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(54) Method of, and apparatus for use in, setting the position of a sensor of a contactless signal generator.

(57) Method of, and apparatus for use in, the setting of the position of a sensor (17) of a contactless signal generator in an ignition distributor, in relation to the path of rotation of the vane (23) of the generator. The method includes the step of engaging with the sensor (17) a component (32, 33) which moves with the sensor during adjustment, and which has a thickness equal to the required spacing of a surface of the vane (23) from a corresponding surface of the sensor (17). The sensor (17) is moved relative to the casing of the distributor (11) until the component (32a, 33a) is trapped between the corresponding surfaces of the sensor (17) and vane (23) and the position of the sensor (17) is then fixed relative to the casing of the distributor (11).

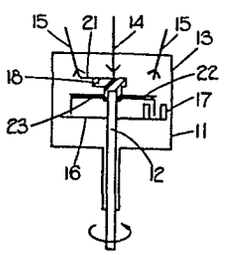

FIG.1.

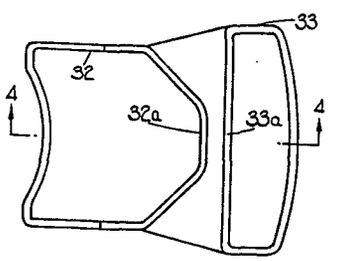

FIG.3.

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In an ignition distributor having a contactless signal generator for supplying control signals to an electronic ignition system it is necessary, at least during assembly of the distributor, to set the position of the sensor in relation to a rotating vane rotation of which, in use, is sensed by the sensor, and the present invention relates to a method of, and apparatus for use in, setting the position of a sensor of a contactless signal generator in an ignition distributor, in relation to the path of rotation of a vane of the generator.

In a known arrangement of a contactless signal generator, the sensor is a Hall effect transducer, the vane passing between the transducer and a magnetic pole, and slots in the vane causing a periodic disruption in the flow of magnetic flux through the transducer. The periodic disruption of flux is sensed by the transducer which produces corresponding output signals. The vane includes a disc concentric with the rotor shaft of the distributor, the disc having a peripheral flange extending at right angles to the plane of the disc and thus defining a cylinder of circular cross-section with its axis coextensive with the shaft axis. The cylindrical flange is formed with a number of equiangularly spaced slots equal in number to the number of ignition pulses required in each revolution of the distributor rotor shaft. The sensor of the generator is adjustably secured to the distributor base plate, and since the cylindrical flange of the vane passes between the transducer and the magnet of the sensor during its rotation then it is important that the flange is spaced from both walls of the slot defined by the transducer and magnet pole or poles. The width of the slot in the sensor is such that when the flange of the vane is at the correct spacing from the magnet pole or poles then it is also clear of the transducer. It has also been proposed in an alternative generator construction for the flange to pass adjacent a face of the sensor, and in such an arrangement the spacing between the face of the

sensor and the mutually presented surface of the flange is critical.

In signal generators of this general type where a vane rotates adjacent a sensor, or through a slot in a sensor it has previously been proposed to set the sensor position by assembling the distributor, releasing the sensor fixing screws, and introducing a feeler gauge between the flange of the vane and the appropriate face of the sensor. The sensor is then manipulated relative to the base plate of the distributor to the correct position and the screws are then tightened to lock the sensor in the set position. It has been found that such a method is problematic in that a degree of skill is required in all cases owing to the lack of accessibility of the gap between the flange and the sensor. Clearly, where the gap is between the inner face of the flange and the sensor then owing to the cup-like nature of the rotatable vane it is almost impossible to insert a feeler gauge into the gap and thus the gap between the outer face of the flange and a further part of the sensor must be used. It will be recognised therefore that since the gap which is being set by means of the feeler gauge is not the critical gap, then inaccuracies in the critical gap setting may well arise as a result of tolerances in the manufacture of the sensor and the vane. It is an object of the present invention to provide a method and apparatus whereby the problems of setting the sensor position in signal generators of the above described general type are minimised.

