(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 463 846 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **07.06.95** (51) Int. Cl.[6]: **B24B 31/033**

(21) Application number: **91305712.1**

(22) Date of filing: **25.06.91**

(54) **Grinding method and apparatus.**

(30) Priority: **26.06.90 JP 167542/90**

(43) Date of publication of application:
02.01.92 Bulletin 92/01

(45) Publication of the grant of the patent:
07.06.95 Bulletin 95/23

(84) Designated Contracting States:
CH DE FR GB IT LI

(56) References cited:
CH-A- 294 446
DE-A- 1 816 133
DE-A- 1 966 474
DE-A- 2 113 495
DE-A- 3 514 175
DE-A- 3 711 944
DE-A- 3 828 756
GB-A- 2 177 955

(73) Proprietor: **Ohno, Ietatsu**
7-26, 3-chome, Nishi-Shinjuku
Shinjuku-ku,
Tokyo (JP)

(72) Inventor: **Ohno, Ietatsu**
7-26, 3-chome, Nishi-Shinjuku
Shinjuku-ku,
Tokyo (JP)

(74) Representative: **Leale, Robin George et al**
FRANK B. DEHN & CO.
Imperial House
15-19 Kingsway
London WC2B 6UZ (GB)

EP 0 463 846 B1

Description

This invention relates to a grinding method and apparatus, and more particularly to a grinding method adapted to enclose objects that are to be ground and a grinding material in a grinding barrel and give the grinding barrel a variety of motions to grind the objects, and a grinding apparatus for implementing such a method.

A conventional grinding method adapted to enclose objects to be ground and a grinding material in a grinding barrel and give the grinding barrel a variety of motions, that is, a so-called barrel grinding method employs a grinding barrel which is axially supported by a carrier or a drum, where the center of the grinding barrel is positioned concentrically with the rotating shaft about which the grinding barrel is rotated. The grinding barrel is rotated by a driving unit or rotated in the same direction as a drum to produce a centrifugal force to thereby perform a grinding process. In either case, the grinding barrel is rotated with the center thereof as the rotating axis, whereby objects to be ground and a grinding material in the grinding barrel are subjected to a repetition of identical circular motions or fixed motions. For this reason, only an upper portion of a mass of the objects to be ground and the grinding material can be agitated by an avalanche phenomenon to grind the objects to be ground.

The above-mentioned grinding method, however, implies a number of problems such as a lack of uniformity in finished products, residue of the grinding materials in recesses, curved surfaces, rear surfaces and so on, bruises on the surfaces of ground objects, and so on. Furthermore, the grinding method as mentioned above is not capable of providing a sufficiently high quality of grinding even if the rotational speed of the grinding barrel is decreased to grind the objects for a long time.

Generally, the above-mentioned grinding barrel is constructed such that the diameter and the length thereof are chosen to be the same size. Such a construction may cause objects being ground to overlap each other, and accordingly a number of bruises are produced on the surface of ground objects. To solve this problem due to the construction of the grinding barrel, there have been proposed a grinding barrel having the diameter and the length different from each other and a method of rotating a grinding barrel in forward and backward directions.

However, in such alternate rotations of the grinding barrel in the forward and backward directions, gears and pulleys for rotating the grinding barrel may be damaged by shocks given to these elements when the rotation is changed from the forward direction to the backward direction and vice versa. For this reason, if the rotational speed of the grinding barrel is decreased, the grinding process takes a long time, thereby rendering it impossible to completely prevent bruises on the surfaces of ground objects.

Further, the above-mentioned grinding barrel generally comprises a single chamber therein and one to four grinding barrels are mounted on a drum. The internal chamber of the barrel is appropriately re-shaped in accordance with the necessity for providing an optimal grinding for objects to be ground.

The conventional grinding barrel as mentioned above, however, comprises a single internal chamber and the volume thereof is definite, so that it is difficult to grind a large number of different objects in a small quantity or precisely grind a heavy-weight or a large-volume object in such a barrel. In addition, a troublesome time-consuming exchange is necessary every time a different grinding is to be performed. It is also difficult to precisely finish the surface of grounded objects due to bruises caused by collisions and contacts of objects being grounded.

DE-A-3828756 discloses a grinding method and apparatus according to the preamble of claim 1 and 2, respectively.

Starting from this prior art the present invention is characterised in that the axis of rotation of the grinding barrel is offset from, but parallel to, the central geometrical axis of the grinding barrel.

Some embodiments of the invention will be described by way of example and with reference to the accompanying drawings, in which:-

FIG. 1 is a lateral view illustrating the positional relationship between a rotary drum and grinding barrels according to an embodiment of the present invention;

FIG. 2 is a plan view of the apparatus shown in FIG. 1;

FIGS 3a and 3c are front views of grinding barrel mounting frames which respectively have the rotating axis eccentrically deviated from the center;

FIG 3b is a lateral view of the grinding barrel mounting frame;

FIG. 4 is a lateral view of a grinding barrel having an eccentric rotating shaft;

FIG. 5 is a front view of the grinding barrel shown in FIG. 4;

FIG. 6 is a diagram showing motions of a grinding material and objects to be ground in a grinding barrel in an operating state;

FIG. 7 is a diagram showing motions of a grinding material and objects to be ground in an eccentrically mounted grinding barrel;

FIG. 8 is a cross-sectional view of a grinding barrel;

FIGS. 9a, 9b, 9c are cross-sectional views respectively illustrating how grinding barrels are mounted on grinding barrel carriers;

FIG. 10 is a perspective view of a grinding barrel having the length 1.3 times longer than the diameter;

FIGs. 11 and 12 are perspective views respectively illustrating a grinding barrel having the length not more than 0.8 times as long as the diameter;

FIG. 13 is a diagram illustrating the inner structure of a grinding apparatus according to an embodiment of the present invention;

FIG. 14 is a side view of the inner structure of the grinding apparatus shown in FIG. 13;

FIGS. 15 and 16 illustrate means for driving a grinding barrel in opposite directions;

FIGS. 17(a) and (b) illustrate means for supporting objects to be ground in a grinding barrel.

FIGS. 18, 19 and 20 are cross-sectional views of grinding barrels;

FIG. 21 is a perspective view of a grinding barrel;

FIGS. 22a - 22e are perspective views respectively illustrating a component of a grinding barrel;

FIG. 23 is a lateral view of a grinding barrel;

FIG. 24 is a cross-sectional view of a grinding barrel;

FIGS. 25a and 25b are plan views illustrating components of a grinding barrel;

FIGS. 25c and 25d are lateral views of the components shown in FIGS. 25a, 25b, respectively;

FIGS. 26a - 26d are cross-sectional views respectively illustrating a grinding barrel;

FIG. 27 is a perspective view of a finned grinding barrel;

FIG. 28a is a lateral view of a grinding barrel;

FIG. 28b is a perspective view of a barrel body shown in FIG. 28a

FIGS. 29, 30 and 31 are diagrams respectively illustrating how to assemble a grinding barrel; and

FIGS. 32 and 33 are sectional views of grinding barrels.

In FIGS. 1 and 2, reference numeral 1 designates a driving unit for-driving a grinding apparatus of the present invention.

A rotary drum 2, formed in a reel shape, has a central shaft 3 which is rotatably supported by main bearing 5 disposed on the inner surfaces of side walls of an apparatus body 4.

On one of turret drum plates 2a, there is integrally fixed a large pulley 6, such that the rotary drum 2 is rotated by the driving bit 1 through the large pulley 6 and a belt 7.

Reference numeral 8 designates a grinding barrel which is mounted on a grinding barrel mounting frame 11 after a grinding material 9 and objects to be ground are enclosed therein. A plurality of (three in the drawing) grinding barrels 8 are mounted between the turret drum plates 2a at locations close to the outer periphery of the rotary drum 2, such that they are rotated in the direction opposite to the rotating direction of the rotary drum 2 through a rotating direction changing mechanism 12, whereby the grinding material 9 and the objects to be ground are agitated in a complex manner which has never been seen, thereby making it possible to provide an extremely precise finishing.

Reference numeral 13 designates a rotating shaft which projects toward the outside of the both sides of the grinding barrel fixing frame 11. The grinding barrel fixing frame 11 is rotated with the rotating shaft 13 at the center.

Incidentally, the rotating direction changing mechanism 12 is principally composed of a motor 14, belts 15a, 15b, 15c, 15d, and a main pulley 16. Alternatively, such mechanism may be composed of chains, sprockets, gears and so on.

The grinding barrel 8 is mounted in a manner that the rotating shaft 13 of the grinding barrel mounting frame 11 is eccentrically deviated from the center O of the grinding barrel 8 as shown in FIGS. 3a, 3b, 3c. The rotating shaft 13 may be directly contacted to the grinding barrel 8 as shown in FIGS. 4, 5. Such changes in the position of the center O allow the grinding barrel to rotate in a complex manner which has never been seen as shown in FIG. 7.

The grinding barrel 8 is provided with a balancing weight 17 for cancelling unbalance caused by the eccentric mounting of the grinding barrel 8 and the grinding material 9 and the objects 10 to be ground enclosed in the grinding barrel 8. This balancing weight 17 may be a flywheel mounted on the driving unit 1. Alternatively, a sufficiently heavy pulley, for example, the aforementioned large pulley 6 may be used as the balancing weight 17 in place of the flywheel.

FIG. 8 illustrates a cross-section of the grinding barrel 8, where the center O is different from the center of the circulation of the grinding material 9 and the objects to be ground 10 in the barrel 8, and the above-mentioned complex movement is produced thereby.

FIGS. 9a - 9c illustrate that the grinding barrels 8 in a variety of shapes are mounted on grinding barrel carriers 11a which are integrated with the rotating shaft 13 of the grinding barrel mounting frame 11. Apart from the examples shown in FIGS. 9a - 9c, many variations can be thought.

Incidentally, reference numeral 18 shown in FIG. 4 designates a lid of the grinding barrel 8, and

19 a fixture for mounting the grinding barrel 8 on the grinding barrel mounting frame 11.

FIG. 10 shows the relationship between the diameter (ϕ) and the length (L) of the grinding barrel 8. When the shape of the grinding barrel 8 is selected to satisfy a condition expressed by $L \geqq 1.3 \times \phi$, objects to be ground will not overlap each other or collide with each other in the grinding barrel 8.

FIGS. 11, 12 illustrate other shapes of the grinding barrel 8 which satisfy a condition expressed by $L \leqq O.8 \times \phi$. Since the grinding barrel is relatively deep, objects to be ground, even if existing in the vertical direction, will not overlap each other or collide with each other in the barrel.

FIGS. 13, 14, 15 illustrate the driving relationship among the constituent elements when the grinding barrel 8 is rotated in the forward and backward direction. Both ends of the central shaft 3 are supported by the main bearings 5 as shown in FIG. 2 for fixing the rotary drum 2. A gear 20 (a rotating body on the driving side) is secured on the central shaft 3.

A rotation of the rotary drum 2, therefore, causes the grinding barrel 8 to rotate through intermediate gears (intermediate rotating bodies) 21, 21a and gears 22 (rotating bodies on the driven side). The rotary drum 2 and the grinding barrel 8 are adapted to be rotated by rotation, revolution, centrifugal force and so on, in the forward and backward directions by means of a known reversing means (not shown) provided therefor.

The above-mentioned intermediate gears 21, 21a are respectively disposed on the left and right sides of the gears 22 on the axial line of the gears 20 and 22 for transmitting the rotation of the gear 20 to the gears 22. Also, in the event of forward and backward rotations, either one of the intermediate gears 21, 21a engages the gears 20, 22 and the other one is made free.

More specifically, when the gear 20 is rotated in the rightward direction, the gear 22 is also rotated in the same direction as shown in FIG. 15a, whereby the intermediate gear 21 engages with both gears 20, 22. On the contrary, when the gear 20 is rotated in the leftward direction (backward direction), the intermediate gears 21a engages with both gears 20, 22, as shown in FIG. 15b.

Thus, the associative actions are smoothly performed by the intermediate gears 21, 21a, and gears 20, 22, whereby the respective gears are prevented from being damaged or torn, in contrast with a conventional case where a single intermediate gear 21 is solely provided.

