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(56) Related Art
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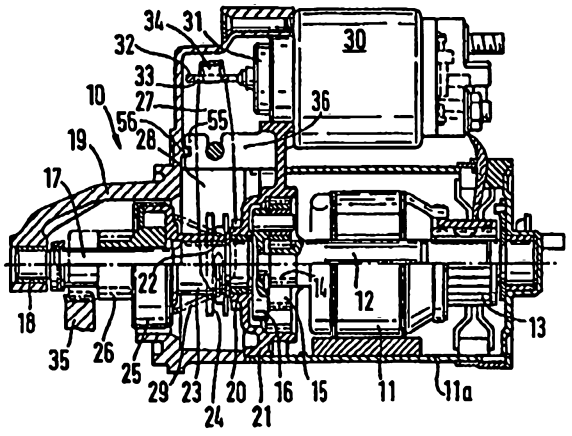

(57) Abstract

The proposal is for a starter (10) for internal combustion engines in which the fitting of a drive (15) with a free-wheel (25), a drive shaft (17) with a starter pinion (26) and of an engagement relay (30) on an intermediate bearing plate (21) is to be automated. To this end, the intermediate bearing plate (21) and a pillow block (36) for the deflecting lever (27) of the engagement relay (30) form a fitting unit on which on the one hand the drive (15) with the drive shaft (17) and the starter pinion (26) and also the engagement relay can be pre-assembled and on the other these components can be secured together with the deflecting lever (27) fitted on the pillow block (36).

Starter for Internal Combustion Engines

Prior Art

The invention relates to a starter for internal combustion engines.

From DE-A-40 06 795 a starter of this type is known. In this solution, an intermediate bearing plate foreseen for a drive bearing is broadened toward the top as a flange for the complete seating of the engagement relay, a pillow block for a deflecting lever of the engagement relay being used in the drive end fitting. The pillow block is supported on the intermediate bearing plate over a rubber sheet.

The geometric adaptation of the starter in the mounting area of the internal combustion engine takes place with reference to the pinion neutral position and the meshing dimension for the pinion to a large extent by means of an adaptation of the pillow block, drive end fitting and relay paddle. The changes are limited to easily manufactured parts, especially for the drive end fitting which, in any case, is a specific part for the automobile manufacturer. In the assembling of the starter, however, the fitting together of the drive end fitting with the other parts of the starter does not meet the requirements for an automatic assembly process as, in this operation, the parts must be put together simultaneously at several critical joints, namely the drive end fitting with the intermediate bearing plate, with the drive shaft, with the pillow block and the rubber sheet and the intermediate bearing plate with the relay slot. Particularly problematic is keeping these parts in place before and during assembly. Complicating matters further is the fact that in pre-assembly, the parts to be assembled on an intermediate bearing plate can be moved towards one another by means of a meshing spring and a return spring, resulting in considerable effort in readjustment.

From DE-A-28 22 165, a further solution is known in which the engagement

relay is inserted and screwed into a slot between the drive end plate and a seal of the starter housing. There, the meshing spring is arranged on a driver sleeve which carries both a free wheel and the starter pinion. This solution, also, without the intermediate bearing plate, has the disadvantage of a multiplicity of joints of the drive end plate in particular when a drive and an intermediate bearing plate is needed for the mechanism of the drive device, since the spring strengths of the meshing spring require a readjustment of the pre-assembled parts.

Finally from US Patent No. 4,649,285, an embodiment is know in which an intermediate plate of the cranking device is joined to a plastic bearing block moulded on by injection for a staring lever. When the gear arrangement and the starting relay are premounted on the intermediate plate, the forked lever must on the one hand be inserted on the gear arrangement and on the other must be secured both to the bearing block and to the tie rod of this staring relay by introducing bearing bolts. However, this cannot be done fully automatically, since the forked lever, loosely inserted on the gear arrangement in the preassembly process, is not positioned exactly enough, and thus the bearing pins have to be inserted individually on the forked lever.

With the present solution, the aim is that the pre-assembly of the parts to be connected to the intermediate bearing plate is to be improved in such a way that a fully automatic assembly of the starter is possible.

