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(54) **Magnetic drive stirring unit.**

(57) A unit for stirring liquid or loose solid products by means of magnetic drive without mechanical seals and with friction bearing means. The unit comprises a driving device (6) outside a container (14) and an inner stirring element (18) which are coaxial and magnetically coupled. The stirring element (8) is pivotally mounted through said friction bearing means, on a support (10) extending from a plate (1) which is connected to the bottom of the container by flanges (1a, 15) and rapid lock connections (17). In this way a very reliable seal is assured between the container and the stirring unit as far as both the product contamination and the environment pollution are concerned. Furthermore, the unit can be easily and quickly mounted to the container and doesn't give maintenance problems.

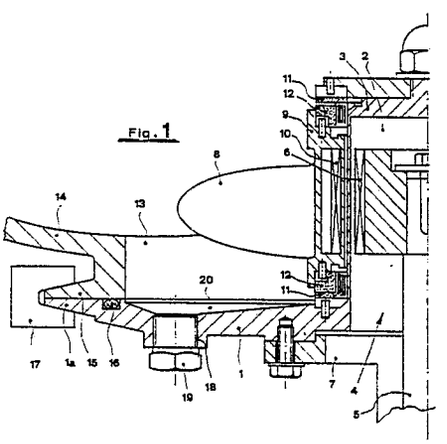

Fig. 1

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Description

MAGNETIC DRIVE STIRRING UNIT

The present invention refers to the field of the industrial mixing equipments with particular, even if not exclusive, reference to the chemical and pharmaceutical field, and, more precisely, concerns a magnetic drive stirring unit.

The stirring equipments known in the art comprise a stirring element, whose design and construction varies according to the uses, integral to a supported shaft, usually on rolling bearings, placed outside the container, which holds the product to be mixed.

Mechanical seals are arranged between the shaft and the container in order to prevent, or at least to limit, the environment pollution and/or the product contamination.

It is well known, on the other hand, that it is impossible to assure a perfect seal, either because of the increasing wear, or on account to the peculiar kind of the product to be mixed. As a consequence, not negligible disadvantages arise both in production and in maintenance.

Magnetic drive stirring units, essentially used in laboratory vessels and small scale plants, are also well known in the art. These stirring units assure the best seal conditions required in most appliances, because they comprise a stirring element inside the vessel magnetically coupled to an outer driving device without any mutual mechanical joint as well as mechanical seals.

It is one object of the present invention to provide a magnetic drive stirring unit for industrial applications and large scale plants, wherein mixing of products has to be carried out in such conditions as to avoid both the product contamination and the pollution of the outer environment.

Another object of the present invention is to provide a magnetic drive stirring unit capable of being easily and rapidly installed on the container and without significant maintenance problems.

The novel feature of the magnetic drive stirring unit according to the invention consists in that it comprises a flanged plate seal mountable in correspondence with a bottom opening of the vessel containing the product to be mixed, from said flanged plate centrally extending a tubular casing on which a stirring element is pivotally mounted, while the driving device is installed inside said tubular casing, in coaxial relation with the stirring element and the container, and is supported by said flanged plate. In particular the stirring element is supported on friction bearings.

According to a preferred embodiment of the invention, the flanged plate is fixed to a corresponding counterflange of the container by means of a rapid lock connection engaging with two tapered surfaces correspondingly formed on said flanged plate and said counterflange.

The invention will become more apparent from the following description of a not limiting and exemplifying embodiment taken in conjunction with the accompanying drawings in which:

- Figure 1 is a partial side view, sectioned by a diametral plane, of a first embodiment of the stirring unit in accordance with the present invention.
- Figure 2 is a side sectional view made by a diametral plane of a second embodiment of the stirring unit according to the present invention.
- Figure 3 is a side section of a further embodiment of the support of the stirrer.
- Figure 4 shows a side view of a possible device supporting the stirring unit according to the present invention.

With reference to figure 1 it has been indicated at 1 a flanged plate, preferably of circular shape, from the central part of which a tubular casing 2 extends upwardly, whose free end is closed by a wall 3.

A driving unit, generically indicated as 4, able to produce a rotating magnetic field, is housed within the tubular casing 2, that has a cylindrical shape.

The driving unit 4 consists of a shaft 5, to the end of which a magnet 6 is keyed. The shaft 5 is supported by bearings, not shown, housed within a bracket 7 fixed to the plate 1.

