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(54) **Power tool**

Angetriebenes Werkzeug

Outil motorisé

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Description

[0001] The present invention relates to a power tool arranged to perform a plurality of operations and in particular to a power tool which is interchangeable between the two tasks of sanding and planing a workpiece. Such a tool is disclosed in DE-A-3 621 240, in accordance with the preamble of claim 1.

[0002] The general concepts of a power tool having interchangeable operative parts are known. For example, UK patent number GB 1515390 discloses a power tool which is said to be of modular construction. The tool comprises a battery unit which is adapted to accept any one of a plurality of operative parts, such as a hedge clipper or a screwdriver. Each of the operative parts has its own motor and an arrangement for converting the output of the motor (usually a rotating spindle) into the type of drive necessary for that particular tool. For example, a linear reciprocating drive is needed for the hedge clipper, whereas a low rotational velocity, high torque drive is needed for the screwdriver.

[0003] This known device therefore suffers from the disadvantage that the only common part to all the tools is the battery. Also as each operative part must include a motor and the necessary drive train/gear system to allow it to carry out its function, the element which makes up the components for the tool can become very expensive and bulky.

[0004] In EP-A-698449 there is disclosed a modular power tool having separate motor and drive mechanisms. The two mechanisms are brought into operative engagement by sliding and rotating the motor relative to the transmission. This device is limited in that the transmission may only be used as a drill/driver and is not able to function in any other mode.

One aspect of the present invention is based on the recognition that the two operations of sanding and of planing a workpiece are discrete, yet clearly related. Generally planing is used to remove a larger amount of stock from a workpiece than sanding. Also, sanding is used to provide a smoother or finer finish to a workpiece than planing. Or for the removal of previously applied surface coatings. Furthermore, in all of the prior art which discusses modular tools, none appears to offer the facility of a tool which can be readily changed from operating as in a sanding mode to operating in a planing mode (or vice versa) despite the advantages that such an operation could achieve.

[0005] The present invention also, however, recognises that one of the most efficient forms of sanding is belt sanding. This utilises a continuous loop of sandpaper being driven around two displaced rollers, as is known in the art. However, to employ a continuous loop of sandpaper in a modular tool (where one of the other modules is a planer - which essentially comprises only a single rotating cylinder or cutting device) could well take up a great deal of space. Thus a modular tool which is able to offer modules capable of both belt sanding and planing is a difficult challenge to achieve, not least because of the different space requirements between tools to achieve each function.

[0006] It is thus an object of the present invention to at least alleviate the above shortcomings. Accordingly, the present invention provides a power tool arranged to perform a plurality of operations, the operations including belt sanding and planing, wherein the tool comprises: a housing; a motor within the housing for providing drive to an output shaft; and a plurality of cartridges, each of which cartridges may be coupled to the housing and to the drive shaft to enable performance of a respective operation, wherein one cartridge performs belt sanding and another cartridge performs planing. Not only is the provision of a modular tool capable of belt sanding and planing particularly advantageous, but also the provision of interchangeable cartridges to accommodate each tool, despite the clear differences in the respective features of each tool, offers significant advantages.

[0007] Preferably the drive shaft projects out of the housing and each cartridge includes a recess for coupling with the drive shaft. Also the drive shaft may rotate under the drive of the motor. Further, the motor may be coupled directly to the drive shaft.

[0008] In a preferred embodiment there is provided an interlock formed on the housing for retaining a cartridge presented for coupling to the housing. Further, each cartridge may include an interlock mechanism co-operable with the interlock formed on the housing.

[0009] Advantageously, each cartridge may be presented to the body in a predetermined orientation in order to couple the cartridge with the body.

[0010] 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.

[0011] 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.

[0012] 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).

[0013] 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.

[0014] 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.

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] Figure 3 shows the cartridge (22) when operatively coupled to the main body (6).

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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).

[0025] 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.

[0026] 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".

[0027] 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).

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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".

[0033] 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.

[0034] Additionally, any suitable cartridge may be coupled with the body (6) in order to achieve the desired operative result.

Claims

1. A power tool arranged to perform a plurality of operations, the operations including belt sanding and planing, wherein the tool comprises:

   a housing (2);

   a motor (42) within the housing for providing drive to an output shaft (20); and **characterized by**

   a plurality of cartridges (22, 36), each of which cartridges may be coupled to the housing and to the drive shaft to enable performance of a respective operation, wherein one cartridge performs belt sanding and another cartridge performs planing.

2. A power tool according to claim 1, wherein the drive shaft projects out of the housing and each cartridge includes a recess for coupling with the drive shaft.

3. A power tool according to either claim 1 or claim 2, wherein the drive shaft rotates under the drive of the motor.

4. A power tool according to any one of the preceding claims, wherein the motor is coupled directly to the drive shaft.

5. A power tool according to any one of the preceding claims, including an interlock (16) formed on the housing for retaining a cartridge presented for cou-

pling to the housing.

6. A power tool according to claim 5, wherein each cartridge includes an interlock mechanism (30) co-operable with the interlock (16) formed on the housing (2).

7. A power tool according to any one of the preceding claims, wherein each cartridge must be presented to the body in a predetermined orientation in order to couple the cartridge with the body.