A method of setting the position of a sensor of a contactless signal generator in an ignition distributor, in relation to the path of rotation of the vane of the generator, according to the invention includes, engaging with the sensor apparatus including a component which, when the apparatus is engaged with the sensor, has a surface spaced by a required distance from an appropriate face of the sensor, assembling the vane of the generator to the

rotor shaft of the distributor, moving the sensor relative to the casing of the distributor until an appropriate face of the vane engages said surface of said component, said required distance being such that when said surface is engaged by said appropriate face of the vane then the position of the sensor relative to the vane is as required, fixing the sensor in that position relative to the casing of the distributor, and, removing said apparatus.

Preferably where said vane is generally cup-shaped and said face of the vane is an inner surface of the vane then the method includes, subsequent to the step of fixing the sensor in position, the step of removing the vane to permit the subsequent step of removing the apparatus.

The invention further resides in apparatus for use in setting the position of a sensor of a contactless signal generator in an ignition distributor, in relation to the path of rotation of the vane of the generator, the apparatus comprising a component having a surface to be engaged by a surface of the vane, and means engagable with the sensor to locate the component on the sensor in such a position that said surface of the component is spaced from a predetermined surface of the sensor by a distance equal to that by which it is desired to position said face of the vane from said predetermined surface of the sensor.

Conveniently said component has a thickness equal to said distance, and said component when engaged with the sensor has its surface opposite said vane engaging surface abutting said predetermined surface of the sensor.

Desirably said means engagable with the sensor comprises a collar or the like which encircles at least part of said sensor.

Preferably said component is one wall of a member of

channel-shaped cross-section, the vane, in use, being received in the channel.

Desirably the width of the channel is equal to the thickness of the part of the vane to be received therein.

Conveniently the width of said channel section member is equal to the width of a channel or slot of the sensor, said member being received in the channel or slot of the sensor.

Desirably the apparatus is of unitary construction and is moulded in a synthetic resin material.

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

Figure 1 is an extremely diagrammatic representation of an ignition distributor incorporating a contactless signal generator,

Figure 2 is an enlarged sectional view of part of the generator of Figure 1,

Figure 3 is a plan view of apparatus for use in setting the position of the sensor of the generator of Figures 1 and 2,

Figure 4 is a sectional view on the line 4-4 in Figure 3, and

Figure 5 is a view similar to Figure 2 but showing the apparatus of Figures 3 and 4 in position.

Referring to the drawings, the ignition distributor includes a hollow cup-shaped casing 11 within which a rotor shaft 12 is journaled for rotation. The casing 11 is closed at an open end by an electrically insulating cap 13 and the cap 13 carries a centrally disposed high voltage input terminal 14 aligned with the axis of rotation of the shaft 12. Equiangularly disposed around the terminal 14 are high tension output terminals 15 which, in use, are

electrically connected to respective sparking plugs of an associated internal combustion engine. Within the casing 11 is a fixed base plate 16 extending at right angles to the axis of the shaft 12, and adjustably mounted on the base plate 16 is a sensor 17 of a contactless signal generator. Carried at the end of the shaft 12 within the casing is a generally conventional rotor arm 18 including a conductive element 21 permanently engaged with the input terminal 14, and co-operating sequentially, during rotation of the shaft 12, with the output terminals 15. Carried by the rotor arm 18 so as to rotate with the rotor arm 18 and the shaft 12 is a flash shield 22 in the form of a disc of electrically insulating synthetic resin material, and a vane 23 of the signal generator. The vane 23 is formed from mild steel, and includes a disc-like portion having a peripheral flange extending at right angles thereto. The peripheral flange defines a cylinder of circular cross-section having its axis coextensive with the axis of the shaft 12, the cylindrical flange being formed with a number of equiangularly spaced slots equal in number to the number of ignition pulses required in each complete revolution of the shaft 12. The flange of the vane 23 co-operates with the sensor 17 to produce a number of output signals, during each revolution of the shaft 12, equal in number to the required number of ignition (sparking) pulses. These output signals are used to produce corresponding high voltage sparking pulses in ancillary equipment, the high voltage sparking pulses being distributed to the sparking plugs of the engine in turn by way of the input terminal 14 the rotor arm element 21 and the output terminals 15.