A stirring element 8, for instance a propeller, radially extends from an annular support body 9 that is pivotally mounted on the outer side of tubular casing 2 in a coaxial relation with shaft 5. Within the annular body 9 there is mounted a second magnet 10 of annular shape driven in rotation by the rotating magnet 6.

Annular body 9 rotates by sliding on side cylindrical surface of tubular casing 2, friction bearing means being provided therebetween. The friction bearing means comprises a pair of substantially L-shaped rings 11, fixed to the outer side of tubular casing 2 in correspondence with the base and, respectively the free end thereof, and a pair of squared section rings 12 correspondingly fixed to the ends of annular body 9 with a face frictionally contacting a corresponding face of L-shaped rings 11. Rings 11 and 12 are made of a material that does not exhibit overheating during the use and compatible with the product to be mixed; the most suitable material for each case can be easily chosen by a person skilled in the art.

In the use, the above described stirring unit is set in correspondence with opening 13, formed in the bottom of a vessel or container 14, in order that the tubular casing 2 results inside the container 14 itself. The bottom opening 13 is provided with a counterflange 15 matching the flange 1a of the plate 1 by interposition of a sealing member, for instance an o-ring 16. The coupling between the flange 1a and the counterflange 15 is firmly assured by a rapid lock connection 17, for instance a jaw connection, as schematically shown in figure 1.

Advantageously the outer faces of the flange 1a and of the counterflange 15 are tapered and converging, giving rise altogether to a frustum of cone surface with which the correspondingly shaped rapid lock connection 17 can be firmly engaged.

In order to prevent any residual product from storing on the bottom of the container after emptying operation, a through hole 18, normally plugged by a cap 19, is formed in the plate 1, and a large conic hollow 20 is formed on the internal surface of the plate 1 in order to make easier the drainage of the product.

Clearly, the stirring element 8 may be of the blade type or a propeller, or it may have any other shape chosen by the designer as a function of the kind of material to be mixed.

A simplified structure of the stirring unit according to the invention is shown in the embodiment of Figure 2. In this case the tubular casing 2 is fixed, for example by means of welding, to the flanged plate 1, whereas the annular body 9, which supports the propeller 8, is fixed to a bell-shaped support 23, coaxially arranged over the tubular casing 2. Support 23, which houses the magnetic element or rotor 9, is magnetically driven into rotation around the tubular casing 2, frictional bearing means being provided comprising two rings 21 and 22. The first ring 21 is housed in a peripheral seat of the plate 3, while the second ring 22 is housed in a seat formed at the base of the tubular casing 2.

In order to increase the "flexibility" of use of the stirring unit according to the present invention, as shown in figure 3, the bell-shaped support 23 may be provided with a screw threaded pivot 24 outwardly extending above it so that a lot of different types of propellers, as far as diameter and shape are concerned, can be mounted on it so as to get the best performance of the stirring unit with every kind of fluid to be mixed.

Since cleaning and sterilization of the container-stirring unit assembly are very frequent, especially in pharmaceutical industry, and since these operations require the disassembly and the removal of the stirring unit followed, after cleaning, by the opposite operations, the stirring unit according to the present invention may advantageously be equipped with a supporting device suitable to make easier the removal of the unit, as schematically shown in figure 4. The supporting device substantially comprises a base 25, preferably mounted on wheels 26 and tubular rod 27 extending vertically therefrom and housed within corresponding cylinders 28 and suitable to mutually slide by means of pneumatic actuation or the like. In this way the stirring unit, once disconnected from the container, may easily be lowered and moved.

The magnetic drive stirring unit according to the present invention allows to get significant advantages in comparison with the mechanic drive stirring units presently known.

First of all the lack of mechanical seals, which are not necessary because of the kind of drive, assures the best seal to the connection between the stirring unit and the container. In the second place, the connection between the stirring unit and the container, by means of flange, counterflange and rapid lock connection, assures a very good static seal and renders very easy and quick the assembly and disassembly operations. In the third place, the magnetic drive transmission may occur in whatever the speed of rotation and the installed horsepower are, thanks to the coaxial configuration of the stirring element and the driving device with respect to the axis of the container. Moreover it is to be considered the further advantage, which positively affects production and maintenance costs, consisting in that any residual product accumulates neither in the mechanical seals, because they do not exist, nor at the bottom of the container, by virtue of the drainage hole.

Variations and/or modification may be made to the magnetic drive stirring unit according to the present invention, without departing from the scope of the invention itself.

