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[54] **STARTER DRIVE FOR COMBUSTION ENGINES**

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[51] **Int. Cl.** **H02k 5/10**

[58] **Field of Search** 310/85, 51, 87, 88, 310/89, 83, 91, 71, 74, 66; 308/187.1; 227/181–183, 189, 187

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[57] **ABSTRACT**

A housing has an opening and accommodates an electric starter motor whose output shaft extends outside through the opening. Connected at the opening is a gear unit cooperating with the output shaft, and located in the opening to protect the interior of the housing against the entry of contaminants is a cupped insert a flange of which is connected with the housing and a transverse wall of which has an opening through which the motor output shaft extends and which is sealed by a sealing ring in sealing engagement with the transverse wall and with the output shaft which the sealing ring surrounds.

6 Claims, 2 Drawing Figures

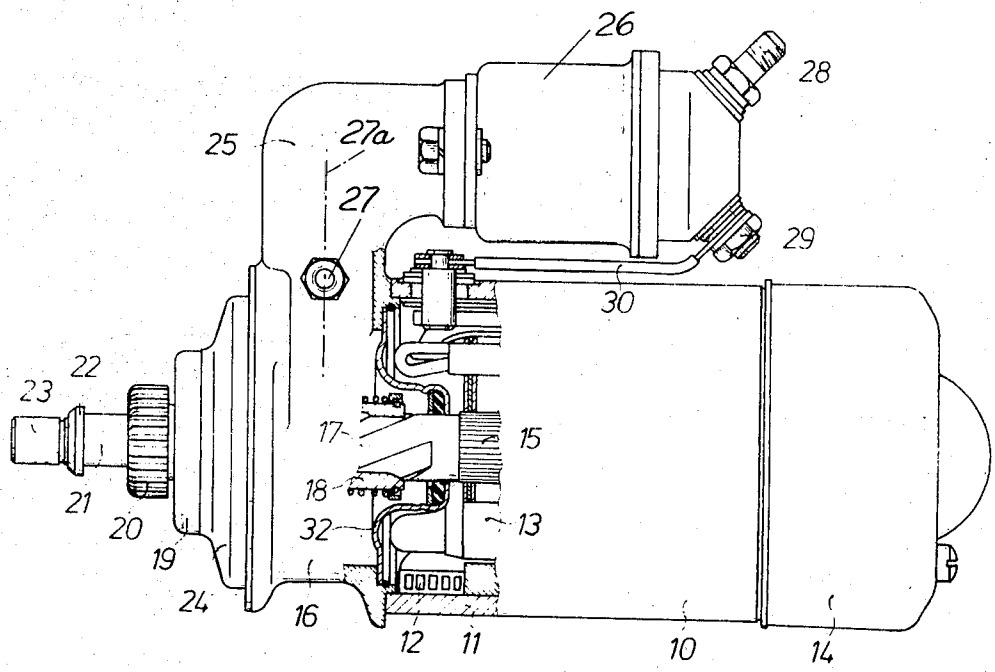


Fig. 1

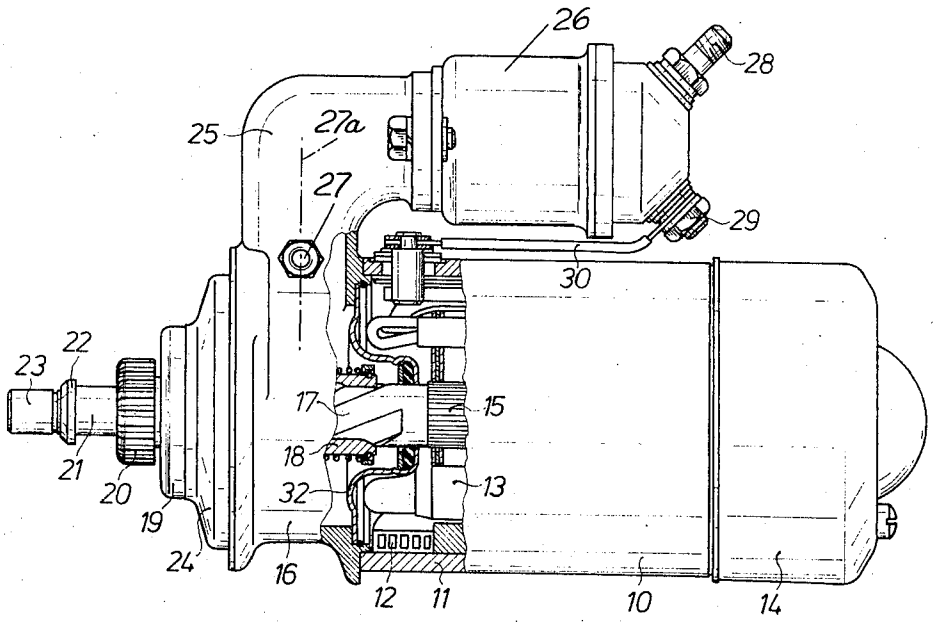
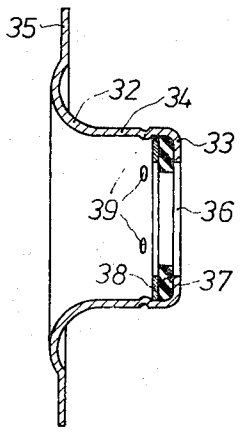

