves and the anchoring holes 13 are arranged on both surfaces instead of only one, said
20 head thus being hollow instead of blind to form an intermediate ring for connection of at least two modular elements.

Illustrated in Fig. 7 is a transverse section of an embodiment of said ring 35.

Illustrated in Fig. 8 is a variation of Fig. 7 in
25 which said ring 35 is not made of only one piece but by back-to-back connection of two single ring-shaped elements connected to each other at 36 by appropriate fixing means.

It is to be noted that the connection of several simple or double modular elements 7, 7' permits the use
30 of the present tank not only as an actual tank, but also as a wall of an upwardly open basin 37 of polygonal form.

For this purpose, it is sufficient to adjust the length of the staves and use annular hollow instead of blind heads to form with said elements a regular polygon (see Figs. 7 and 8).

5 The completion in situ of said embodiments will necessitate some variations; the prefabricated element 39 (see Fig.11) will be completed by the intermediate ring 35 and will define the profile assumed by the outer surface of the side wall of the tank.

10 As in the construction of the simple and multiple modular tank, the compacting of the appropriately reinforced concrete between the two (outer and inner) surfaces of the side wall will meet the static requirements of the structure.

CLAIMS

1. Tank of prefabricated elements of reinforced concrete for storing liquids and purifying domestic and industrial waste water, characterized in that said tank (7) having the form of a cylindroid solid having an horizontal axis is constituted by a plurality of prefabricated modular elements of reinforced concrete such as:
- the staves (1) and (3) forming, when assembled, the empty case double side wall (5) or planking consisting of two groups of rectangular battens (1) and (3) slightly curved relative to their transverse profile with two different radii of curvature and adapted to form the inner surface and the outer surface, respectively, of the above-mentioned double side wall (5), the concrete (9) being compacted in situ into said empty case double side wall;
 - the heads (11) each formed of two superimposed semicircular monolithic portions of reinforced concrete with through holes (13) and inner and outer circumferential grooves (15) and (17) on at least one of the side surfaces, the staves (1) and (3) being inserted in said grooves (15) and (17) to delimit a peripheral circular crown of the head in which the above-mentioned holes (13) are provided for insertion therein of metal anchoring elements between the head (11) and side wall (5) which are subsequently locked by the filling concrete (9);
 - the stabilizing wedges (21) at least two of which are provided for each head to ensure stability of the tank (7) during its installation;
 - the spacer elements (23) which are provided in a

number of at least two and have a length identical to the distance between the heads and have the function of spacers between the heads (11) and jet containers during casting as well as casing for containing the concrete
5 (9) compacted during casting, said concrete (9) serving as an anchoring plinth and pavement;

- the elements for forming the hatches (25).

2. Tank of prefabricated elements of reinforced concrete according to claim 1, characterized in that
10 said tank (7) is upwardly provided with apertures (25) of the required width and length, which are obtained by insertion, into the longitudinal aperture of the tank (7), of small beams (27) in the form of spaced segments of a circular crown between which appropriate frames (29)
15 adapted to carry grid structures (31) are inserted, said small beams, frames and grids constituting the hatches (25) of the tank (7).

3. Tank of prefabricated elements of reinforced concrete according to a modification of claim 1, adapted
20 to permit the connection of further modular tanks (7) to the modular tank (7) described above and form a compound tank (33) for the purpose of meeting particular requirements of capacity of a plant, characterized in that one of the heads of said modular container is provided with
25 two surfaces (35), i.e. with the grooves (15) and (17) for the insertion of the staves and the holes (13) for anchoring arranged on both surfaces, said head (35) being hollow instead of blind so as to form an intermediate ring for connection of at least two modular elements (7).

4. Tank of prefabricated elements of reinforced concrete according to the preceding claims, characterized in that, for the purpose of utilizing the connection of several simple (7) or double (7') modular tanks not only
5 as an actual tank but also as a wall of an upwardly open polygonal basin (37), the staves forming the modular tanks (7) are of different lengths for connecting the heads angularly, each of said modular tanks (7) constituting one side of a regular polygon.

