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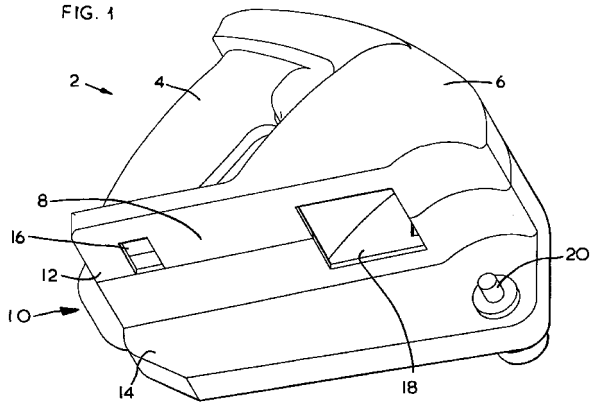
(54) Cartridge

(57) A cartridge (22) for use with a modular power tool (6) is disclosed having an interlock (6) and a rotatable cylinder (24). The cylinder (24) includes a drive conversion means (54, 56, 58) for reversing the sense of rotation as between the output shaft (20) and the rotatable cylinder (24).

FIG. 1



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Description

[0001] The present invention relates to a cartridge for a modular power tool and has particular, although not exclusive, relevance to such a cartridge as may be used to allow the tool to function as a belt sander.

[0002] Modular power tools have been known for a long time. GB 1515390 shows such a tool. Each of the modules which is designed to work with the tool is capable of performing a specific task. Although, theoretically, it should be possible to design modules capable of any range of tasks which should simply connect to the body of the power tool, this has not hitherto been achieved.

[0003] There are many reasons why a broad range of such modules are not available. Some of the reasons are cost of manufacture and physical size of the module.

[0004] It has been found with reference to the present invention however, that the ability provide a cartridge capable of being used as a module for a modular power tool, and which provides a function which has not been hitherto available, is possible.

[0005] According to one aspect of the present invention, therefore, there is provided a cartridge for use with a modular power tool, the cartridge including: an interlock for coupling the cartridge to the tool; a cylinder, rotatable under drive applied thereto by the tool; and drive conversion means to reverse the sense of rotation as between the drive applied to the cylinder by the tool and the sense of rotation of the cylinder itself. The provision of the drive conversion means allows the cartridge to be used in roles previously not possible in the art.

[0006] Preferably the drive conversion means comprises an epicyclic gearbox which may be housed within the cylinder.

[0007] Advantageously, the drive conversion comprises a cartridge wherein the epicyclic gearbox is housed within the cylinder.

[0008] The cartridge may include a further rotatable cylinder.

[0009] According to a further aspect of the present invention there is provided a power tool for use with a cartridge according to the first aspect, the tool including a modular power tool for use with a cartridge, the tool including: a housing; an interlock formed on the housing for engagement with the interlock of the cartridge; and drive means for applying rotational drive to the cylinder of a cartridge presented for coupling with the housing of the tool.

[0010] Preferably the cartridge allows the tool to function as a belt sander.

[0011] Advantageously, the drive means comprises an output shaft from a motor within the housing.

[0012] The present invention will now be described, by way of example only, and with reference to the following drawings of which:-

Figure 1 shows a perspective view from below of a tool housing of one embodiment in accordance with one aspect of the present invention;

Figure 2 shows the same perspective view as Figure 1, but also shows the coupling of a cartridge according to another aspect of the present invention being coupled to the housing;

Figure 3 shows a perspective view from below of the coupled housing and cartridge of Figure 2;

Figure 4 shows a perspective view from above of the embodiment of Figure 3;

Figure 5 shows a perspective view from above of a housing in accordance with one aspect of the present invention coupled to an alternative cartridge according to another aspect of the present invention;

Figure 6 shows a perspective view from below of the embodiment of Figure 5;

Figure 7 shows a schematic view of a cartridge in accordance with one aspect of the present invention;

Figure 8 shows a sectional view taken along the line X-X of Figure 7, and

Figure 9 shows a schematic illustration of another cartridge for use with a power tool according to an aspect of the present invention.

[0013] Referring now to Figure 1, a housing for a power tool is shown generally as 2. The housing comprises a handle (4) and a main body (6) in use of the device a user may hold both the main body (6) and the handle (4) in order to guide the power tool against a workpiece.

[0014] The underside portion (8) of the housing is shaped to accept a cartridge (described further below) presented thereto. In order for such a cartridge to be accepted the underside (8) defines an abutment (10) formed by the two side walls (12 and 14).

[0015] In the side wall (12) is formed an interlock member (16) for co-operable engagement with a cartridge presented to the housing (2), as will be described below. The side wall (12) also includes a recess (18) for stock removal/ dust extraction when the power tool is in use.

[0016] Within the main body (6) is housed a motor (not shown). The motor is a conventional electric motor and is described with reference to Figures 7 and 9 in more detail. The motor is coupled to an output shaft (20) for providing drive to a cartridge presented thereto.

[0017] Referring now also to Figure 2 a cartridge,

shown generally as 22, has been presented to the main body (6) for coupling thereto. In the example of Figure 2, the cartridge comprises a belt sander module for incorporation with the main body (6) so that the entire tool (2) (when the main body (6) and the cartridge (22) are coupled operatively together) operates as a belt sander.

[0018] The cartridge (22) includes a first cylinder (24) and a further cylinder (26). The cylinders (24 and 26) are surrounded by a continuous loop of sandpaper (28) thereby forming a belt sander. Those skilled in the art will appreciate that the cylinders (24, 26) need to be resiliently biassed so as to keep the loop of sandpaper (28) under sufficient tension so that it may perform efficaciously as a belt sander.