Summary of the Invention

According to the invention there is provided a starter for internal combustion engines, having a starting motor, a gear arrangement, a free-wheel coupling, a drive shaft, and a shifting pinion, which can be shifted axially displaceably into a toothed ring of the engine by a starting relay via a deflection lever pivotally supported on a bearing block and an intermediate plate receives a gear member and/or the starting relay and its inserted between a housing of the starting motor on the one hand and a drive bearing plate on the other, and

wherein the intermediate plate and the bearing block form an assembly unit, on which the gear arrangement with the drive shaft and the shifting pinion, on the one hand, and the starting relay on the other can be pre-mounted, and are to be joined together via the deflection lever and the deflection lever in the pre-assembled state is locked in detent fashion on the bearing block.

Advantages of the Invention

In the invention the mechanism with the drive shaft, the starting relay, the shifting pinion if necessary with the free wheel and the deflection lever with the meshing spring can be assembled in succession on the intermediate plate in which, through the positioning of the deflection lever onto the bearing block forming an assembly unit with the intermediate bearing plate, the meshing spring now holds these parts in position.

It is particularly advantageous for the assembly of the drive end plate that this is connected with only two joints onto the pre-assembled component of intermediate bearing plate, drive, drive shaft, shifting pinion, starting relay and deflection lever. A first joint is formed through an insertion of the outer wall of the intermediate bearing plate into a collar of the drive end fitting. In the insertion is a sealing rubber and a relay slot.

Diagram

Embodiment examples of the invention are depicted in the diagram and are described in further detail in the following. Figure 1 shows a cross-section of a starter in accordance with a first embodiment example of the invention, Figure 2 an intermediate bearing plate with pillow block as assembly unit with the pre-assembled parts drive, drive shaft, pinion with coupling and meshing spring as well as engagement relay before the insertion of the deflecting lever. Figure 3 shows the pre-assembled component from Figure 2 with inserted deflecting lever and Figure 4 shows the pre-assembled component with attached drive end fitting. Figure 5 shows a cross section of the front section

of a starter in accordance with a second embodiment example, Figure 6 shows the intermediate bearing plate with integrated pillow block and assembled deflecting lever and Figure 7 shows the deflecting lever from the front prior to insertion in the pillow block. Figure 8 shows a deflecting lever as alternative to Figure 7, Figures 9 and 10 show an intermediate bearing plate with a deflecting lever which goes with it and Figure 11 shows the drive end fitting of the starter according to Figure 1 with supports for the intermediate bearing plate. Figure 12 shows, as a further embodiment example, a starter without a back gear.

Description of the Embodiment Example

In Figure 1, the starter depicted for an internal combustion engine of a motor vehicle is indicated by the number 10. It has a direct current driven starter motor 11 whose rotor shaft 12 bears a commutator 13 at the rear end and, at the front end, a drive pinion 14 which, as solenoid, enters a known planetary gear 15. The planetary gear is connected via a planetary gear 15. The planetary gear is connected via a planet carrier 16 with a drive shaft 17, the far end of which is taken up in a bearing 18 of a drive end fitting 19. The planetary gear 15 is further taken up via a further transmission bearing which, both in the front end section of the starter motor housing 11a and in the rear end section of the drive end fitting 19, is taken up and centrically directed. The rear section of the drive shaft 17 has, on its external circumference, a coarse pitch thread 22 on which a driver sleeve 23 is slidable and, by means of the coarse pitch thread, is screwable. On the exterior of the driver sleeve, a slidable U-shaped guide ring 24 is situated. On the front end of the driver sleeve 23 is, as a further drive part, a free wheel 25 whose inner ring in the front section is constructed as a shifting or starter pinion 26. A deflecting lever with a fork at the lower end, represented in more detail in Figure 6, engages with the guide ring. Between the free wheel 25 and the guide ring 24 a meshing spring is located which, with the preliminary meshing of the starter pinion 26 in the case of tooth-on-tooth positioning with a toothed rim 35 of

an internal combustion engine not depicted, is tightened and, through the turning of the pinion, slots it into the toothed rim.