Patentansprüche

1. Angetriebenes Werkzeug ausgebildet zur Durchführung mehrerer Vorgänge einschließlich Bandschleifen und Hobeln, mit einem Gehäuse (2), einem im Gehäuse vorgesehenen Motor (42) für den Antrieb einer Abgabewelle (20) und **gekennzeichnet durch** mehrere Kassetten (22, 36), von denen jede mit dem Gehäuse und der Antriebswelle gekoppelt werden kann, um die Durchführung eines jeweiligen Vorgangs zu ermöglichen, wobei eine Kassette Bandschleifen und eine andere Kassette Hobeln durchführt.

2. Angetriebenes Werkzeug nach Anspruch 1, bei dem die Antriebswelle aus dem Gehäuse vorsteht und jede Kassette eine Aussparung zur Kopplung mit der Antriebswelle hat.

3. Angetriebenes Werkzeug nach Anspruch 1 oder 2, bei dem sich die Antriebswelle unter dem Antrieb des Motors dreht.

4. Angetriebenes Werkzeug nach einem der vorhergehenden Ansprüche, bei dem der Motor direkt mit der Antriebswelle gekoppelt ist.

5. Angetriebenes Werkzeug nach einem der vorhergehenden Ansprüche mit einer am Gehäuse ausgebildeten Verriegelung (16) zur Halterung einer zur Kopplung mit dem Gehäuse zugeführten Kassette.

6. Angetriebenes Werkzeug nach Anspruch 5, bei dem jede Kassette einen Verriegelungsmechanismus (30) aufweist, der mit der am Gehäuse (2) ausgebildeten verriegelung (16) zusammenarbeiten kann.

7. Angetriebenes Werkzeug nach einem der vorhergehenden Ansprüche, bei dem jede Kassette dem Körper in einer vorgegebenen Ausrichtung zugeführt werden muss, um sie mit dem Körper zu koppeln.

Revendications

1. Un outil motorisé agencé pour effectuer une pluralité d'opérations, les opérations comprenant le ponçage à bande et le rabotage, l'outil comprend :

   un boîtier (2),

   un moteur (42) placé à l'intérieur du boîtier, pour assurer l'entraînement à un arbre de sortie (20), et **caractérisé par**

   une pluralité de cartouches (22, 36), chacune des cartouches pouvant être accouplée au boîtier et à l'arbre d'entraînement pour permettre d'effectuer une opération respective, une cartouche effectuant le ponçage à bande et une autre cartouche effectuant le rabotage.

2. Un outil motorisé selon la revendication 1, dans lequel l'arbre d'entraînement fait saillie du boîtier et chaque cartouche comprend une cavité pour assurer l'accouplement à l'arbre d'entraînement.

3. Un outil motorisé selon la revendication 1 ou la revendication 2, dans lequel l'arbre d'entraînement tourne sous l'effet de l'entraînement du moteur.

4. Un outil motorisé selon l'une quelconque des revendications précédentes, dans lequel le moteur est accouplé directement à l'arbre d'entraînement.

5. Un outil motorisé selon l'une quelconque des revendications précédentes, comprenant un verrouillage mutuel (16) formé sur le boîtier, pour retenir une cartouche présentée pour accouplement au boîtier.

6. Un outil motorisé selon la revendication 5, dans lequel chaque cartouche comprend un mécanisme de verrouillage mutuel (30), coopérant avec le verrouillage mutuel (16) formé sur le boîtier (2).

7. Un outil motorisé selon l'une quelconque des revendications précédentes, dans lequel chaque cartouche doit être présentée au corps selon une orientation prédéterminée, afin d'accoupler la cartouche au corps.

