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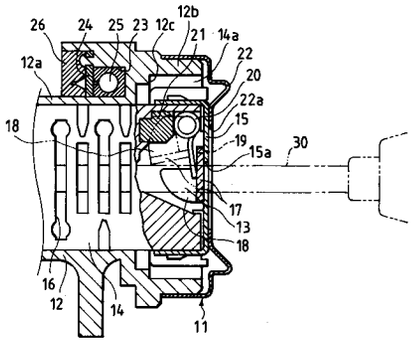
(54) Key-operated cylinder lock.

(57) A key-operated cylinder lock includes a rotor casing; a rotor having a key inserting channel, which is
rotatably arranged in the rotor casing; a permanent magnet provided in the rotor near the key inserting channel; a magnetic detecting element provided in the rotor casing in such a manner that the magnetic flux of the permanent magnet acts on the magnetic detecting element; a magnetic shutter swingably provided in the rotor in such a manner as to open and close the key inserting channel, the shutter being made of a magnetic material and adapted to interrupt the application of the magnetic flux of the permanent magnet to the magnet detecting element when the shutter is swung to a channel closing position to close the key inserting channel by a key inserted into the key inserting channel; and a spring member provided in the rotor, which is adapted to urge the shutter towards the channel closing position

EP 0 631 029 A2

FIG. 1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BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a key-operated cylinder lock having a function of detecting the presence and absence of the key.

Related Art

A key-operated cylinder lock, for instance, for an automobile door has not been put in practical use yet which includes a detecting device for electrically detecting whether the key is inserted into the rotor of the cylinder lock or it is removed therefrom; i.e., the presence or absence of the key.

A key-operated cylinder lock of this type is liable to be adversely affected by external conditions, because it is mounted on the outer surface of a vehicle; that is, it is exposed outside. Hence, it is, in general, difficult for the key-operated cylinder lock to have a detecting device for electrically detecting the presence or absence of the key. On the other hand, it is not always impossible to provide such a detecting device for the key-operated cylinder lock; however, the detecting device thus provided is unavoidably intricate in structure and bulky.

SUMMARY OF THE INVENTION

In view of the foregoing, an object of this invention is to provide a key-operated cylinder lock having a function of electrically detecting the presence or absence of the key which is small in the number of components and is not bulky.

In view of the foregoing, another object of this invention is to provide a key-operated cylinder lock which is relatively simple in construction and is able to electrically detect the presence or absence of the key with higher accuracy.

The foregoing object of the invention has been achieved by the provision of a key-operated cylinder lock which, according to the invention, comprises: a rotor casing including a cylindrical main portion, and an engaging portion larger in diameter than the main portion which is extended forwardly from the main portion; a rotor having a large-diameter portion on the outer cylindrical surface of the front end portion, and a key inserting channel opened in the front end face thereof, the rotor being rotatably arranged in the rotor casing with the large-diameter portion engaged with the engaging portion; a permanent magnet provided in the rotor near the key inserting channel; a magnetic shutter swingably provided in the rotor in such a manner that when the shutter is at a channel closing position to close the key inserting channel, the shutter is away from the permanent magnet, and when the shutter is swung to a channel opening position by a key inserted into the key inserting channel to open the key inserting channel, the shutter approaches the permanent magnet to concentrate the magnetic flux of the permanent magnet; a spring member adapted to urge the shutter towards the channel closing position; an accommodating recess formed in the rear of the outer periphery of the rotor casing in such a manner that the accommodating recess is located behind the engaging portion and near the permanent magnet and that the accommodating recess is opened only backwardly; a magnetic detecting element provided in the accommodating recess, for detecting variations of the magnetic flux of the permanent; and a sealing resin sealing the magnetic detecting element in the accommodating recess.