FIG. 16 shows a modification where the respective gears 20, 21, 21a, 22 are replaced with pulleys. It is also possible to couple a pulley 23 (a rotating body on the driving side) with a pulley 24 (a rotating body on the driven side) by means of a belt 25. If intermediate pulleys 26, 26a (intermediate rotating bodies) are arranged on both sides of the belt 25, switching of rotation in the forward and backward directions can be smoothly performed by an interaction of the intermediate pulleys 26, 26a, in a manner similar to the above-mentioned construction which employs gears.

FIGS. 17a, 17b show that objects to be ground are supported by supporters 8c or mounted on a supporting shaft 8d in the grinding barrel 8, which enables a highly precise grinding in a relatively short time.

FIGS. 18a, 18b illustrate the grinding barrel 8 in another shape, that is, octagonal in cross-section. The internal chamber is divided into a plurality of sub-chambers 31 by parallel partition walls 30 disposed perpendicular to the rotating shaft 13 of the grinding barrel 8. The respective sub-chambers 31 are provided with a lid, and a variety of different objects are accommodated separately in the respective sub-chambers 30 and ground. The partition walls 30 are not limited to be perpendicular to the rotating shaft 13, and alternatively may be disposed with a predetermined angle with respect to the rotating shaft 13.

The grinding barrel 8 may also be formed as shown in FIGS. 19a, 19b, 20a, 20b, where partition walls 32, 32a, 33, 33a are disposed in parallel with the rotating shaft 13 in addition to the partition walls 30 to further divide the respective sub-chambers 30 into smaller chambers. With these grinding barrels, it is possible to simultaneously grind a more number of different objects by a single grinding apparatus as well as facilitate the accesses to the ground objects.

FIG. 21 shows that the grinding barrel 8 may be divided into sub-chambers by means of an inner barrel 34 without partition walls. In this embodiment, the grinding barrel 8 is composed of an outer barrel 35 and the inner barrel 34, both formed in a substantially identical shape. The inner barrel 34 is made of a material such as rubber or synthetic resin in order to ensure the inner barrel 34 may be readily inserted into the outer barrel 35. An opening 36 of the inner barrel 34 is provided with an engaging edge 38 projecting from the peripheral edge thereof for ensuring an engagement with an opening 37 of the outer barrel 35. After removably inserting the inner barrel 34 into the outer barrel 35, a lid 39 is attached on the engaging edge 38 for integrally closing the inner and outer barrels 34, 35. Reference numeral 40 in the drawing designates a mount.

Further, the grinding barrel 8 may be separately composed of an outer barrel 35 and an inner barrel 34 as shown in FIGS. 22a to 22d, which facilitates accesses to ground objects accommo-

dated in the grinding barrel 8. By previously providing a plurality of inner barrels 34, the grinding barrel 8 can be exchanged with another one in a short time. Incidentally, reference numeral 41 shown in FIGS. 22b, 22c designates ribs protrusively formed on the inner wall of the inner barrel 34 for improving the agitating effect of the grinding material and the objects to be ground when the grinding barrel 8 is rotated.

A lid 42 shown in FIG. 22e is used for tightly closing each of the inner barrels 34.

A further embodiment of the grinding barrel 8 shown in FIG. 23 has an outer barrel 35 divided into a plurality of sub-chambers in two columns and inner barrels 34 respectively accommodated in the sub-chambers with lids 42 (see FIG. 22e) placed on the respective sub-chambers. The inner barrel 34 is not necessarily provided with partition walls, and the lid 34 may be of any shape as long as it can tightly close the opening of the inner barrel 34. The inner barrel 34 has a cross-sectional shape substantially identical to that of the outer barrel 35 so as to facilitate the insertion into and removal from the outer barrel 35 and is made of a material such as rubber or polyurethane which is readily formed in arbitrary shapes. The inner barrel 34, since made of such elastic and flexible material, serves as a shock absorbing cushion for contents and promotes grinding. This grinding barrel 8 also facilitates the exchange of each of the inner barrels 34 accommodated in the divided outer barrel 35. The inner barrel 34 is provided with an engaging edge 38 for a correct accommodation in the outer barrel 35. Objects enclosed in the respective inner barrels 34 are ground by rotating the outer barrel 35.

A grinding barrel 8 shown in FIG. 24 has an outer barrel 35 appropriately divided by partition walls 30 and inner barrels 34 each accommodated in a sub-chamber of thus divided outer barrel 35 with a lid 42 attached thereon.

In a grinding barrel 8 shown in FIGS. 25a to 25d, after inner barrels 34 are separately accommodated in an outer barrel 35, an opening of the outer barrel 35 is closed by a lid 43, and a fixing plate 44 is engaged with protrusions 46 formed on an edge portion 45 of the opening of the outer barrel 35 and fastened by a nut 46a together with the lid 43 disposed therebelow. The inner barrels 34, if previously formed in a hexagonal or circular shape, can be accommodated in the outer barrel 35 without producing swinging motions. Reference numeral 47 in FIGS. 25a, 25d designates a handle.

FIGS. 26a, 26b, 26c illustrates possible shapes of the inner barrel 34 which is provided with an opening 34a at one end portion thereof. FIG. 26d shows one having the inside formed in a spherical shape.

A grinding barrel 8 shown in FIG. 27 has cooling fins 50, 51 formed on the outer surface of an outer barrel 48 and the lid 49 for a long-time grinding operation or for grinding heavy objects. The cooling fins 50, 51 are cooled by surrounding air agitated by the rotation of the grinding barrel 8, whereby a heat produced in the grinding barrel 8 is irradiated to prevent the grinding barrel 8 from being heated.

In a further embodiment shown in FIGS. 28a, 28b, it is supposed that the appearance and the cross-section of the grinding barrel 8 is arbitrary, and a plurality of chambers in an arbitrary shape, for example, rectangle, ellipse, circle or the like are formed in the grinding barrel 8. FIGS. 28a, 28b show, as an example, that a polygonal, for example, rectangular barrel body 8a is divided to form a multitude of sub-chambers 52 as shown in FIG. 28b, each of which is provided with a lid 53. This construction permits individually grinding objects, whereby bruises, caused by collisions, will not be produced on the surface of the ground objects, and accordingly a fine and high-quality grinding can be achieved. It is also possible to accommodate different kinds of objects to be ground in the sub-chambers 52.

The grinding barrel 8 of the present invention may be composed of a plurality of stacked cylindrical barrels 53, 54, as shown in FIGS. 29, 30. FIG. 29 illustrates that a multitude of small cylindrical barrels 55, serving as the sub-chambers, are arranged in a cylindrical barrel 53, and a plurality of the cylindrical barrel 53 are stacked and fastened by fastening bolts 56. FIG. 30 illustrates that a multitude of small cylindrical barrels 57 or spherical barrels 58, serving as the sub-chambers, are arranged in a cylindrical barrel 54, and a plurality of the cylindrical barrels 54 are stacked and fastened by a fastening bolt penetrating the center of the cylindrical barrels 54.

Further, the grinding barrel 8, as shown in FIG. 31, may have chambers, each of which is made up of a hemispherical half barrel 61a having a threaded portion and another hemispherical half barrel 61b corresponding to the half barrel 61a which are engaged with each other by the threaded portions to form an internal spherical chamber 63. FIG. 31 illustrates a two-coupled barrel composed of two of the integrated grinding barrels 8.

A yet further embodiment of the grinding barrel 8 as shown in FIG. 32 comprises a plurality of long cylindrical grinding barrel bodies 64 having one end 64a in a hemispherical shape and the other end covered with a hemispherical lid 64b. With this long cylindrical type of the grinding barrel 8, it is possible to enclose a large number of objects to be ground therein at a time as well as provide a fine grinding for elongated objects which are suscept-

ible to deformation, flexure or the like without such damages. Incidentally, FIG. 33 illustrates a grinding barrel 8 having both ends forced of flat plates 65.

It will thus be seen that there is provided, at least in preferred embodiments of the present invention, a grinding method which is capable of uniformly and precisely grinding objects to be ground in a short time and a grinding apparatus for implementing this method. The grinding method and apparatus is capable of softening shocks produced when the rotation of a grinding barrel is changed between the forward direction and the backward direction to thereby eliminate bruises on the surface of grounded objects; is capable of coping with grinding for a large number of objects to be ground in a small quantity or a heavy-weight or a large-size object to be ground, preventing contacts and collisions between objects to be ground, and enabling a precise grinding; and permits an arbitrary selection of a material, e.g., hard or soft material for the inner construction of a grinding barrel in accordance with the characteristics of objects to be ground and purposes for grinding.

Claims

1. A grinding method comprising the steps of:

rotatably mounting a grinding barrel (8) on an axis of rotation spaced away from, but parallel to, the central axis of rotation of a rotary drum (2);

enclosing a grinding material and objects to be ground in said grinding barrel; and

grinding said objects by rotating said grinding barrel in directions the same as and opposite to the direction in which said rotary drum is rotated;

characterised in that the axis of rotation of the grinding barrel is offset from, but parallel to, the central geometrical axis of the grinding barrel.

2. A grinding apparatus comprising:

a rotary drum (2) mounted for rotation about a central axis;

a grinding barrel (8) rotatably mounted on an axis of rotation spaced away from, but parallel to, the said central axis of the rotary drum; and

drive means (12) for rotating said grinding barrel in directions the same as and opposite to the direction of rotation of said rotary drum;

characterised in that the axis of rotation of the grinding barrel is offset from, but parallel to, the central geometrical axis of the grinding barrel.

3. Apparatus according to claim 2, wherein the said grinding barrel (8) is mounted by way of a frame (11) which is itself mounted on a rotary shaft (13) whose axis is the axis of rotation of the grinding barrel.

4. Apparatus according to claim 3, wherein the said mounting frame shaft (13) is mounted between two plates (2a) forming side walls of said rotary drum (2).

5. Apparatus according to any of claims 2 to 4, wherein the said grinding barrel (8) is provided with a balancing weight (17).

6. Apparatus according to claim 5, wherein the said balancing weight (17) is a flywheel.

7. Apparatus according to any of claims 2 to 6, wherein the length of the said grinding barrel (8) is greater than or equal to 1.3 times the diameter thereof.

8. Apparatus according to any of claims 2 to 6, wherein the length of the said grinding barrel (8) is less than or equal to 0.8 times the diameter thereof.

9. Apparatus according to any of claims 2 to 8, wherein the said drive means (12) is arranged to rotate the said grinding barrel in opposite directions in intermittent fashion.

10. Apparatus according to any of claims 2 to 9, further comprising carriers (8c) for supporting objects (10) to be ground in said grinding barrel (8).

11. Apparatus according to any of claims 2 to 9, further comprising a supporting shaft (8d) for supporting objects (10) to be ground in said grinding barrel (8).

12. Apparatus according to any of claims 2 to 11, wherein the said grinding barrel (8) has an internal chamber for accommodating objects to be ground, said internal chamber being divided in the axial direction and/or in the radial direction to form a plurality of sub-chambers (31).

13. Apparatus as claimed in any of claims 2 to 12, wherein the said grinding barrel comprises an outer barrel (35) and an inner barrel (34) having the same external shape as the outer barrel, the inner barrel being provided with an opening (36) and being removably received in the outer barrel.

14. Apparatus according to any of claims 2 to 12, wherein the said grinding barrel comprises an outer barrel (35) and a plurality of inner barrels (34) removably received in the outer barrel, the respective inner barrels being divided in parallel in the axial direction, or at a predetermined angle with respect to the axial direction, to form a plurality of sub-chambers.

15. Apparatus according to any of claims 2 to 14, comprising a plurality of said grinding barrels (8).

Patentansprüche

1. Schleifverfahren, umfassend die Schritte:
drehbares bringen einer Schleiftrommel (8) auf einer
Drehachse, die mit Abstand von aber parallel zu der Mitteldrehachse einer Drehtrommel (2) angeordnet ist;
Einschließen eines Schleifmaterials und von zu schleifenden Gegenständen in der Schleiftrommel; und
Schleifen der Gegenstände durch Drehen der Schleiftrommel in gleiche und entgegengesetzte Richtungen zu der Richtung, in der die Drehtrommel gedreht wird;
dadurch gekennzeichnet,
daß die Drehachse der Schleiftrommel versetzt von aber parallel zu der geometrischen Mittelachse der Schleiftrommel ist.