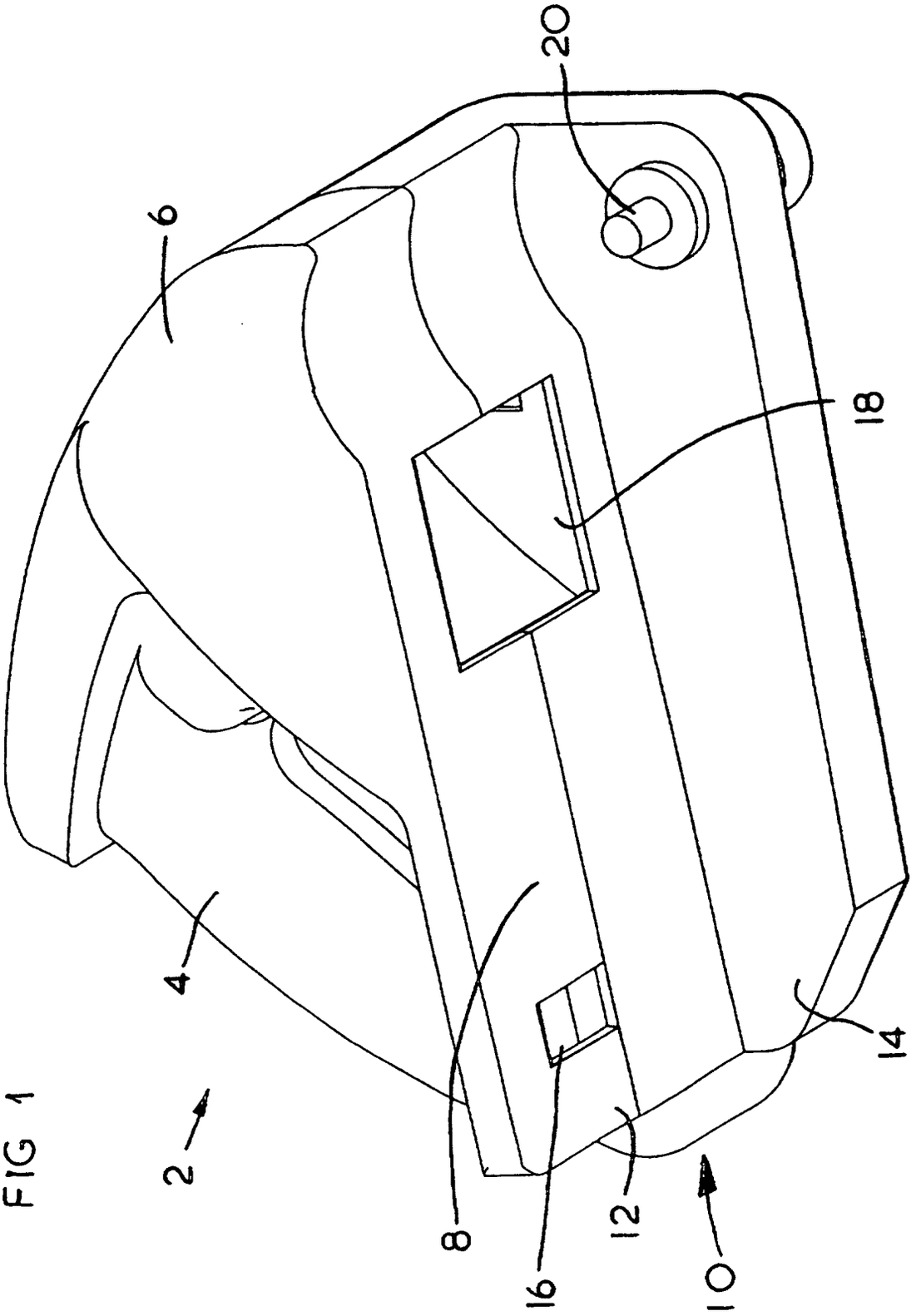

FIG 1

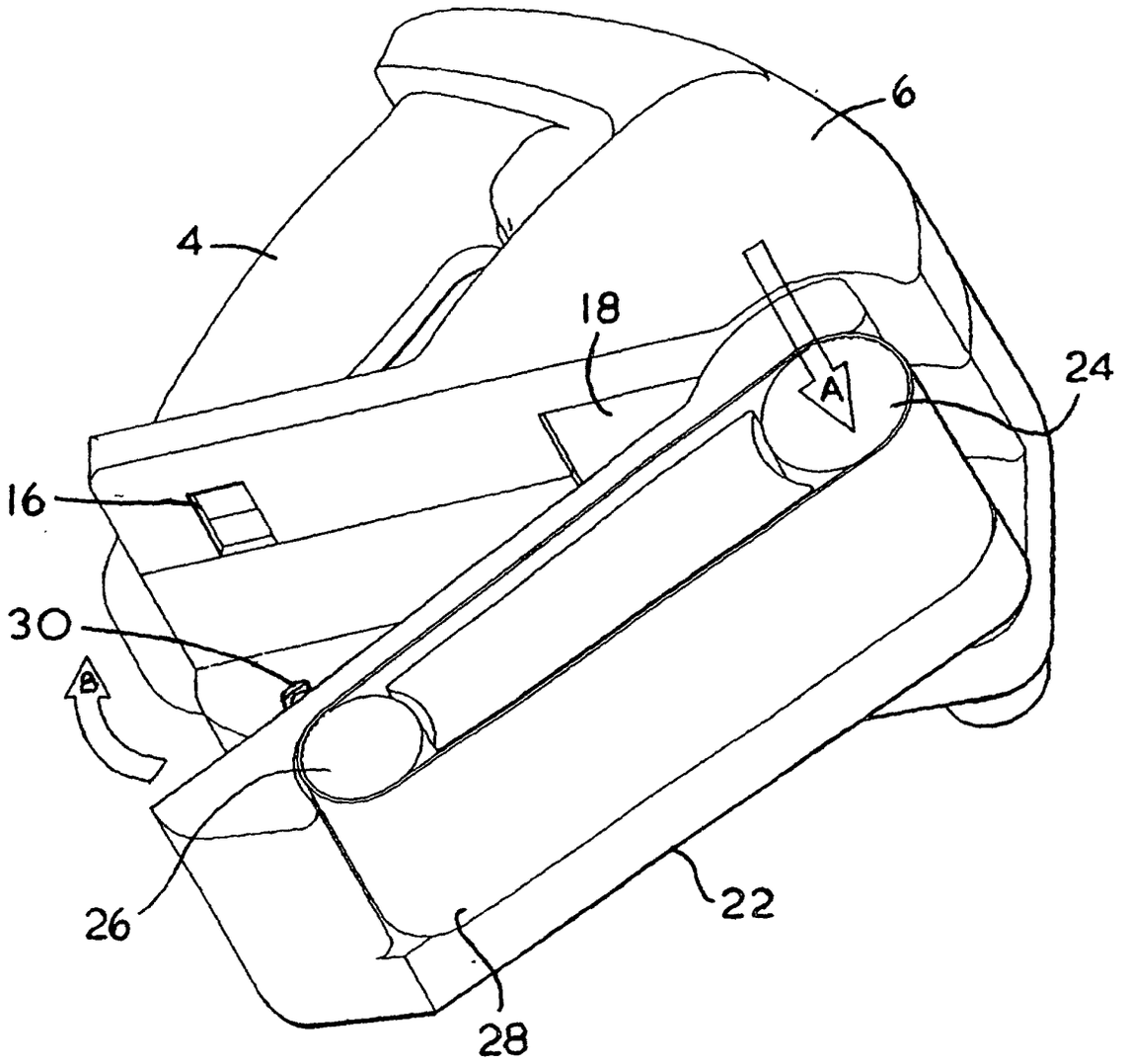

