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

(11) Publication number: **0 054 381**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **81305700.7**

(22) Date of filing: **03.12.81**

(51) Int. Cl.³: **F 02 P 7/06**
F 02 P 7/02

(30) Priority: **11.12.80 GB 8039729**

(43) Date of publication of application:
23.06.82 Bulletin 82/25

(84) Designated Contracting States:
BE DE FR GB IT

(71) Applicant: **LUCAS INDUSTRIES LIMITED**
Great King Street
Birmingham, B19 2XF(GB)

(72) Inventor: **Edmonds, Richard David**
46 Weoley Hill Selly Oak
Birmingham, B29 4AE(GB)

(74) Representative: **Carpenter, David et al,**
MARKS & CLERK Alpha Tower ATV Centre
Birmingham B1 1TT(GB)

(54) **Rotor vane assembly.**

(57) A rotor vane assembly including a rotor arm (19, 21) formed from electrically insulating material and having therein a recess (31) within which in use one end of a shaft (12) is received to mount the assembly on said shaft, a vane (23) formed from conductive material and secured to said rotor arm to rotate therewith and a conductive clip (33) having a first portion (34) within said recess (31) and arranged to engage said shaft end in use to retain said assembly on said shaft, the clip (33) having an integral second portion (35c) which engages said vane (23) so as to be electrically connected thereto, whereby, in use the clip (33) provides an electrical connection between the vane (23) and the shaft (12) upon which the assembly is mounted.

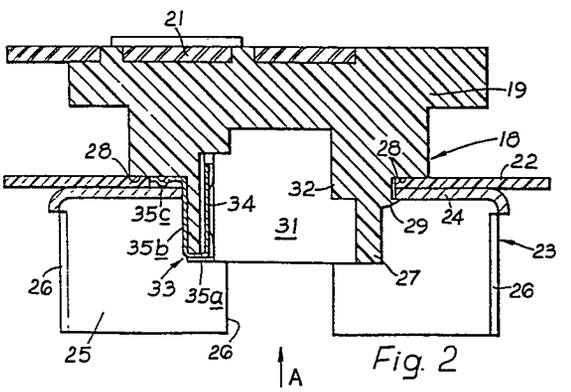

Fig. 2

./...

EP 0 054 381 A1

Croydon Printing Company Ltd.

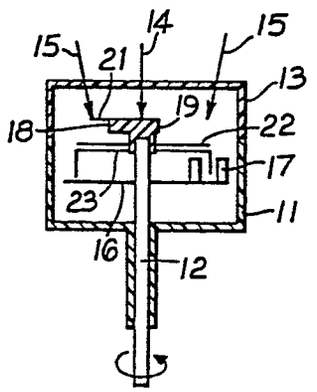

Fig. 7

In an ignition distributor which includes a contactless signal generator, for example a Hall effect transducer, forming part of a spark ignition system for an internal combustion engine, the rotated shaft (the cam shaft in a conventional ignition distributor utilizing a mechanical contact breaker assembly) carries a rotor arm which distributes high voltage pulses to a plurality of output terminals in turn, and a vane which forms part of the contactless signal generator. It has previously been proposed to mount the vane on the rotor arm to produce an assembly and the present invention relates to such a rotor vane assembly.

In a rotor vane assembly where the vane is electrically conductive it is desirable for the vane to be electrically earthed. In a road vehicle application earthing of the vane usually means that the vane should be electrically connected to the engine and body of the vehicle. The distributor shaft which carries the rotor vane assembly is electrically earthed through the engine in use, and it has been proposed previously to provide an electrical connection between the vane of the assembly and the distributor shaft by means of a layer of electrically conductive paint applied to the surface of the electrically insulating rotor arm moulding. Such an arrangement however proves to be disadvantageous in that its production is labour intensive, and in that it is not as reliable as might be desired. It is an object of the present invention to provide a rotor vane assembly wherein the above-mentioned disadvantages are minimised.