2. Schleifvorrichtung, umfassend:
eine Drehtrommel (2), die zur Drehung um eine Mittelachse angebracht ist;
eine Schleiftrommel (8), die auf einer Drehachse drehbar angebracht ist, die mit Abstand von aber parallel zu der Mittelachse der Drehtrommel angeordnet ist; und
ein Antriebsmittel (12) zur Drehung der Schleiftrommel in gleiche und entgegengesetzte Richtungen zu der Drehrichtung der Drehtrommel;
dadurch gekennzeichnet,
daß die Drehachse der Schleiftrommel versetzt von aber parallel zu der geometrischen Mittelachse der Schleiftrommel ist.

3. Vorrichtung nach Anspruch 2, in der die Schleiftrommel (8) mittels eines Rahmens (11) angebracht ist, der selber an einer Drehwelle (13) angebracht ist, dessen Achse die Drehachse der Schleiftrommel ist.

4. Vorrichtung nach Anspruch 3, in der die Anbringungsrahmenwelle (13) zwischen zwei Platten (2a) angebracht ist, die Seitenwände der Drehtrommel (2) bilden.

5. Vorrichtung nach einem der Ansprüche 2 bis 4, in der die Schleiftrommel (8) mit einem Ausgleichsgewicht (17) versehen ist.

6. Vorrichtung nach Anspruch 5, in der das Ausgleichsgewicht (17) ein Schwungrad ist.

7. Vorrichtung nach einem der Ansprüche 2 bis 6, in der die Länge der Schleiftrommel (8) größer als oder gleich dem 1,3-fachen ihres Durchmessers ist.

8. Vorrichtung nach einem der Ansprüche 2 bis 6, in der die Länge der Schleiftrommel (8) kleiner als oder gleich dem 1,8-fachen ihres Durchmessers ist.

9. Vorrichtung nach einem der Ansprüche 2 bis 8, in der das Antriebsmittel (12) zur intermittierenden Drehung der Schleiftrommel in entgegengesetzte Richtungen eingerichtet ist.

10. Vorrichtung nach einem der Ansprüche 2 bis 9, die ferner Träger (8c) zum Tragen zu schleifender Gegenstände (10) in der Schleiftrommel (8) aufweist.

11. Vorrichtung nach einem der Ansprüche 2 bis 9, die ferner eine Tragwelle (8d) zum Tragen zu schleifender Gegenstände (10) in der Schleiftrommel (8) aufweist.

12. Vorrichtung nach einem der Ansprüche 2 bis 11, in der die Schleiftrommel (8) eine Innenkammer zur Aufnahme zu schleifender Gegenstände aufweist, wobei die Innenkammer in der Achsrichtung und/oder der Radialrichtung zur Bildung einer Mehrzahl von Unterkammern (31) unterteilt ist.

13. Vorrichtung nach einem der Ansprüche 2 bis 12, in der die Schleiftrommel eine Außentrommel (35) und eine Innentrommel (34) mit der gleichen Außenform wie die Außentrommel aufweist, wobei die Innentrommel mit einer Öffnung (36) versehen und in der Außentrommel entfernbar aufgenommen ist.

14. Vorrichtung nach einem der Ansprüche 2 bis 12, in der die Schleiftrommel eine Außentrommel (35) und eine Mehrzahl von Innentrommeln (34) aufweist, die in der Außentrommel entfernbar aufgenommen sind, wobei die jeweiligen Innentrommeln parallel in der Achsrichtung oder mit einem vorbestimmten Winkel bezüglich der Achsrichtung zur Bildung einer

Mehrzahl von Unterkammern unterteilt sind.

15. Vorrichtung nach einem der Ansprüche 2 bis 14, die eine Mehrzahl der schleiftrommeln (8) aufweist.

Revendications

1. Procédé de meulage oomprenant les étapes de :

monter de manière rotative un tonneau de meulage (8) sur un axe de rotation écarté de l'axe central de rotation d'un tambour rotatif (2) mais parallèle à celui-ci ;

enfermer un matériau de meulage et des objets à meuler dans ledit tonneau de meulage ; et

meuler lesdits objets par rotation dudit tonneau de meulage dans des sens identiques et opposés au sens dans lequel ledit tambour rotatif est mis en rotation ; caractérisé en ce que l'axe de rotation du tonneau de meulage est décalé de l' axe géométrique central du tonneau de meulage mais est paralléle à celui-ci.

2. Appareil de meulage comprenant :

un tambour rotatif (2) monté à rotation autour d'un axe central ;

un tonneau de meulage (8) monté de manière rotative sur un axe de rotation écarté dudit axe central du tambour rotatif mais parallèle à celui-ci ; et

des moyens d'entraînement (12) pour faire tourner ledit tonneau de meulage dans des sens identiques et opposés au sens de rotation dudit tambour rotatif ; caractérisé en ce que l'axe de rotation du tonneau de meulage est décalé de l'axe géométrique central du tonneau de meulage mais est parallèle à celui-ci.

3. Appareil selon la revendication 2, dans lequel ledit tonneau de meulage (8) est monté au moyen d'un bâti (11) qui est lui-même monté sur un arbre rotatif (13) dont l'axe est l'axe de rotation du tonneau de meulage.

4. Appareil selon la revendication 3, dans lequel ledit arbre (13) de montage du bâti est monté entre deux plaques (2a) formant des parois latérales dudit tambour rotatif (2).

5. Appareil de meulage selon l'une quelconque des revendications 2 à 4, dans lequel ledit tonneau de meulage (8) est muni d'un poids d'équilibrage (17).

6. Appareil selon la revendication 5, dans lequel ledit poids d'équilibrage (17) est un volant.

7. Appareil selon l'une quelconque des revendications 2 à 6, dans lequel la longueur dudit tonneau de meulage (8) est plus grande ou égale à 1,3 fois le diamètre de celui-ci.

8. Appareil selon l'une quelconque des revendications 2 à 6, dans lequel la longueur dudit tonneau de meulage (8) est inférieure ou égale à 0,8 fois le diamètre de celui-ci.

9. Appareil selon l'une quelconque des revendications 2 à 8, dans lequel lesdits moyens d'entraînement (12) sont agencés pour faire tourner ledit tonneau de meulage dans des sens opposés de manière intermittente.

10. Appareil selon l'une quelconque des revendications 2 à 9, comprenant en outre des supporte (8c) pour supporter des objets (10) à meuler dans ledit tonneau de meulage (8).

11. Appareil selon l'une quelconque des revendications 2 à 9, comprenant en outre un arbre de support (8d) pour supporter des objets (10) a meuler dans ledit tonneau de meulage (8).

12. Appareil selon l'une quelconque des revendications 2 à 11, dans lequel ledit tonneau de meulage (8) a une chambre interne pour loger des objets à meuler, ladite chambre interne étant divisée dans la direction axiale et/ou dans la direction radiale pour former une pluralité de sous-chambres (31).

13. Appareil selon l'une quelconque des revendications 2 à 12, dans lequel ledit tonneau de meulage comprend un tonneau extérieur (35) et un tonneau intérieur (34) ayant la même forme externe que le tonneau extérieur, le tonneau intérieur étant muni d'une ouverture (36) et étant reçu de manière amovible dans le tonneau extérieur.

14. Appareil selon l'une quelconque des revendications 2 à 12, dans lequel ledit tonneau de meulage comprend un tonneau extérieur (35) et une pluralité de tonneaux intérieurs (34) reçus de manière amovible dans le tonneau extérieur, les tonneaux intérieurs respectifs étant divisés en parallèle dans la direction axiale ou à un angle prédéterminé par rapport à la direction axiale pour former une pluralité de sous-chambres.