FIG. 2

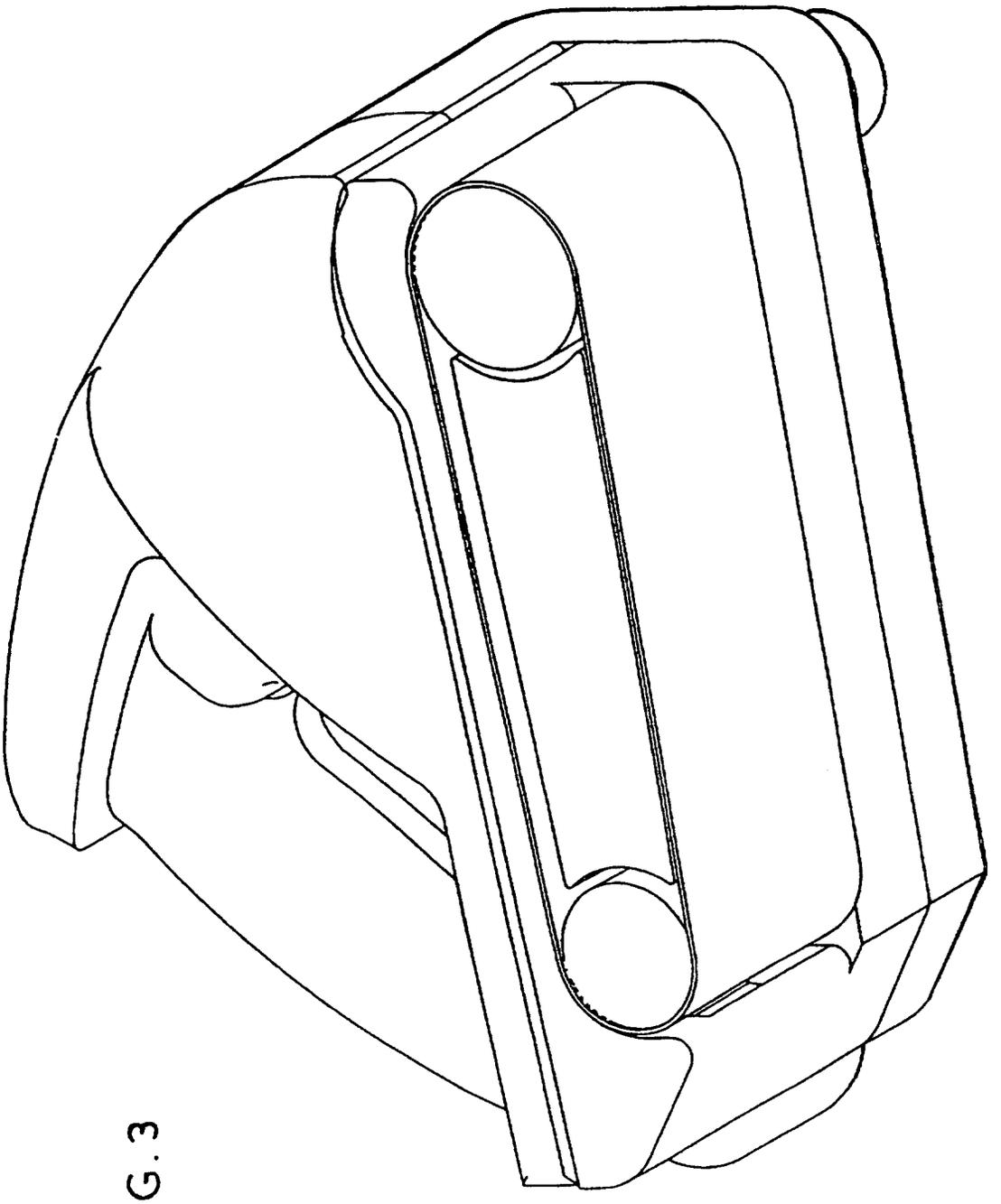

FIG. 3

