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(54) An apparatus for surface finishing.

(57) An apparatus for surface finishing faces on workpieces which are moved past, comprising sanding heads which may be caused to rotate about an axis which is preferably perpendicular to the faces being finished, a plurality of sanding spindles protruding radially from a sanding head, the axes of the spindles being substantially parallel with the faces being finished, said spindles being so connected with respective sanding heads that in addition to being caused to rotate about their own axes they can also be caused to rotate about the axis of the sanding head. The apparatus comprises two sanding heads which are arranged successively so that they have substantially the same working region on a passing workpiece, and moreover comprises means for rotating the first sanding head in one direction and the second in an opposite direction.

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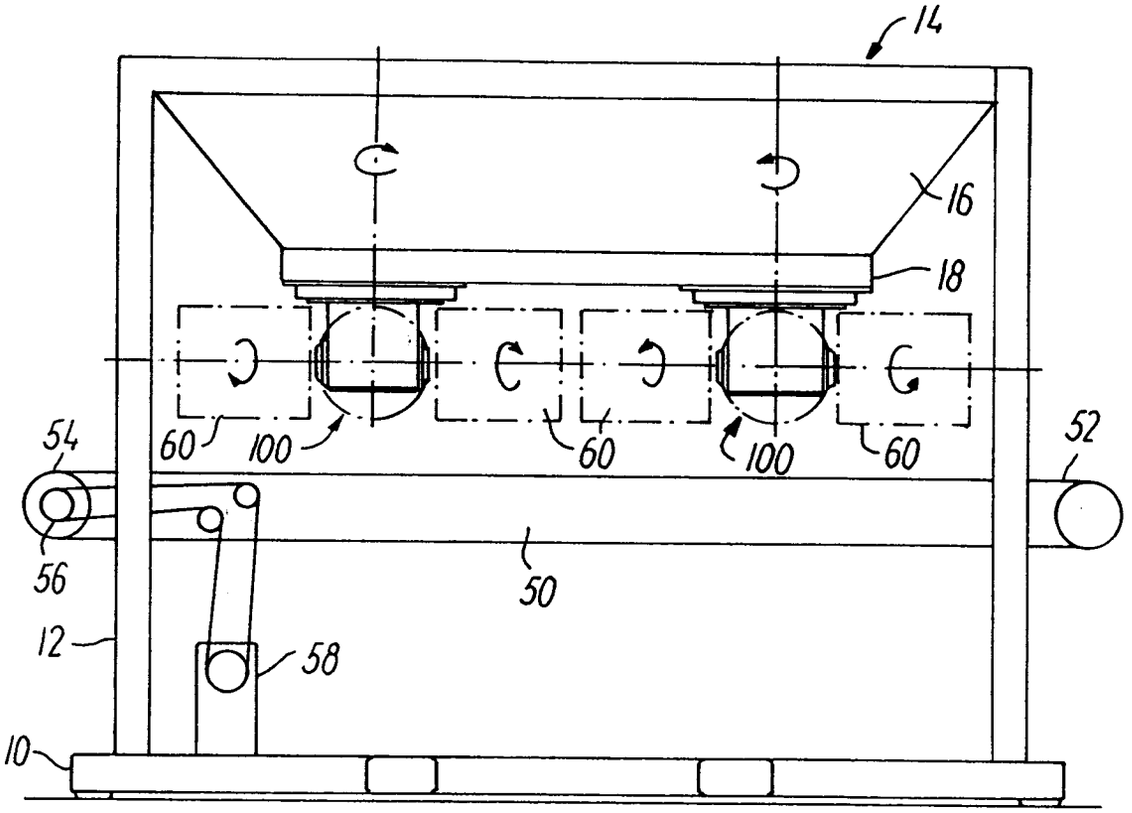

FIG. 1

The invention concerns an apparatus for finishing surfaces on workpieces by moving these past rotating sanding or polishing elements which are caused to rotate about their own longitudinal axis, while the elements are caused to perform a circular movement over the workpiece being finished. Such an apparatus of the above-mentioned type is often referred to as a carousel machine.

Carousel machines according to the prior art comprise an upstanding carousel element at right angles to the face being finished. The carousel element mounts a sanding head with a plurality of radially protruding sanding spindles with cylindrical sanding elements, which in operation are caused to rotate about the longitudinal axis of the spindles over the face being finished, while the sanding head is caused to rotate about its axis. The workpieces are placed manually or automatically on a conveyor moving them past the sanding head, during which passage the face of the workpiece in question is finished.

To maintain a high production rate the workpieces are advanced on the conveyor with a relatively high speed, e.g. 5-6 m/min or about 10 cm/sec. Typically, the sanding elements on the spindles have a diameter of 25-30 cm and may be caused to rotate with e.g. 1000 rpm. The carousel is rotated so that the sanding elements are moved in a circular working region around the axis of rotation of the carousel. Sanding according to the prior art proceeds unsymmetrically in several ways. If e.g. all the sanding elements on the carousel rotate in the same direction, they will pass the surface of the workpiece with a relatively great speed in the side where they rotate against the feed direction of the workpiece, while they will pass in cumflow at the other side and can therefore work relatively longer in the same region. A difference in sanding effect of minimum 25% can often be observed between the cumflow side and the counterflow side, which may e.g. mean that a lacquered door panel is sanded insufficiently at one side, while the lacquer is sanded away at the other side.

To ensure that two successively positioned sanding elements overlap a workpiece so that it does not have an unfinished rim area of varying width, the speed of rotation of the carousel itself must be suitably high. Such a high speed of rotation is unfortunate since the sanding elements will not have time to penetrate into the profiles of the workpiece. This problem is solved according to the prior art by reducing the speed - both the feed speed of the conveyor as well as the speed of the carousel, which is of course an unacceptable solution.