As can more clearly be seen in Figure 2 the sensor 17 comprises a base moulding 24 which, in use, is anchored to the base plate 16 by means of screws passing through elongate slots in the base moulding 24. The moulding 24 includes an integral upstanding limb 25 within which is provided a Hall effect transducer. The sensor further

includes a mild steel frame member 26 carried by the moulding 24 and including an upstanding limb 27 parallel to the limb 25. The frame 26 includes a second limb 28 extending at right angles to the limb 27, towards the limb 25, but terminating short of the limb 25. Between the limb 25 and the moulding 24 the limb 27 supports a permanent magnet 29 the dipole length of which extends parallel to the limb 28. Thus one pole of the magnet 29 engages the limb 27 and the other pole of the magnet 29 is presented to the limb 25 of the moulding 24. It will be recognised therefore that there will be a flow of flux in a curved path between the free end of the limb 28, and the end of the magnet 29 remote from the limb 27, and furthermore it will be recognised that part of this flux flow will pass through the transducer contained in the limb 25 of the moulding 24. The limb 25 contains a mild steel pole piece adjacent the transducer which improves the flux flow from the magnet via the transducer and back to the limb 28.

As can be seen in Figure 2 the sensor contains what is in effect a slot 31 one wall of which is defined by the limb 25 of the moulding 24 and the other wall of which is defined by the magnet 29 and the free end of the limb 28. The disc-like portion 23a of the vane 23 extends parallel to the limb 28 of the frame 27, and the cylindrical flange 23b of the vane 23 extends into the slot 31. Since the flange 23b is formed with apertures, or slots, and is itself constructed from mild steel, then it will be recognised that as the vane 23 rotates with the rotor shaft 12 alternately apertures and solid portions of the flange 23b will pass between the magnet and limb 28 on the one side, and the transducer on the opposite side, and thus there will be a periodic disruption of the flux flow through the transducer. The transducer utilizes this periodic disruption in flux flow to produce the output signals.

When assembling the ignition distributor it is obviously important that the flange 23b does not rub against either the limb 25 of the moulding 24 or the magnet 29 and limb 28. Thus adjustment of the position of the sensor 17 relative to the base plate 16 is required in order to ensure that the vane 23 runs freely through the slots 31 of the sensor. The clearances illustrated in the drawings are exaggerated, and it will be recognised that with the vane 23 in position it is not possible for an operator to visually check that the inner surface of the vane is not touching the magnet 29 and limb 28. In the past it has been necessary to use a feeler gauge of appropriate thickness inserted between the outer surface of the flange 23b and the limb 25 to set the gap between the flange 23b and the limb 25. The thickness of the feeler gauge was of course chosen to ensure that a gap would be achieved between the flange 23b and the magnet 29. As will be recognised the interior of an ignition distributor may well be relatively inaccessible when the distributor is mounted on an engine, and a certain degree of skill is required to use a feeler gauge in the appropriate manner. In order to minimise the problems associated with setting this, and other types of contactless signal generator the apparatus of Figures 3 and 4 was developed. The apparatus comprises a single synthetic resin moulding in the form of a pair of interconnected collars 32, 33. The collar 32 is shaped closely to encompass the portion of the sensor 17 to the left of the slot 31, and the collar 33 is shaped closely to encompass the limb 25 of the moulding 24. When the apparatus is engaged with the sensor 17 it will be recognised that a portion 32a of the wall of the collar 32 and a portion 33a of the wall of the collar 33 both lie within the slot 31. The wall thickness of the portions 32a, 33a is controlled closely during the manufacture of the apparatus in order that the gap between the two wall regions 32a, 33a is equal to the thickness of the flange 23b of the vane 23, and also to ensure that their thicknesses are equal.