[0019] It can also be seen from Figure 2 that the cartridge (22) includes a further interlock member (30) which is co-operable with the interlock member (16) on the main body (6) so as to retain the cartridge (22) in rigid engagement with the main body (6) in operation of the tool.

[0020] In order to couple the cartridge (22) with the main body (6), the cartridge (22) must be held relative to the main body (6) in a predetermined disposition. The cylinder (24) includes a recess (not shown in Figure 2) for co-operating with the output shaft (20). The first operation necessary to couple the cartridge (22) to the body (6) is that of mating the recess in the cylinder (24) with the output shaft (20). This is shown from the large arrow "A" in Figure 2. The cartridge (22) is then pivoted about the axis of the cylinder (24) (because the cylinder (24) is now operatively coupled to the output shaft (20)) and the interlock members (16 and 30) are coupled together. This pivoting movement is shown by the arrow "B" in the figure.

[0021] Figure 3 shows the cartridge (22) when operatively coupled to the main body (6).

[0022] From Figures 2 and 3 it can be seen that the main body (6) includes an arcuate portion (32). The cartridge (22) includes a correspondingly shaped arcuate portion (34). The purpose of the arcuate portions (32, 34) is to ensure unimpeded motion when pivoting the cartridge (22) to its final operative position.

[0023] Referring now to Figures 5 and 6, there is shown a power tool whose main body (6) is operatively coupled to a cartridge (36). The cartridge (36) is an alternative to that (22) with reference to Figures 1 to 4. In Figures 5 and 6, the cartridge (36) is that of a planer, rather than a belt sander.

[0024] It can be seen particularly from Figure 6 that the cartridge (36) includes a cylinder (38) which, in common with the cylinder (24) has a recess formed therein to mate with the output shaft (20). Indeed, the operation of coupling the cartridge (36) to the main body (6) is exactly the same as that with respect to cartridge (24). The main differences between the two cartridges (22 and 36) is that the cartridge (22) is a belt sander whereas the cartridge (36) is a planer. This means, that the cartridge (36) does not require a rear roller and therefore only cylinder (38) is present. Those skilled in the art will appreciate that the cylinder (38) is that of a planer and therefore includes the common characteristics of the planer, such as a radial projection (cutting blade) and depth of cut adjustment means as shown by reference numeral 40. However, as these features are not germane to the present invention, they will not be discussed any further herein, although they are clearly apparent to those skilled in the art.

[0025] It would be apparent, therefore, with reference to Figures 1 to 6, that the power tool (2) has a main body (6) which can be operatively coupled to any one of a plurality of cartridges, of which two illustrative embodiments (22, 36) are shown. It will be further apparent that further cartridges are possible and these are clearly within the scope of those skilled in the art, although they are not described herein. For example, an alternative cartridge could achieve orbital sanding or polishing tasks or the like.

[0026] Referring now to Figures 7 and 8, the operation of the cartridge (22) will be described in more detail. From these figures it can be seen that the cartridge (22) is operatively coupled to a motor (42) by a belt drive mechanism (44). The output of the motor (42) is coupled by rotating shaft (46) to a drive cog (48). The drive cog (48), in this example, rotates at around 30,000 revolutions per minute. The belt drive (44) is coupled to a driven cog (50) which is coupled to the output shaft (20) via a drive shaft (52).

[0027] The driven cog (50) has generally a greater number of teeth than the drive cog (48). Therefore there is a speed reduction between the drive cog (48) and driven cog (50) which results in the driven cog (50) (and therefore the drive shaft (52) and therefore the output shaft (20)) rotating at around 16,000 revolutions per minute.

[0028] Whilst the rotational rate of the output shaft (20) is 16,000 revolutions per minute, it will be apparent from Figure 7 that the belt sander cartridge (22) needs to rotate in the sense shown by the arrow "C" yet the driving cogs (48 and 50) are rotating in the opposite sense shown by arrows "D".

[0029] It will be understood that the belt sander cartridge (28) needs to have the drive roller (24) rotating in the opposite sense to that of the planer cylinder (38) of the planer cartridge (36).

[0030] Referring now also to Figure 8, it can be seen how the reversal of the sense of rotation as between the output shaft (20) and the sense of rotation of the cylinder (24) is achieved. Figure 8 shows a section taken along the line X-X of the cylinder (24) in Figure 7. The output shaft (20) terminates in a sun gear (54) which is at the centre of the cylinder (24). The sun gear rotates in a first sense, say, clockwise as shown in Figure 8. A plurality of planet gears (56), in this example 3, are fixed in position relative to the sun gear (54). Although the planet gears are fixed, they are free to rotate about their respective central axis. This means,

that when the sun gear (54) rotates in a clockwise position, each planet gear (56) rotates about its own axis in an anti-clockwise sense.

Surrounding the planet gears (56) is a rotatable ring gear (58) which is rigidly coupled to the outer periphery of the cylinder (24). The inner periphery of the ring gear (58) carries a plurality of teeth which co-operatively engage with the gearing teeth of the planet gears (56). This means, therefore, that the ring gear (58) (and therefore the cylinder (24)) rotate in an anti-clockwise sense as shown by the outermost arrow of Figure 8.

[0031] In this manner, therefore, there is a reversal between the sense of the drive of the output shaft (20) and the sense of rotation of the cylinder (24). In addition, there is a gear reduction of around 8:1 in this example. This means that because the output shaft is rotating at around 16,000 revolutions per minute, the speed of rotation of the cylinder (24) is around 2,000 revolutions per minute. This is suitable for belt sanding.

[0032] Referring now to Figure 9, there is shown a representation of the planer cartridge (36). In Figure 9, similar components are numbered correspondingly with those of Figure 7, because the motor (42) and the belt drive (44) and the output shaft (20) are all common with that of the housing (6) of Figure 7. Because of this, further description of the mechanism up to and including the output shaft (20) will not be given herein.