The foregoing object of the invention has been achieved by the provision of a key-operated cylinder lock which, according to the invention, comprises: a rotor casing; a rotor having a key inserting channel, which is
rotatably arranged in the rotor casing; a permanent magnet provided in the rotor near the key inserting channel; a magnetic detecting element provided in the rotor casing in such a manner that the magnetic flux of the permanent magnet acts on the magnetic detecting element; a magnetic shutter swingably provided in the rotor in such a manner as to open and close the key inserting channel, the shutter being made of a magnetic material and adapted to interrupt the application of the magnetic flux of the permanent magnet to the magnet detecting element when the shutter is swung to a channel closing position to close the key inserting channel by a key inserted into the key inserting channel; and a spring member provided in the rotor, which is made of a non-magnetic material and is adapted to urge the shutter towards the channel closing position.

In the key-operated cylinder lock, it is preferable that in the case where a rotor cover is provided on the front end portion of the rotor, the rotor cover is made of a non-magnetic material. Furthermore, it is preferable that, in the case where a casing cover is provided on the front end portion of the rotor casing, the casing cover is made of a non-magnetic material.

In the key-operated cylinder lock of the invention, the magnetic detecting element for detecting the variations of the magnetic flux of the permanent magnet is arranged in the accommodating recess formed in the rear of the rotor casing. Therefore, it is unnecessary to additionally provide a special casing for the magnetic detecting element. Furthermore, since the accommodating recess is formed in the rear of the engaging portion of the rotor

casing which is larger in diameter than the main portion, the engaging portion is substantially not inflated outwardly by the formation of the accommodating recess containing the magnetic detecting element.

Until the key is inserted into the key inserting channel, the shutter is held at the channel closing position, and the magnetic flux of the permanent magnet acts on the magnetic detecting element. When, under this condition, the key is inserted into the key inserting channel, the shutter is swung to the channel opening position against the elastic force of the spring member; that is, the shutter approaches the permanent magnet so that the magnetic flux of the latter is concentrated on the shutter. As a result, the application of the magnetic flux of the permanent magnet to the magnetic detecting element is interrupted.

As is apparent from the above description, the magnetic flux of the permanent magnet acting on the magnetic detecting element is varied with the operation of the shutter. Hence, the presence or absence of the key can be electrically detected by detecting the variations of the magnetic flux.

In this detecting operation, the spring member urging the shutter towards the channel closing position will not affect the magnetic flux of the permanent magnet acting on the magnetic detecting element, because it is made of non-magnetic material.

In addition, both the rotor cover mounted on the front end portion of the rotor, and the casing cover mounted on the front end portion of the rotor casing are made of non-magnetic material. Hence, the rotor cover and the casing cover will not affect the magnetic flux of the permanent magnet acting on the magnetic detecting element, either.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an enlarged fragmentary sectional view showing essential components of a key-operated cylinder lock, which constitutes a second embodiment of this invention;

FIGS. 2 and 3 are a front view and a side view, respectively showing the key-operated cylinder lock.

FIG. 4 is a rear view of a rotor casing in the key-operated cylinder lock;

FIG. 5 is a perspective view of lead wire holders in the key-operated cylinder lock;

FIG. 6 is an enlarged fragmentary sectional view showing essential components of a key-operated cylinder lock of a first embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

First embodiment

First embiodiment will be now described with the reference to FIG. 6.

The body 1 of the key-operated cylinder lock comprises: a cylindrical rotor casing 2; and a rotor 3 with a key inserting channel 3a which is rotatably arranged in the rotor casing 2. The rotor casing 2 comprises: a main portion 2a; and an engaging portion 2b extended from the former 2a, forming the front end portion of the rotor casing 2. The engaging portion 2b is larger in diameter than the main portion 2a. A step 2c is formed inside the engaging portion 2b, while a large-diameter portion 3b is formed on the outer cylindrical surface of the front end portion of the rotor 3, so that the large-diameter portion 3b of the rotor 3 is engaged with the step 2c to prevent the backward movement of the rotor 3.