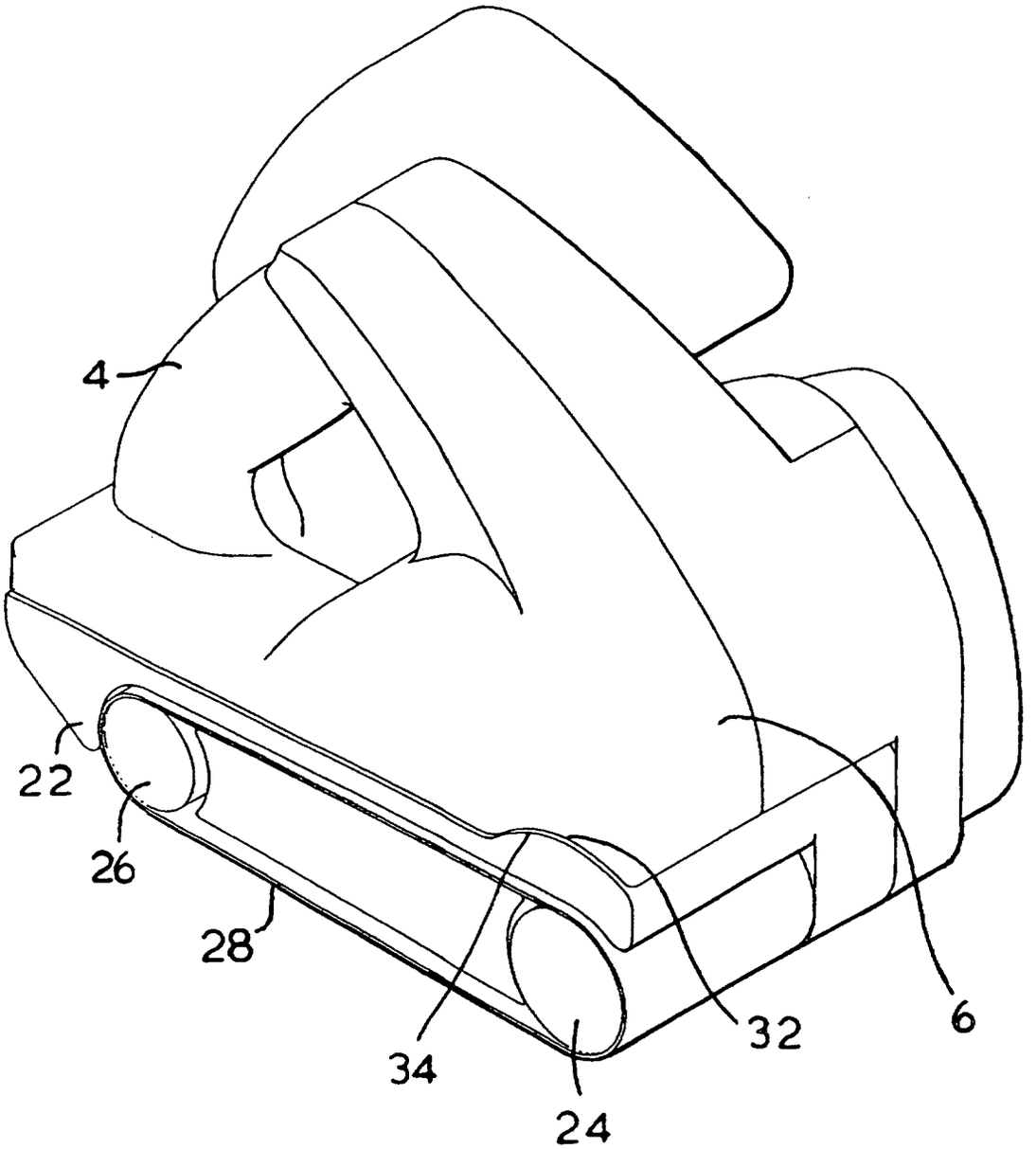

FIG. 4

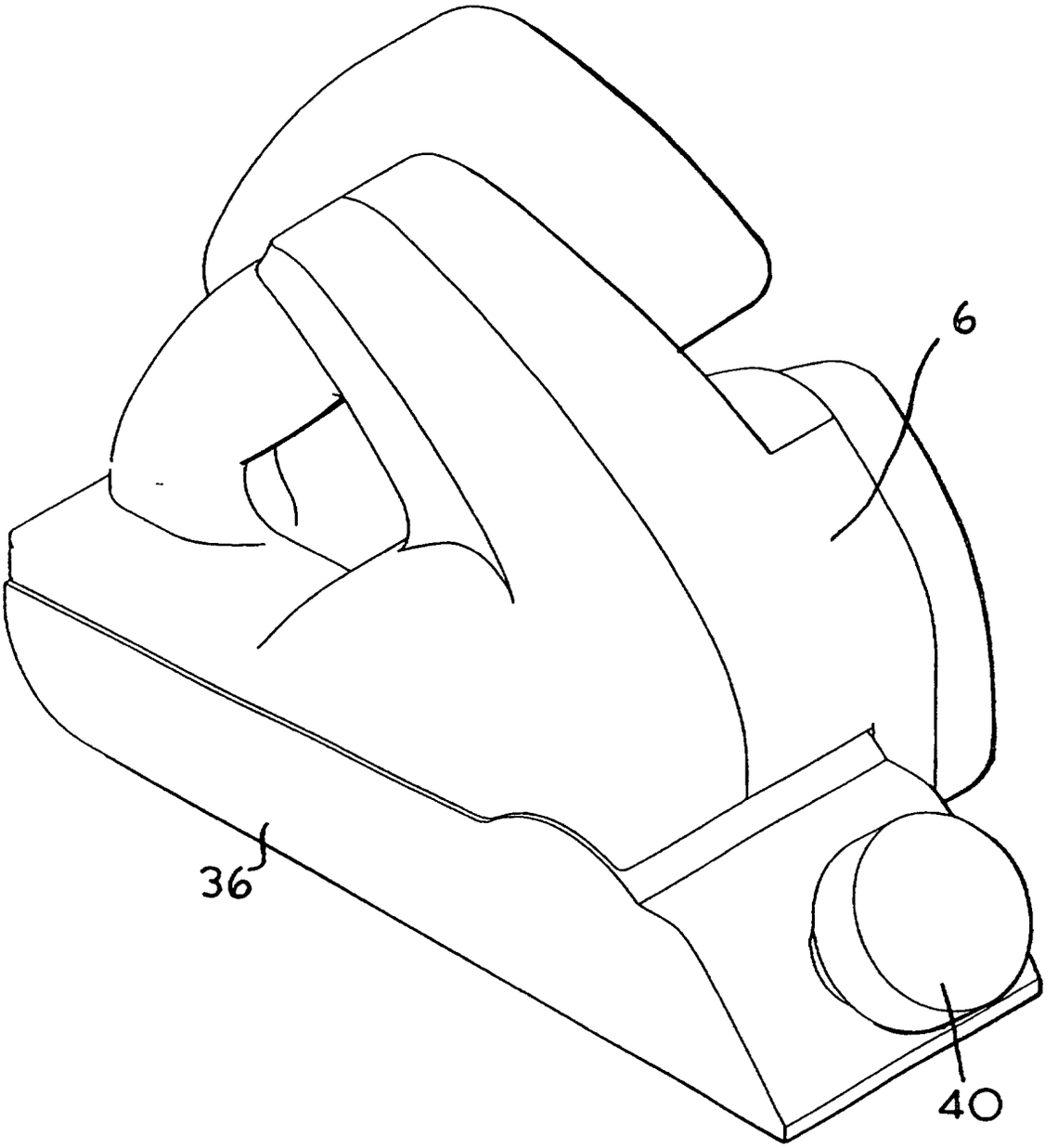