Others try to solve the problem by providing the carousel element with more spindles than six, e.g. eight or ten, whereby the unfinished rim area can be eliminated, but for the necessary torque to be imparted to the spindles, the diameter of the hub of the carousel element has to be increased significantly. This involves disuniform sanding of in particular small workpieces, which gives the machine a large, passive area just below the carousel element, and this area does not contribute to the finishing process.

Others (US 4 646 473) have tried to compensate for the unsymmetrical sanding occurring in the cumflow side and the counterflow side, respectively, by turning the direction of rotation of every other spindle. This entails that the areas in the sides of the finished workpieces, i.e. to the right and to the left of the centerline of the machine, are alternately worked with a sanding element in cumflow and one in counterflow so that the finished face has a characteristic "washboard"-like structure.

The object of the invention is to provide an apparatus for surface finishing of workpieces, which are given a high flow rate, the surface being treated symmetrically so that the drawbacks of the prior art of disuniform sanding or polishing in the cumflow side and the counterflow side are eliminated. Further, the diameter of the hub of the carousel element should desirably be reduced so that the passive area below the carousel element is diminished.

This object is achieved in that the apparatus is provided with two sanding heads mounted successively so that they have substantially the same working area on a suitable workpiece, said apparatus comprising means for rotating the first sanding head in one direction and the second in an opposite direction.

The second head will hereby compensate for the unsymmetrical working or finishing which the first head applies to the workpiece.

In addition to the opposite direction of rotation of the carousel elements, the spindles may advantageously be mounted so that they rotate clockwise on one head and counterclockwise on the other.

The two carousel elements may expediently be driven by a common drive, such as an electric motor. Likewise, the rotation of the spindles on the two carousel elements may be driven by a drive common to the two pairs of spindles.

Alternatively, a powerful electric motor can drive both the rotation of the spindles and the rotation of the carousel elements.

The invention will be explained more fully by the following description of a preferred embodiment with reference to the drawing, in which

fig. 1 is a side view of a preferred embodiment of an apparatus for finishing surfaces according to the invention,

fig. 2 is an end view of the apparatus shown in fig. 1,

fig. 3 schematically shows a preferred embodiment of the power transfer configuration, seen from above, for the apparatus shown in fig. 1,

fig. 4 is a side view of part of the configuration shown in fig. 3,

fig. 5 is a schematic side view of the rotatable parts in a sanding head,

fig. 6 shows schematically how the spindles are caused to rotate through engagement with the crown wheel shown in fig. 5,

fig. 7 shows a preferred embodiment of the movement of thefinishing tool according to the invention, and

fig. 8 shows schematically how the apparatus according to the invention can be built so as to comprise four rotating sanding heads.

Figs. 1 and 2 show a preferred embodiment of the apparatus for surface finishing of workpieces. The apparatus comprises a frame including a horizontally positioned, rectangular base 10, four preferably vertical legs 12 which are secured in each of the four corners of the base. The frame moreover comprises an upper, horizontal frame member 14 which is attached to each of the four legs 12. The frame is moreover stiffened with a plurality of cross braces; a pyramidal housing 16 extends downwardly from the upper frame member 14 and terminates in an inner, horizontal frame 18 which carries the actual carousel elements.

The frame moreover mounts a conveyor 50 adapted to move the workpieces to be finished past the sanding heads; this conveyor 50 comprises a conveyor belt which is stretched by two rollers 52, 54, said conveyor belt being driven by an electric motor 58 which is secured to the base 10, and which has a wheel on its drive shaft, said wheel being connected through a V-belt to a wheel 56 on one of the rollers of the conveyor. The electric motor 58 is thus adapted to drive the conveyor through the belt drive, which usually takes place by continuous operation.

The inner frame 18 carries two sanding heads 100 each of which, as appears from fig. 7, has four spindles with sanding elements 60. As shown, the sanding heads 100 are adapted to rotate about a vertical axis, and the sanding elements 60 can then simultaneously rotate about their own horizontal longitudinal axis. This will be explained more fully below.

Fig. 3 shows the inner horizontal frame 18 which accommodates a plate 20 carrying partly two electric motors 22, 24, two drive wheels 26, 28 and two carousel elements 30, 32. The electric motor 24, which rotates the carousel units, are shown from the side in fig. 4. A plurality of details are omitted for clarity; it may e.g. be mentioned that the electric motor 24 has a motor casing 40 which is attached to the frame of course, but this is not shown in the drawing. The electric motor 24 has a drive shaft 41 which is journalled in two sets of roller bearings 42 for mechanical stability. A gear wheel 43, which meshes with a corresponding gear wheel 63 on a shaft 61, is secured on the drive shaft 41, said shaft 61 moreover carrying a drive wheel 64. The shaft 61 is journalled in two sets of roller bearings 62. Further, the drive shaft 41 mounts a drive wheel 44 which, in operation of the electric motor 24, rotates in a direction opposite to the drive wheel 64, which takes place because of the tooth engagement between the gear wheels 43, 63.

The two carousel elements are moreover indicated in fig. 4 which shows the top of a vertical shaft 81 on which a wheel 85 is secured. An additional wheel 84 is present below this wheel 85, the additional wheel 84 being secured to a shaft section arranged on the exterior of the shaft 81, as will be explained later in connection with fig. 5, so that the wheel 84 is movable with respect to the wheel 85. To the left on the carousel element the wheel 84 is connected with the wheel 64 through a V-belt 70 shown in fig. 3, while to the right on the carousel element the wheel 84 is connected with the drive wheel 44 on the drive shaft 41 of the electric motor 24 through a V-belt 71. Similarly, the other wheels 85 on the carousel elements are connected with the electric motor 22 through a V-belt 73 and a V-belt 72 connected with the wheel 26, respectively.