A magnetic shutter 4 is swingably provided inside the rotor 3, to open and close the key inserting channel 3a. Furthermore, inside the rotor 3, a spring member 5 is provided to urge the shutter 4 to close the key inserting channel 3a, and a permanent magnet 6 is positioned near the spring member 5.

On the other hand, a magnetic detecting element, namely, a reed switch 7 is provided on the outer cylindrical surface of the engaging portion 2b of the rotor casing 2 near the permanent magnet 6. More specifically, the reed switch 7 is set in its own casing 8, which is covered by a casing cover 9 mounted on the front end portion of the rotor casing 2.

In the case where the key 10 is not inserted into the key inserting channel 3a yet, the shutter 4 is held at a channel closing position to close the key inserting channel, and the reed switch 7 is held, for instance, turned off by the magnetic flux of the permanent magnet 6.

When, under this condition, the key 10 is inserted into the key inserting channel 3a, the shutter 4 is swung against the elastic force of the spring member 5 to its channel opening position (as indicated by the two-dot chain lines); that is, the shutter 4 approaches the permanent magnet 6, so that the magnetic flux of the latter 6 is concentrated on the shutter 4. As a result, the application of the magnetic flux of the permanent magnet 6 to the reed switch 7 is interrupted, so that the latter 7 is turned on.

As was described above, the magnetic flux of the permanent magnet 6 acting on the reed switch 7 varies depending on whether the shutter 4 is opened or it is closed. Therefore, the presence or

absence of the key can be electrically detected by detecting the variations of the magnetic flux.

With the above-described key-operated cylinder lock, it is necessary to use the casing 8 to provide the reed switch 7, which increases the number of components as much. Furthermore, since the casing 8 is greatly outwardly protruded from the engaging portion 2b of the rotor casing 2, the key-operated cylinder lock is bulky.

Moreover, in the above-described key-operated cylinder lock, the spring member adapted to urge the shutter towards the channel closing position is a coil spring made of a piano wire. The piano wire is generally of magnetic substance, and is positioned near the permanent magnet, so that the magnetic flux of the permanent magnet is allowed to pass through the spring member. Hence, when the shutter is positioned at the channel closing position, a larger part of the magnetic flux passes through the spring member; that is, the magnetic flux acting on the reed switch is decreased as much. As a result, when the shutter is operated, the magnetic flux applied to the reed switch is less varied. Hence, the detection of the presence or absence of the key is lowered in accuracy.

Second embodiment

In view of the forgoing the problem, a key-operated cylinder lock of a second embodiment of the present invention applied to an automobile door will be described with reference to FIGS. 1 through 5.

As shown in FIGS. 1 through 3, a cylinder lock body 11 mounted on an automobile door comprises: a rotor casing 12; and a rotor 14 having a key inserting channel 13 which is rotatably provided inside the rotor casing 12.

The rotor casing 12 comprises: a cylindrical main portion 12a; and an engaging portion 12b extended forwardly (to the right in FIG. 1) from the former 2a, thus forming the front end portion of the rotor casing 12. The engaging portion 12b is larger in diameter than the main portion 12a. A step 12c is formed inside the engaging portion 12b, while a large-diameter portion 14a is formed on the outer cylindrical surface of the front end portion of the rotor 14. When the rotor 14 is inserted into the rotor casing 12 from the front, the large-diameter portion 14a of the rotor 14 is engaged with the step 12c of the engaging portion 12b to prevent the further backward movement of the rotor 14. The rotor casing 12 and the rotor 14 are made of non-magnetic material, zinc.

A rotor cover 15 is mounted on the front end portion of the rotor 14. The rotor cover 15 has a key inserting hole 15a which is communicated with the key inserting channel 13. A plurality of tumbler grooves 16 are formed in the outer periphery of the rotor 14, and tumblers (not shown) are movably arranged inside it in correspondence to the tumbler grooves 16. The rotor cover 15 is made of non-magnetic stainless steel.