10 5. Tank of prefabricated elements of reinforced concrete according to the preceding claims, characterized in that said prefabricated elements are made of vibrated reinforced concrete and the concrete of the additional structural works is appropriately reinforced according to
15 the static requirements of the plant.

6. Tank of prefabricated elements of reinforced concrete according to the preceding claims, characterized in that, when the plant is to be made suitable for storing solid and/or liquid foodstuffs, the elements forming the
20 tank are treated with appropriate agents such as glazing agents and the like.

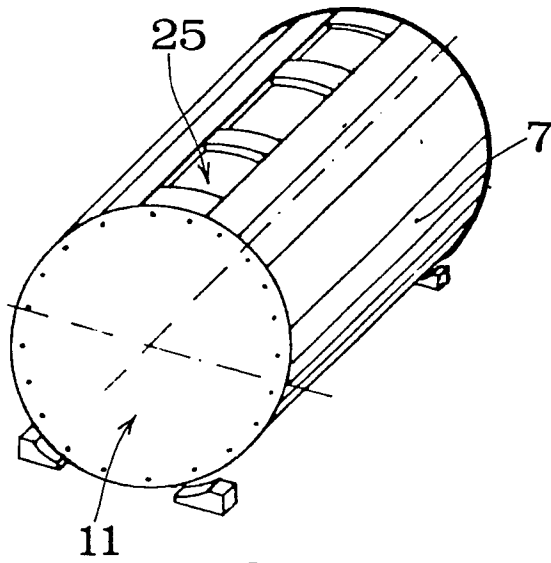


FIG. 1

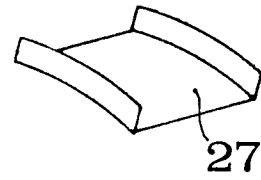


FIG. 3

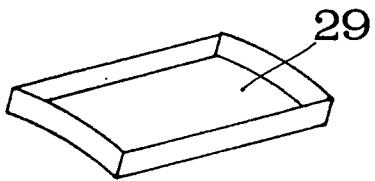


FIG. 4