15. Appareil selon l'une quelconque des revendications 2 à 14, comprenant une pluralité desdits tonneaux de meulage (8).

FIG 1

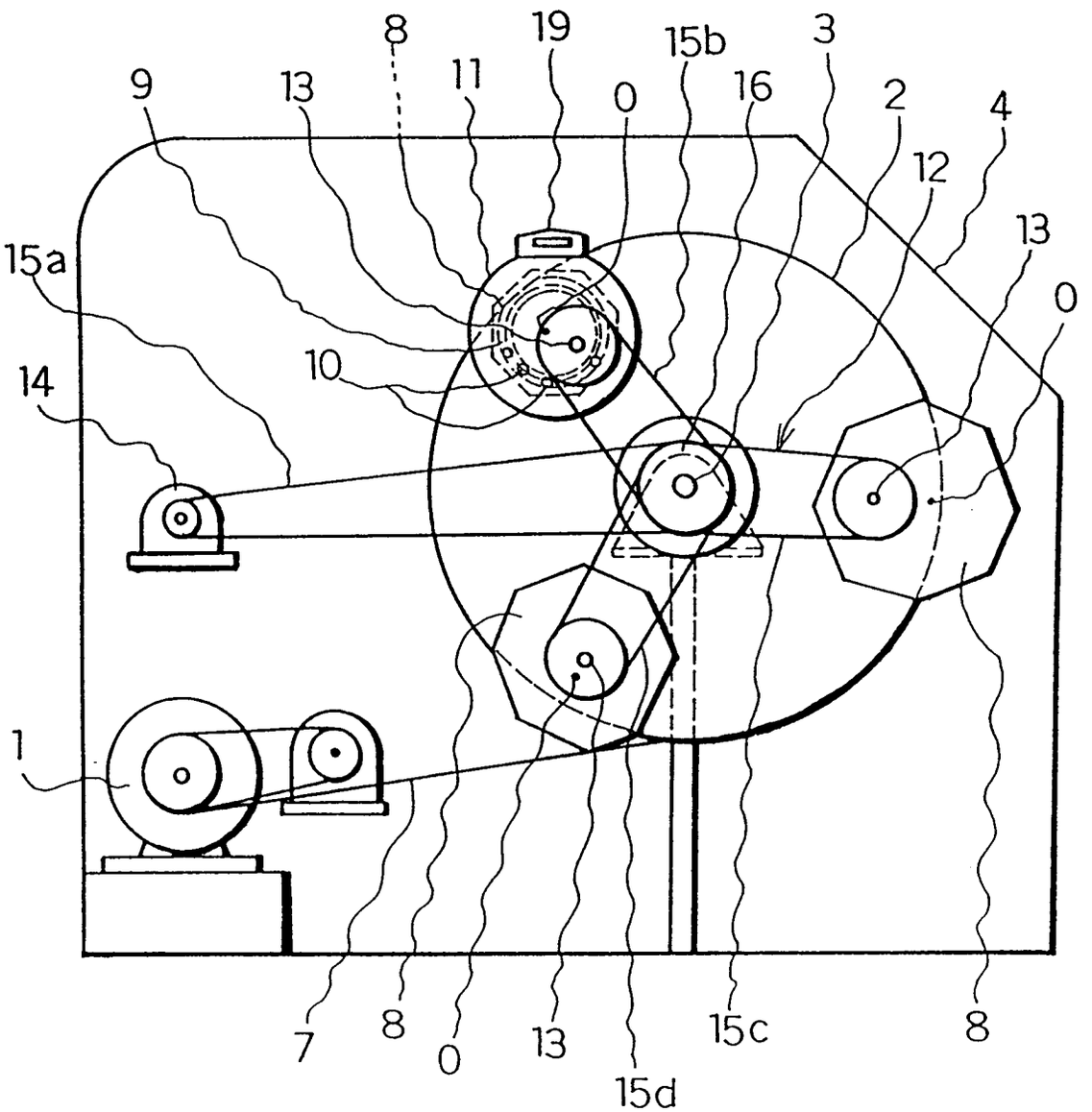

FIG 2

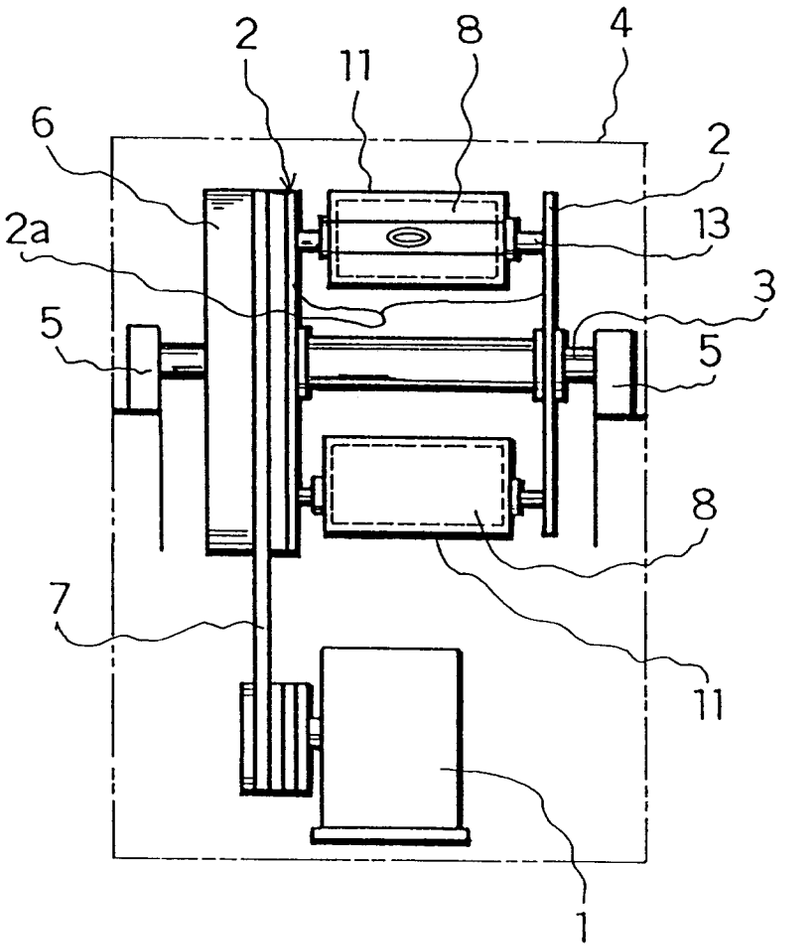

FIG 3(a)

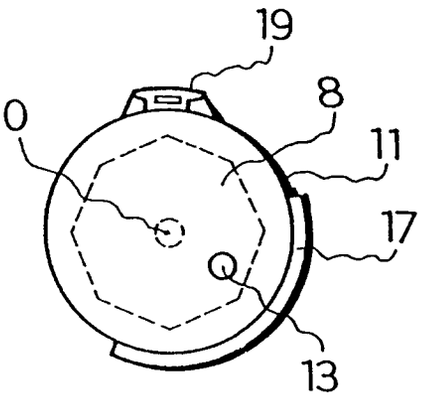

FIG 3(b)

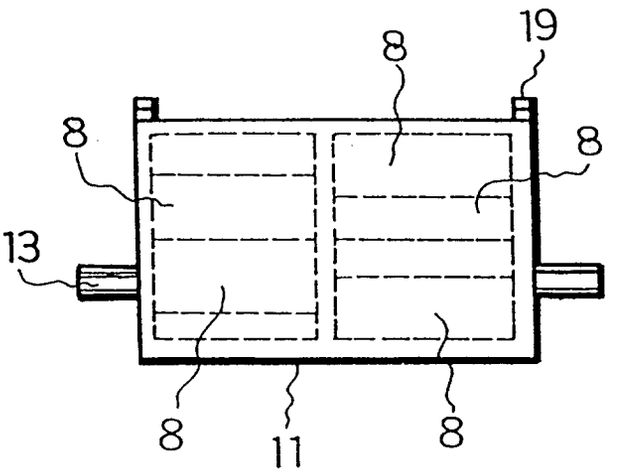

FIG 3(c)

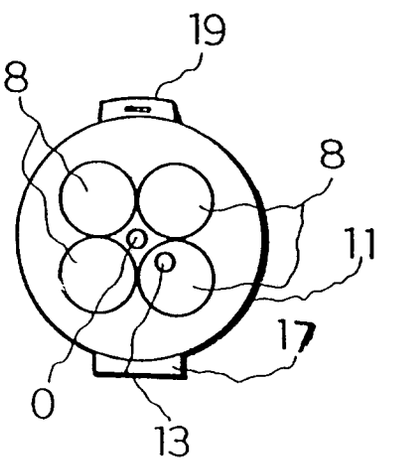

FIG 4

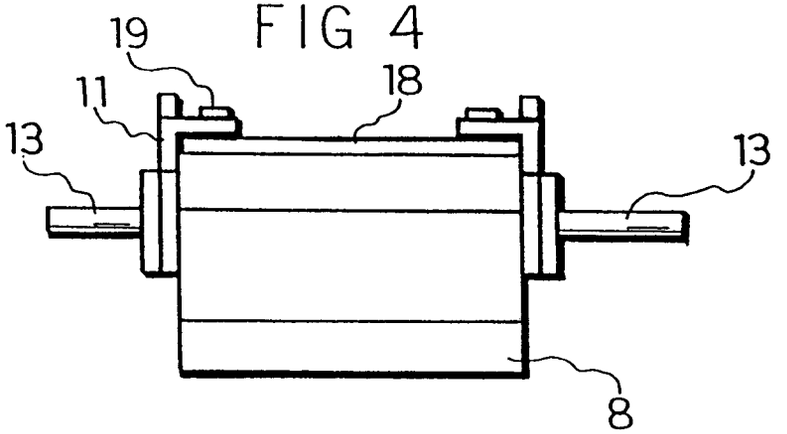

FIG 5

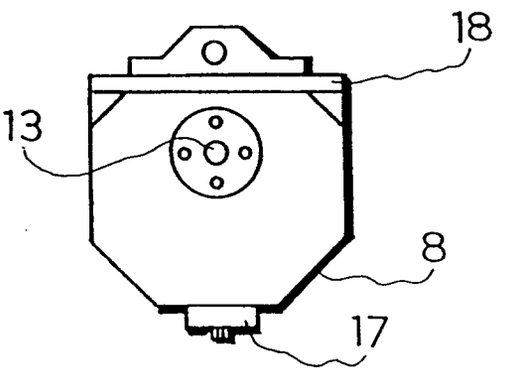

FIG. 6

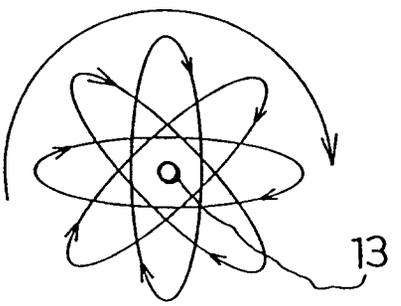

FIG 7

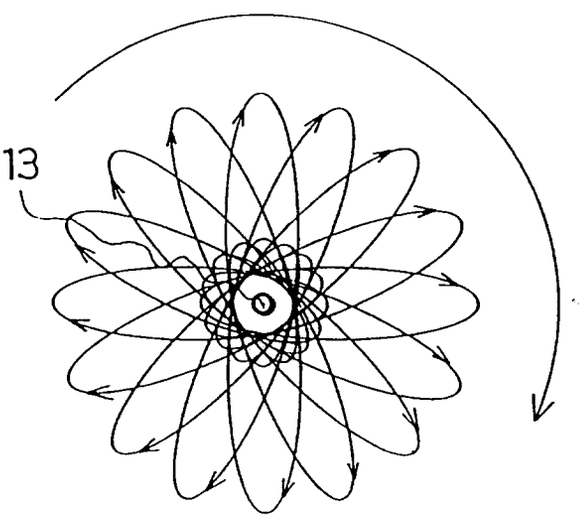

FIG 8

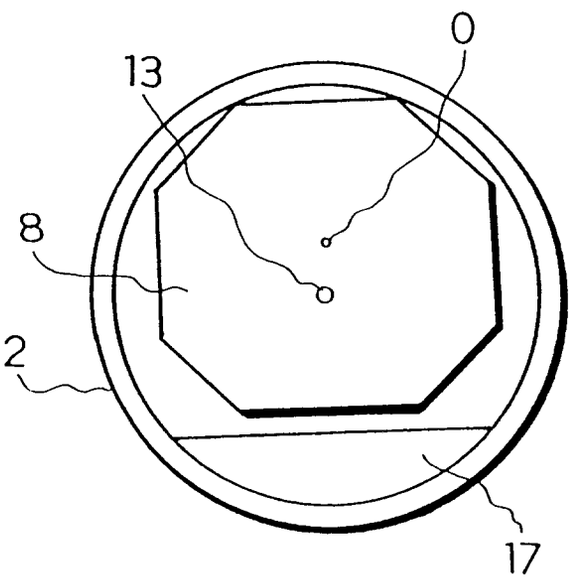

FIG 9(a)

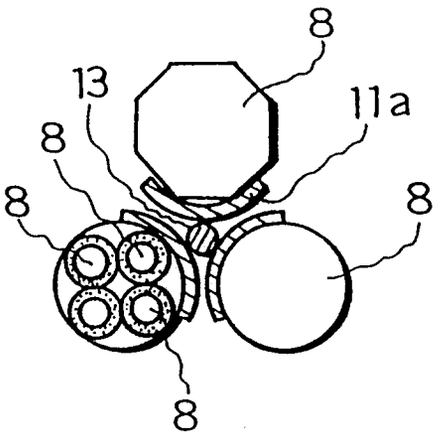

FIG 9(b)

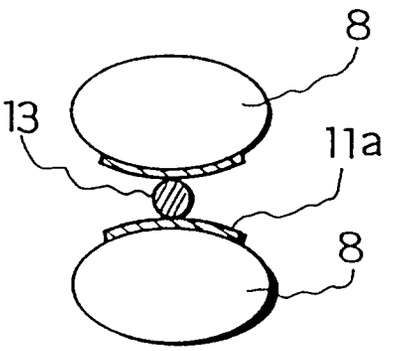

FIG 9(c)