[0033] However, as has been previously discussed, there is no need to reverse the sense of rotation of the cylinder (38) compared to the output shaft (20). Because the driven cog (50) is rotating at around 16,000 revolutions per minute, this in itself is suitable for planing. It can be seen, therefore, from the arrows shown in the figure that all rotating parts rotate in the same sense, that is as shown by the arrows marked "D".

[0034] Those skilled in the art will appreciate that various changes may be made to the embodiments which are illustrated above whilst still remaining within the scope of the invention. For example, any number of planet gears (56) may be employed rather than just the three which are shown.

[0035] Additionally, any suitable cartridge may be coupled with the body (6) in order to achieve the desired operative result.

Claims

1. A cartridge for use with a modular power tool, the cartridge including:

   an interlock for coupling the cartridge to the tool;
   a cylinder, rotatable under drive applied thereto by the tool; and
   drive conversion means to reverse the sense of rotation as between the drive applied to the cylinder by the tool and the sense of rotation of the cylinder itself.

2. A cartridge according to claim 1, wherein the drive conversion means comprises an epicyclic gearbox.

3. A cartridge according to claim 2, wherein the epicyclic gearbox is housed within the cylinder.

4. A cartridge according to either claim 2 or claim 3, wherein the epicyclic gearbox comprises:

   a sun gear caused to rotate by the drive from the tool;
   a plurality of rotatable planet gears disposed in fixed disposition around the sun gear; and
   a rotatable ring gear, surrounding and driven by, the planet gears.

5. A cartridge according to any one of the preceding claims, including a further rotatable cylinder.

6. A modular power tool for use with a cartridge according to any one of claims 1 to 5, the tool including:

   a housing;
   an interlock formed on the housing for engagement with the interlock of the cartridge; and
   drive means for applying rotational drive to the cylinder of a cartridge presented for coupling with the housing of the tool.

7. A modular power tool according to claim 6, wherein the cartridge allows the tool to function as a belt sander.

8. A modular power tool according to claims 6 or 7, wherein the drive means comprises an output shaft from a motor within the housing.