The use of the apparatus is as follows. After assembly of the sensor 17 to the base plate 16, but before attachment of the rotor arm assembly 18, 22, 23, to the shaft 12 the fixing screws of the sensor 17 are released to permit movement of the sensor relative to the base plate 16 and the apparatus 32, 33 is engaged with the sensor. The rotor arm assembly 18, 22, 23 is then engaged with the shaft 12 so that the flange 23b of the vane 23 enters between the wall portions 32a and 33a of the collars 32, 33. In order for the flange 23b to enter between the portions 32a, 33a it will in all probability be necessary to move the sensor relative to the base plate. When the rotor arm assembly is in its final position on the shaft 12 with the flange 23b passing into the channel defined by the wall portions 32a, 33a, the fixing screws of the sensor 17 are tightened to set the position of the sensor relative to the base plate. The rotor arm assembly is then removed and the apparatus 32, 33 is lifted off the sensor 17, and either discarded, or stored for future use. The rotor arm assembly is then replaced, and since the position of the sensor 17 was fixed with the apparatus 32, 33 in position, and since the rotor arm assembly has only one correct orientation on the shaft 12, then the flange 23b when the rotor arm assembly is replaced, will pass midway between the magnet 29 and limb 28 on the one hand, and the limb 25 of the moulding 24 on the other hand. Clearly, the setting of the sensor 17 by use of the apparatus 32, 33 is exceedingly simple, and does not require a level of skill in any way comparable with the level of skill required to utilize a feeler gauge. In particular, the wall section 32a of the collar 32 of the apparatus ensures that the inner face of the flange 23b is spaced from the magnet 29 and limb 28 even though these parts cannot be seen with the vane 23 in position.

The sensor of the generator described above utilizes a Hall effect transducer. However, many alternative arrangements using a similar type of vane 23 are possible. In each

of the alternative arrangement there is some requirement for accurancy in setting the position of the sensor 17, and thus an apparatus similar to that shown in Figures 3 and 4 can be produced for such alternative arrangements. For example, a known alternative is an optical arrangement utilizing a light source in place of the magnet 29 and a photosensitive device in place of the Hall effect transducer. Again it is necessary to ensure that the slotted flange of the vane runs freely between the light source and the photosensitive device. Thus an apparatus similar to that shown in Figures 3 and 4 can be produced, the shapes of the collars of course being altered to suit the different shaping of the sensor. In both the optical device, and the Hall effect device described above the spacing is not critical providing that the vane 23 can rotate through a complete revolution without touching any part of the sensor. Thus during the setting operation it is advisable to cause the shaft 12 and therefore the vane 23 to perform at least one complete revolution to ensure accurate setting. However, there are sensors which require a more specific air gap to be set between the flange of the vane and some part of the sensor. In such arrangements the degree of skill required when setting the position of the sensor by means of a feeler gauge is far greater than with the optical, and Hall effect arrangements. Moreover, where the gap between the flange of the vane and the part of the sensor lies within the confines of the vane 23 then of course it is not possible to introduce a feeler gauge, and the sensor will carry an external reference point so that the feeler gauge is inserted between the external reference point and the outer face of the flange. Even though a high degree of skill may be utilized, the effect of tolerances in the manufacture of the sensor and the vane may still prejudice the accuracy of the gap which is ultimately set. However, utilizing an apparatus similar to that illustrated in Figures 3 and 4 will overcome such problems, and will permit setting of the sensor with minimal skill. For example, in such an arrange-