A shutter 17 is provided inside the rotor 14. More specifically, the shutter is located beside the rotor cover 15. The shutter 17 is made of magnetic stainless steel, and has side plates 18 on its both edges, and pivot pins 19 on its both ends through which the shutter is mounted inside the rotor 14 in such a manner that it is swingable about the pivot pins 19. As the shutter 17 is swung, the key inserting hole 15c and accordingly the key inserting channel 13 are opened and closed. For this purpose, a spring member 20, which is a coil spring, is provided inside the rotor 14 to urge the shutter 17 to close the key inserting channel. The spring member 20 is made of non-magnetic material, for instance, beryllium copper.

Furthermore, inside the rotor 14, a permanent magnet 21 is provided in contact with the spring member 20. More specifically, the permanent magnet 21 is so positioned that, when the shutter 17 is swung to its channel opening position as indicated at the two-dot chain lines in FIG. 1, it is covered by the shutter 17.

On the other hand, a casing cover 22 having a circular hole 22a at the center is mounted on the front end portion of the rotor casing 12 in such a manner that it covers the rotor 14 from the front. The casing cover 22 is made of non-magnetic stainless steel, similarly as in the case of the rotor cover 15.

An accommodating recess 23 is formed in the outer periphery of the rotor casing 12 in such a manner that it is located behind the engaging portion 12b and near the permanent magnet 21 in the rotor 14 (cf. FIG. 4). In the accommodating recess 23, provided are a printed circuit board 14, and a magnetic detecting element, namely, a reed switch 25 which is coupled to the printed circuit board 14. The printed circuit board 14 and the reed switch 25 are sealed in the accommodating recess 23 with sealing resin 26.

U-shaped lead wire holders 27 and 28 are formed on the outer cylindrical surface of the main portion 12a of the rotor casing 12 in such a manner that, as shown in FIG. 5, they are shifted from each other in the direction of axis of the rotor casing 12 and are confronted with each other, so as to hold a lead wire extended from the aforementioned printed circuit board 24.

Now, the operation of the key-operated cylinder lock thus constructed will be described.

In the case where the shutter 17 is held at its channel closing position as indicated by the solid lines in FIG. 1, the magnetic flux of the permanent

magnet 21 acts on the reed switch 25, so that the latter 25 is held turned off for instance.

When, under this condition, the key 30 is inserted into the key inserting channel 13 through the key inserting hole 15a, the shutter 17 is swung by the key 30 to the channel opening position against the elastic force of the spring member 30 as indicated by the two-dot chain lines in FIG. 1. That is, the shutter 17 approaches the permanent magnet 21, so that the side plates 18 of the shutter 17 embraces the permanent magnet 21 from both sides; that is, the permanent magnet 21 is covered by the shutter 17.

When the shutter 17 is swung to the channel opening position, the magnetic flux of the permanent magnet 21 is concentrated on the shutter 17, so that the application of the magnetic flux to the reed switch 25 is interrupted. As a result, the reed switch 25 is turned on.

In the case where the predetermined key 30 is inserted into the key inserting channel 13 as was described above, the tumblers (not shown) are accommodated inside the rotor 14, thus permitting the rotation of the rotor 14. If, on the other hand, a key different from the key 30 is inserted into the key inserting channel, then some of the tumblers are protruded out of the tumbler grooves 16, thus inhibiting the rotation of the rotor 14.

In the above-described embodiment, as the shutter 17 is operated, the magnetic flux of the permanent magnet 21 acting on the reed switch 25 varies. Therefore, the presence or absence of the key 30 can be detected by detecting the variations of the magnetic flux.