FIG. 5

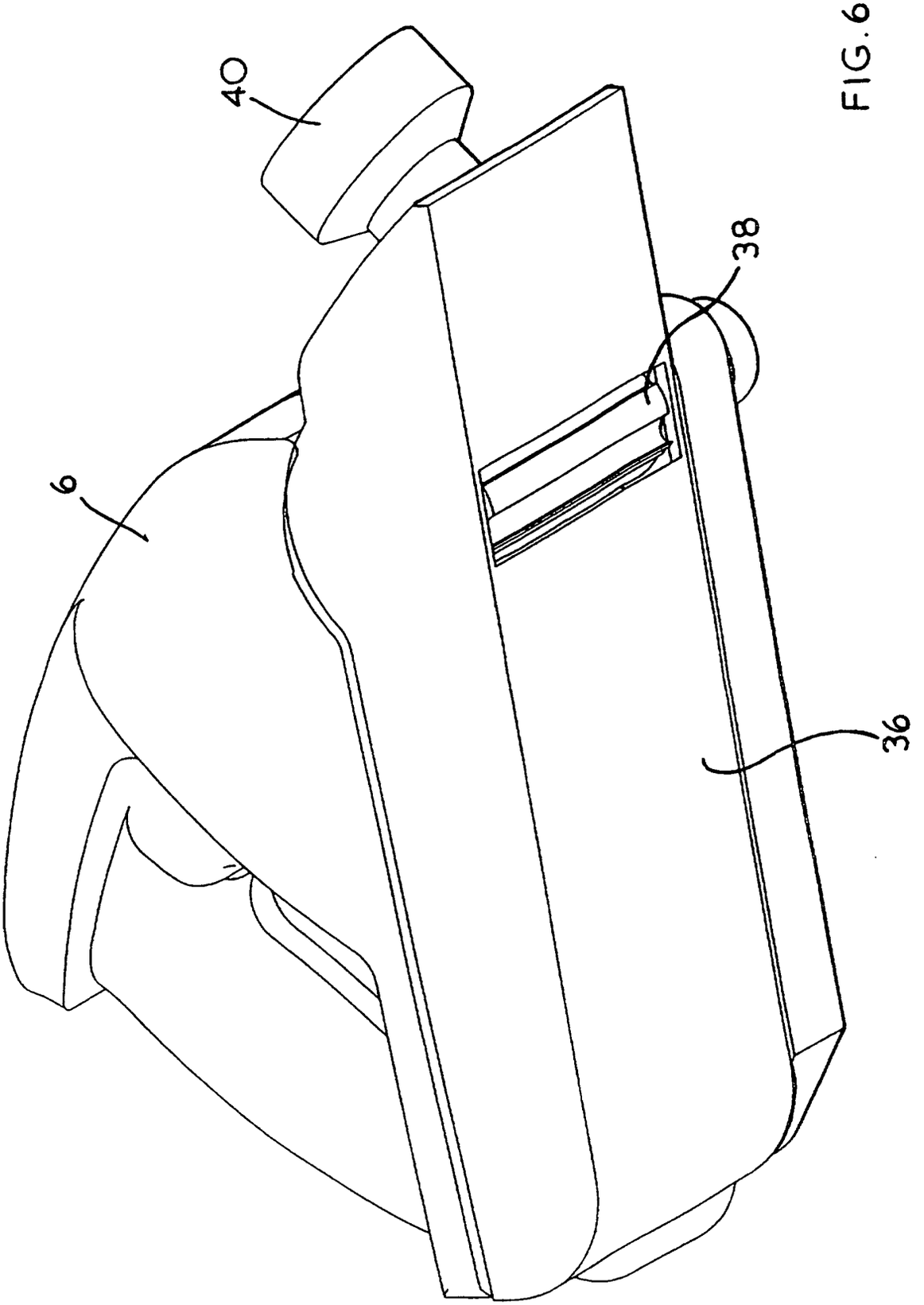

FIG.6