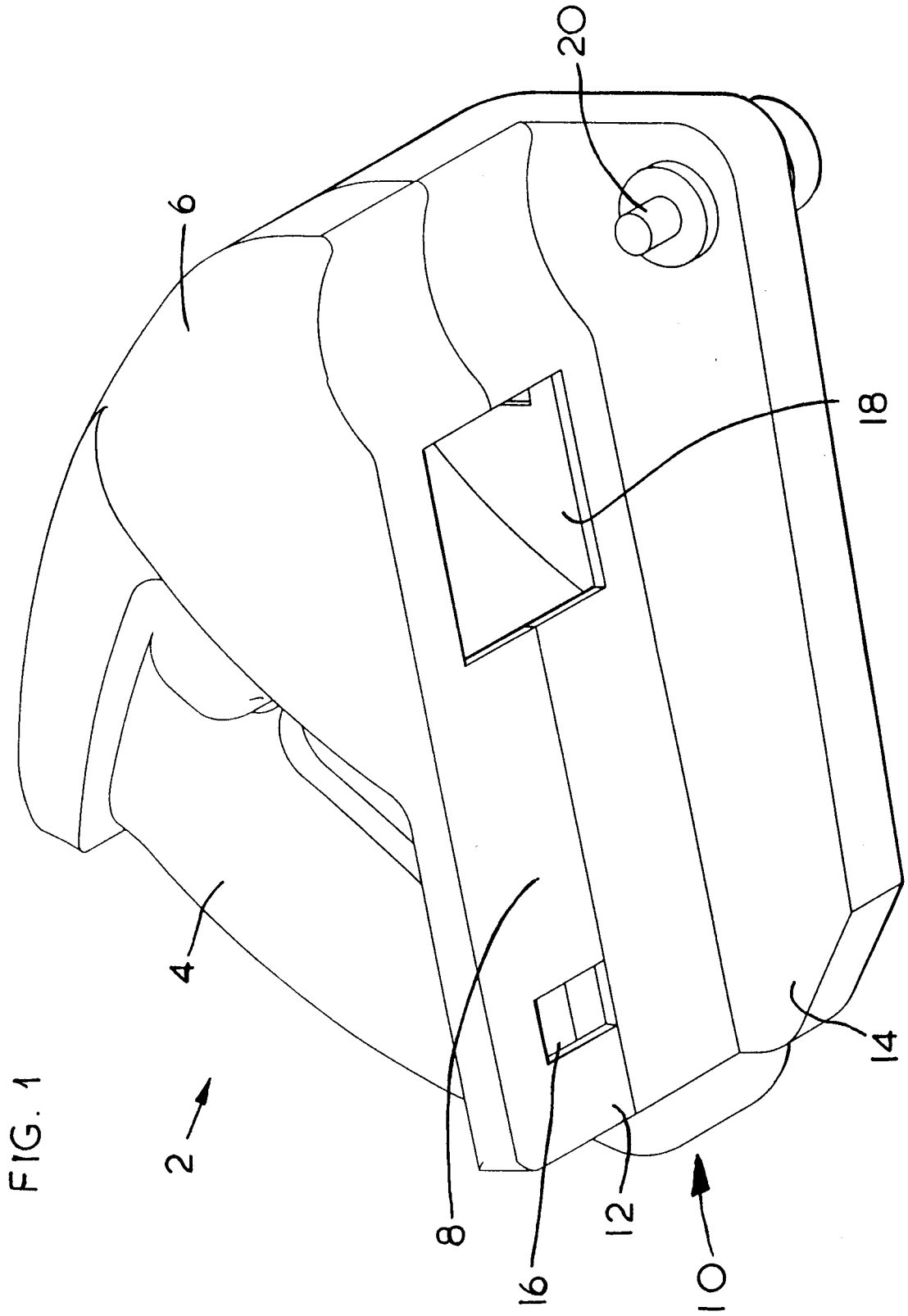

FIG. 1

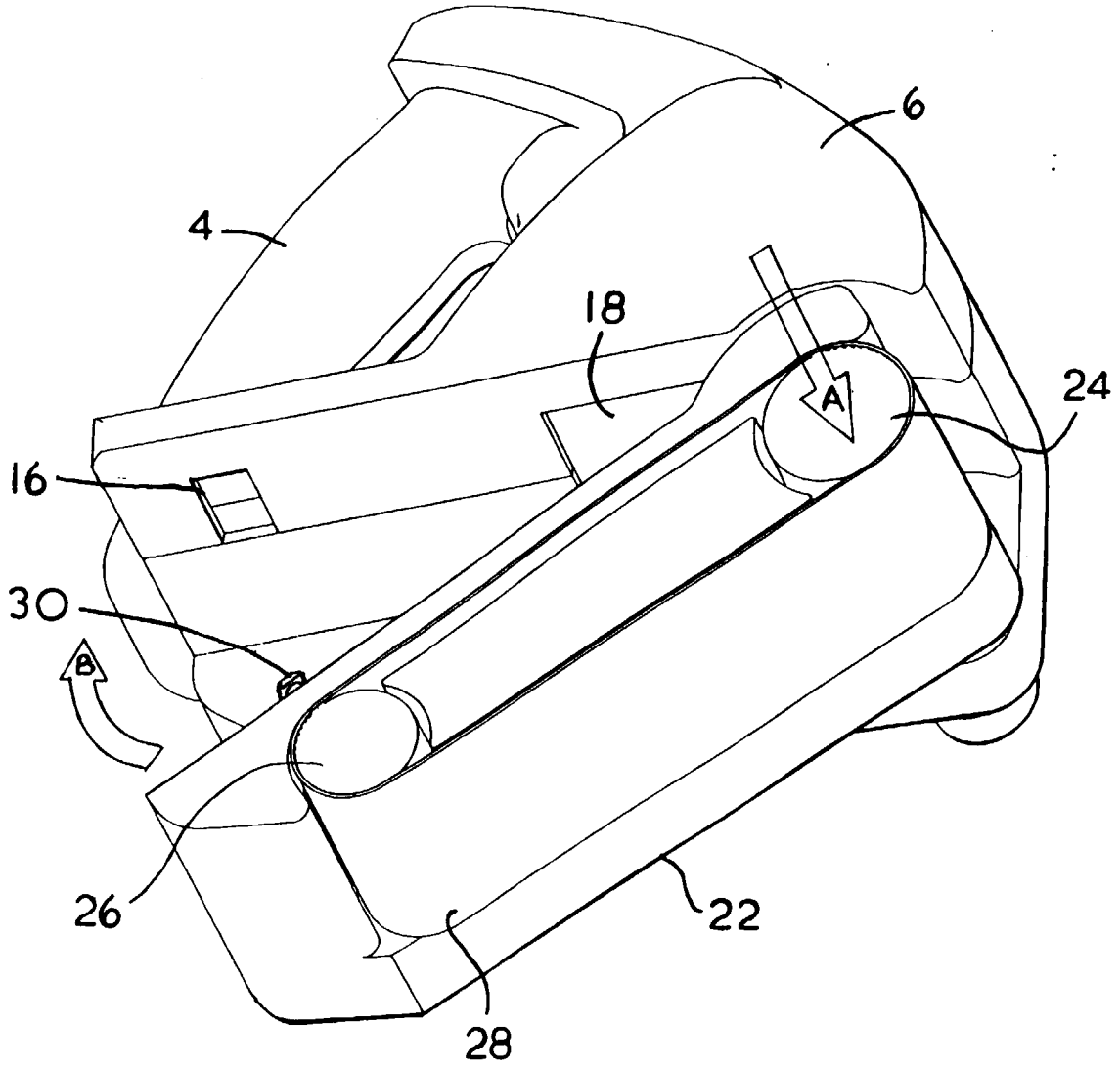