Claims

1. A magnetic drive stirring unit comprising a stirring element (8) inside a vessel (14) containing a fluid to be mixed and a driving unit (4), outside said vessel (14) magnetically coupled to said stirring element (8), characterized in that it comprises a flanged plate (1) seal mountable in correspondence of an opening (13) formed in the bottom of said vessel, from said flanged plate centrally extending a tubular casing (2) to which said stirring element (8) is pivotally connected, said drive unit being housed within said tubular casing (2) coaxially with said stirring element (8) and said vessel, and being supported by said flanged plate (1).

2. A stirring unit according to claim 1 wherein friction bearing means are provided between a support (10) of said stirring element (8) and said tubular casing (2).

3. A stirring unit according to claim 2 wherein the support (10) of said stirring element (8) is an annular body (10) mounted for rotation around said tubular casing (2).

4. A stirring unit according to claims 1 and 2 wherein said support (10) of said stirring element (8) is a substantially bell-shaped body (23) coaxially arranged around said tubular casing (2), said friction bearing means being interposed between them.

5. A stirring unit according to claim 4, wherein said bell-shaped body (23) comprises support means (24) for securing said stirring element (8) to the outer face of its bottom plate.

6. A stirring unit according to the previous claims wherein said flanged plate (1) is fixable to a corresponding counterflange (15) of the vessel (14) by a rapid lock connection (17).

7. A stirring unit according to the previous claims wherein two tapered converging surfaces are formed on said flanged plate (1) and said counterflange (15) for engaging with said rapid lock connection (17).

8. A stirring unit according to the previous claims wherein a large conic hollow (20), from which extends a through drainage hole (18), is formed on the internal surface of said flanged plate (1).

9. A stirring unit according to the previous

claims wherein said flanged plate (1) is equipped with an actuator device for lifting, lowering and transferring it during the maintenance operations.

10. A stirring unit according to claim 9, wherein said actuator device comprises a mobile base (25), first tubular rods (27) vertically extending from it, second tubular rods (28) extending from said flanged plate (1) and telescopically connected to said first tubular rods (27).

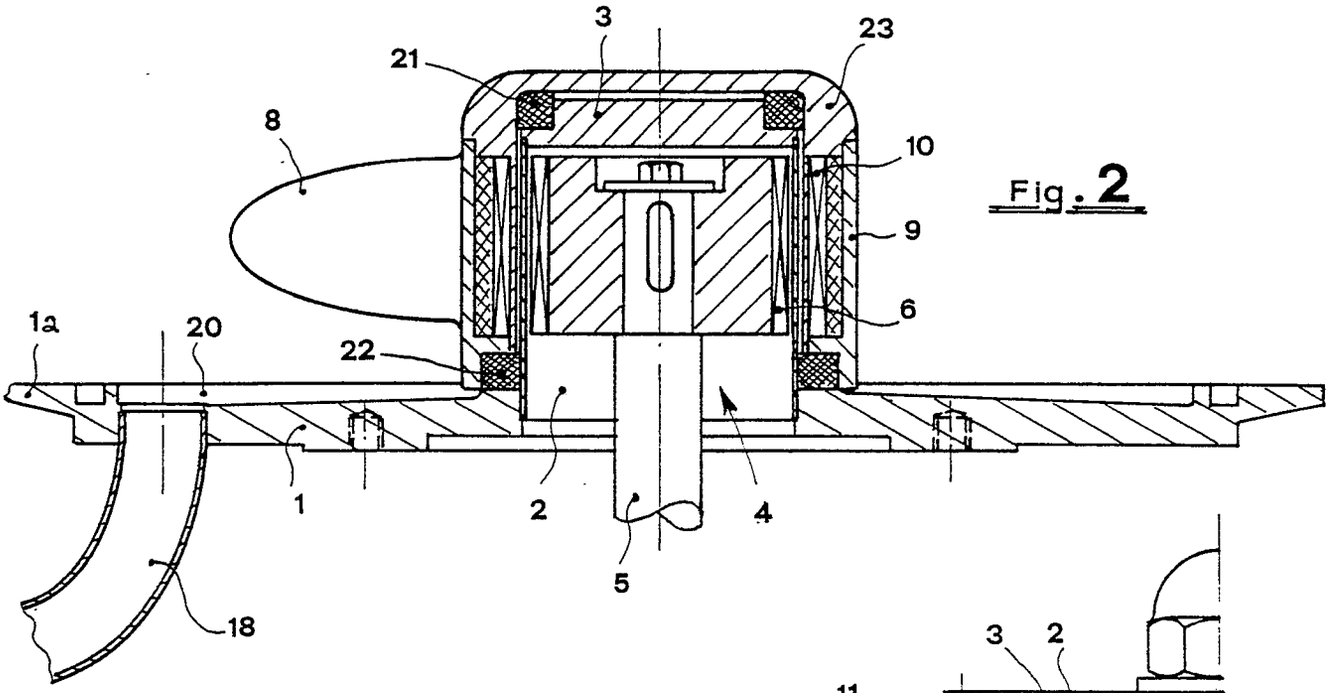
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Fig. 2