A rotor vane assembly according to the invention includes, a rotor arm formed from electrically insulating material and having therein a recess within which in use one end of a shaft is received to mount the assembly on said shaft, a vane formed from conductive material and secured to said rotor arm to rotate therewith, and a conductive clip having a first portion within said recess and

arranged to engage said shaft end in use to retain said assembly on said shaft, the clip having an integral second portion which engages said vane so as to be electrically connected thereto, whereby, in use the clip provides an electrical connection between the vane and the shaft upon which the assembly is mounted.

Preferably said second portion of said clip has three integral regions, a first region extending at right angles to the first portion, a second region extending parallel to the first portion and defining with the first portion and the first region a U-shape within which a wall section of the rotor arm is received, and a third region in contact with said vane.

Desirably said second region extends through said vane and said third region engages the face of the vane remote from the shaft in use.

Preferably said third region has a projection thereon which contacts the vane.

Conveniently there is provided a disc-like flash shield overlying the vane and the flash shield has an aperture therein to accommodate the third region of the clip.

One example of the present invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a plan view, to an enlarged scale of a rotor vane assembly;

Figure 2 is a sectional view on the line A-A of Figure 1;

Figure 3 is a side elevational view of a clip seen in section in Figure 2;

Figure 4 is a sectional view on the line B-B of Figure 3;

Figure 5 is a sectional view on the line C-C of Figure 3;

Figure 6 is an end view of the clip of Figure 3;

Figure 7 is a diagrammatic representation of an ignition

distributor utilizing the rotor vane assembly of Figures 1 and 2;

Figure 8 is a view, to a reduced scale, in the direction of arrow A in Figure 2;

Figure 9 is a view similar to Figure 2 of a modification;

Figure 10 is a sectional view to an enlarged scale of the clip shown in Figure 9 and;

Figure 11 is a perspective view of the flash shield shown in Figure 9.

Referring to the drawings it can be seen from Figure 7 that the ignition distributor housing a contactless signal generator, includes a hollow cup-shaped casing 11 supporting a rotor shaft 12 for rotation therein. An open end of the casing 11 is closed by an electrically insulating cap 13 having a high voltage input terminal 14 disposed thereon. The terminal 14 is aligned with the axis of rotation of the shaft 12 and positioned around the terminal 14 are a plurality of high tension output terminals 15 equal in number to the number of spark plugs of an internal combustion engine of which the ignition distributor forms part of the spark ignition system.

Housed within the casing 11 of the distributor is a fixed base plate 16 through which the shaft 12 extends and upon which is mounted the fixed sensor 17 of the contactless signal generator. At the end of the shaft 12 within the casing 11 is a rotor vane assembly 18 comprising a moulded synthetic resin body 19 carrying a conductive element 21.

The body 19 together with the element 21 comprise what would, in a conventional ignition distributor having a mechanical contact breaker assembly, be called a rotor arm. As with a conventional rotor arm the element 21 co-operates permanently with the input terminal 14, and during its rotation with the shaft 12 relative to the casing 11 and cap 13 the element 21 co-operates in turn with the output

terminals 15 so as to distribute high voltage sparking pulses supplied by way of the terminal 14 to the appropriate sparking plug of the engine in turn by way of the output terminals 15.

The rotor vane assembly 18 includes, in addition to the rotor arm, a moulded synthetic resin flash shield 22 in the form of a disc, the flash shield 22 minimizing the risk of "flash-over" from the element 21 to the conductive shaft 12 which of course is electrically earthed through the engine of the vehicle in use. The assembly further includes a vane 23 of the contactless signal generator. The vane is in the form of a disc 24 having a peripheral flange 25, the flange 25 extending at right-angles to the plane of the disc 24 and being formed with a plurality of equi-angularly spaced slots 26 equal in number to the number of cylinders of the engine to be served by the ignition distributor. In the example shown in the drawings the distributor is to serve a four cylinder engine and thus the flange 25 of the vane 23 has four equi-angularly spaced slots 26.