ment it may be possible to dispense with the collar 33 and wall portion 33a leaving the apparatus with a collar equivalent to the collar 32. The thickness of the wall portion 32a of the collar 32 would then be controlled very accurately so as to be equal to the exact thickness of the gap needed between the inner face of the flange 23b and the appropriate part of the sensor. When using the apparatus the gap, and the collar 32 although obscured from view by the vane 23 can be used to set the gap accurately merely by sliding the sensor 17 relative to the base plate until resistance to further movement is felt. At this point of course the wall portion 32a is being trapped directly between the inner face of the flange 23b and the surface of the appropriate part of the sensor, and the gap between the flange 23 and the surface of the appropriate part of the sensor must therefore be correct. However, with such an arrangement it may be preferable not to dispense with the whole of the collar 33, and to retain at least the wall portion 33a thereof since all that is then required during the setting operation is to ensure that the rotor arm is correctly seated on the rotor shaft with the flange 23b correctly seated between the wall portion 32a, 33a. Then, assuming that the thicknesses of the wall portions 32a and 33a are correct, and assuming also that the collar 32 is such that the inner face of the wall portion 32a engages the surface of the appropriate part of the sensor, then the gap between the flange 23b and the sensor must be correct, and there is no need for the operator to form a subjective view of whether or not the wall portion 32a is touching the inner surface of the flange 23b.

CLAIMS:

1. A method of setting the position of a sensor of a contactless signal generator in an ignition distributor, in relation to the path of rotation of the vane of the generator, characterized by comprising the steps of engaging with the sensor 17 apparatus 32, 33 including a component 32a, 33a which, when the apparatus is engaged with the sensor, has a surface spaced by a required distance from an appropriate face of the sensor, assemblying the vane 23 of the generator to the rotor shaft of the distributor, moving the sensor 17 relative to the casing of the distributor until an appropriate face of the vane 23 engages said surface of said component 32a, 33a, said required distance being such that when said surface is engaged by said appropriate face of the vane 23 then the position of the sensor 17 relative to the vane 23 is as required, fixing the sensor 17 in that position relative to the casing 11 of the distributor, and, removing said apparatus 32, 33.

2. A method as claimed in claim 1 characterized in that said vane is generally cup-shaped and said face of the vane is an inner surface of the vane, characterized in that subsequent to the step of fixing the sensor 17 in position, there is provided the step of removing the vane 23 to permit the subsequent removal of the apparatus 32, 33.

3. Apparatus for use in setting the position of a sensor of a contactless signal generator in an ignition distributor, in relation to the path of rotation of the vane of the generator, the apparatus being characterized by comprising a component 32, 33a having a surface to be engaged by a surface of the vane 23, and means 32, 33 engageable with the sensor 17 to locate the component 32a, 33a on the sensor 17 in such a position that said surface of the component is spaced from a predetermined surface of the sensor 17 by a distance equal to that by which it is desired to position said face of the vane 23 from said predetermined surface of the sensor 17.

4. Apparatus as claimed in claim 3 characterized in that said component 32a, 33a has a thickness equal to said distance, and, said component 32a, 33a when engaged with the sensor 17 has its surface opposite said vane engaging surface abutting said predetermined surface of the sensor 17.

5. Apparatus as claimed in claim 3 or claim 4 characterized in that said means engageable with the sensor 17 comprises a collar 32a, 33a or the like which encircles at least part of said sensor 17.

6. Apparatus as claimed in any one of claims 3 to 5 characterized in that said componet 32a, 33a is one wall of a member of channel-shaped cross-section, the vane 23, in use, being received in the channel.

7. Apparatus as claimed in claim 6 characterized in that the width of the channel is equal to the thickness of the part 23b of the vane 23 to be received therein.

8. Apparatus as claimed in claim 6 or claim 7 characterized in that the width of said channel section member is equal to the width of a channel or slot 31 of the sensor 17, said member being received in the channel or slot 31 of the sensor 17.

9. Apparatus as claimed in any one of claims 3 to 8 characterized by being of unitary construction and by being moulded in a synthetic resin material.