A starting relay 30 is inserted and screwed above the starter motor between the intermediate bearing plate 21 and the drive end fitting 19. On the rotor armature 31 of the starting relay, at the front a diaphragm link 32 is secured which has a longitudinal opening 33. The upper end of the deflecting lever 27 with a journal 34 extends into this opening 33. A pillow or bearing block 36 is constructed on the intermediate bearing plate 21 on which the deflecting lever can be swivelled. With the switching on of the starting relay 30, the engine is started, the deflecting lever 27 of the diaphragm link being so rotated that the starter pinion 26 slots into the toothed rim 35 of the internal combustion engine (represented by a broken line) on the one hand and, on the other, the starter motor 11 is switched on via a contact bridge of the starting relay. Through the planetary mechanism 15, the driver sleeve 23, the free wheel 25 and the starter pinion 16, the toothed rim 35 is driven for the starting of the internal combustion engine. Through the turning off of the starting relay, the rotor armature is pressed back into the initial starting position by the return spring 52 (Figure 5), the deflecting lever is rotated back again and the starter pinion is drawn out of the toothed rim 35. Simultaneously the starter motor 11 is switched off.

In order to ensure an improved, automatic assembly of the starter, it is planned that the intermediate bearing plate 21 and the pillow block 36 form an assembly unit 53 on which the drive 15 with the drive shaft 17 and the starter pinion 26 axially connectable by means of a coarse pitch thread 22 on the one hand and the starting relay 30 on the other can be pre-assembled. Figure 2 shows a pre-assembled arrangement of this kind in which here the free wheel 25 is assigned to the starter pinion 26 which, however, can alternatively be a fixed free wheel assigned to the drive. The deflecting lever is initially still assigned to it.

Figure 3 shows the deflecting lever 27 assembled fixed to the pillow block 36 which connects the starting relay 30 with the starter pinion 26 and the assigned free wheel 25 on the drive shaft 17. The intermediate bearing plate 21 with the pillow block 36, the drive 15, the drive shaft 17, the starter pinion 26 with the free wheel 25 and the starting relay 30 with the deflecting lever 27 form a pre-assembled component 37 of parts connected together whose position with respect to one another is stabilised with the introduction of the deflecting lever 27.

In accordance with Figure 4, the drive end fitting 19 is fixed on only two joints 38 and 39 on the component pre-assembled in this way. The first joint 38 forms the bearing 20 in the drive end fitting 19 in which the end of the drive shaft 17 is inserted. The second joint 39 is formed by a collar 40 on the outer circumference of the drive end fitting 19 into which the outer wall of the intermediate bearing plate 21 is inserted.

In the first embodiment example with the Figures 1 to 4, the pillow block 36 with the intermediate beating plate 21 is made in one piece as an plastic injection moulding piece. This pillow block 36 is open at the top with a somewhat narrow bearing bore 42 into which a journal pin 43 of the deflecting lever 27 can be engaged.

In Figure 5, a further embodiment example of the invention is depicted in which here only the front part of the starter is shown in cross section. In this embodiment form, an intermediate bearing plate 121 of the fibre-reinforced plastic or a similarly dimensionally stable material which is sprayed or cast. For a better adaptation of the dimension H (Figure 5) to the required installation requirements of clients, a rear side opening on the intermediate beating plate 121 in the vicinity of the pillow block is foreseen in which a seal 44 of plastic or hard rubber is inserted. Through the construction shown, a modular tool construction is possible which can be equipped as a saddle free construction by means of few exchange parts of various dimensions H.

Figure 6 shows, as a further embodiment example, the intermediate bearing plate 221, a sprayed or cast embodiment form in which, in the vicinity of the pillow block 236 instead of the opening, a hollow 45 is foreseen. Below the pillow block a support web 46 is formed. In this embodiment form, also, a deflecting lever 127 with its journal pin 43 engages with the upper open bearing bore 42, the meshing position being represented in a broken line. In Figure 7, the deflecting lever 127 is depicted in the frontal view before insertion into the pillow block 236, It can be seen there that the arm of the deflecting lever 127 is constructed in a "u" or bow configuration. Through this bow 47 the free end of the diaphragm link 32 of the starting relay extends. On the upper part of the bow 47, a journal 34 facing downwards is constructed which enters into the long opening 33 on the flat end of the diaphragm link 32.

Figure 8 shows another embodiment form of the deflecting lever 227 in the vicinity of the bow 47. There, in the upper area of the bow 47, two adjacent strips 48 are connected which enter corresponding, opposite recesses 49 on the flat end of the diaphragm link 132.

It can be seen from Figure 6 in connection with Figure 7 that the pillow block 236 forms a console protruding to the front onto which the prongs of a fork 28 of the deflecting lever 127 are pushed and in which the journal pin 43 of the deflection lever 127 with which the bearing bore 42 open at the top can be engaged.