Fig. 5 shows an example of a carousel element where the upper wheel 85 is fixed to the shaft 81 in a manner known per se. The lower wheel 84 is secured to a shaft section 98 extending coaxially with the shaft 81, said shaft section 98 being connected with a horizontal, plate-shaped member 97 which peripherally merges into an upwardly directed bead and is rotatable with respect to the plate 20 about the vertical axis of the carousel element. The rotatability is ensured through an annular ball bearing 95, but the apparatus moreover comprises means for retaining the carousel in a vertical direction, but this problem is well-known by persons skilled in the art and will therefore not be described in more detail here. Thus, the sanding head is formed by the wheel 84, the plate-shaped member 97, the coaxially arranged shaft member 98 and also by a guard member 92, which, as shown in fig. 6, may be square in horizontal section, and a base plate 93 for guarding the gear wheels against dust. Further, a plurality of bearing casings 95 are attached to the guard 92.

The upper wheel 85, which is secured to the shaft 81 as mentioned before, is connected with the crown wheel 86 through a central shaft member. The central shaft member is rotatable with respect to the coaxially arranged shaft member 98, said rotatability being ensured through bearings 96 between the two shaft members. The crown wheel 86 is thus adapted to mesh with a plurality of conical gear wheels, so that rotation is transferred to the spindle shafts 91 journalled in the bearing casing 95. Each sanding head comprises four spindles in the preferred embodiment, so four conical gear wheels 90 mesh with the crown wheel 86. The spindle shafts 90 are rotatably journalled through roller bearings 94 mounted in the bearing casing 95. This embodiment ensures that the sanding

head (84, 92, 93, 95, 97, 98) is movable with respect to the plate 20, and that the shaft 81 driving the spindle shafts 91 is movable with respect to the sanding head (84, 92, 93, 95, 97, 98).

Fig. 6 shows schematically how the spindle shafts 91 are mounted in engagement with the crown wheel 86 through respective conical gear wheels 90. The sanding head is shown to be square, but nothing prevents imparting a cylindrical shape to it.

It appears from fig. 7 how a workpiece is finished according to the invention, it being moved past two rotating sanding heads which are rotated about their own vertical axis of symmetry, the rotation of the two sanding heads being so arranged that the sanding heads rotate in different directions. Further, as appears from fig. 7, the spindles are so arranged in the preferred embodiment that all spindles on a sanding head rotate in the same direction, and so that the sanding spindles of the two heads rotate in mutually different directions. However, this is not necessary for the invention to be worked.

Fig. 8 shows schematically that the machine can be constructed so as to comprise more than two sanding heads; these may e.g. be arranged so that the direction of rotation of successive sanding heads 200, 210 and 220, 230 are oppositely directed, but otherwise operate according to the principles already mentioned. The working region of the two pairs of sanding heads 200, 210 and 220, 230 may advantageously overlap along the rim. The number of pairs of sanding heads is determined by the width of the workpiece being finished.

The drive of the spindles does not have to be placed over the carousels, but may e.g. take place in the actual sanding head where an electric motor will then be provided.

Claims

1. An apparatus for surface finishing faces on workpieces which are moved past, and comprising sanding heads which may be caused to rotate about an axis which is preferably perpendicular to the faces being finished, a plurality of sanding spindles protruding radially from a sanding head, the axes of the spindles being substantially parallel with the faces being finished, said spindles being so connected with respective sanding heads that in addition to being caused to rotate about their own axis they can also be caused to rotate about the axis of the sanding head, wherein two sanding heads are arranged successively so that they have substantially the same working region on a passing workpiece, said apparatus comprising means for rotating the first sanding head in one direction and the second in an opposite direction.

2. An apparatus according to claim 1, wherein the apparatus moreover comprises means adapted to rotate the spindles on the first sanding head in one direction, and means for rotating the spindles on the second sanding head in an opposite direction.

3. An apparatus according to claim 1 or 2, wherein a conveyor is adapted to move workpieces being finished past the successively positioned sanding heads.

4. An apparatus for surface finishing faces on workpieces which are moved through the apparatus, comprising:
a frame;
two sanding heads secured to the frame and having axes of rotation which are substantially perpendicular to the face being finished, said sanding heads being arranged so as to have substantially the same working region on a passing workpiece;
a plurality of sanding spindles secured to respective sanding heads and arranged so as to protrude radially therefrom and adapted to rotate about their own longitudinal axis;
means for rotating the spindles about their longitudinal axis; and
means for rotating one sanding head in one direction and the other in an opposite direction.

5. An apparatus according to claim 4, wherein the means for rotating the sanding spindles about their longitudinal axis are moreover adapted to rotate the spindles on one sanding head in one direction and the spindles on the other in another direction.

6. An apparatus according to claim 4, moreover comprising a conveyor adapted to automatically move the workpieces past the sanding heads.

7. An apparatus for surface finishing workpieces which are moved through the apparatus, comprising:
a frame;
several successively positioned sanding heads secured to the frame and having axes of rotation which are substantially perpendicular to the face being finished, said sanding heads being arranged so that several successively arranged sanding heads have substantially the same working region on a passing workpiece;
a plurality of sanding spindles mounted on respective sanding heads and arranged so as to protude radially therefrom and adapted to rotate about their own longitudinal axis;
means for rotating the spindles about their own

longitudinal axis; and
means for rotating a sanding head in one direction, and another sanding head having substantially the same working region in an opposite direction.