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Fig. 2


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STARTER DRIVE FOR COMBUSTION ENGINES

BACKGROUND OF THE INVENTION

The present invention relates generally to a starter drive for combustion engines, and more particularly to an improved starter drive in which the entry of contaminants into the motor of the drive is prevented.

Starter drives for combustion engines serve to turn over the engine until the latter reaches a point where its operation is possible without external aid, that is until the engine is "started." Such starter drives use an electromotor which cooperates with a gear unit via which it transmits starting torque to the engine. The motor is accommodated in a housing which of course must be protected against the entry of contaminants, especially when one considers that the ambient conditions in which such starter drives are required to operate are particularly likely to produce such contaminants in form of dust, dirt, water and the like.

It is known from the prior art to afford such protection by utilizing a substantially planar sheet metal disk which is provided with an annular bead engaging the winding head of the armature winding of the motor, with the disk having a central bore through which the output shaft of the motor extends. Of course, there is a certain amount of play between the shaft and the edge bounding the bore, so that at the very least the interior of the motor housing is not reliably protected against the entry of moisture and water.

Another prior-art construction provides a rubber sealing ring which is inserted into the housing of the gear unit, surrounding the latter and being pressed in the non-operated condition of the gear unit (that is when the latter is not in use for starting the engine) against a planar annular member which is provided for this purpose. In this arrangement there is of course the obvious disadvantage that the interior of the motor housing is sealed and protected against the entry of contaminants only when the dirve is not energized, aside from the fact that when, after starting of the engine, the drive becomes disconnected from the engine, the rubber ring may exert an undesirable braking influence upon the drive, which in some instances may lead to a renewed engagement of the drive with the starting gear of the already turning engine.

Still another prior-art construction covers the open side or opening of the motor housing with a bearing plate having a bearing sleeve for the motor output shaft. This of course does protect the interior of the housing against entry of contaminants, but it brings with it a different disadvantage, namely the requirement that the components needed for journalling of the motor output shaft must be produced with very considerable accuracy because in this instance the motor shaft is usually journalled at three locations and, if even a small dimensional variation in the journalling components is permitted to exist, a binding of the motor shaft will very likely occur at the journalling locations.

SUMMARY OF THE INVENTION

Accordingly it is a general object of the present invention to avoid the disadvantages of the prior art.

More particularly it is an object of the invention to provide an improved starter drive for combustion engines, which is not possessed of the disadvantages of the prior art.

Still more particularly it is an object of the present invention to provide such an improved starter drive which is simple to produce and to assemble and which nevertheless provides a reliable protection of the interior of the starter drive housing against the entry of all types of contaminants.

Another object of the invention is to provide such an improved starter drive in which tolerance variations in the manufacture, and journalling tolerances of the motor output shaft, are largely without adverse consequences.

A concomitant object of the invention is to provide such an improved starter drive which will provide complete protection against the entry of contaminants in all conditions of operation or rest of the starter drive, and which does not adversely affect the drive or any of its components, including the gear unit.

