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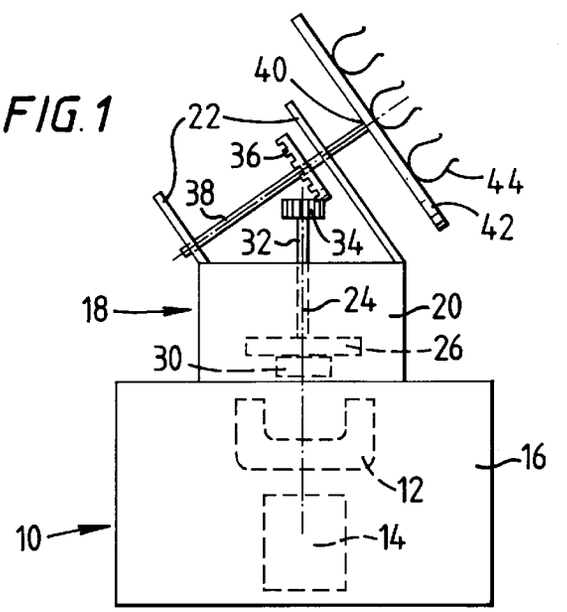
(54) Vessel agitating device.

(57) A tube mixing device and a bottle rolling device each for use with a magnetic stirring (10) device having a propelling magnet (12) mounted on the motor shaft of an electric motor. The devices both comprise a base element (20) and an outer element (42). The outer element of the tube mixing device is disposed at an angle relative to the base element and is adapted to hold tubes. The outer element (114) of the bottle rolling device comprises a plurality of rollers rotatably mounted in side by side arrangement. Both outer elements have a propelled magnetic field means associated therewith and are provided with drive means through which the respective outer elements may be driven by the propelled magnetic field means, the arrangement being such that movement of the outer elements is effected by magnetic coupling of the propelled magnetic field means to a propelling magnetic field means of a magnetic stirring device.

FIG. 1



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The present invention relates to a vessel agitating device for use with a magnetic stirring device. More particularly, but not exclusively the present invention relates to a tube mixer device and a bottle roller device for use with a magnetic stirring device.

One kind of existing device used to agitate vessels containing materials to be mixed generally comprises a plate arranged at an angle between 45° to 90° to a horizontal plane and adapted to rotate. The plate is provided with gripping means to attach the vessels, typically tubes, arranged around the periphery of the plate. Such devices are commonly referred to as tube mixers. Tubes containing materials to be agitated are placed within the gripping means on the rotating plate and the rotary motion of the angled plate acts upon the material in the tubes thereby mixing the contents. Rotation of the angled plate is conventionally effected by an electric motor.

Another kind of existing device used to agitate vessels containing materials to be mixed generally comprises a plurality of horizontal rollers rotatably mounted in a side by side arrangement. Vessels such as bottles containing materials to be agitated are placed on their sides on the arrangement of horizontal rollers and the rolling motion of the rollers acts upon the material in the bottles thereby mixing the contents. Such devices are commonly referred to as bottle rollers. Movement of the horizontal rollers is conventionally effected by an electric motor.

It is also known to effect stirring or agitation of materials in a vessel by means of magnetic stirring equipment. Such equipment generally comprises a vessel support table and a propelling magnet mounted on one end of the motor shaft of an electric motor arranged beneath the vessel support table. In use, a vessel whose contents are to be mixed is placed upon the vessel support table and a magnetic bar is placed inside the vessel. When the electric motor is activated, the propelling magnet mounted on the motor shaft rotates and the magnetic bar in the vessel follows the motion of the propelling magnet thereby mixing the contents of the vessel. Often such magnetic stirring devices also include a heating element so that the vessel contents can be heated and/or stirred.

Such equipment is widely used for example in laboratories to effect efficient mixing of liquid constituents. Often each piece of equipment is dedicated to one particular use or position within the laboratory, in particular, if the equipment is to be used to agitate vessels containing microbial cultures, cellular cultures, radioactive materials or any other material that must be strictly contained to comply with safety regulations for the avoidance of contaminations.