Figures 9 and 10 show a further embodiment example of an intermediate bearing plate 321 which, in common with the pillow block 336 is stamped and formed. In this embodiment form, the pillow block 336 forms a U-shaped console open to the front with lateral bearing bores 142 in the arms of the console. A deflecting lever 327 in the plan view of Figure 9 has here, in its bearing area, journal pins 143 mounted on both sides. In the pushing in of the

bearing area of the deflecting lever 327 into the pillow block 336 the arms 50 of the console are pressed apart so far until the journal pins 143 slip into the bearing bores 142. The sheet metal part is so formed that here, too, the same joint direction is reached for the fork lever as for the plastic intermediate bearing.

In Figure 11 the rear view of the drive end fitting 19 is depicted in profile. For snug seating onto the intermediate bearing plate 21, five shoulders are provided around the circumference of the collar 40. For the upper section of the intermediate bearing plate 21 featuring the pillow block 36 are two further shoulders 51. A seal 44 is inserted from the rear in the vicinity of the pillow block 336 before the starting relay 30 and the starter motor 11 are assembled.

As the intermediate bearing plate can be clamped to a work carrier during assembly, all the parts to be assembled on it can be fixed, immovably by means of the, deflecting lever, the meshing spring 29 and the rotor armature return spring 52 of the starting relay 30 being able to assume the retaining function by means of the employment of the deflecting lever in the pillow block. The starter motor 11 can, in this case, be pre-assembled as previously. It is then attached to the intermediate bearing plate 21 from the rear and finally, as is the case with the starting relay 30, is screwed to the drive end fitting 19.

In Figure 12, a starter device is represented as a further embodiment example which drives the internal combustion engine without planetary back gear via its toothed rim, not depicted, directly through the starter pinion 26. The starter motor, with its rotor shaft 12 is coupled directly via the free wheel 25a with the starter pinion 26. As in the previous embodiment examples, the free wheel 25a is moveable axially together with the starter pinion 26 from the starting relay 30 over the deflecting lever 27. The pinion torsion in the preliminary meshing of the starter pinion 26 takes place by means of a coarse

pitch thread 22a attached to the front section of the rotor shaft 12. Inner projections 22b which are arranged on the inner side of the driver sleeve 23 and, in the case of a preliminary meshing of the starter pinion 26 bring about a relative rotation between the free wheel 25a with the pinion 26 on the one hand and the rotor shaft 12 on the other.

The pillow block 436 for the deflecting lever 27 is here formed on an intermediate plate 421 which is constructed in the upper section in accordance with the first embodiment example for the reception of the starting relay 30. In the lower section, a collar ring is formed with which a centred reception of the intermediate plate 421 both on the front end section of the housing 11a of the starter motor 11 and on the rear end section of the drive end fitting 19 is achieved. A location of centre support is foreseen in the starter with the back gear through the transmission bearing 20 in the first embodiment example is not required in this embodiment of the directly actuated starter.

In the construction of this starter, the construction of a pre-assembly of the engagement relay 30, the free wheel 25a and the deflection lever 27 will consequently firstly take place on the intermediate plate 421. The drive end fitting 16 is placed at the joints 38 and 39 - as described for the first embodiment example - on this pre-assembled assembly unit. Then the starter motor 11 is placed from the other side onto the collar ring 54 of the intermediate plate 421 and finally starting relay 30 and starter motor 11 are screwed to the drive end fitting 19.

The intermediate plate, the intermediate bearing plate, is essential to the invention which is combined in its construction with the pillow block of the deflecting lever. By this means, a complete drive construction group in which all individual drives such as free wheel, planetary and meshing drives are combined. The pillow block and intermediate bearing plate can be constructed in two parts, these parts, however, being combined in a joined condition, eg.

in a dove-tall joint, to an assembly unit. With the use of a seal 44 according to the embodiment of Figure 5, it is possible to take up the starting relay independent of the construction of the intermediate bearing plate on the drive end fitting 19 and the seal 44, with the advantage that, by this means, further adaptations to the respective assemblies of the starter are possible.

As in the construction of the intermediate plate made of plastic, the pillow block can be in danger of breakage through frequent impacting stress, it is further proposed that, for protection against breakage, the pillow block 36 be strengthened with a console 55 which is directed towards the drive end fitting 19 into which a shoulder 56 attached to the drive end fitting 19 extends, as in the first embodiment, so that the pillow block 36 support itself with its console at this shoulder 56.