8. An apparatus according to claim 7, wherein the means for rotating the sanding spindles about their longitudinal axis are moreover adapted to rotate the spindles on one sanding head in one direction and the spindles on the other in another direction.

9. An apparatus according to claim 7, further comprising a conveyor adapted to automatically move the workpieces past the sanding heads.

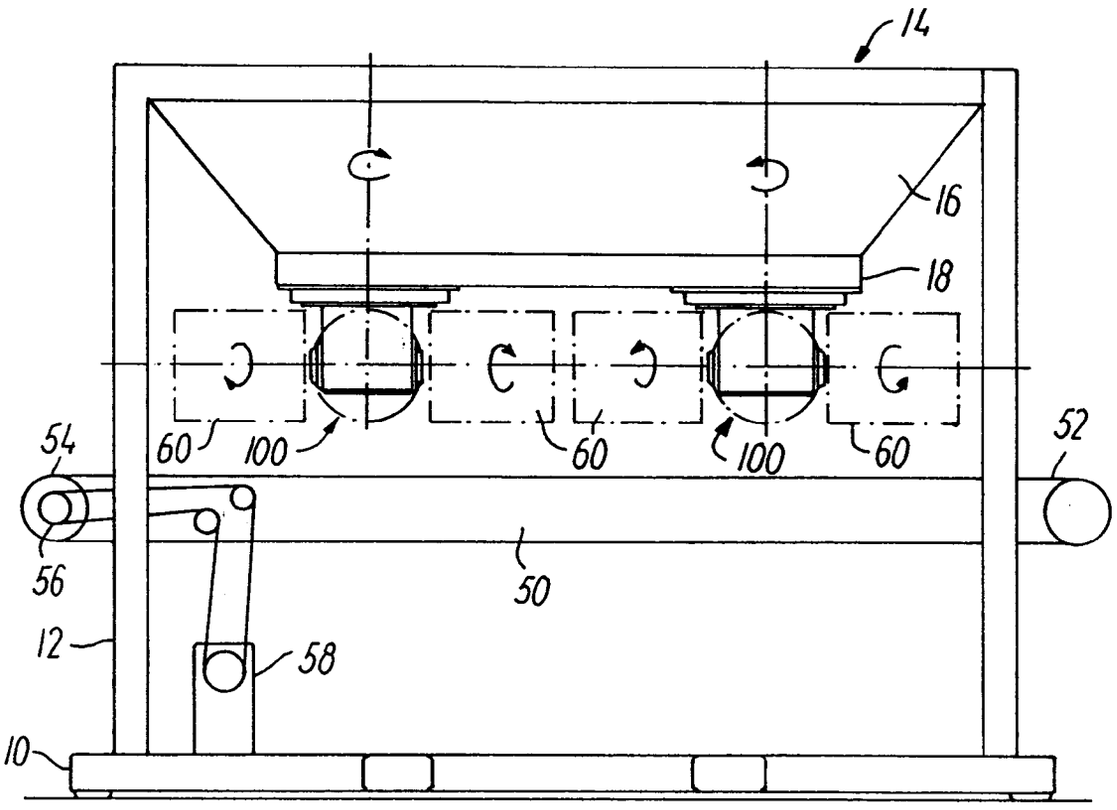

FIG. 1

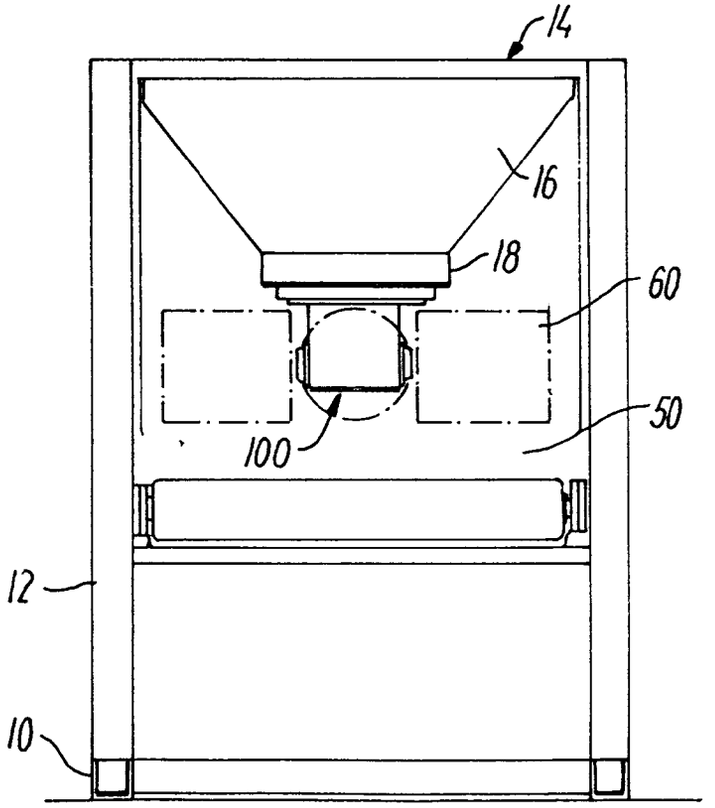