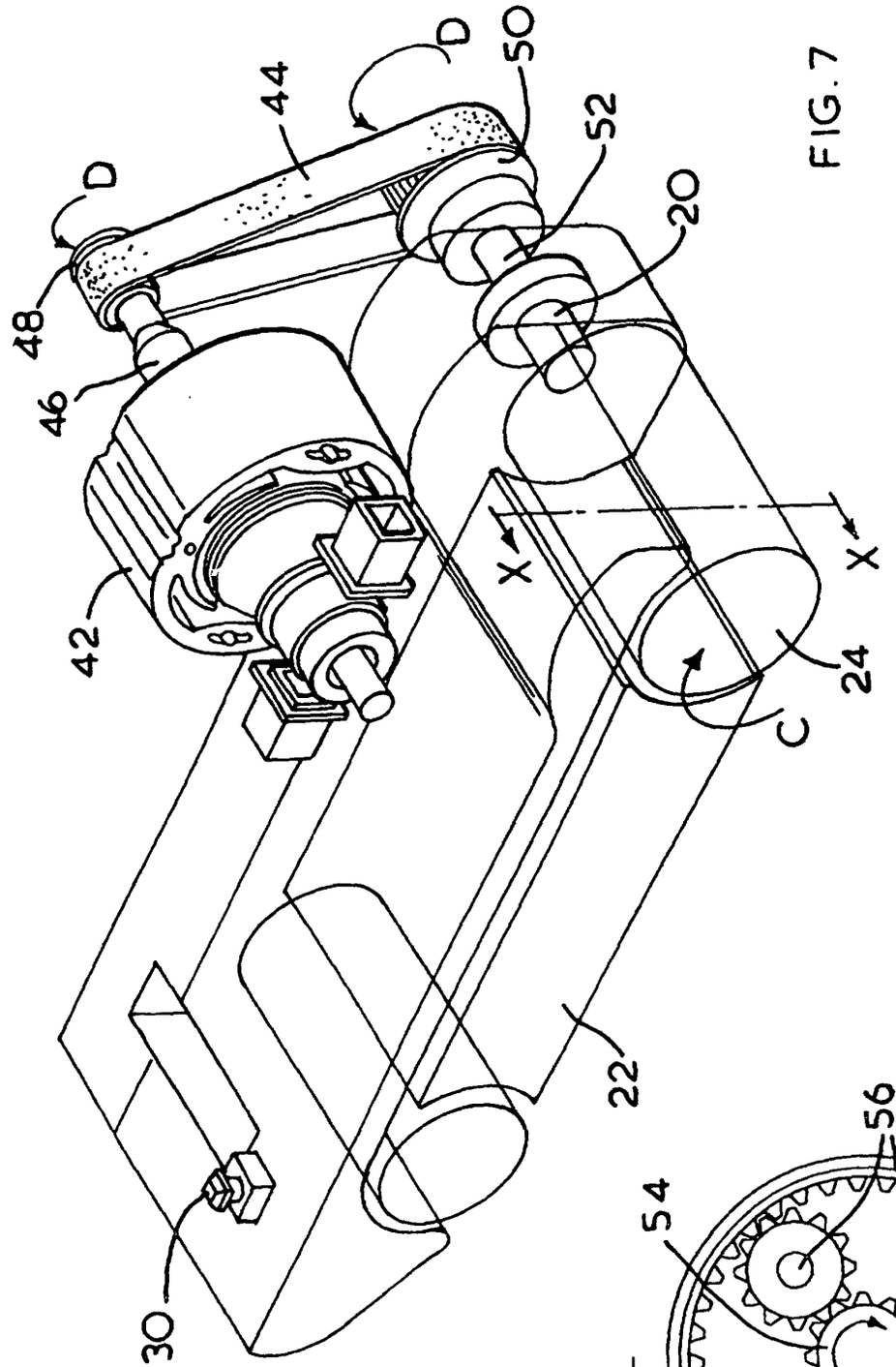

FIG. 7

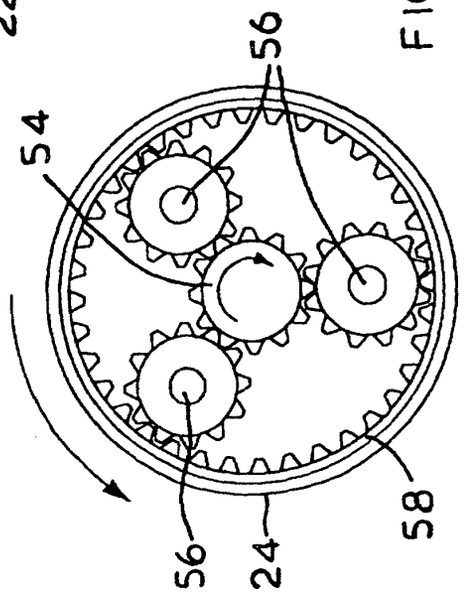