The body 19 of the rotor arm of the assembly 18 is conveniently moulded in 40% talc filled polypropylene and has an axially extending region 27 of D-shaped cross-section. The region 27 extends from one axial end of the body 19 and terminates at a shoulder 28 extending at right-angles to the axis of the region 27. The flash shield 22 abuts the shoulder 28, having therein an aperture through which the region 27 extends. Similarly the disc 24 of the vane 23 has a centrally disposed circular aperture through which the region 27 extends, the disc 24 of the vane 23 lying in facial contact with the flash shield 22. The material of the region 27 is deformed, by the application of heat around the region 27 to provide a rib 29 which overlies the disc 24 and thus trap the vane 23 and shield 22 against the shoulder 28. The periphery of the circular aperture in the disc 24 of the vane 23 is castellated, the castellations providing a key within the material forming the rib 29. Thus by virtue of the deformation of the region 27 to form the rib 29 trapping the disc 24 and shield 22 against the shoulder 28 the shield and vane are incapable of axial movement relative to the body, and in particular the vane, which prior to formation of the rib 29 could rotate on the body, is locked against rotation relative to the body. Thus the vane, the shield, and the rotor arm are combined to form the rotor vane assembly.

The deformation of the material of the region 27 to form the rib 29 can be achieved by "hot staking" or by "ultrasonic riveting" or by any allied technique. The material of the body 19 is of course thermoplastic and so permits such deformation methods. The rib 29 can be continuous or can be defined by a number of spaced deformations of the region 27.

In order to provide a driving connection between the end of the shaft 12 and the rotor vane assembly 18 the rotor arm is formed with an axially extending bore 31 of circular cross-section having a driving key 32 extending

therein. The end of the shaft 12 which is received in the bore 31 has a slot therein for receiving the key 32 thereby establishing a driving connection between the shaft 12 and the rotor vane assembly 18.

In order to retain the rotor vane assembly on the end of the shaft 12 there is provided a spring steel clip 33. The clip 33 includes a first, rectangular region 34 which lies within the bore 31, its edges being received in respective grooves in the wall of the bore 31. The region 34 of the clip 33 thus obstructs part of the bore 31 and is flexed by the shaft 12 entering the bore 31 and thus provides a strong frictional grip between the shaft 12 and the wall of the bore 31. A clip which consists of a single part similar to the region 34 of the clip described above is conventionally used to secure a rotor arm to the rotor shaft of a conventional ignition distributor. However, the clip 33 includes an integral strip-like second portion 35.

The portion 35 of the clip 33 although a single strip integral with the portion 34, can be considered as three separate sections. Thus the portion 35 includes a first section 35a which extends from an edge of the portion 34 at right-angles to the plane of the portion 34. A second section 35b integral with the section 35a extends at right-angles thereto and thus lies parallel to the plane of the portion 34. The third section 35c extends at right-angles to the section 35b and thus lies parallel to the section 35a. The portion 34 together with the sections 35a and 35b define a U-shape within which a portion of the wall of the bore 31 of the body 19 extends. The section 35c extends radially outwardly from the region 27 of the body 19. The length of the section 35b of the clip 33 is such that the section 35c lies in contact with the shoulder 28 of the body 19. The flash shield 22 is provided with a small slot within which the section 35c of the clip 33 is accommodated, and the section 35c is formed with a raised projection the

height of which is fractionally greater than the thickness of the flash shield 22 so that when the metallic disc 24 of the vane 23 traps the flash shield 22 against the shoulder 28 then the projection on the section 35c of the clip 33 is pressed firmly against the metallic disc 24 of the vane 23 and so makes electrical connection thereto. It will be recognised that the shaft 12 of the ignition distributor is electrically connected to the engine of the vehicle, and so is electrically earthed in use. The portion 34 of the clip 33 engages the shaft 12, and thus the vane 23 is electrically earthed in use by way of clip 33 and the shaft 12. It will be seen from Figure 8 that the region 35b of the clip 33 engages the flat surface of theD-section region 27 and thus passes through the clearance between the flat of the D-section and the wall of the generally circular aperture of the disc 24.

Figures 9, 10 and 11 illustrate a modification of the arrangement described above with reference to Figures 1 to 8. The basic construction of the rotor vane assembly of Figure 9 is very similar to that of Figure 2, but the clip and flash shield are modified. Where appropriate the reference numerals ascribed to the components in Figure 2 are applied to the same components in Figure 9. It can be seen from Figures 9 and 11 that the flash shield 122 differs from the flash shield 22 of Figure 2 in that the small slot for receiving the section 35c of the clip 33 is omitted. Instead the flash shield 122 is formed, on one face thereof, with a circumferential groove 122a which, when the shield 122 is assembled to the body 19, faces towards the end of the body 19 remote from the conductive element 21.