A laboratory procedure may also require the use of more than one type of the aforementioned equipment. For example, it may be necessary to use a magnetic stirring device for the preparation of a culture medium and then a bottle roller device for culturing microorganisms or cells in the liquid culture medium where continuous agitation during the growth phase is required.

In most laboratories, contamination risks must be stringently regulated and it may not be possible for one piece of equipment to be moved from one work station to another. In such circumstances it is necessary to have each type of equipment required available at each restricted site and as a result, lack of space can be a problem. Furthermore, in some circumstances the use of electrical equipment can be hazardous, for example in the presence of materials that are highly combustible or explosive.

It is an object of the present invention to ameliorate the aforementioned problems by providing a magnetic stirring device that is capable of functioning as a tube mixing device or bottle rolling device thereby obviating the need for three separate pieces of equipment.

It is a further object of the invention to provide a dedicated tube mixing device or bottle rolling device for use in an area where electrical equipment could be a hazard.

According to the present invention there is provided a vessel agitating device for use with a magnetic stirring device having a propelling magnetic field means characterised in that said vessel agitating device comprises a base element and an outer element said outer element being adapted to receive and retain vessels and being rotatably mounted relative to the base element and having a propelled magnetic field means associated therewith and further characterised in that drive means are provided through which said outer element is driven by said propelled magnetic field means, the arrangement being such that the rotary movement of the outer element is effected by magnetic coupling of the propelled magnetic field means associated with the outer element to a propelling magnetic field means of a magnetic stirring device.

In a first preferred embodiment the outer element comprises a member adapted for releasable attachment of vessels to be agitated said member being rotatably mounted at an angle relative to the base element and wherein the drive means are inclined relative to the axis of rotation of the propelled magnetic field means.

In a second preferred embodiment the outer element comprises a plurality of substantially parallel aligned rollers each being rotatably mounted and spaced apart one from another by an amount sufficient to form a valley therebetween which provides a seating for receiving vessels to be agitated and the rollers being mounted for unidirectional rotation about their longitudinal axes in response to output from the drive means.

By magnetically coupling movement of the propelled magnet associated with the outer element to

the movement of the propelling magnet of the magnetic stirrer the stirrer can be converted to perform either a tube mixing or a bottle rolling function. By use of the tube mixing or bottle rolling devices of the present invention, a magnetic stirring device can acquire dual functions and thus obviate the need for the provision of separate tube mixing or bottle rolling equipment. This has particular advantages in confined laboratory working conditions.

The tube mixing or bottle rolling devices can be used as attachments for a magnetic stirring device or as dedicated tube mixing, or bottle rolling devices which could be used within an oven, incubator, flame proof area or any other vessel or tank, where for example, the provision of electrical equipment would be a hazard.

Preferably, the drive means comprises a gears system.

The proportion of gearing required will depend on the required revolutions per minute and also the amount of torque required.

In an alternative embodiment the drive means comprises a belt system. Other suitable drive means will be well known to a person skilled in the art but a further example could include a chain and sprocket arrangement.

Preferably, the propelled magnetic field means is housed within the base element.

Preferably, the propelled magnetic field means is a bar shaped magnet.

Preferably, the tube mixing device or bottle rolling device is constructed of substantially non-ferrous materials, for example, aluminum or plastics materials, with the exception of magnetic field means.

According to a second aspect of the present invention there is provided a magnetic stirring device incorporating a tube mixing device.

According to a third aspect of the present invention, there is provided a magnetic stirring device incorporating a bottle rolling device.

Preferably, the base element of the tube mixing device or bottle rolling device is releasably secured to the magnetic stirring device by fixing means.

Typically the outer element of the tube mixing device will be a plate but it will be understood that it could comprise a frame member provided it is capable of fulfilling its function.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying illustrative drawings, in which:-

Figure 1 is a partially sectional view of a tube mixing device and magnetic stirring device constructed in accordance with a first aspect of the invention;

Figure 2 is a partially sectional view of a bottle rolling device and magnetic stirring device constructed in accordance with a second aspect of the invention; and

Figure 3 is an exploded perspective view of a tube mixing device shown in Figure 1.