In the embodiment, the reed switch 25 for detecting the variations of the magnetic flux of the permanent magnet 21 is arranged in the accommodating recess 23 formed in the outer periphery of the rotor casing 12. Therefore, it is unnecessary to additionally provide a special casing for the reed switch 25, which decreases the number of components as much. Furthermore, the accommodating recess 23 is formed in the rear of the engaging portion 12b of the rotor casing 12 which is larger in diameter than the main portion 12a. Therefore, the engaging portion 12b is substantially not inflated by the formation of the accommodating recess; that is, the resultant key-operated cylinder lock is not bulky.

Furthermore, in the key-operated cylinder lock thus constructed, the distance between the permanent magnet 21 and the reed switch 25 is substantially equal to that in the key-operated cylinder lock shown in FIG. 6. This means that the reed switch is high in detecting performance.

Moreover, in the above-described embodiment, the spring member 20 adapted to urge the shutter 17 towards the channel closing position is made of non-magnetic material. Therefore, although the spring member 20 is provided in contact with the permanent magnet 21, it will not affect the magnetic flux of the permanent magnet 21 acting on the reed switch 25. This means that the reed switch 25 is improved in detecting accuracy.

In addition, the rotor cover 15 mounted on the front end portion of the rotor 14, and the casing cover 22 mounted on the front end portion of the rotor casing 12 are both made of non-magnetic material. That is, the rotor cover 15 and the casing cover 22 will not affect the magnetic flux of the permanent magnet 21 acting on the reed switch 25, which further improves the detecting accuracy of the reed switch 25.

As is apparent from the above-description, in the key-operated cylinder lock according to the invention, the magnetic flux of the permanent magnet acting on the magnetic detecting element is varied as the shutter adapted to open and close the key inserting channel is operated, and the variations of the magnetic flux are detected with the magnetic detecting element, so that the presence or absence of the key is detected. In addition, the spring member adapted to urge the shutter towards the channel closing position is made of non-magnetic material. Therefore, the reed switch 25 is improved in detecting accuracy.

In the key-operated cylinder lock of the invention, the magnetic detecting element is arranged in the accommodating recess formed in the outer periphery of the rotor casing, which makes it unnecessary to additionally provide a special casing for the magnetic detecting element, and reduces the number of components as much. Furthermore, since the accommodating recess is formed in the rear of the engaging portion of the rotor casing which is larger in diameter than the main portion, the engaging portion is substantially not inflated outwardly by the formation of the accommodating recess.

In addition, the rotor cover mounted on the front end portion of the rotor, and the casing cover mounted on the front end portion of the rotor casing are both made of non-magnetic material. Thus, the magnetic detecting element is improved in detecting accuracy.

Claims

1. A key-operated cylinder lock comprising:

a rotor casing;

a rotor having a key inserting channel, which is rotatably arranged in the rotor casing;

a permanent magnet provided in the rotor near the key inserting channel;

a magnetic detecting element provided in the rotor casing in such a manner that the

magnetic flux of the permanent magnet acts on the magnetic detecting element;

a magnetic shutter swingably provided in the rotor in such a manner as to open and close the key inserting channel, the shutter being made of a magnetic material and adapted to interrupt the application of the magnetic flux of the permanent magnet to the magnet detecting element when the shutter is swung to a channel closing position to close the key inserting channel by a key inserted into the key inserting channel; and

a spring member provided in the rotor, which is adapted to urge the shutter towards the channel closing position.

2. A key-operated cylinder lock as claimed in claim 1, wherein the rotor includes a cylindrical main portion, an engaging portion larger in diameter than the cylindrical main portion which is extended forwardly from the cylindrical main portion and an accommodating recess formed in the rear of an outer periphery of the rotor casing in such a manner that the accommodating recess is located behind the engaging portion and near the permanent magnet and that the accommodating recess is opened only backwardly.

3. A key-operated cylinder lock as claimed in claim 2, further comprising:

a sealing member for sealing the magnetic detecting element in the accommodating recess.