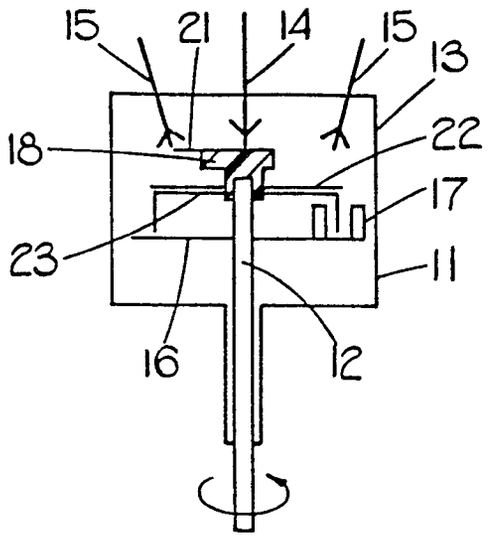

FIG. 1.

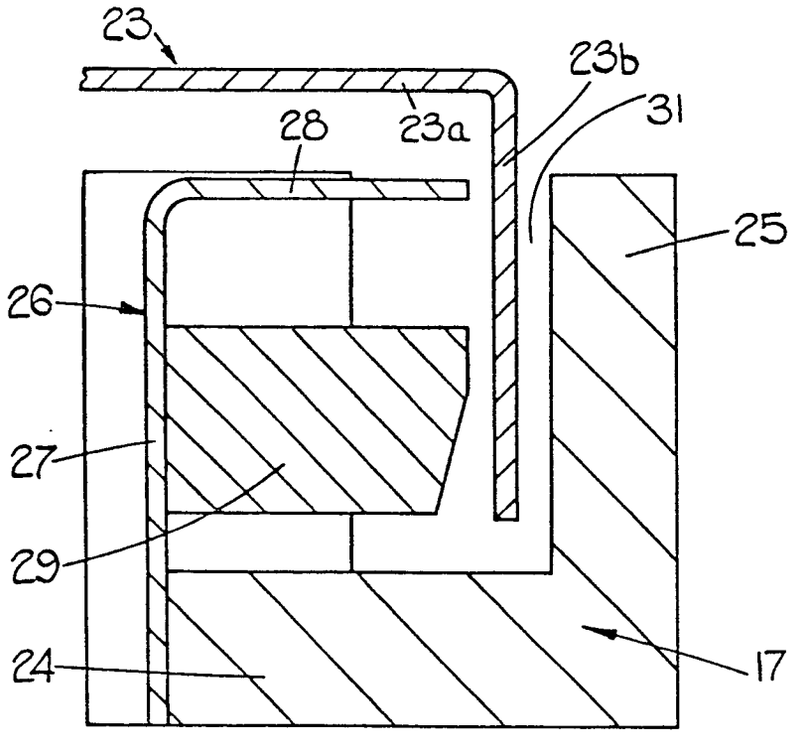

FIG. 2.

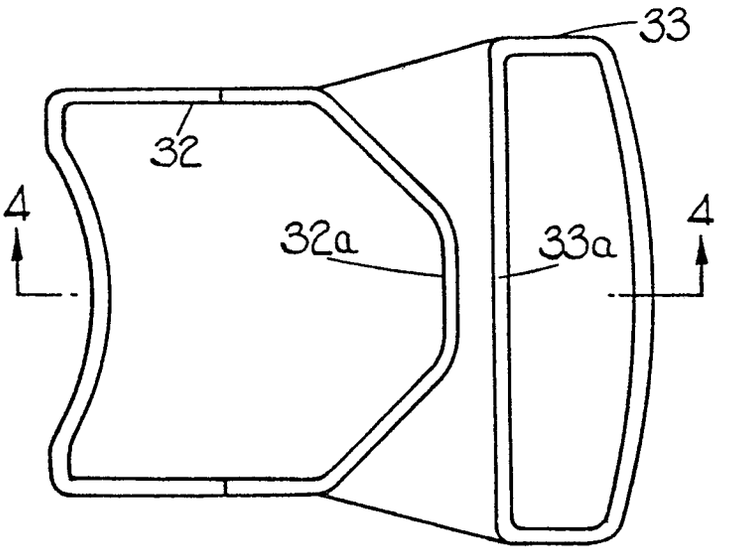

FIG. 3.