FIG. 2

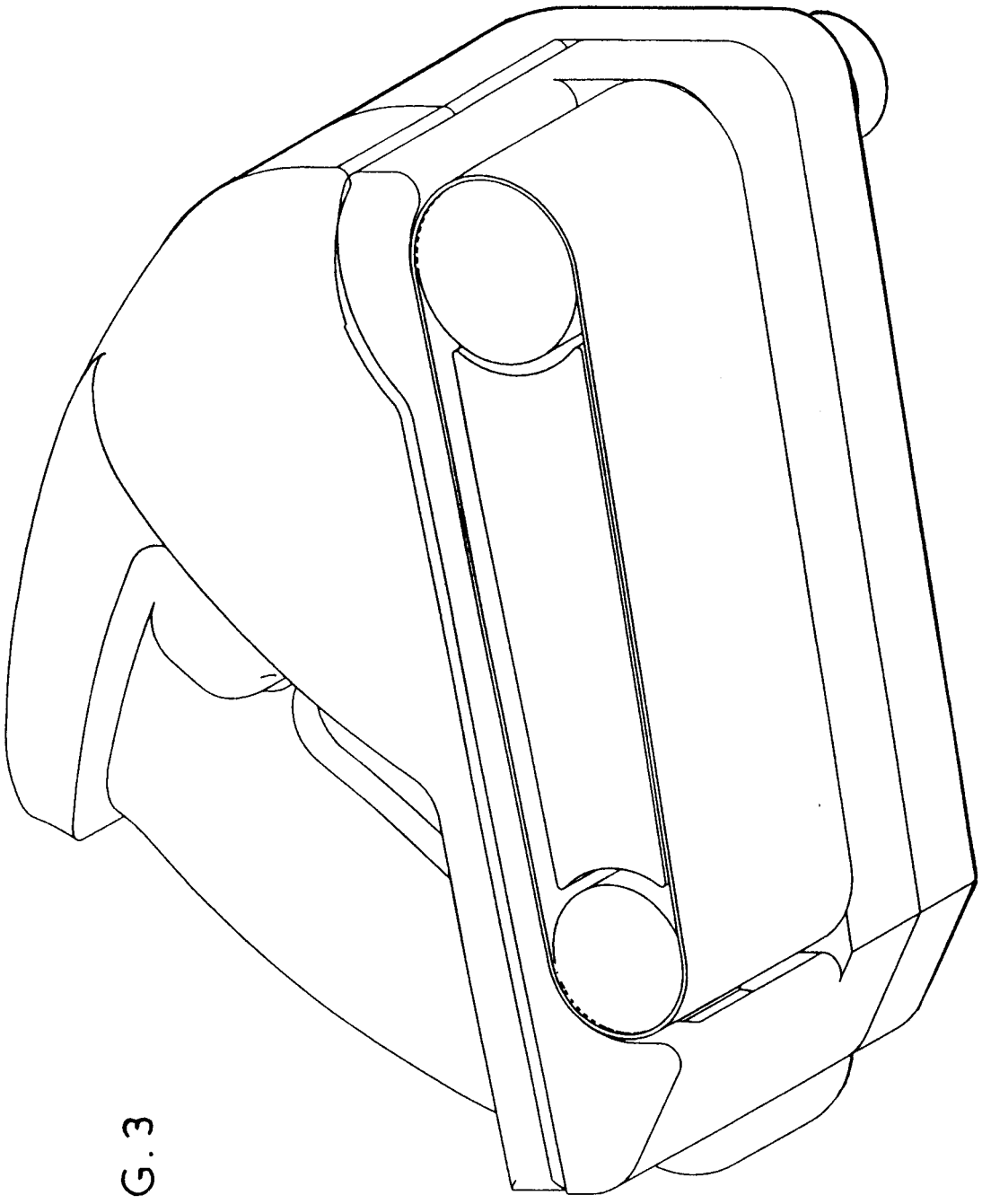

FIG. 3

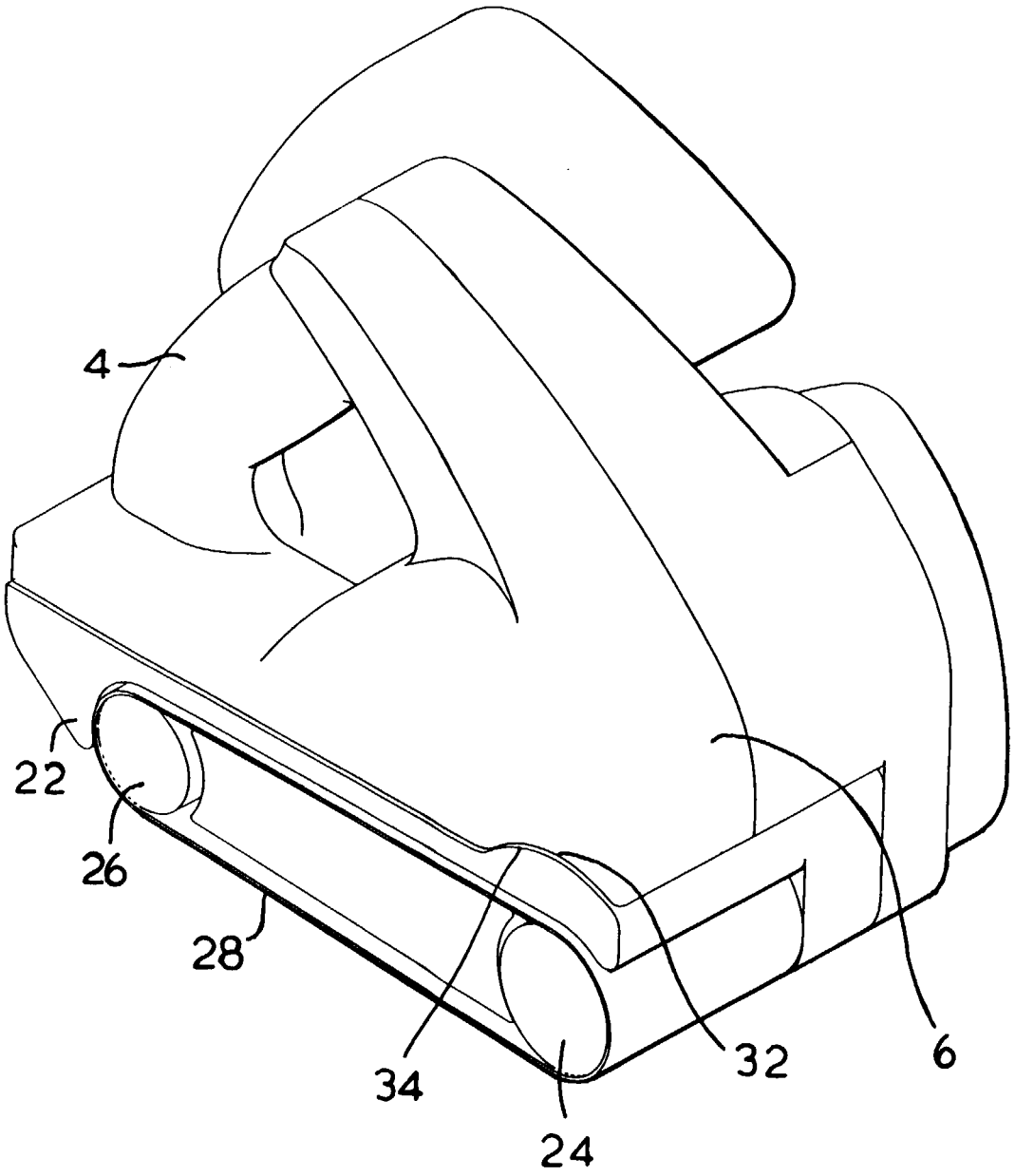