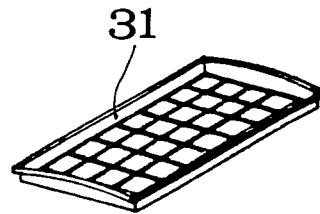


FIG. 5

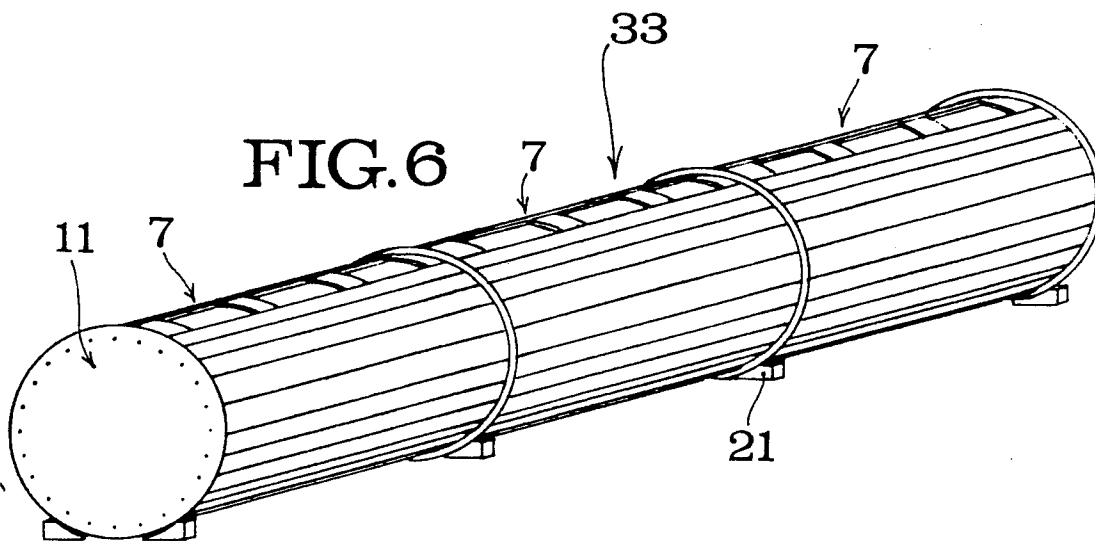


FIG. 6

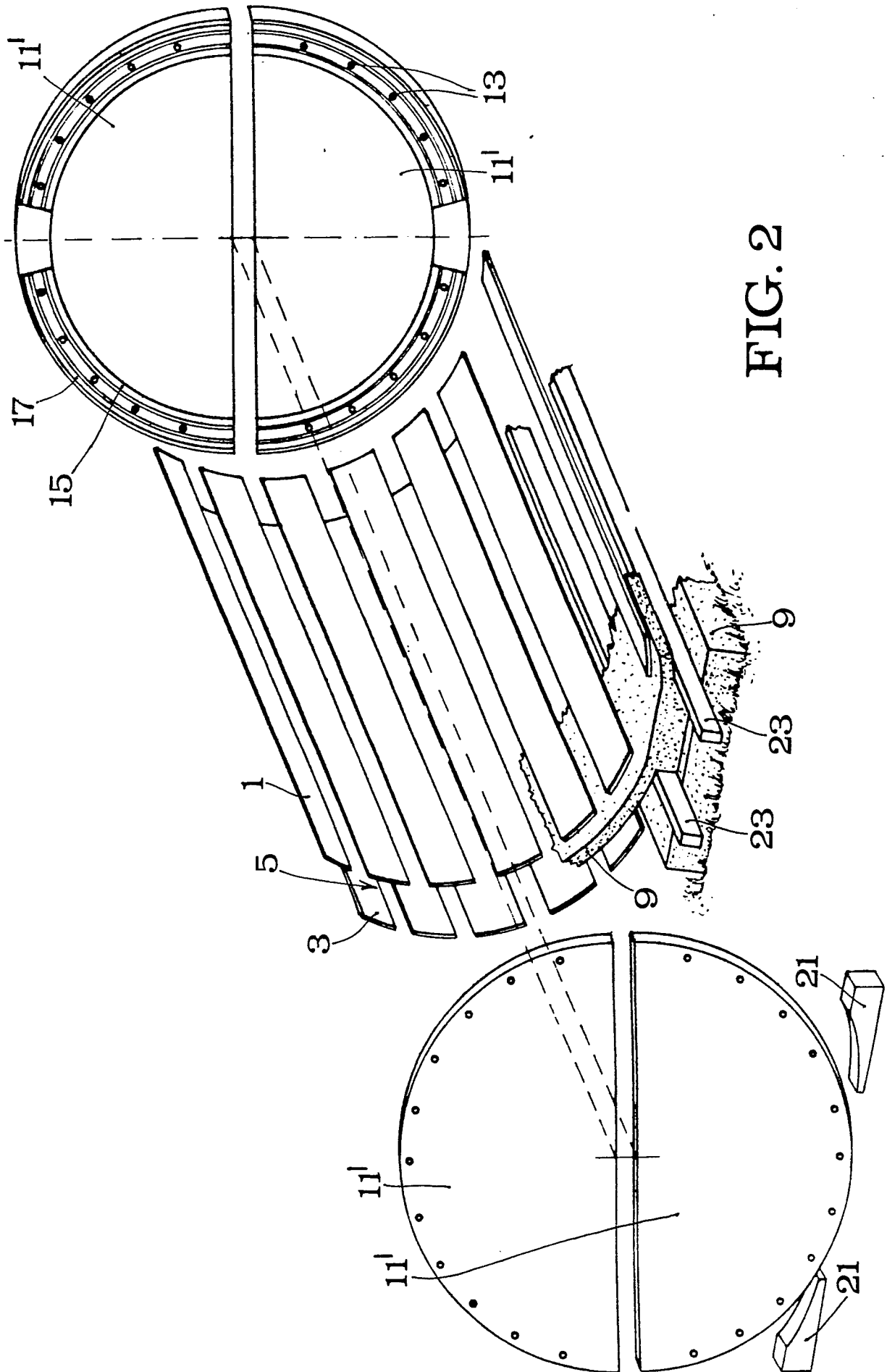


FIG. 2

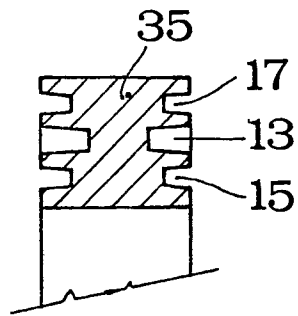


FIG. 7

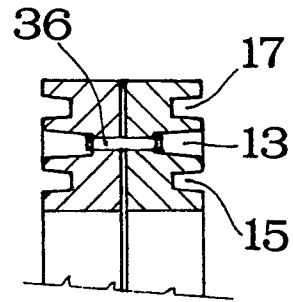


FIG. 8

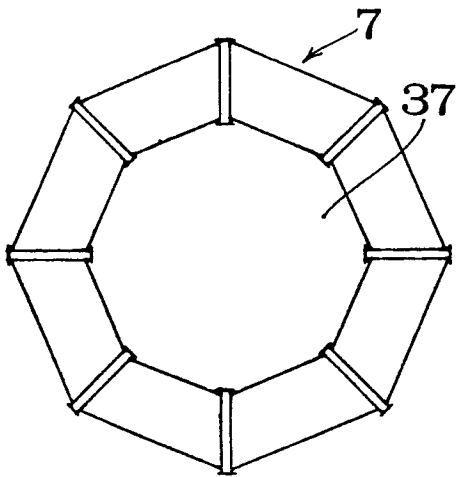


FIG. 9

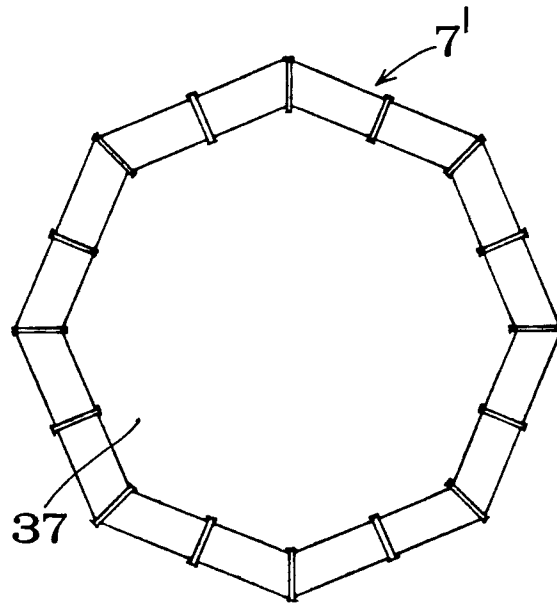


FIG. 10

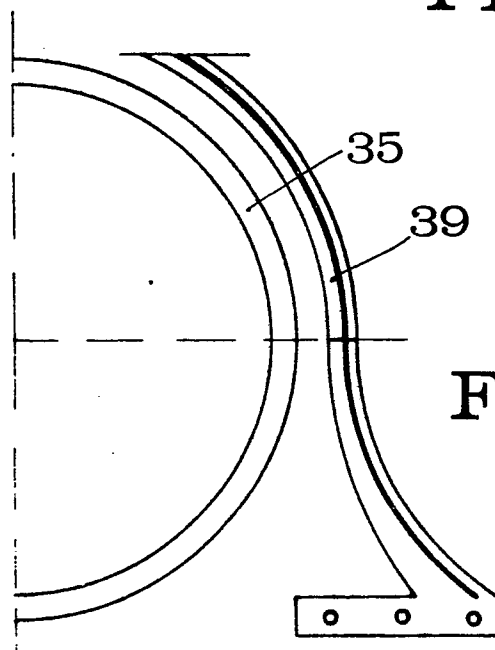


FIG. 11