FIG. 2

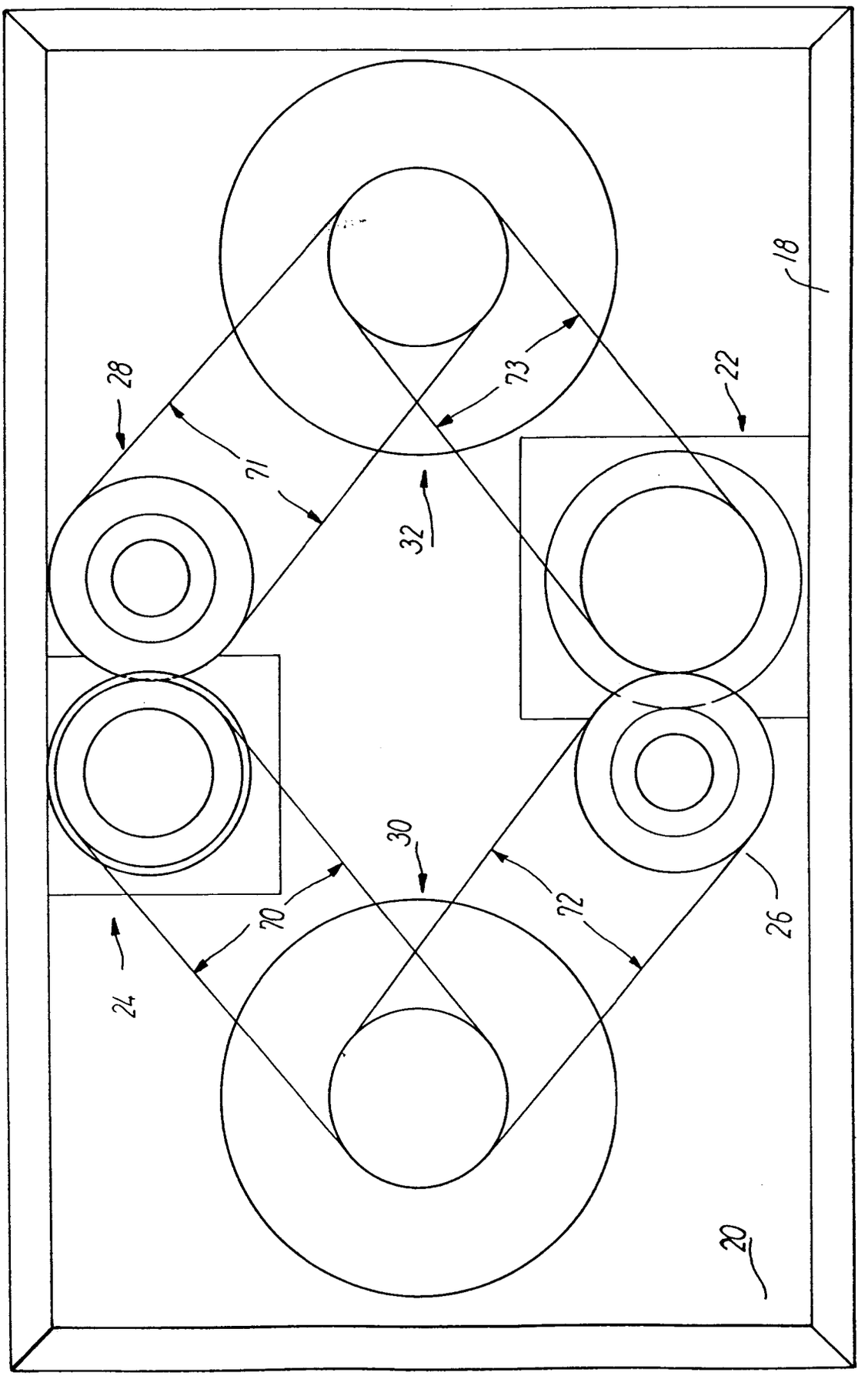

FIG.3

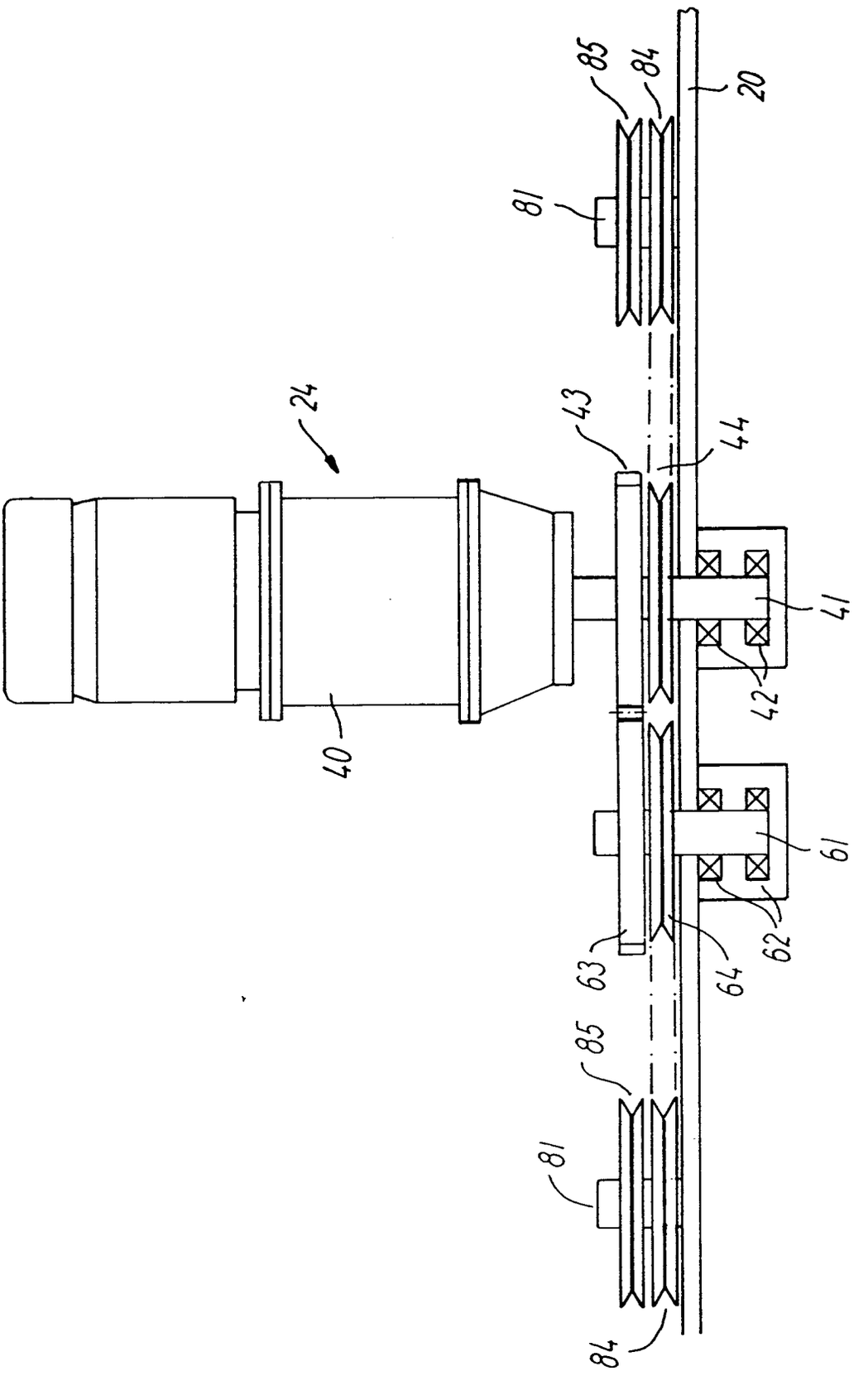

FIG. 4

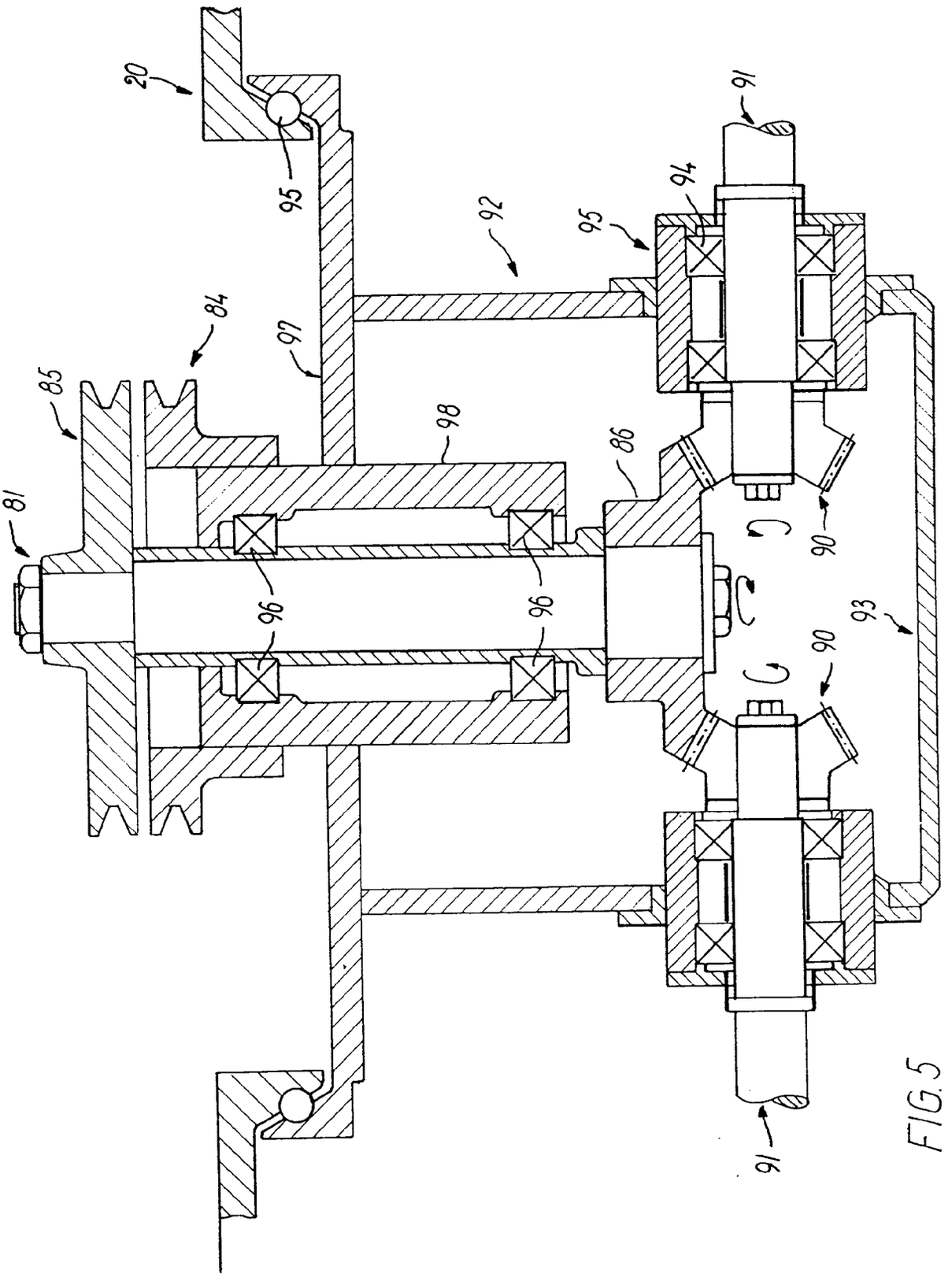