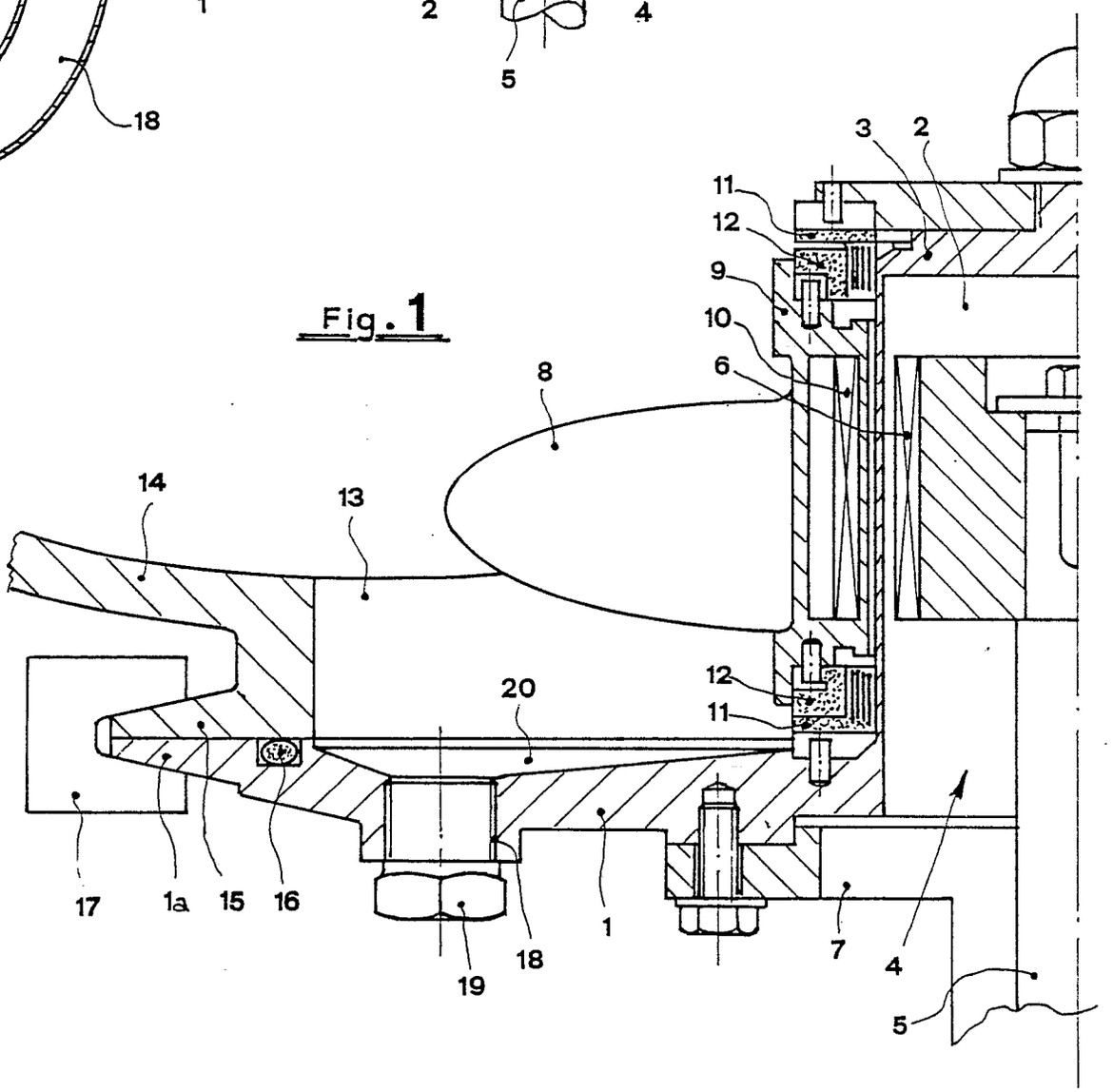
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Fig. 1