Referring to Figures 1 and 3, there is shown a magnetic stirring device 10 comprising a rotating magnet element 12 coupled to an electric motor means 14 accommodated within a housing 16. The tube mixing device 18 comprises a base element 20 and an outer element 42 arranged at an acute angle relative to each other. The base element 20 houses a vertically oriented driving rod 24 which has a permanent bar magnet 26 which is to be propelled fixed adjacent to a lower end 28 thereof. The lower end 28 of the driving rod 24 is mounted on ball bearings 30, the arrangment being such that the bar magnet 26 and driving rod 24 can rotate freely on the ball bearings. The upper end 32 of the driving rod 24 extends to the exterior of the base element 20 and carries a first gear wheel 34 which is arranged in meshing engagement with a further gear wheel 36. The further wheel gear 36 is carried on an inclined second driving rod 38 which is arrangeable at any angle between 0° to 90° to the driving rod 24.

The upper end 40 of the second driving rod 38 is attached to the outer element a plate 42 which will rotate when the device is driven. The plate 42 is provided with gripping means 44 such as spring clips which will hold the tubes containing the materials to be mixed. The second driving rod 38 and the plate 42 may be supported by bracket means 22.

Although not shown in Figures 1 and 3, there is also provided fixing means for securing the tube mixing device 18 to the magnetic stirring device 10. Suitable fixing means will be well known to the person skilled in the art but examples could include straps, brackets, screws, adjustable eccentric cams or the like.

In order to convert the magnetic stirring device 10 to a tube mixing device 18, the base structure 20 is positioned and fixed on to the housing 16 of the magnetic stirring device 10. When the electric motor means 14 of the magnetic stirring device 10 is activated, the propelling magnetic element 12 carried on the motor shaft rotates. The propelled bar magnet 26 attached to the driving rod 24 is magnetically coupled to the propelling magnetic element 12 and thus also rotates. Rotation of the propelled bar magnet 26 effects rotation of the vertically orientated driving rod 24 which drives in turn the meshed gear wheels 34 and 36 and the inclined second driving rod 38. Rotation of the inclined second driving rod 38 causes the plate 42 to rotate. A vessel (not shown) containing materials to be agitated may be fixed in the gripping means 44 of the plate 42. The rotational motion of the plate 42 acts upon the material in the tube to agitate and mix the contents.

Referring to Figure 2, there is shown a magnetic stirring device 100 comprising a rotating magnet element 102 coupled to an electric motor means 104 ac-

commodated within a housing 106. The bottle rotating device 108 comprises a base element 110 and an outer element 114. The outer element 114 comprises a series of rotatably mounted rollers. The rollers 114 are mounted in substantially parallel alignment and each roller is spaced apart from the adjacent roller by an amount sufficient to form a valley therebetween which provides a seating for receiving the vessel to be agitated. The rollers will all rotate in the same direction and may all be driven by the drive means. In an alternative arrangement some of the rollers may be driven and some of the rollers may be passive. Obviously in an arrangement including both driven rollers and passive rollers positioning of passive rollers next to each other is best avoided. The base element 110 houses a vertically oriented driving rod 116 which has a permanent bar magnet 118 which is to be propelled fixed adjacent a lower end 120 thereof. The lower end 120 of the driving rod 116 is mounted on ball bearings 124, the arrangement being such that the bar magnet 118 and the driving rod 116 can rotate freely on the ball bearings. The upper end 126 of the driving rod 116 extends to the exterior the base element 110 and carries a first gear wheel 128 which is arranged in meshing engagement with a further system of connecting gear wheels 130. The final gear wheel 132 of the system of interconnecting gear wheels 130 is arranged in meshing engagement with a drive wheel 134 of the horizontal arrangement of rollers 114. The system of interconnecting gears and the roller assembly are accommodated within a housing 136 mounted on top of the base at 110.