The claims defining the invention are as follows:

1. Starter for internal combustion engines, having a starting motor, a gear arrangement, a free-wheel coupling, a drive shaft, and a shifting pinion, which can be shifted axially displaceably into a toothed ring of the engine by a starting relay via a deflection lever pivotally supported on a bearing block and an intermediate plate receives a gear member and/or the starting relay and its inserted between a housing of the starting motor on the one hand and a drive bearing plate on the other, and wherein the intermediate plate and the bearing block form an assembly unit, on which the gear arrangement with the drive shaft and the shifting pinion, on the one hand, and the starting relay on the other can be pre-mounted, and are to be joined together via the deflection lever and the deflection lever in the pre-assembled state is locked in detent fashion on the bearing block.

2. Starter as claimed in claim 1, wherein a drive end fitting can be set onto only two joints of a pre-assembled component of an intermediate plate with bearing block, drive, drive shaft, shifting pinion, starting relay, being formed through the insertion of the end of the drive shaft into a bearing of said drive end fitting and the other joint through an insertion of the outer wall of the intermediate bearing plate into a collar of said drive end fitting.

3. Starter as claimed in claim 1, wherein the bearing block is constructed in one piece with the intermediate plate and features a bearing bore open at the top into which a bearing lugs of the deflecting lever snaps.

4. Starter as claimed in claim 3, wherein the pillow block forms a console protruding to the front, onto which the arm of a fork of the deflecting lever is pushed and a bearing lugs of the deflecting lever can be fitted into the bearing bore open to the top.

5. Starter as claimed in claim 3, wherein the bearing block forms

console, U-shaped to the front into which the deflecting lever is inserted and with bearing lugs on both sides can be fitted into bearing bores into the legs of the console.

6. Starter as claimed in claim 3, wherein the intermediate plate with the bearing block is pressed and formed from one piece of sheet metal.

7. Stater as claimed in claim 3, wherein the intermediate plate is sprayed or case from dimensionally stable material.

8. Starter according to any one of the preceding claims, wherein a seal is inserted from the rear of the intermediate plate.

9. Starter as claimed in any one of the preceding claims, wherein the deflecting lever forms a bow with its upper leg into which the end of the diaphragm link of the starting relay is received.

10. Starter as claimed in claim 9, wherein a journal formed above on the bow pointing downward enters a long breakthrough on the flat end of the diaphragm link.

11. Starter as claimed in claim 9, wherein on the sides of the bow, two adjacent strips are formed which enter corresponding adjacent lateral grooves on the flat end of the diaphragm link.

12. Starter as claimed in claim 2, wherein the drive end fitting in the vicinity of the collar features several stop shoulders for the intermediate bearing plate.

13. Starter as claimed in any one of the preceding claims, wherein the bearing block is supported on a shoulder of the drive end fitting with a console.

14. Starter as claimed in claim 1, wherein the intermediate plate without a location of centre support is centrically received and directed with a collar ring formed on it and both in the front end section of a housing of the starter motor and in the rear end section of the drive end fitting.

Dated this 15th day of May, 2000.

ROBERT BOSCH GMBH

By their Patent Attorneys:

CALLINAN LAWRIE

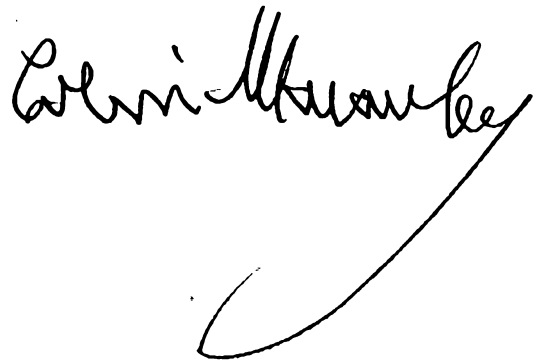

FIG.1

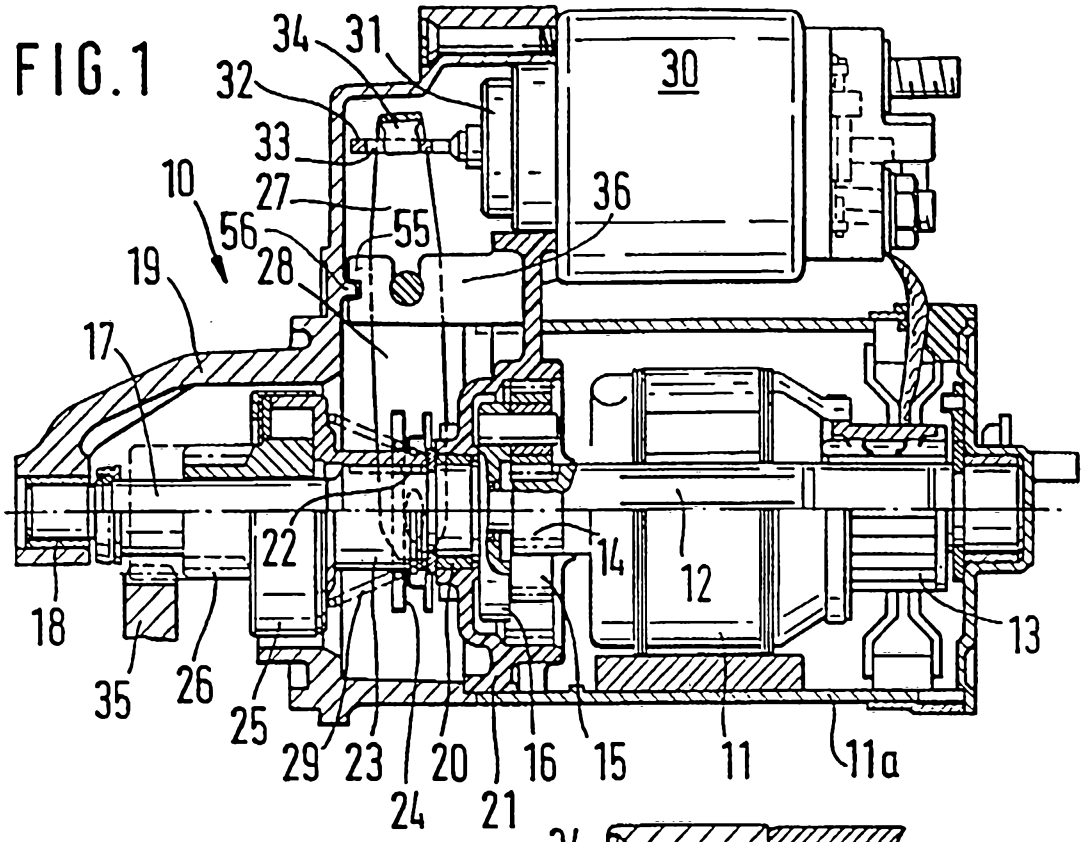
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FIG.5

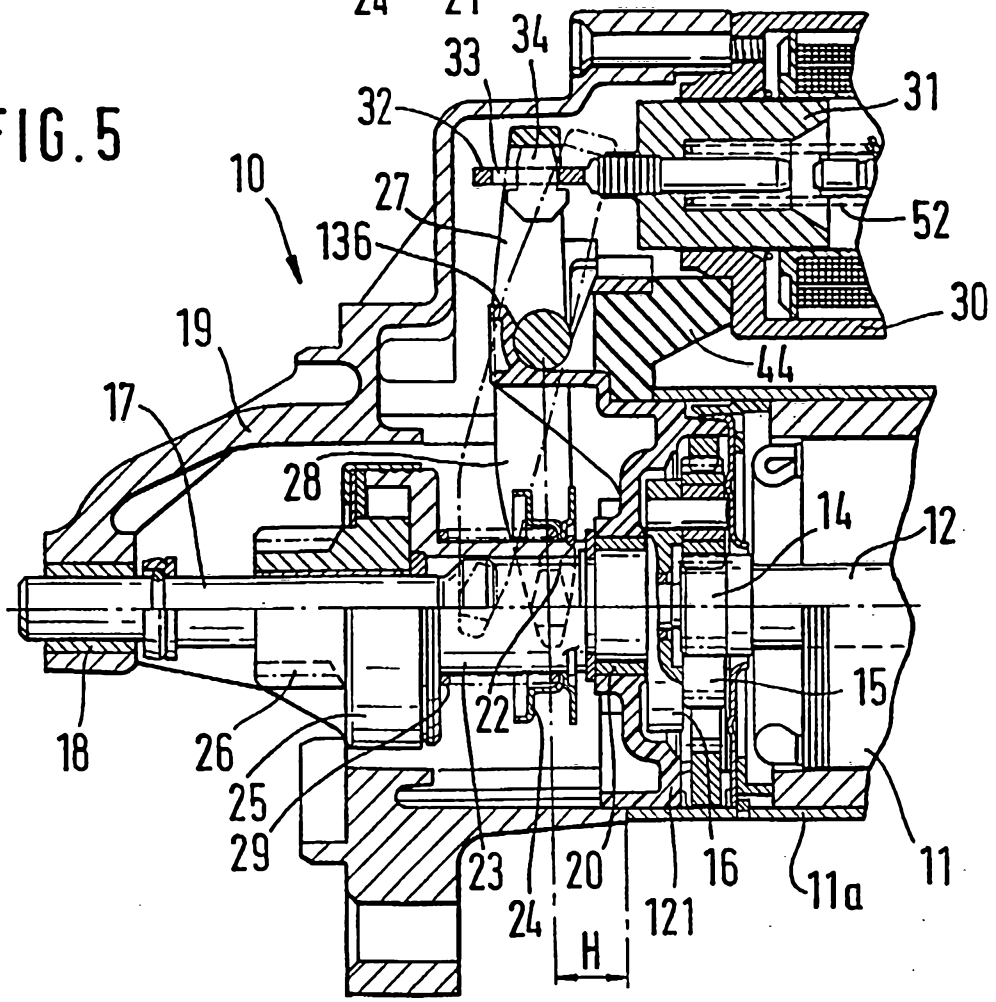
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FIG.2