FIG. 8

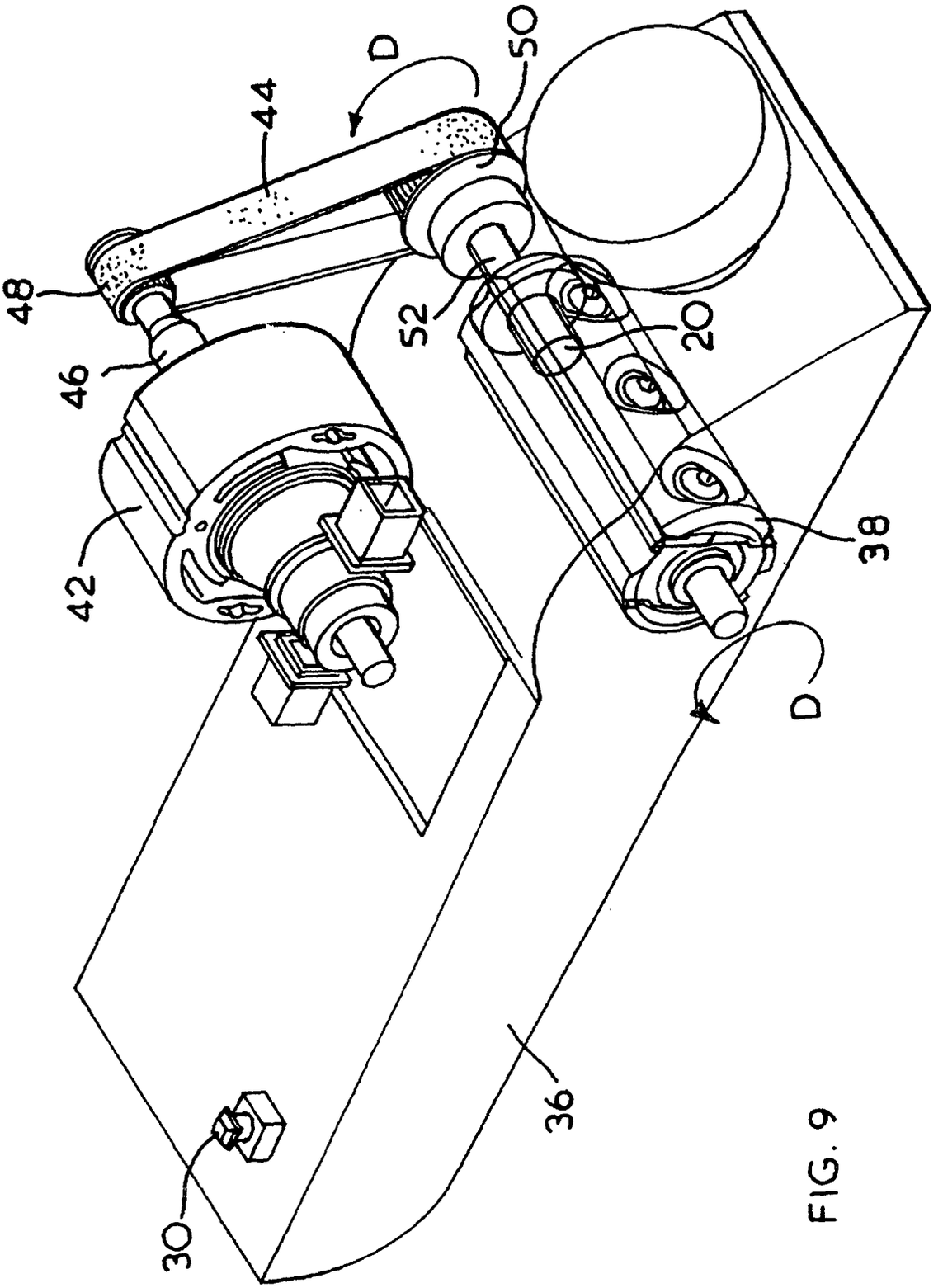

FIG. 9