Although not shown in Figure 2, there is also provided fixing means securing the bottle rolling device 108 to the magnetic stirring device 100. Suitable fixing means will be well known to a person skilled in the art but examples could include the straps, brackets, screws, adjustable eccentric cams or the like.

In order to convert the magnetic stirring device 100 to a bottle rolling or rotating device 108, the base structure 110 is positioned and fixed on to the housing 106 of the magnetic stirring device 100. When the electric motor means 104 of the magnetic stirring device 100 is activated, the propelling magnetic element 102 carried on the motor shaft rotates. The propelled bar magnet 118 attached to the driving rod 116 is magnetically coupled to the propelling magnet element 102. Rotation of the propelled bar magnet 118 effects rotation of the vertically oriented driving rod 122 which drives in turn the first gear wheel 128, the system of interconnecting wheels 130, the final gear wheel 132 and the drive wheel 134. Rotation of the drive wheel 134 causes the arrangement of horizontal rollers 114 to rotate in one direction relative to the base structure.

A vessel (not shown) containing material to be agitated may be placed on its side in the valley between adjacent rollers 114. The rotational motion of the rollers 114 acts upon the material within the vessel thereby agitating and mixing the contents.

Claims

1. A vessel agitating device for use with a magnetic stirring device 10,100 having a propelling magnetic field means 12,102 characterised in that said vessel agitating device comprises a base element 20,110 and an outer element 42,114 said outer element being adapted to receive and retain vessels and being rotatably mounted relative to the base element 20,110 and having a propelled magnetic field means 26,118 associated therewith and further characterised in that drive means 24,34,36,128,130 are provided through which said outer element is driven by said propelled magnetic field means 26,118, the arrangement being such that the rotary movement of the outer element 42,114 is effected by magnetic coupling of the propelled magnetic field means 26,118 associated with the outer element to a propelling magnetic field means 12,102 of a magnetic stirring device.

2. A vessel agitating device as claimed in claim 1 wherein the outer element comprises a member 42 adapted for releasable attachment of vessels to be agitated said member being rotatably mounted at an angle relative to the base element 20 and wherein the drive means 36,38 are inclined relative to the axis of rotation of the propelled magnetic field means 26.

3. A vessel agitating device as claimed in claim 1 wherein the outer element 114 comprises a plurality of substantially parallel aligned rollers each being rotatably mounted and spaced apart one from another by an amount sufficient to form a valley therebetween which provides a seating for receiving vessels to be agitated and the rollers being mounted for unidirectional rotation about their longitudinal axes in response to an output from the drive means 126,128,130.

4. A vessel agitating device as claimed in claims 1 - 3 wherein the drive means comprises a gears system.

5. A vessel agitating device as claimed in claim 1 - 4 wherein the propelled magnetic field means 26,118 is housed within the base element 20,110.

6. A vessel agitating device as claimed in claims 1 - 5 wherein the propelled magnetic field means 26,118 is a bar shaped magnet.

7. A vessel agitating device as claimed in any one of the preceding claims wherein the vessel agitating device, excluding the magnetic field means, is constructed of substantially non-ferrous materials.

8. A magnetic stirring device incorporating a vessel agitating device as claimed in any one of the preceding claims.

9. A magnetic stirring device as claimed in claim 8 wherein the base element of the vessel agitating device is releasably secured to the magnetic stirring device by fixing means.