FIG. 4

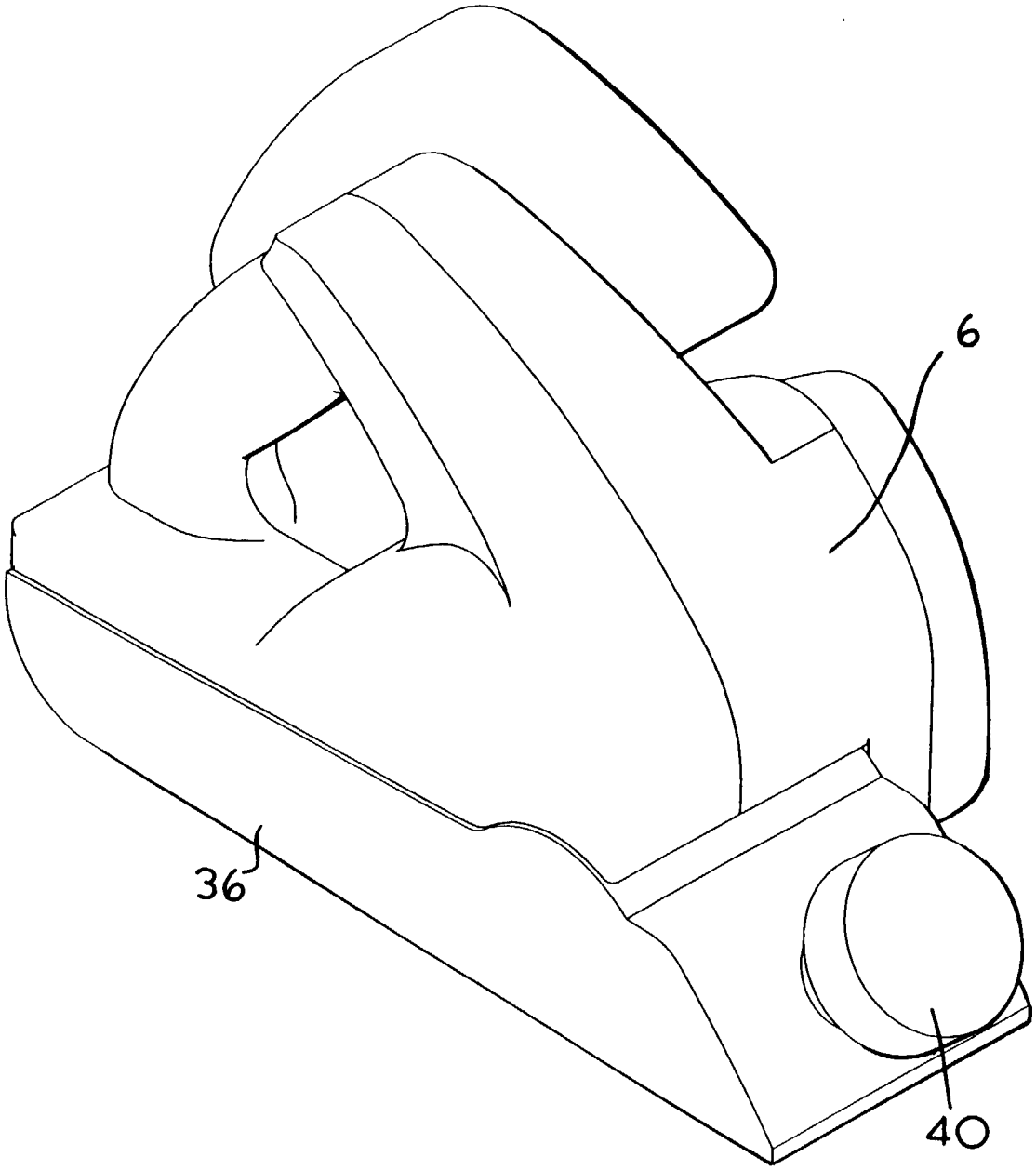

FIG. 5