The clip 33 of Figure 2 is replaced by the clip 133 illustrated in Figure 10, the clip 133 having a region 134 equivalent to the region 34 of the clip 33. Furthermore, the clip 133 has a portion 135 generally equivalent to the portion 35 of the clip 33. The portion 135 of the clip 133

has a first section 135a corresponding to the section 35a of the clip 33 and a second section 135b corresponding to the section 35b of the clip 33. However, the third section 135c of the clip 133 differs from the section 35c of the clip 33 in that firstly the section 135c does not have a projection equivalent to the projection of the section 35c of the clip 33, and secondly in that in the rest condition of the clip, that is to say before the section 135c is trapped between the body 19 and the disc 24 of the vane 25, the section 135c is so positioned relative to the section 135b that they subtend between them an angle of approximately 55°. The angle of 55° is not critical, and it is believed that the angle can lie anywhere in the range 50 to 70°. Thus after assembly of the clip 133 to the body 19, and prior to engagement of the vane 23 the junction of the section 135c with the section 135b lies within the groove 122a, and the section 135c is inclined with respect to the plane of the flash shield 122 so as to project outwardly from the groove. When the annular disc 24 of the vane 23 is engaged over the body 19 and pressed towards the flash shield 122 to trap the flash shield 122 against the shoulder 28 the section 135 is flexed to lie within the depth of the groove 122a of the flash shield, but at the same time to press firmly against the annular disc 24 of the vane 23 and so make a good electrical contact thereto.

As with the arrangement illustrated in Figure 2 the vane 23 and flash shield 122 are secured in position by hot deforming the material of the region 27 of the body 19 to define a rib 29 which overlies the disc 24.

Dispensing with the slot in the flash shield 122 extends the distance over which electrical tracking must occur before the conductive element 21 is electrically earthed through the clip 133. Thus the construction illustrated in Figure 9 will have a greater resistance

to tracking between the element 21 and the clip 133 than has the construction illustrated in Figure 2.

The nature of the contactless signal generator of the ignition distributor is not of particular importance to the present invention, and may for example be the electromagnetic type known as a "Hall Effect" transducer. In such a construction the vane is formed from mild steel and the passage of alternate slots and solid parts of the flange 25 adjacent electromagnetic poles of the sensor 17 causes generation of appropriate output signals.

It will be recognised that Figure 7 and the foregoing description thereof are somewhat simplified, and, for example, the distributor may include both or either of centrifugal, and vacuum advance systems for varying the timing of the production of the signals by the signal generator, in relation to the speed of rotation of the rotor shaft 12.

CLAIMS:

1. A rotor vane assembly including a rotor arm (19, 21) formed from electrically insulating material and having therein a recess (31) within which in use one end of a shaft (12) is received to mount the assembly on said shaft and a vane (23) formed from conductive material and secured to said rotor arm (19, 21) to rotate therewith, characterized by the provision of a conductive clip (33) having a first portion (34) within said recess (31) and arranged to engage said shaft end in use to retain said assembly on said shaft (12), the clip (33) having an integral second portion (35) which engages said vane (23) so as to be electrically connected thereto, whereby, in use the clip (33) provides an electrical connection between the vane (23) and the shaft (12) upon which the assembly is mounted.

2. An assembly as claimed in claim 1, characterized in that said second portion (35) of said clip (33) has three integral regions, a first region (35a) extending at right angles to the first portion (34), a second region (35b) extending parallel to the first portion (34) and defining with the first portion (34) and the first region (35a) a U-shape within which a wall section of the rotor arm (19, 21) is received, and a third region (35c) in contact with said vane (23).

3. An assembly as claimed in Claim 2, characterized in that said second region (35b) extends through said vane (23) and said third region (35c) engages the face of the vane (23) remote from the shaft (12) in use.

4. An assembly as claimed in Claim 2 or Claim 3, wherein said third region (35c) has a projection thereon which contacts the vane (23).