FIG. 1

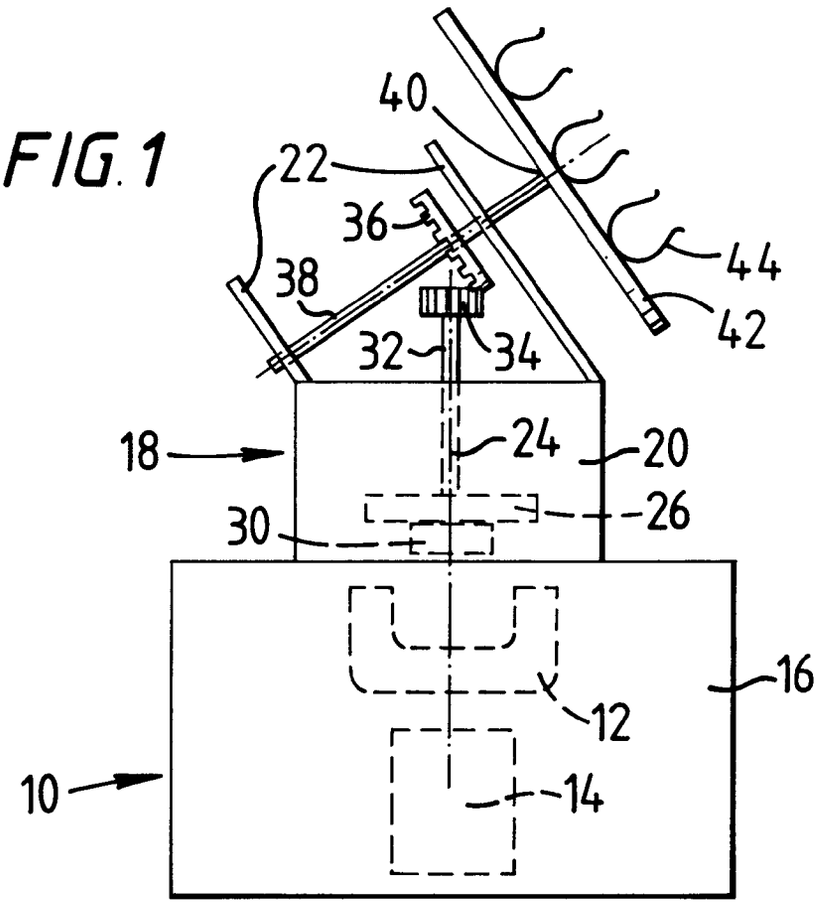
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FIG. 2