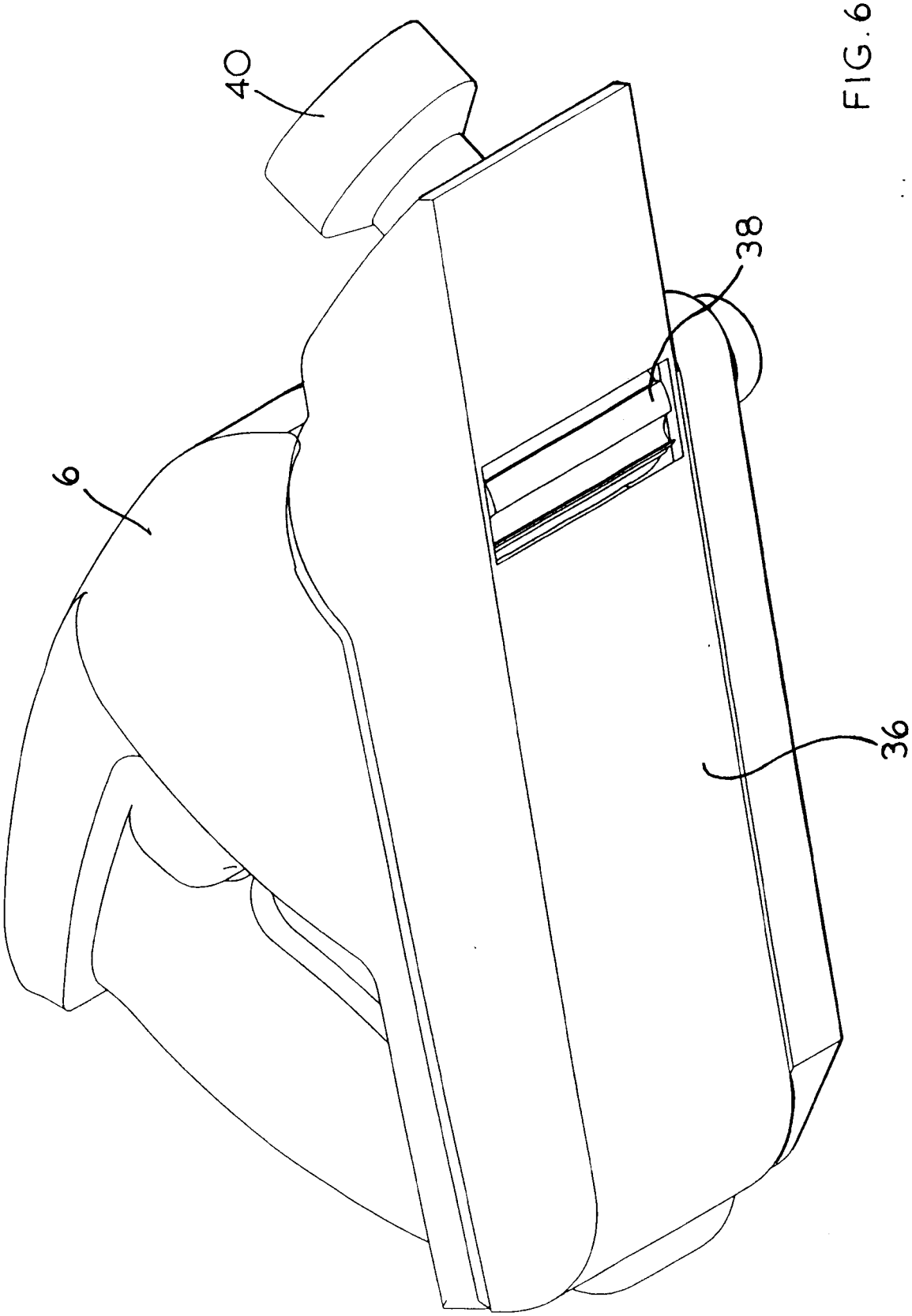

FIG. 6

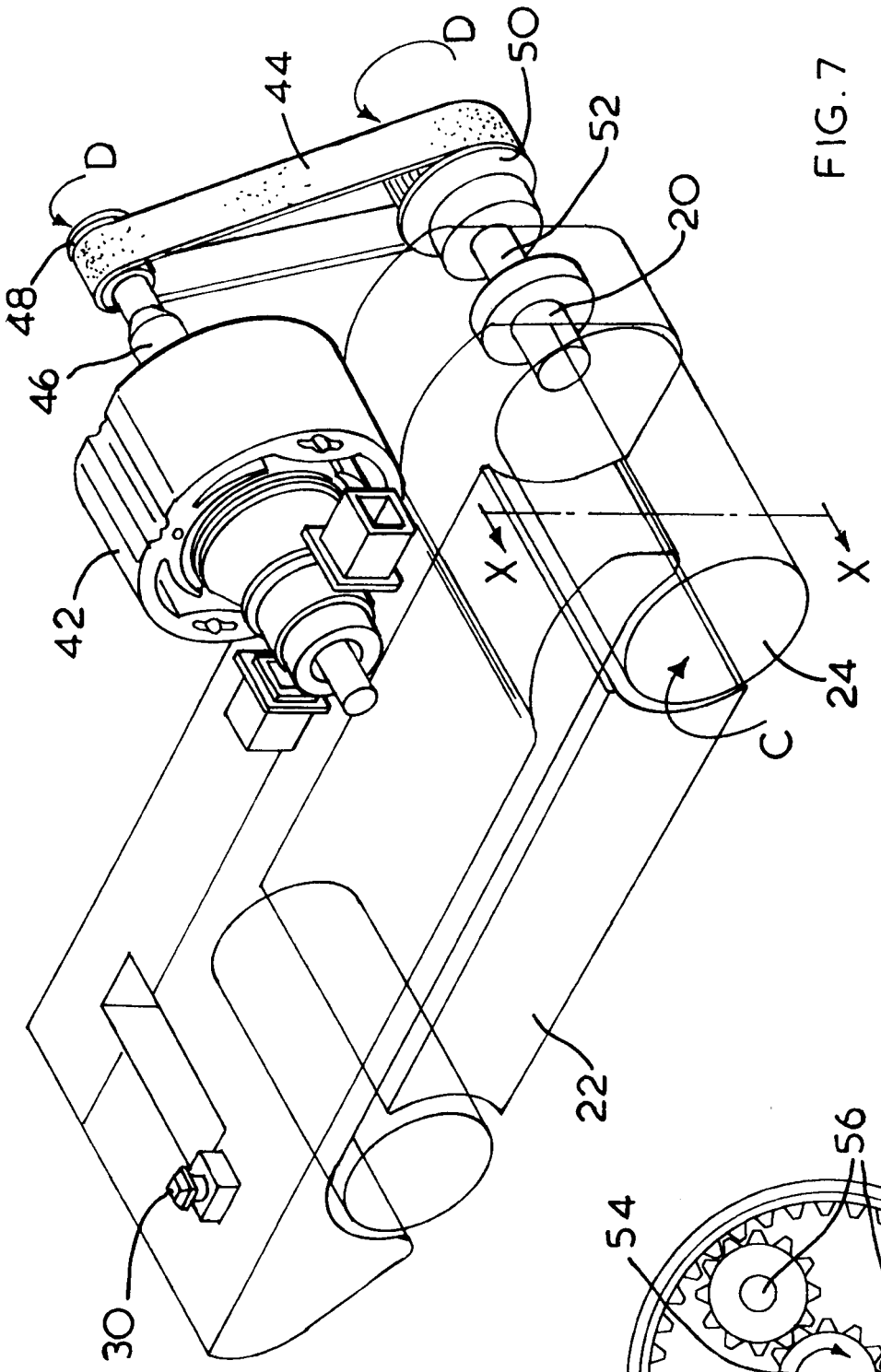

FIG. 7