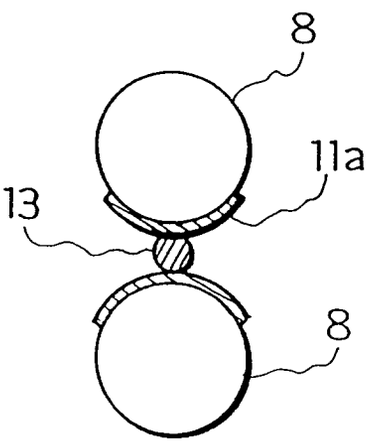

FIG 10

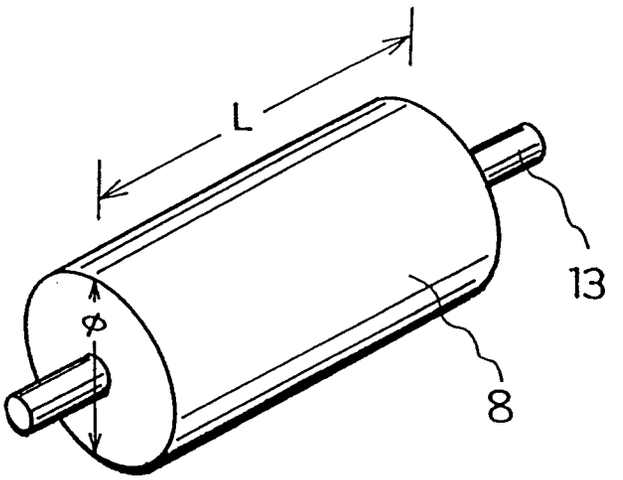

FIG 11

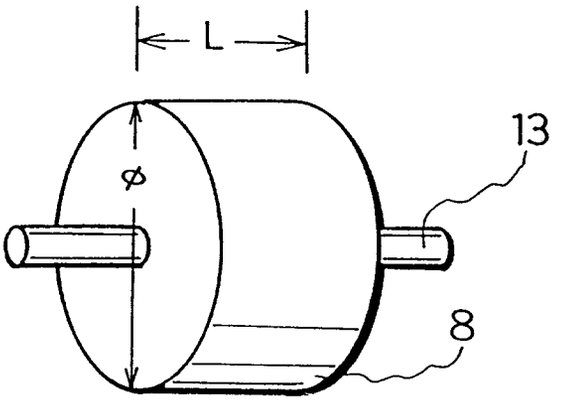

FIG 12

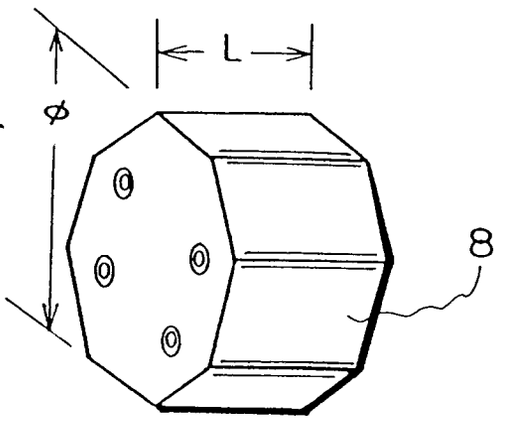

FIG 13

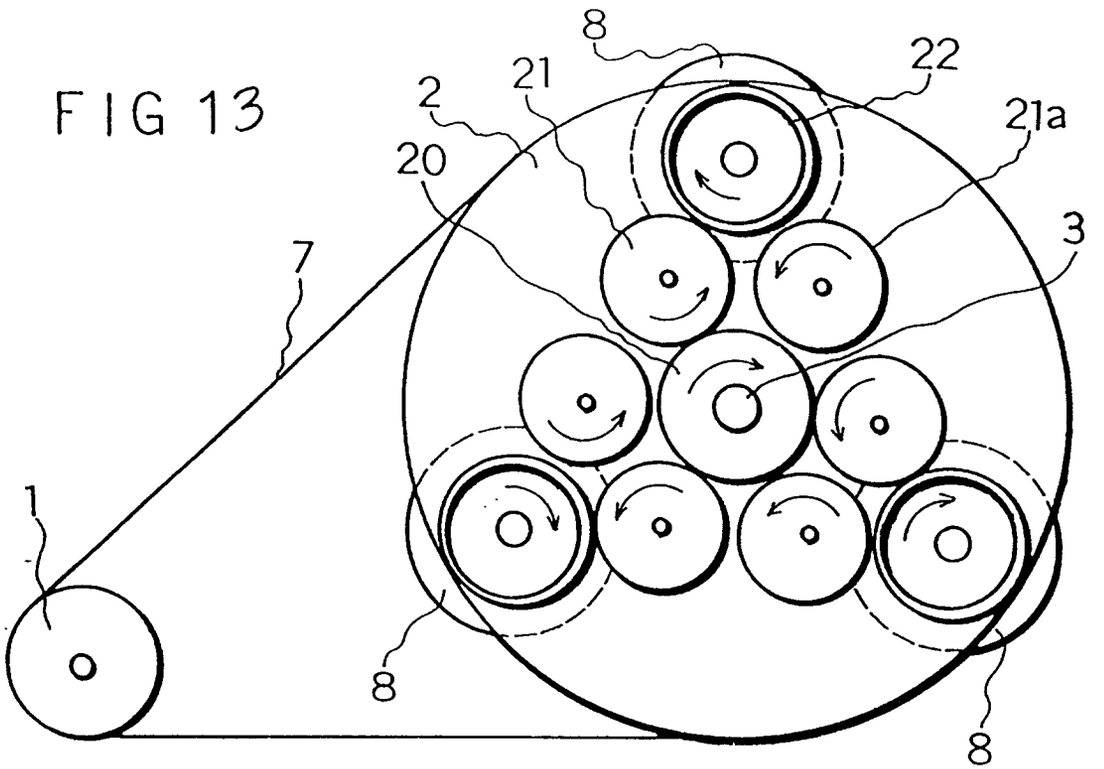

FIG 14

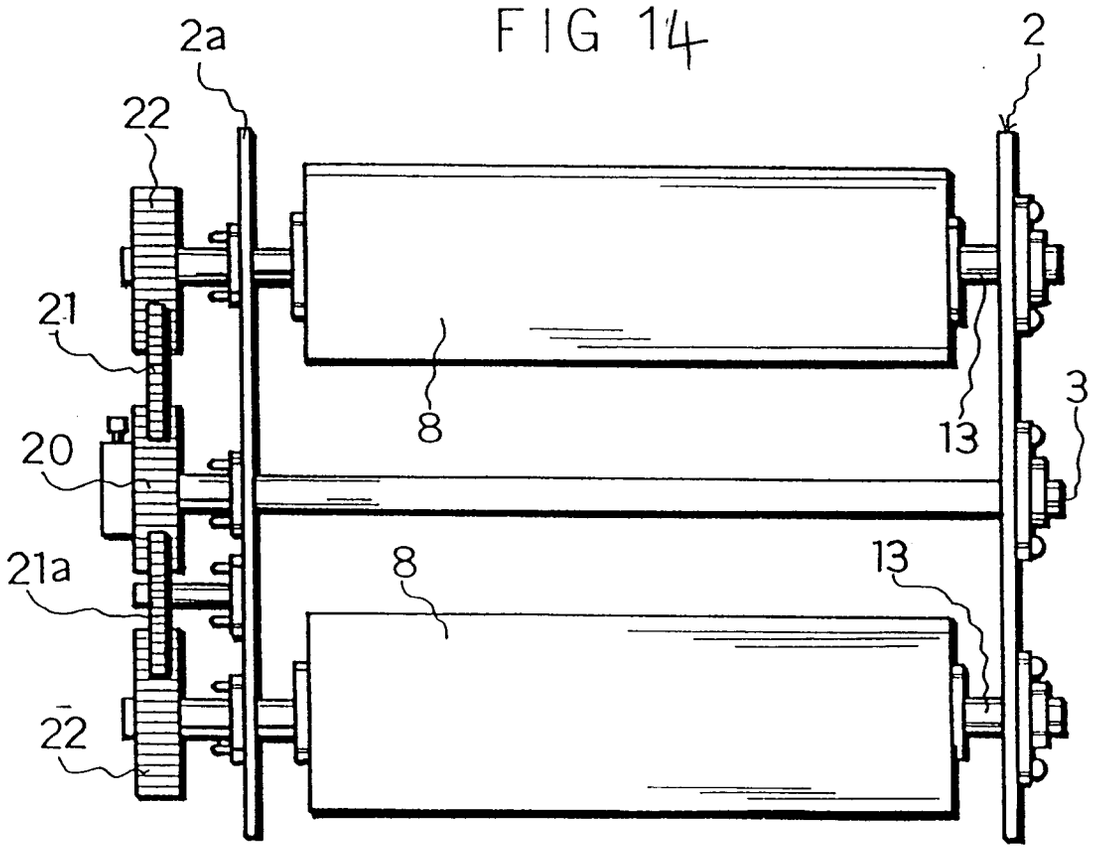

FIG 15(a)

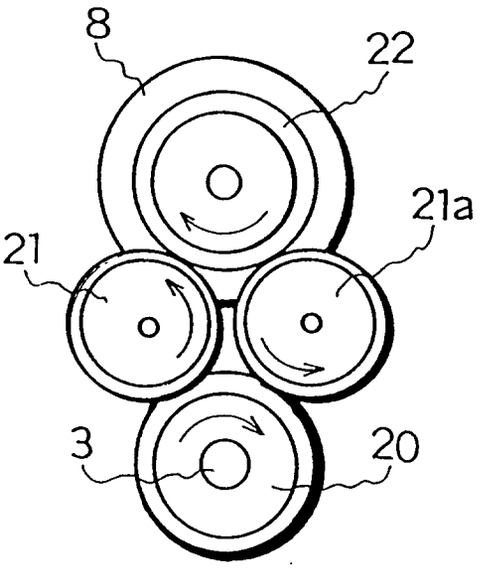

FIG 15(b)

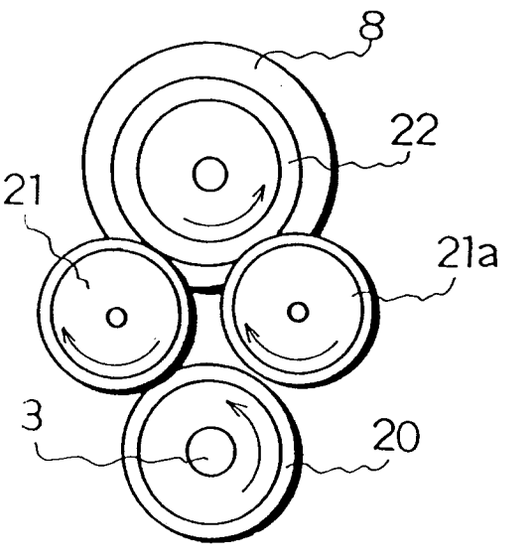

FIG 16

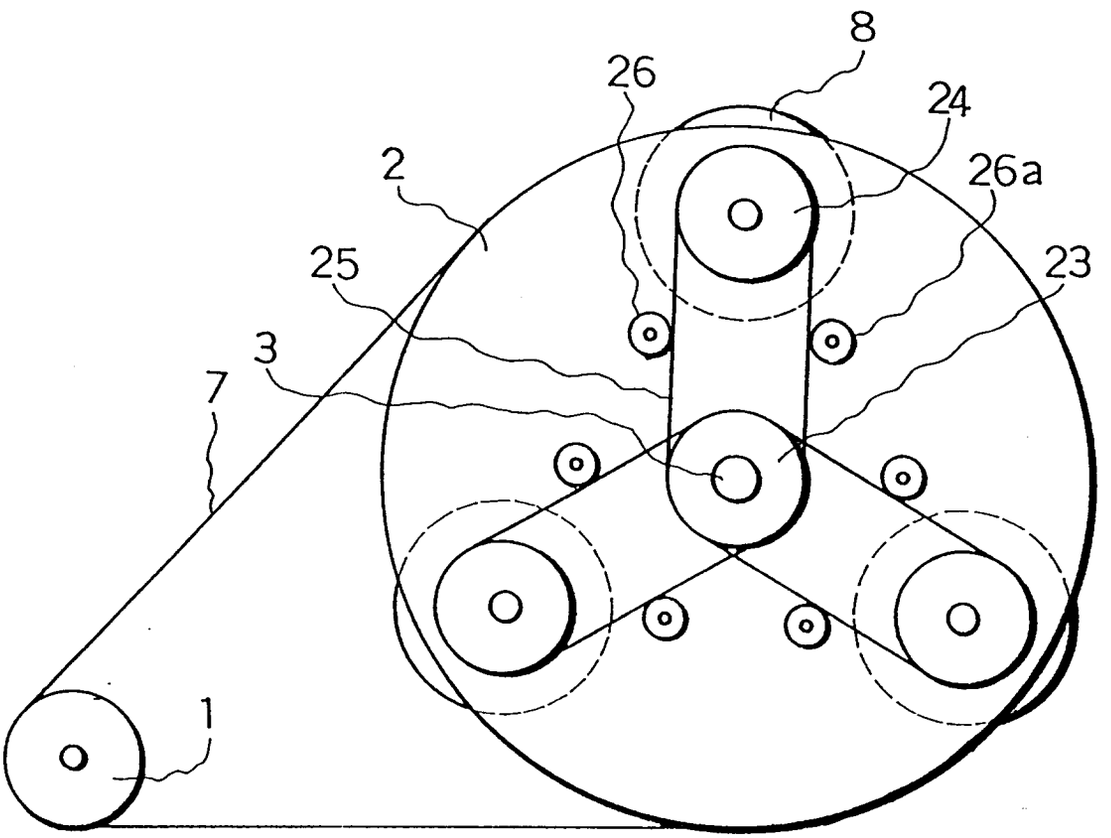

FIG 17(a)