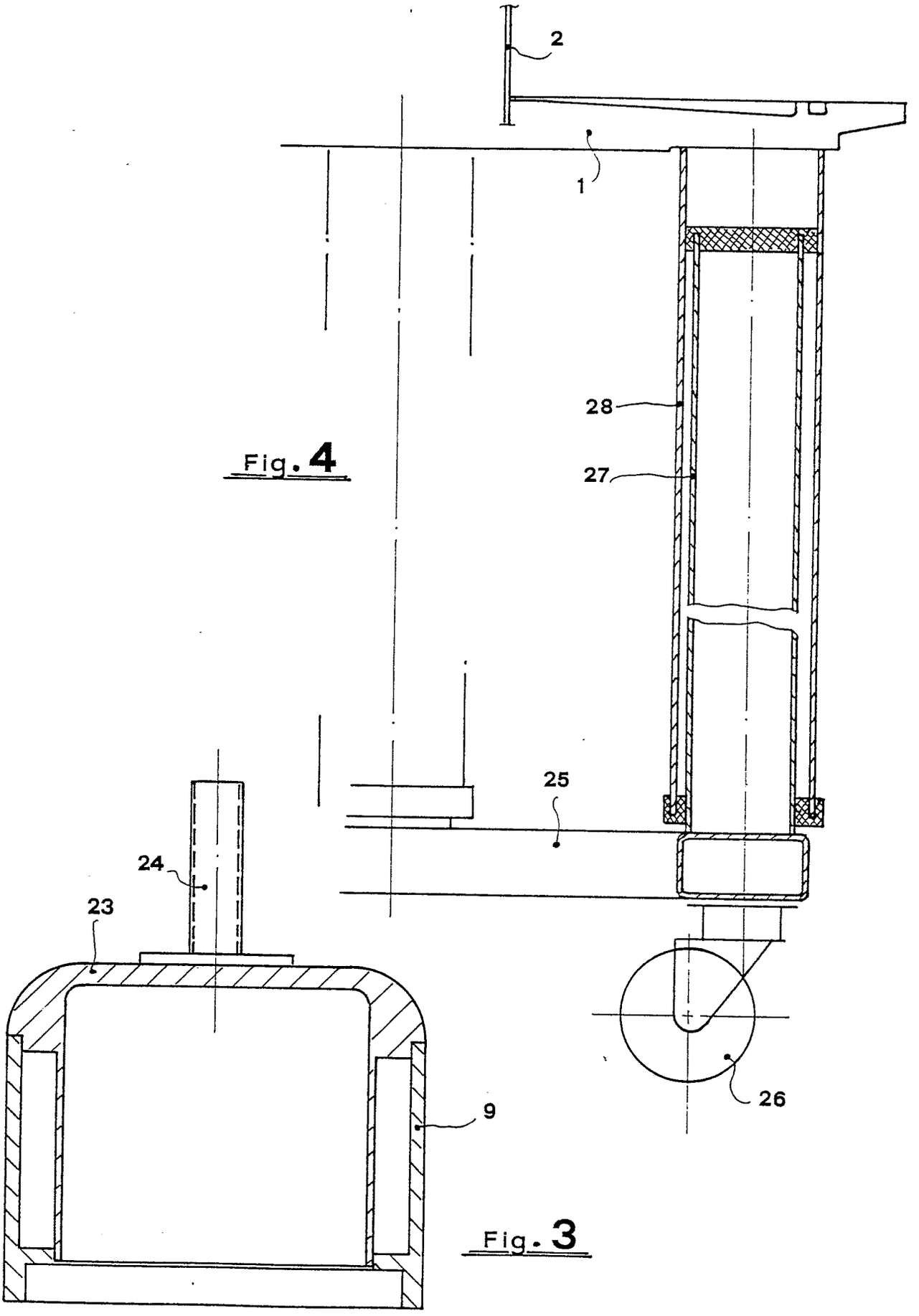

Fig. 4

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number

EP 89 83 0408

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-2 495 895 (HERVERT) * Column 3, line 32 - column 4, line 17; figures *	1-8	B 01 F 13/08 B 01 F 15/00
Y	GB-A-2 185 862 (CHEM-PLANT) * Abstract; figures *	1-8	
A	FR-A-2 164 837 (NIPPON) * Page 5, claim 1; figures *	9-10	
A	US-A-2 810 556 (ZOZULIN)		
A	US-A-2 506 886 (OKULITCH)		
A	DE-B-1 294 936 (TEIKOKU)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 01 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29-11-1989	PEETERS S.

CATEGORY OF CITED DOCUMENTS

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