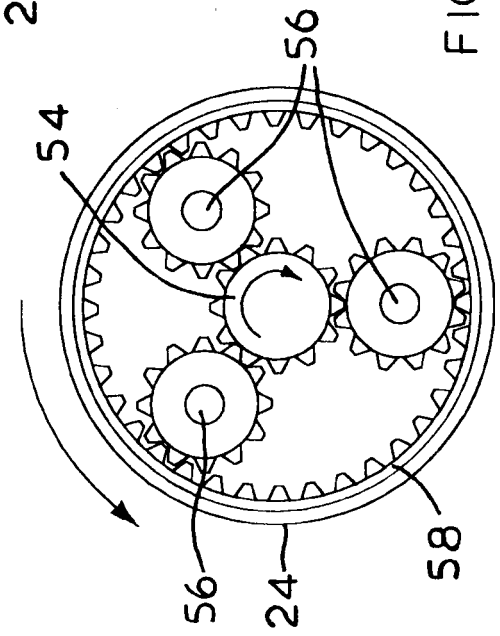

FIG. 8

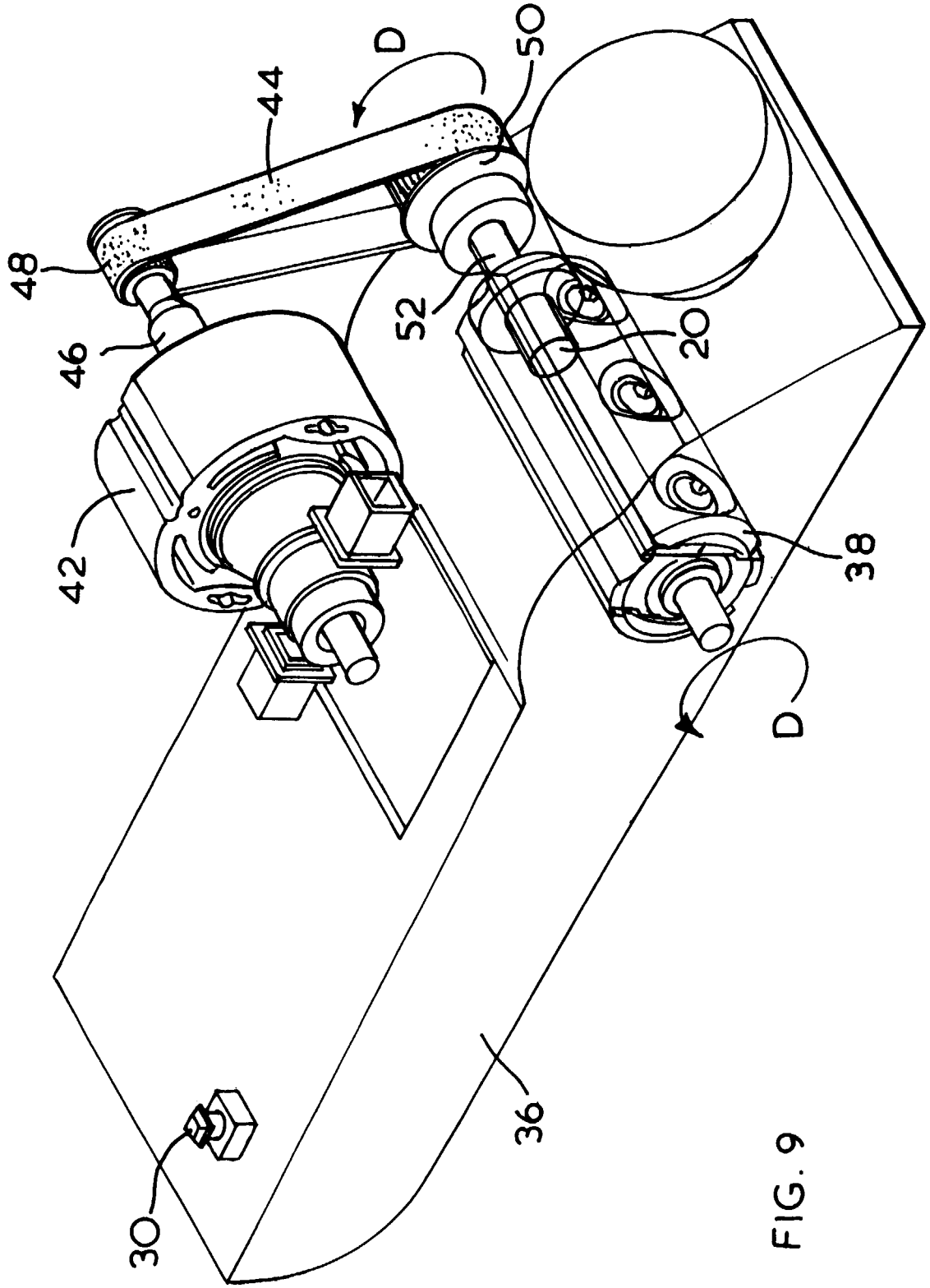

FIG. 9