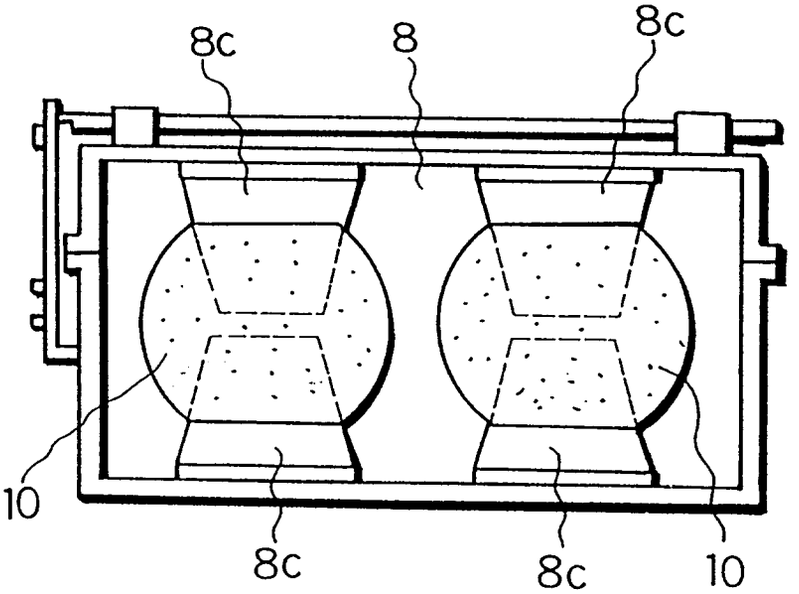

FIG 17(b)

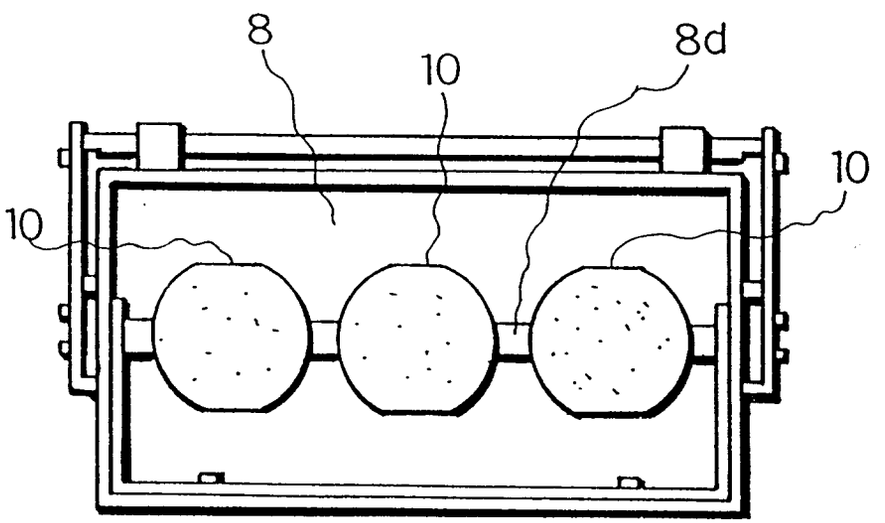

FIG 18 (a)

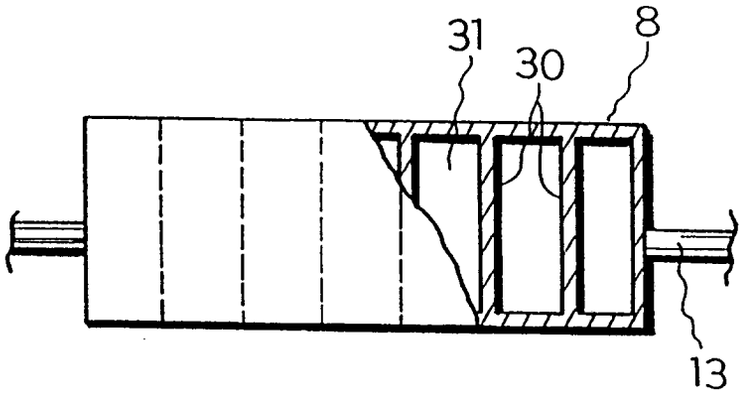

FIG 18(b)

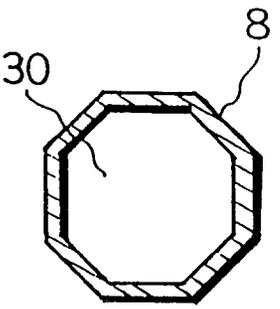

FIG 19(a)

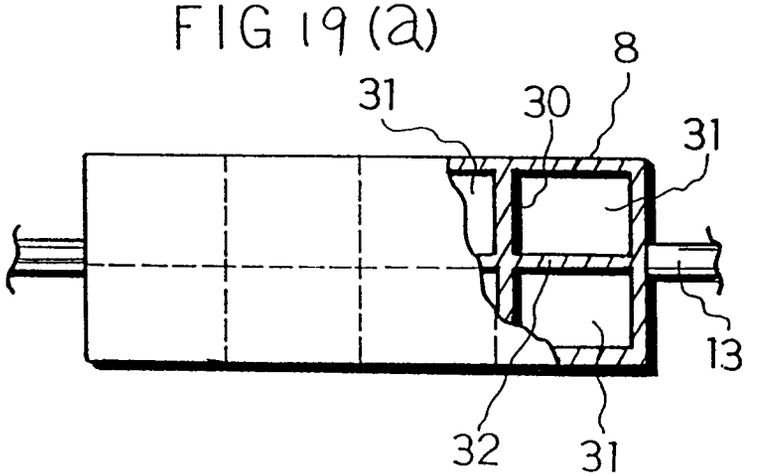

FIG 19(b)

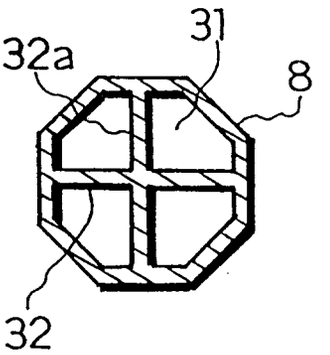

FIG 20(a)

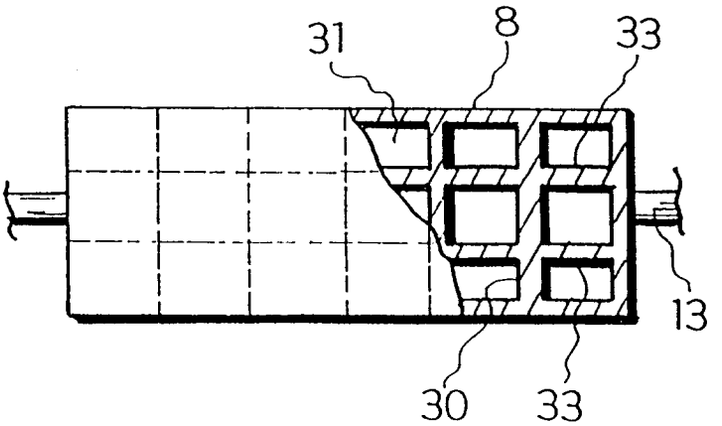

FIG 20(b)

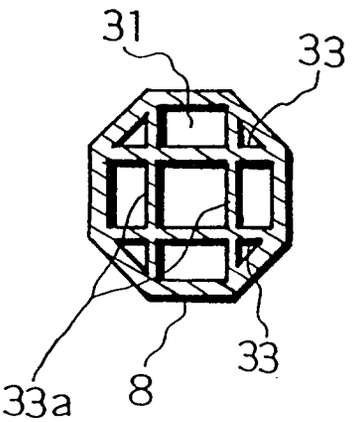

FIG 21

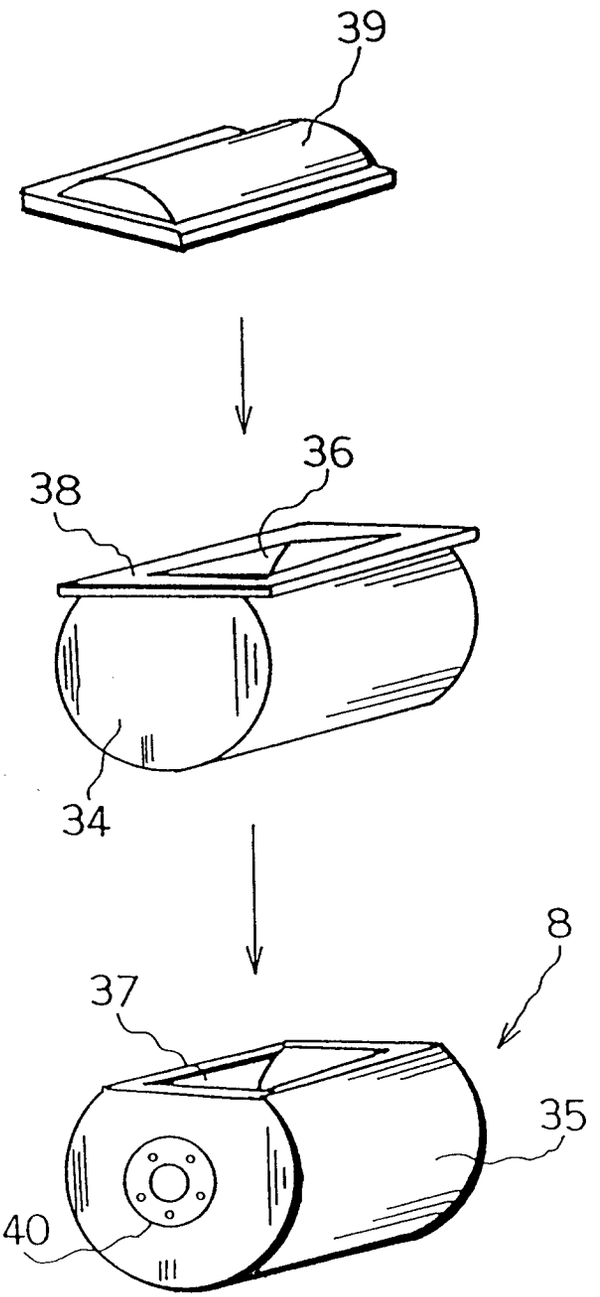

FIG 22(a)

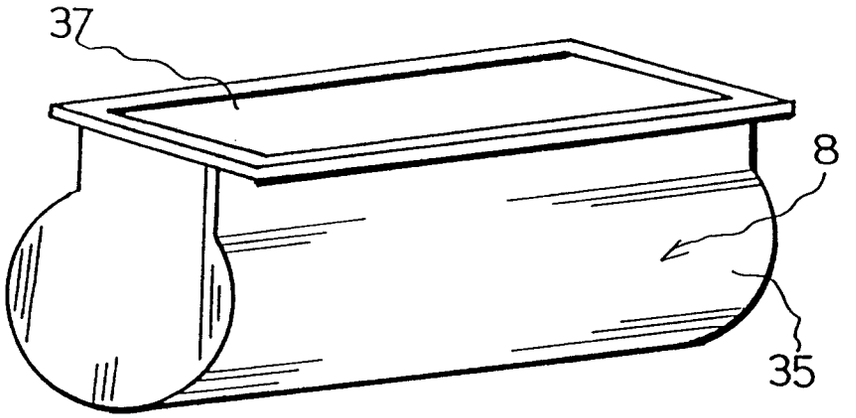

FIG 22(b)

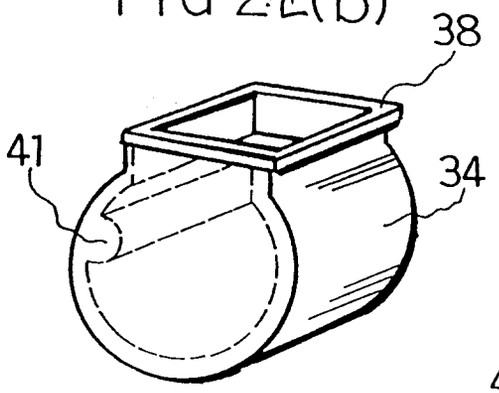

FIG 22(c)

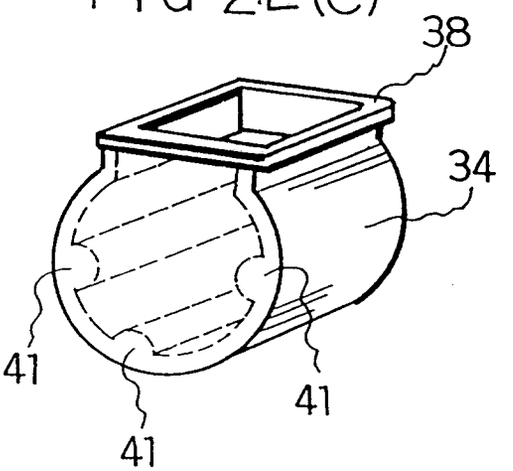

FIG 22(d)