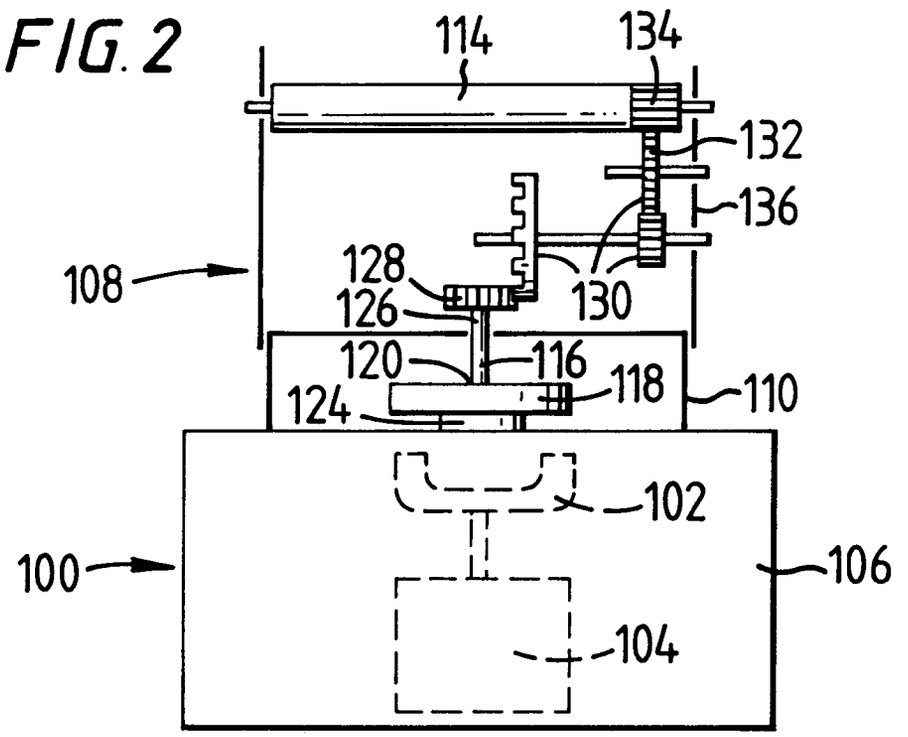
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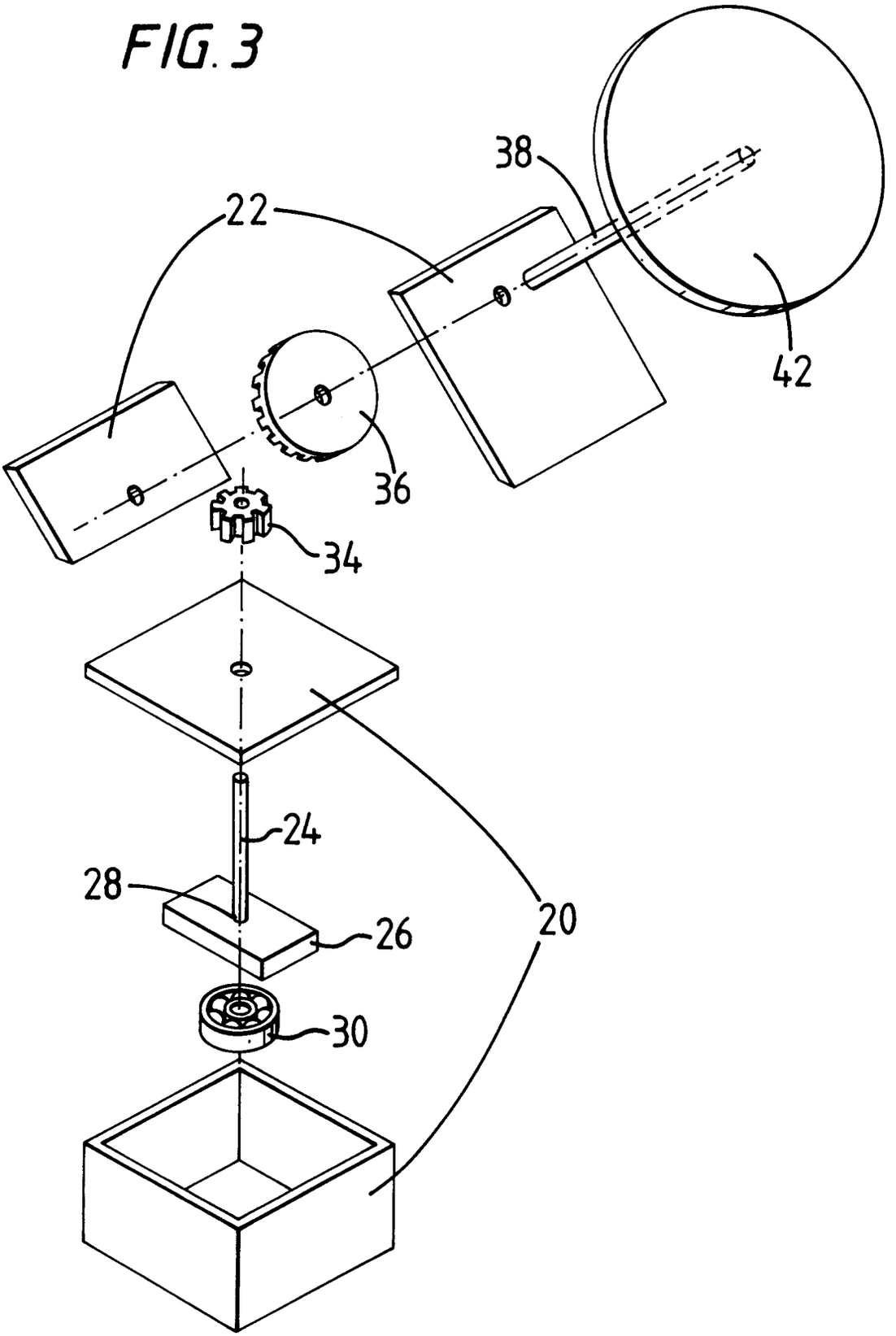
FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 2203

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.6)
A	FR-A-2 514 510 (MOCHIDA)	1	B01F13/08
A	US-A-5 299 864 (REYNOLDS)	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 July 1995	Peeters, S

CATEGORY OF CITED DOCUMENTS

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