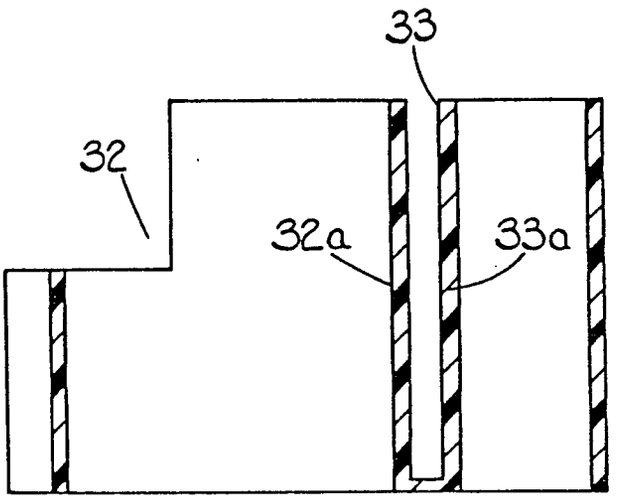

FIG. 4.

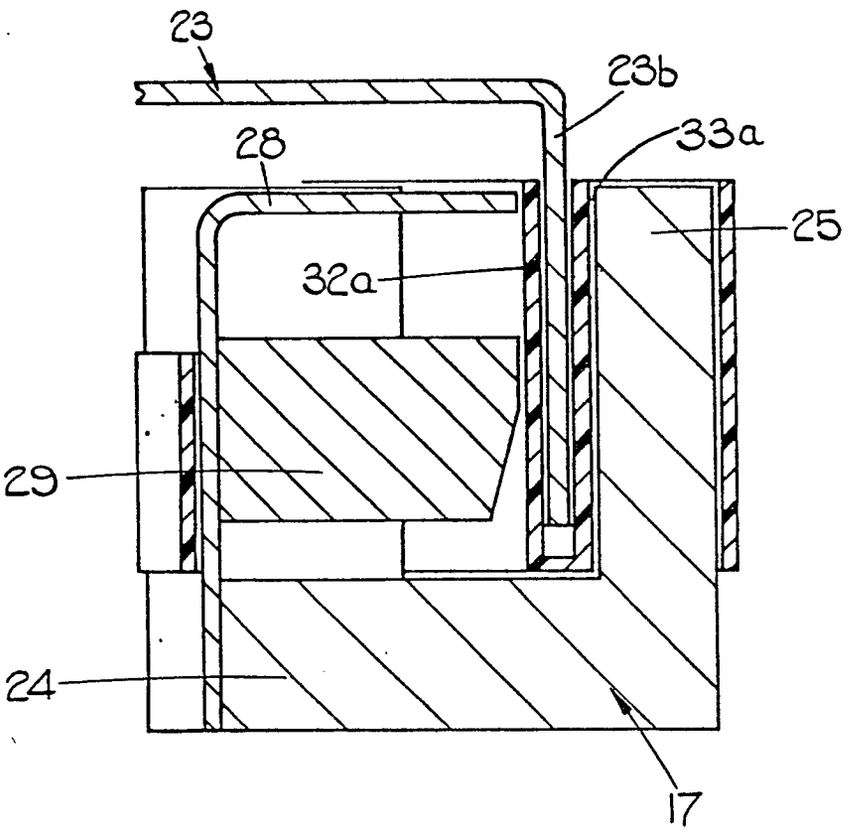

FIG. 5.

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 80 30 3801.7

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	DE - A1 - 2 716 510 (R. BOSCH GMBH)	
A	US - A - 3 875 920 (M. WILLIAMS)	
A	WO - A1 - 79/00495 (R.J. VINCE et al.)	

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

F 02 P 7/06

TECHNICAL FIELDS SEARCHED (Int Cl.³)

F 02 P 7/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation 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	09-02-1981	BORRELLY

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