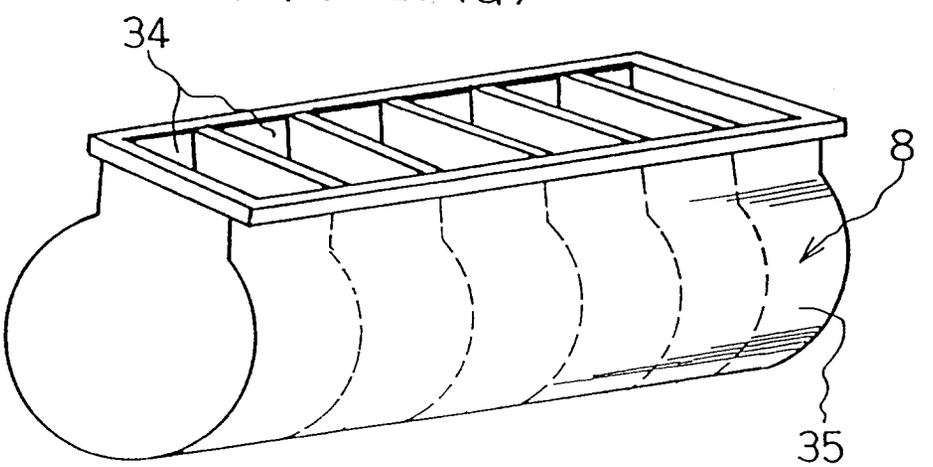

FIG 22(e)

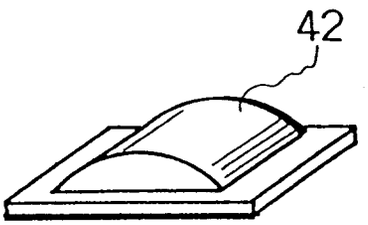

FIG 23

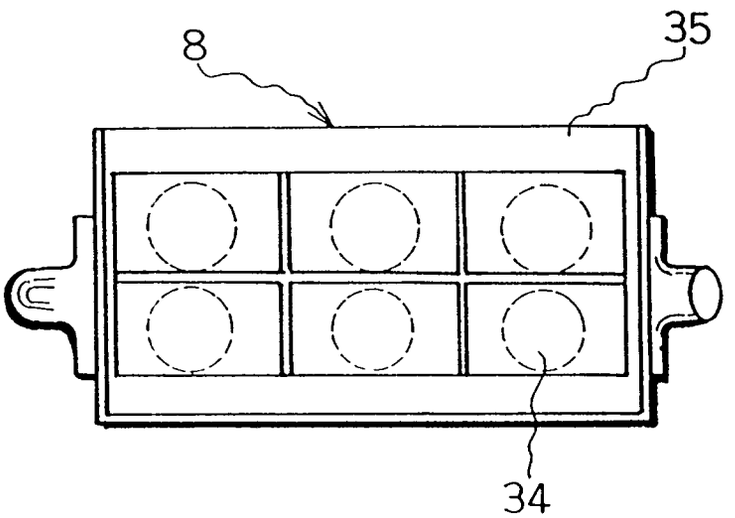

FIG 24

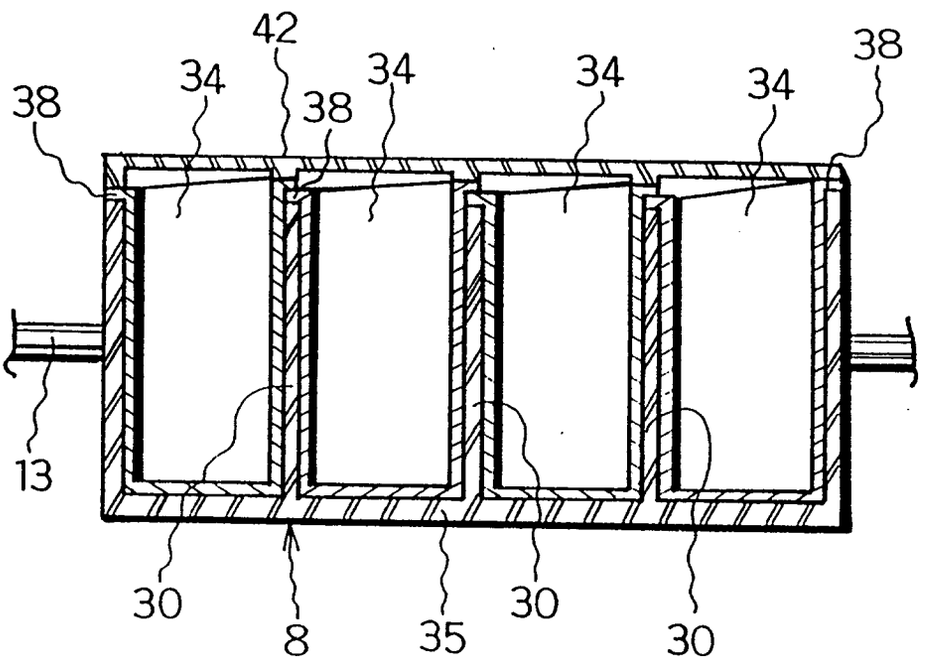

FIG 25(a)

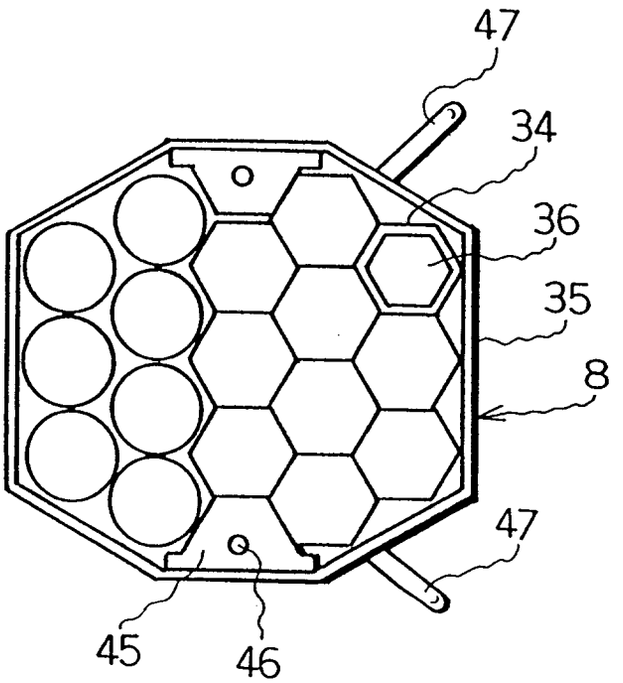

FIG 25(b)

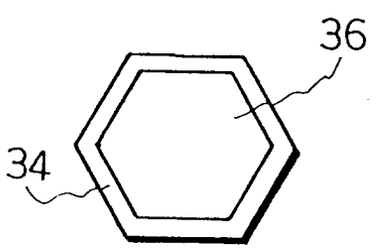

FIG 25(C)

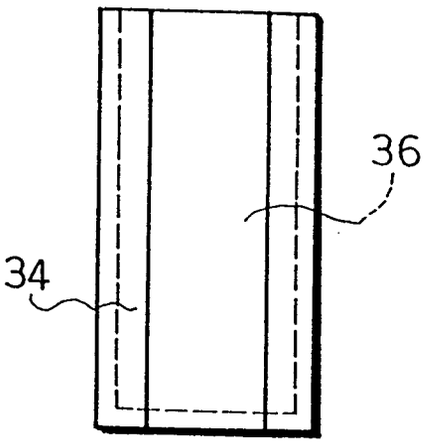

FIG 25(d)

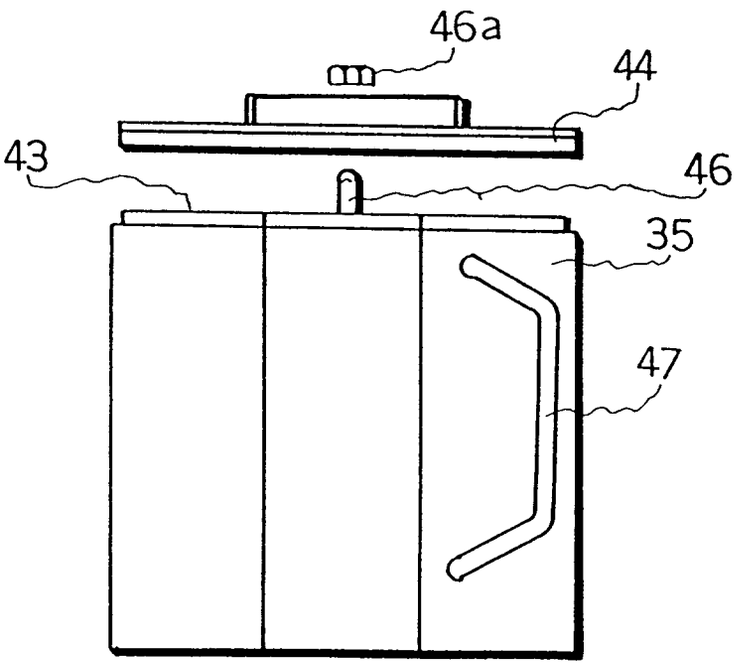

FIG 26(a)

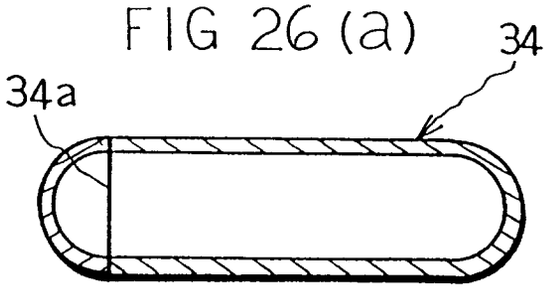

FIG 26(b)

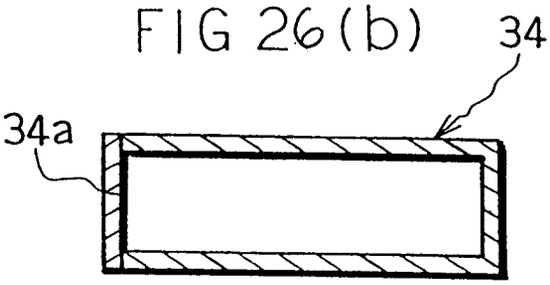

FIG 26(c)

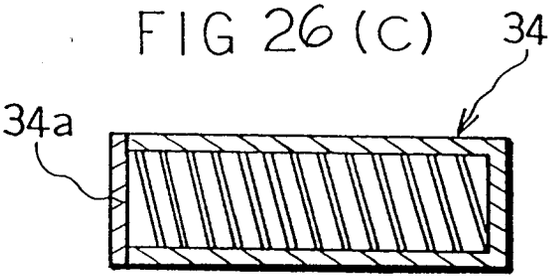

FIG 26(d)