5. An assembly as claimed in Claim 3 or Claim 4, wherein there is provided a disc-like flash shield (22) overlying the vane (23) and the flash shield (22) has an aperture therein to accommodate the third region (35c) of the clip (33).

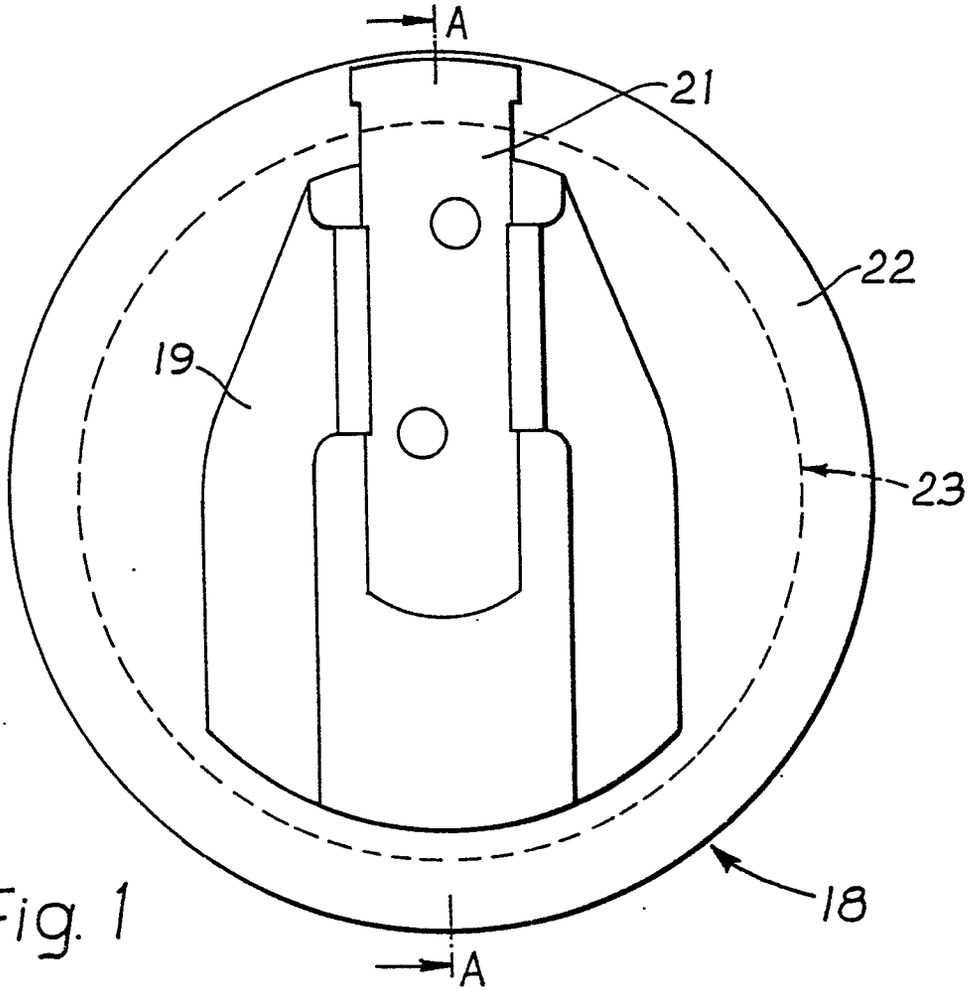
A
21
22
19
23
18
A

Fig. 1

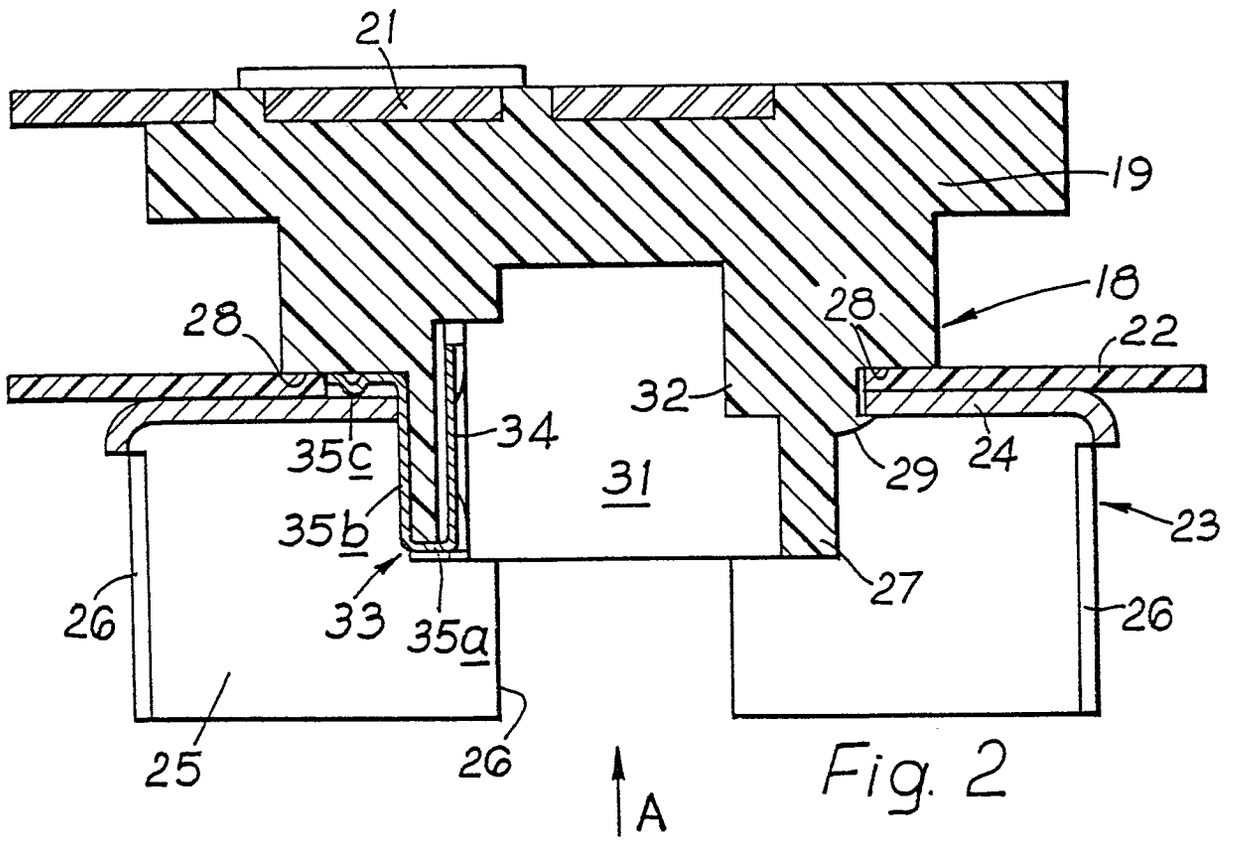
21
19
18
28
28
22
32
34
35c
31
29
24
35b
23
27
26
33
35a
26
25
26
A