FIG.5

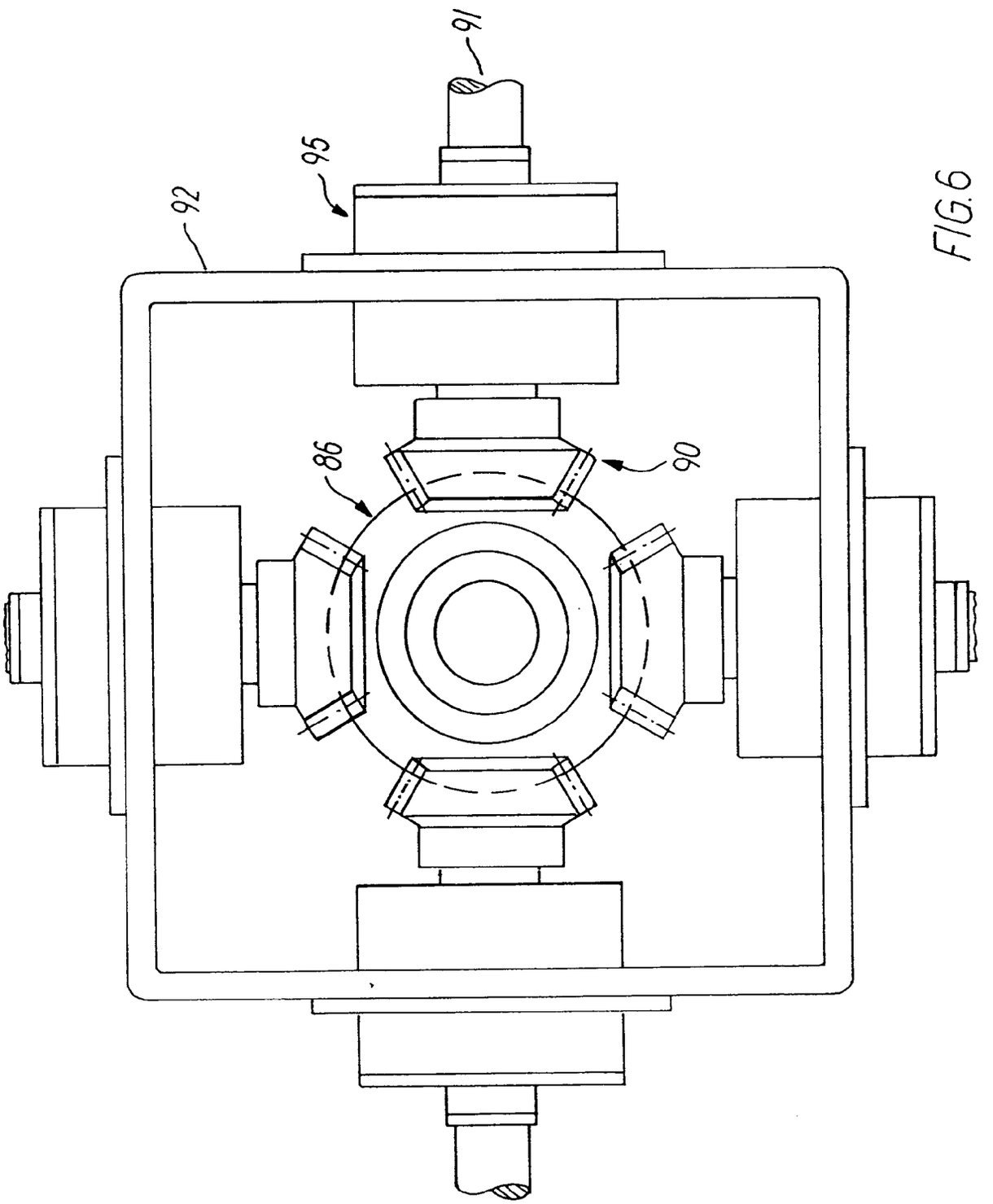

FIG.6

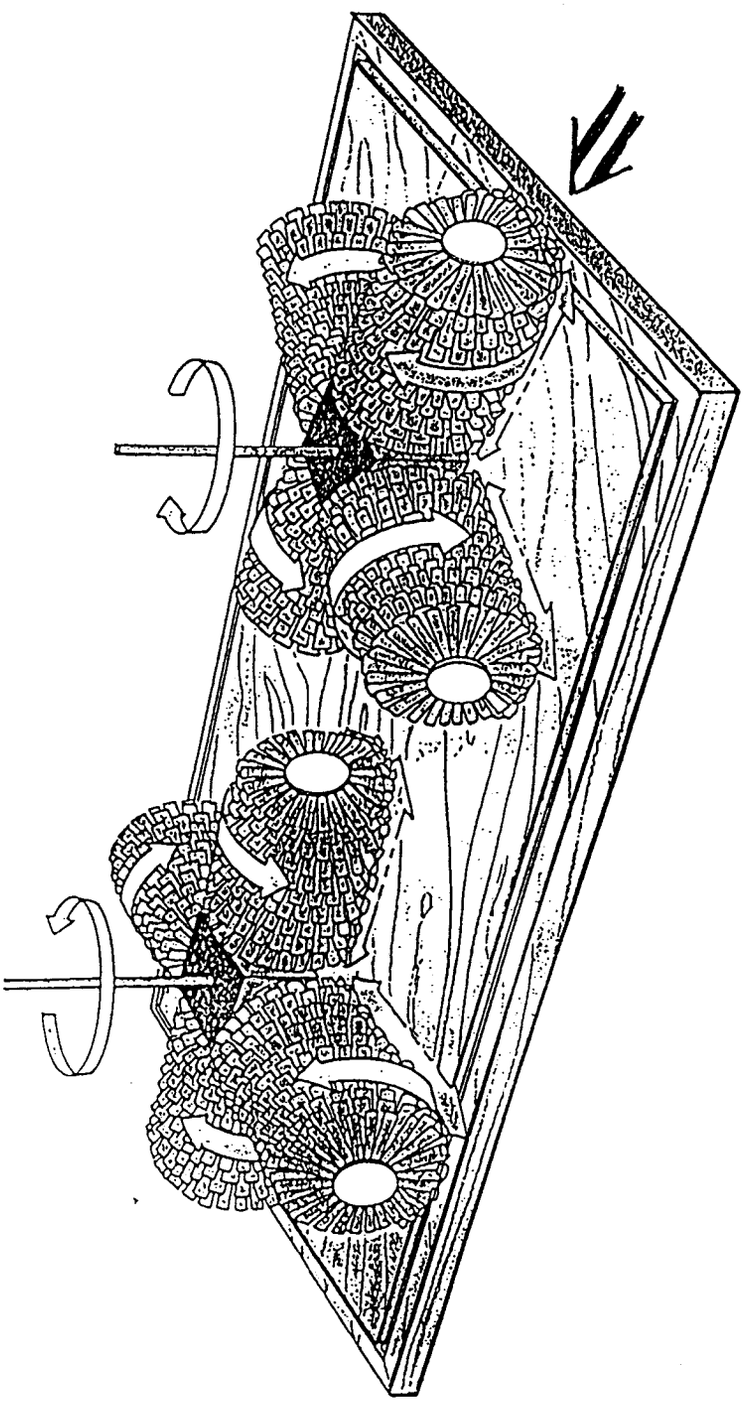

FIG. 7

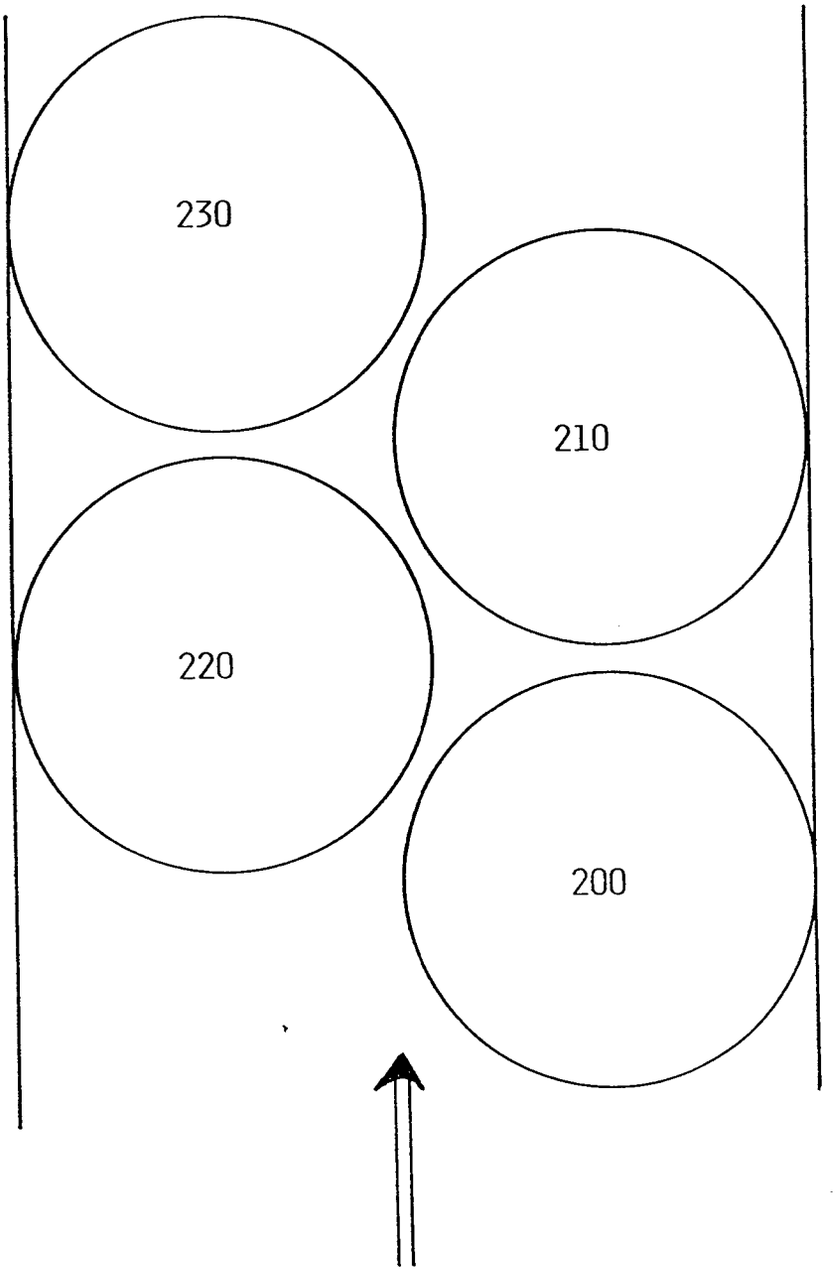

FIG. 8