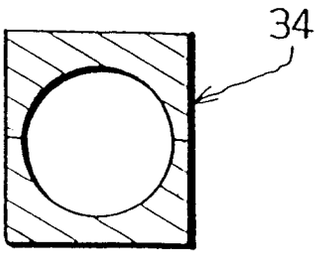

FIG 27

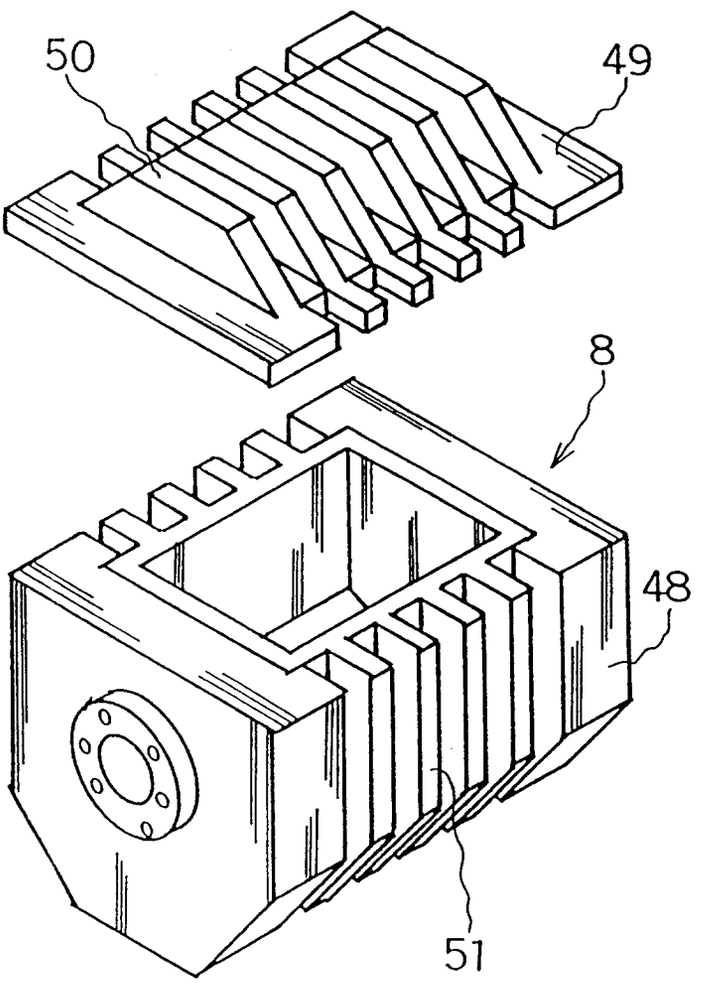

FIG 28(a)

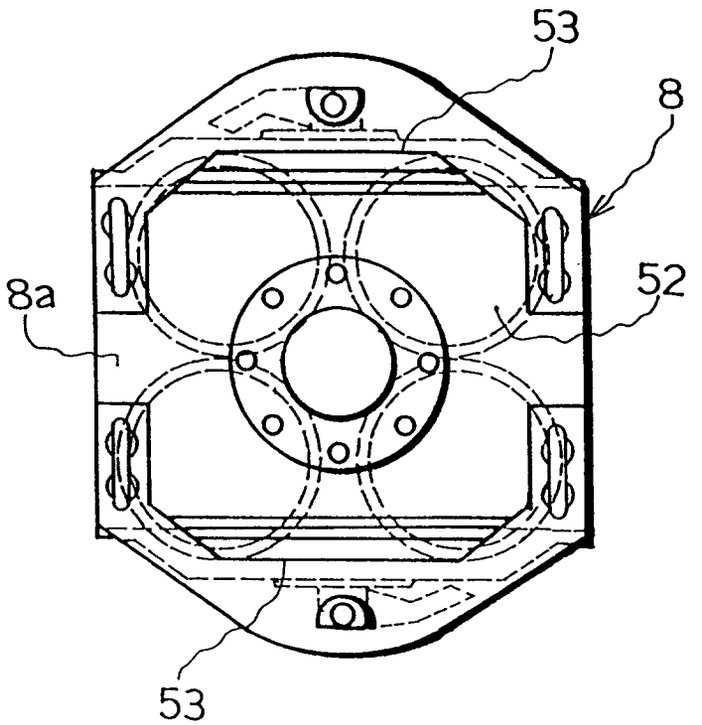

FIG 28(b)

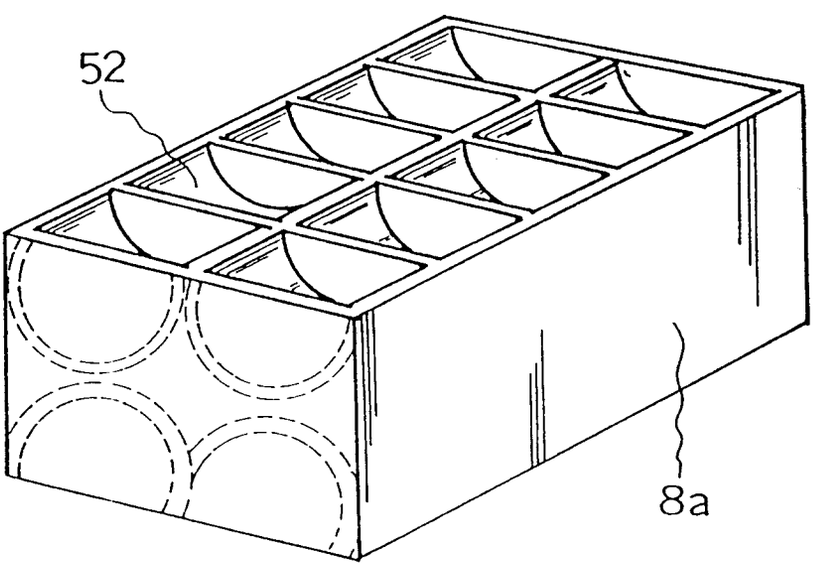

FIG 29

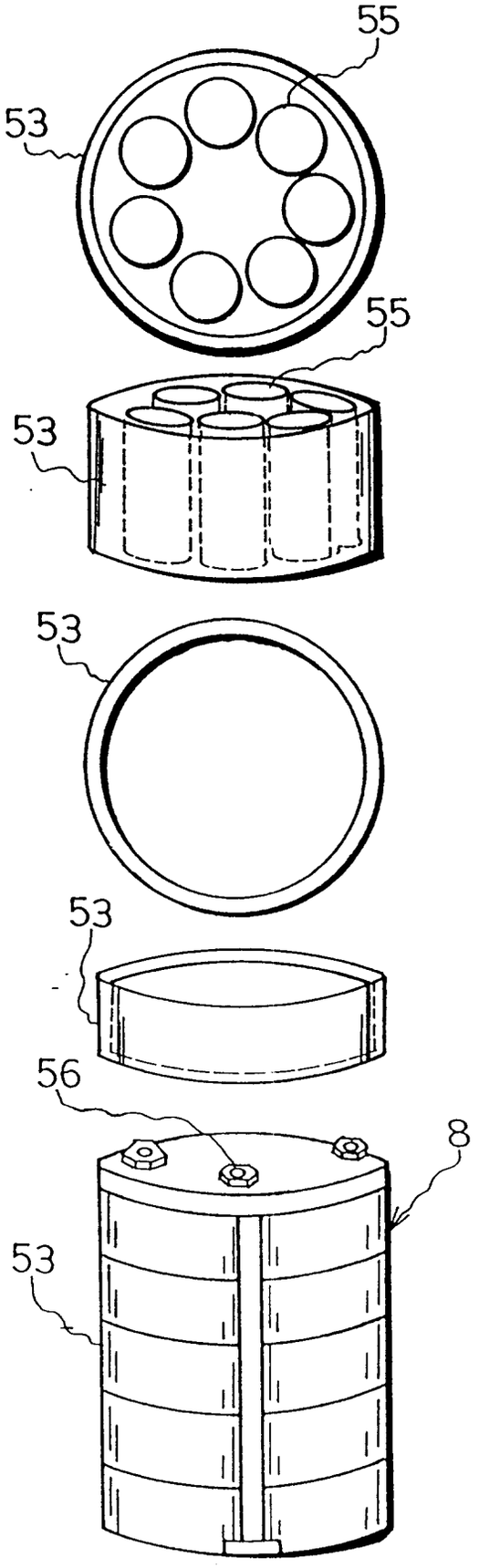

FIG 30

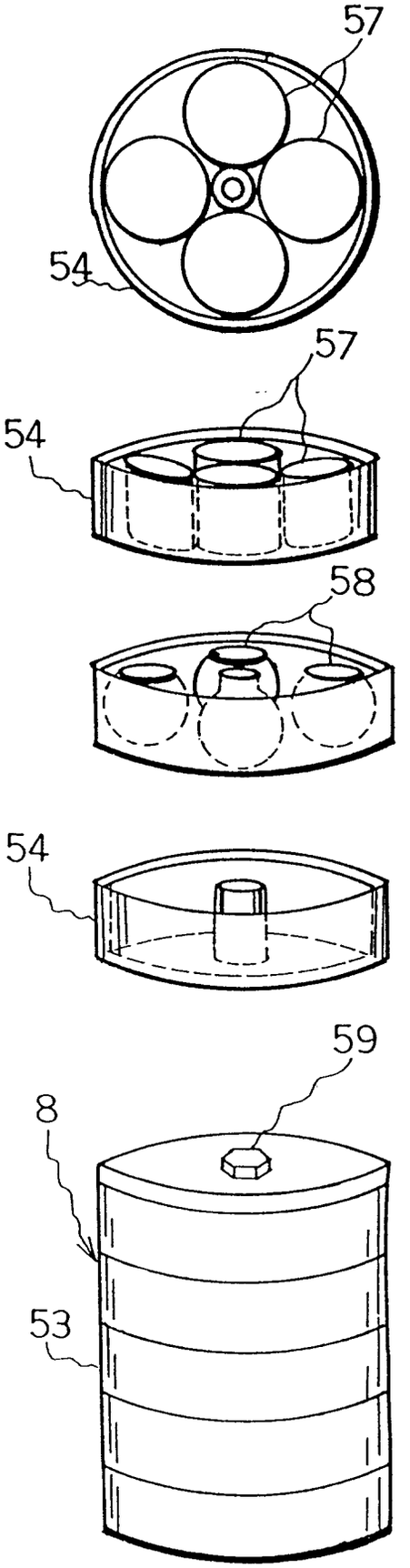

FIG 31

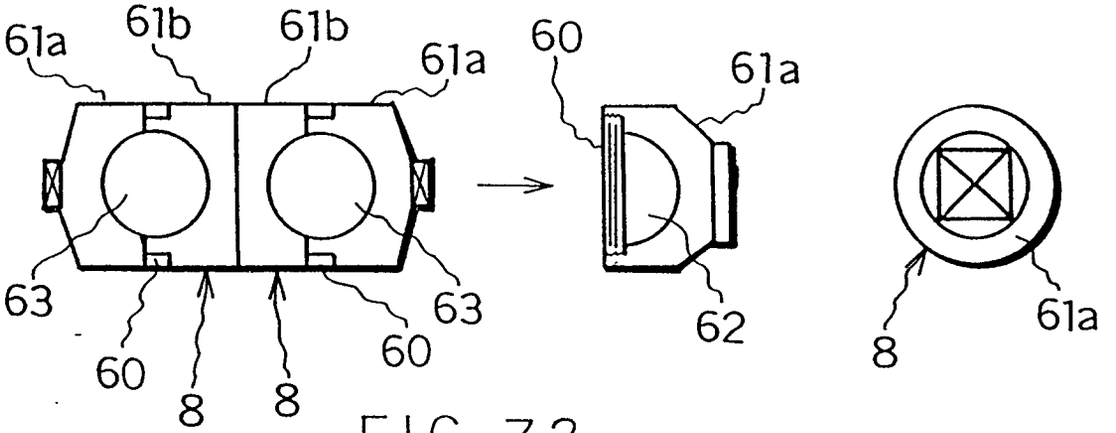

FIG 32

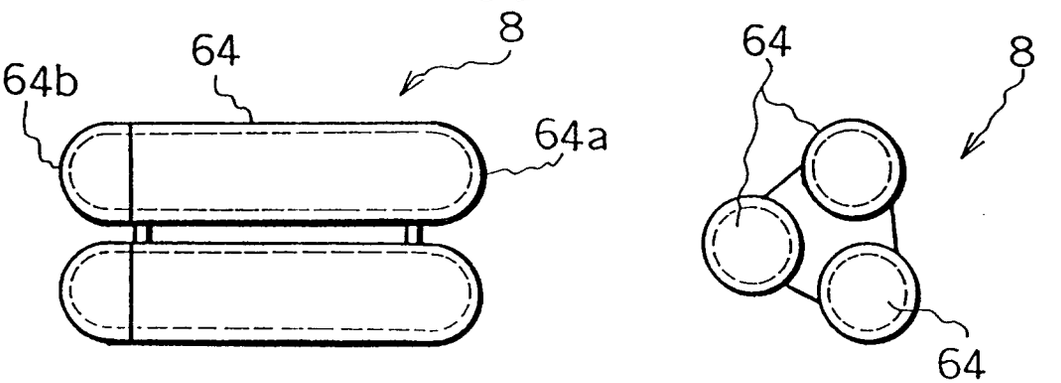

FIG 33