4. A as claimed in claim 3, wherein the sealing member includes a sealing resin.

5. A key-operated cylinder lock as claimed in claim 1, further comprising:

a rotor cover on the front end portion of the rotor, the rotor cover being made of a non-magnetic material.

6. A key-operated cylinder lock as claimed in claim 1, further comprising:

a casing cover on the front end portion of the rotor casing, the casing cover being made of a non-magnetic material.

7. A key-operated cylinder lock as claimed in claim 5, further comprising;

a casing cover on the front and portion of the rotor cover, the casing cover being made of a non-magnetic material.

8. A key operated cylinder lock as claimed in claim 1, wherein a spring member is made of a non-magnetic material.

FIG. 1

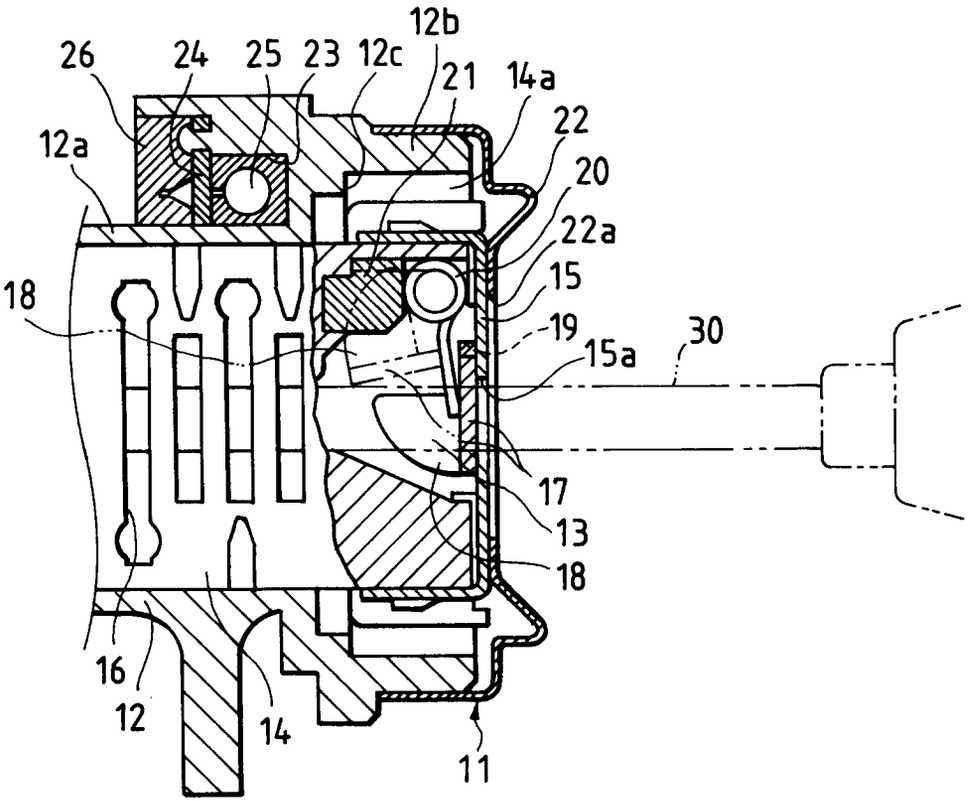
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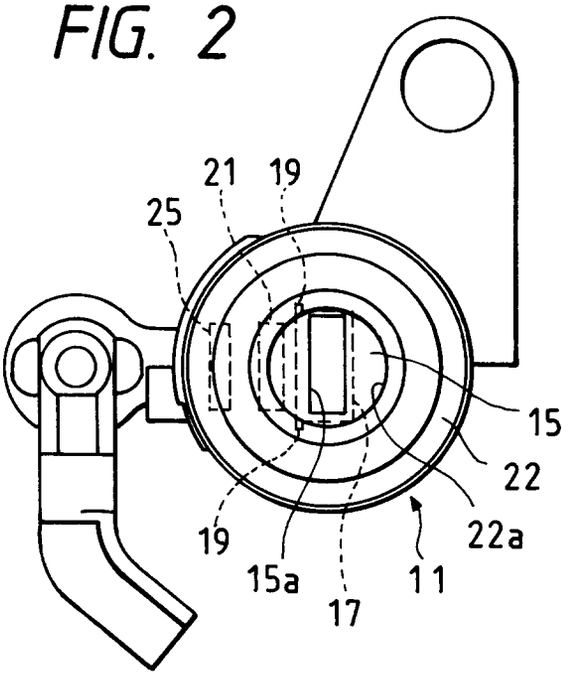
FIG. 2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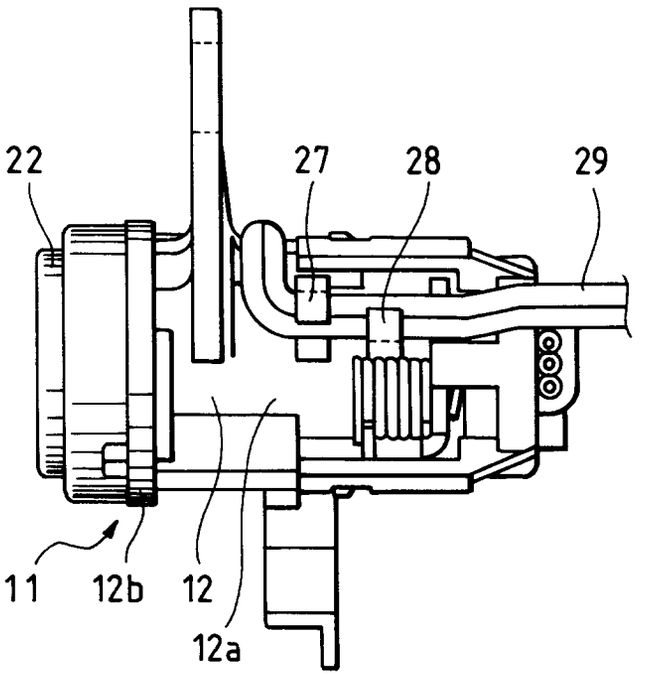