In pursuance of these objects, and of others which will become apparent hereafter, one feature of the invention resides in a starter drive for combustion engines, which, briefly stated, comprises housing means having an opening, and electric starter motor means in the housing means and having an output shaft extending outside through the opening. Gear unit means is connected with the housing means at the open side. Closure means is provided for protecting the interior of the housing means against entry of contaminants via the opening and, in accordance with the invention, comprises a cupped insert received in the opening and having a flange connected with the housing means, a peripheral wall and a bottom wall provided with an aperture through which the output shaft extends. At least one sealing ring is centered about the aperture and surrounds the output shaft in sealing engagement therewith.

The cupped insert can be held in place in a simple manner by being retained between the housing means of the electric starter motor and the housing of the gear unit, or it can be suitably connected to one of the housings or to both of them, and when the drive is assembled, the sealing ring will inherently contact and seal with respect to the output shaft. The small braking moment exerted by the sealing ring on the motor output shaft has no influence on the gear unit itself and in any case is so low that the energy loss resulting from it is negligible.

The cupped insert is particularly well and simply retained if the sealing ring is compressed between the bottom wall and a pressure washer, with both the sealing ring and the pressure washer being centered at the inner surface of the peripheral wall of the cupped insert, and the cupped washer being retained by at least one radial projection extending inwardly from the inner surface.

The cupped washer can advantageously be made of sheet metal, for instance by drawing or stamping, and the projection can be produced by impressing the outer side of the circumferential wall of the cupped insert with a depression which will produce a corresponding radially extending projection at the inner surface of the peripheral wall.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following de-

scription of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side-elevational view of a starter drive according to the present invention, partly sectioned; and

FIG. 2 is an axial section through the cupped insert used in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing the drawing now in detail it will be seen that the starter drive which has been illustrated by way of example has an electric starter motor **10** which is accommodated in a housing **11.** Four field coils **12** and a turnable armature **13** are provided in the housing **11** one axial end of which is provided with a bearing shield **14** surrounding the collector of the armature. The brushes sliding on the collector are carried by the shield **14** and the latter also has a journalling sleeve for the output shaft **15.** The opposite axial end of the housing **11** is open, having secured thereto a housing **16** of a gear unit, and the armature shaft or output shaft **15** extends through the open end of the housing **11** and through the housing **16** to extend beyond the latter (to the left in FIG. 1).

The portion **17** of the shaft **15** which is located within the housing **16** has a steep-pitch external screwthread on which a sleeve **18** is rotatably and axially displaceably engaged, having a corresponding internal screwthread. A free wheeling unit **19** connects the sleeve **18** in a manner known per se with a pinion **20.** In the illustrated embodiment the latter is located outside the housing **16.**

The end portion **21** of the shaft **15** which extends outside the housing **16** is provided with an annular shoulder **22** serving as an abutment for the pinion **20** when the same moves towards the left in FIG. **1.** It further is provided with a journalling portion **23** which when the drive is installed will be journalled in a sleeve of the gear housing of the combustion engine, which sleeve will thus serve as a second journal for the shaft **15.**

A removable protective cap **24** is between the free wheeling device **19** and a bore through which the gear unit in the gear unit housing **16** can be inserted, and this cap prevents damage of the components, particularly the shaft **15** as well as the components mounted on it, and also centers the shaft **15** and these components with respect to the housing during transport. When the drive is installed, however, the cap **24** is removed and thereupon the portion **23** is inserted into the non-illustrated journalling sleeve at the gear housing of the combustion engine.

A lateral arm portion **25** of the housing **16** has secured thereto the housing of an electromagnet **26** whose non-illustrated armature acts in conventional manner (which is not believed to require detailed illustration) via a double-armed lever **27***a* shown in broken lines and pivotably journalled at **27** in the arm portion **25,** upon the hollow shaft **18.** It is known that with such an arrangement the energization of the electromagnet results in a displacement of the sleeve **18** together with the device **19** and the pinion **20** towards the left in FIG. **1,** that is towards the engaging gear of the combustion engine (not shown) until the pinion **20** is fully in mesh with such gear, at which point it will be in abutment with the shoulder **22.** The armature of the electromagnet **26** also operates two electrical contacts **28** and **29** of which one is connected with a starter switch and the other via a conductor **30** with the motor **10.** This means that the motor **10** receives current via the contacts **28** and **29** and thus turns the pinion **20,** rotating the combustion engine until the latter can start and operate by itself.