Fig. 2

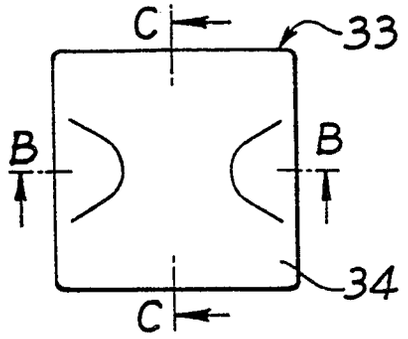

Fig. 3

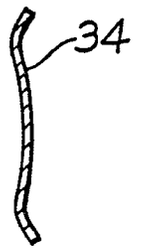

Fig. 5

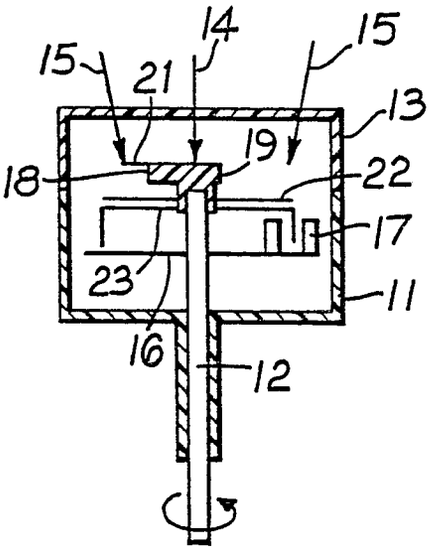

Fig. 7

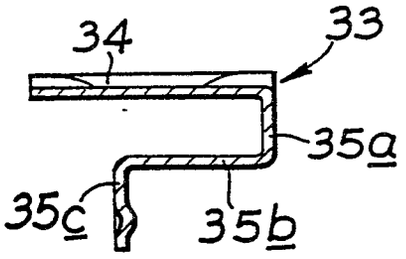

Fig. 4

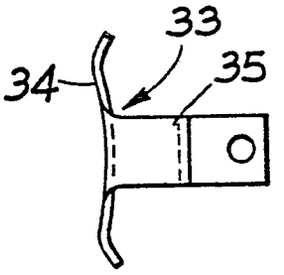

Fig. 6

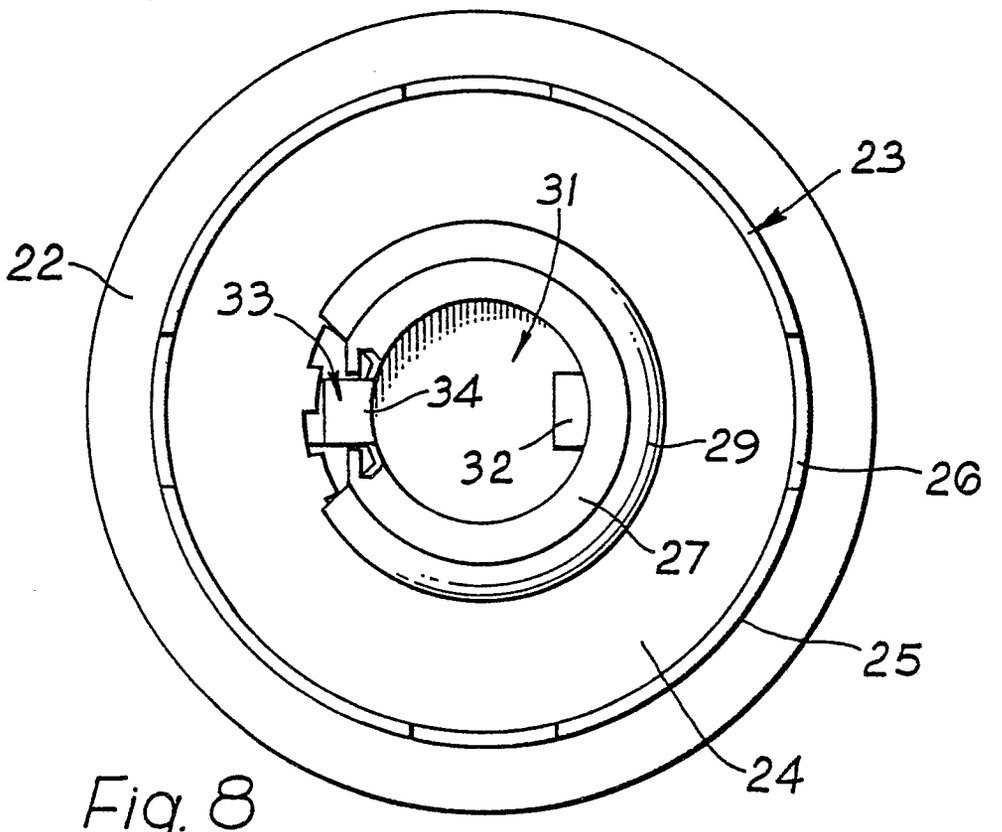

Fig. 8

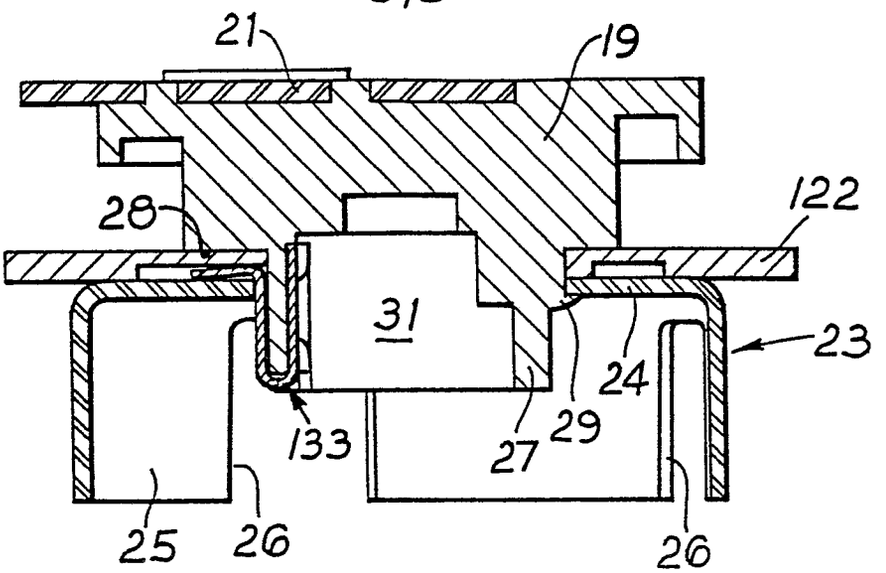

Fig. 9

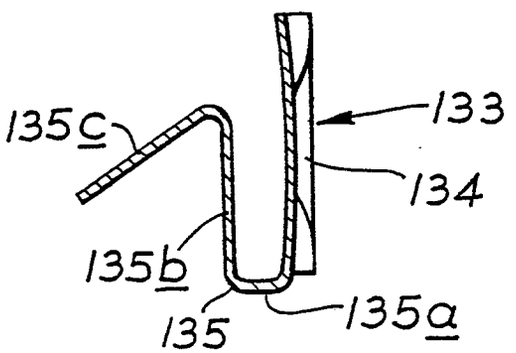

Fig. 10

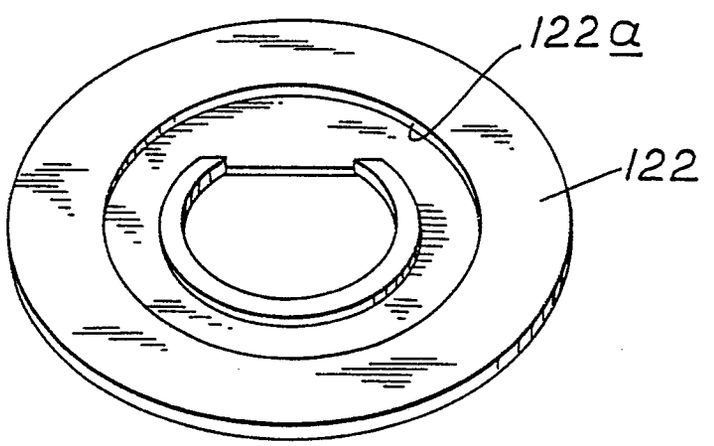

Fig. 11

0054381

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 81 30 5700.7

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	DE - A1 - 2 716 510 (R. BOSCH GMBH) * page 8, paragraphs 2, 3; fig. 1, 2 * & US - A - 4 185 600	1
Y	DE - A1 - 2 800 621 (CHRYSLER CORP.) * page 10, last paragraph to page 11, first paragraph; page 19, last paragraph to page 21; fig. 1 * & GB - A - 1 563 039	1
P,Y	EP - A1 - 0 030 078 (LUCAS INDUSTRIES LTD.) * page 6, paragraph 1; page 8, paragraph 2, to page 9, paragraph 2; fig. 3 *	1,5
Y	DE - A1 - 2 823 531 (FORD-WERKE AG) * page 7, last paragraph to page 8, first paragraph; fig. 1 * & GB - A - 1 602 070	1,5

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

F 02 P 7/06
F 02 P 7/02

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

F 02 P 7/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same category
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: earlier patent document, but published on, or after the filing date
D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	22-02-1982	ROUSSEL