FIG. 4

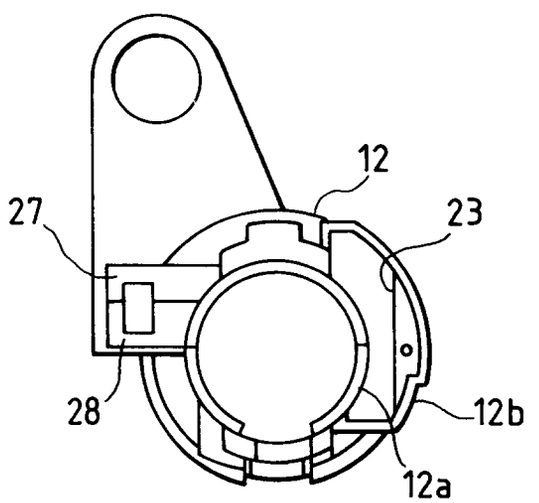

FIG. 5

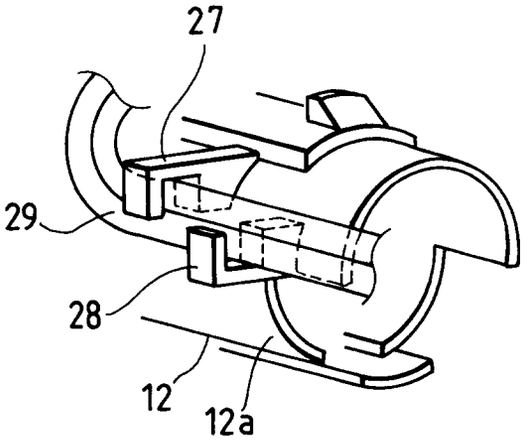

FIG. 6