In accordance with the present invention the open side of the housing **11** is protected against the entry of contaminants by a cupped insert **32** of circular outline and advantageously consisting of sheet material, such as drawn sheet metal. The drawing shows, particularly in FIG. **2,** that the insert **32** has a transverse or bottom wall **33,** a circumferential wall **34** and a flange **35** which latter in the illustrated embodiment is connected with the housing **16** via a circlet or spring ring. An aperture or bore **36** is provided in the transverse wall **33** and the shaft **15** extends with play through this aperture **36.** Surrounding the aperture **36** at the interior of the cupped insert, in sealing engagement with the bottom wall **33,** is at least one sealing ring or **37** of rubber or synthetic plastic material which engages the shaft **15** in sealing relationship. The outer diameter of the ring **37** corresponds to the inner diameter of the peripheral wall **34,** so that the ring **37** is centered by the wall **34.** In the illustrated embodiment a metallic retaining and pressure washer **38** is also placed about the shaft **15,** pressing the sealing ring **37** against the transverse wall **33** and having also such a diameter that it is centered by the inner circumferential surface of the wall **34.** A plurality of projections **39** are provided, circumferentially distributed about the circumference of the wall **34,** engaging and maintaining the washer **38** in its axial position in which it presses the washer **37** against the wall **33** in sealing relationship. These projections **39** are advantageously formed after the elements **37** and **38** are in place, and the element **37** has been compressed by axial pressure upon the element **38,** by means of a suitable tool which deforms the wall **34** from the outer side, forming recesses in it which result in the formation of corresponding projections **39** at the inner side of the wall **34.** Of course, a single one of these projections **39** might be sufficient or there may be several provided.

In any case, the present invention provides for a highly effective but equally simple construction, utilizing simple and inexpensive components which assure a reliable sealing of the interior of the housing **11** against the entry of any kinds of contaminants, including dust, dirt and moisture. The entry of such contaminants in the gap between the device **19** and the bore in the housing **16,** and from there into the housing **11,** is thus precluded.

It will be appreciated that the rubber or other elastomeric material of the ring **37** could be replaced by different material, for instance by a ring made of felt or a ring made of a suitable composition material such as is used for gaskets or other sealing purposes. Similarly, the insert **32** can also be connected with the housing **11** rather than the housing **16,** or it can be pressed and held between the housings **11** and **16** during the assembly of the drive, so that separate operations for mounting the insert **32** can be completely avoided.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a starter drive for combustion engines, it is not intended to be limited to the details shown, since modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended

1. In a starter drive for combustion engines, in combination, housing means having an opening; electric starter motor means in said housing means and having an output shaft extending with clearance outside through said opening; gear unit means connected with said housing means adjacent said opening; and closure means for protecting the interior of said housing means against entry of contaminants via said opening, comprising a cupped insert received in said opening and having a flange connected with said housing means, a peripheral wall and a bottom wall provided with an aperture whose diameter is only slightly larger than that of said output shaft and through which said output shaft extends, at least one sealing washer located inwardly of said bottom wall in abutment therewith and surrounding said output shaft in sealing engagement with the latter, said sealing washer having an outer periphery in engagement with an inner circumferential surface of said peripheral wall so that said sealing washer is centered by the letter with reference to said aperture, and said closure means further including an annular retaining washer surrounding said shaft with clearance inwardly of and in abutment with said sealing washer and being retained by abutment with said inner circumferential surface.

2. In a starter drive as defined in claim **9**, said gear unit means comprising an additional housing connected with said housing means.

3. In a starter drive as defined in claim **9**, said output shaft having a portion extending beyond said gear unit means on a side thereof remote from said housing means; and further comprising a gear member carried by said portion of said output shaft.

4. In a starter drive as defined in claim **1**; further comprising at least one radial projection on said peripheral wall engaging said retaining washer and maintaining it in pressure engagement with said sealing washer so that the latter is compressed between said retaining washer and said bottom wall.

5. In a starter drive as defined in claim **4**, wherein said insert is a sheet material member; and wherein said projection is formed by an inwardly extending depression provided in the outer side of said peripheral wall.

6. In a starter drive as defined in claim **1**, wherein said insert is a sheet material member.

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