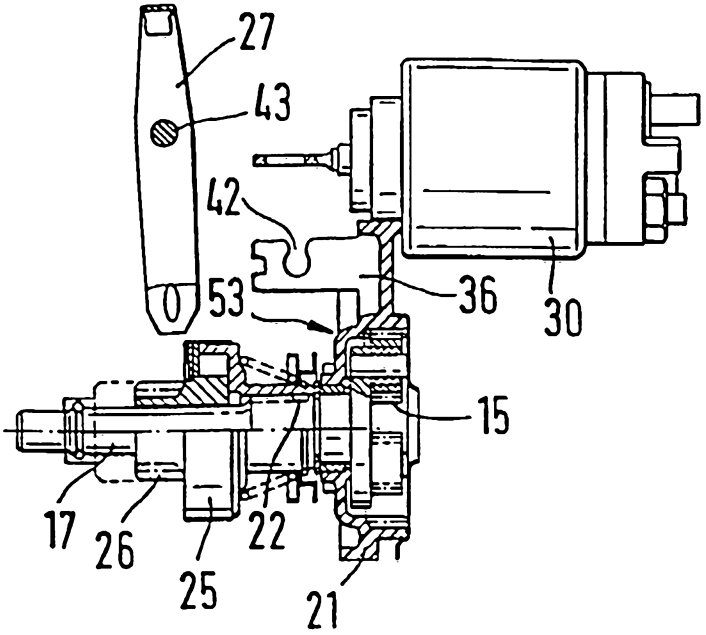


FIG.3

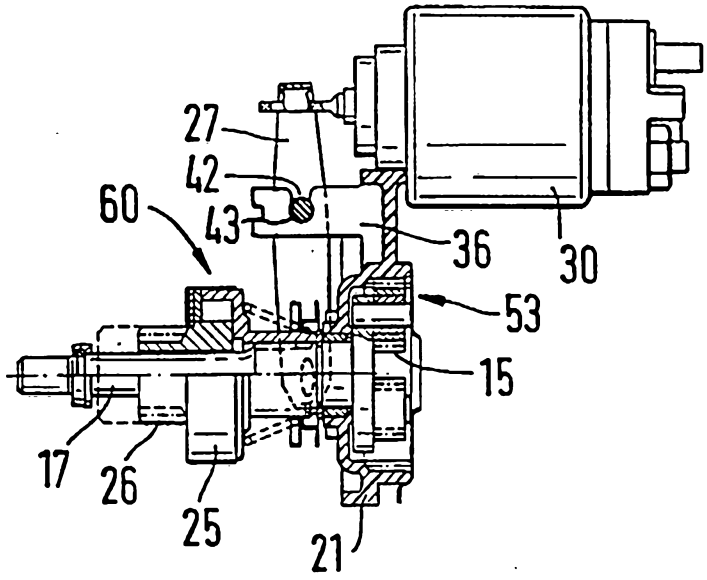


FIG.4

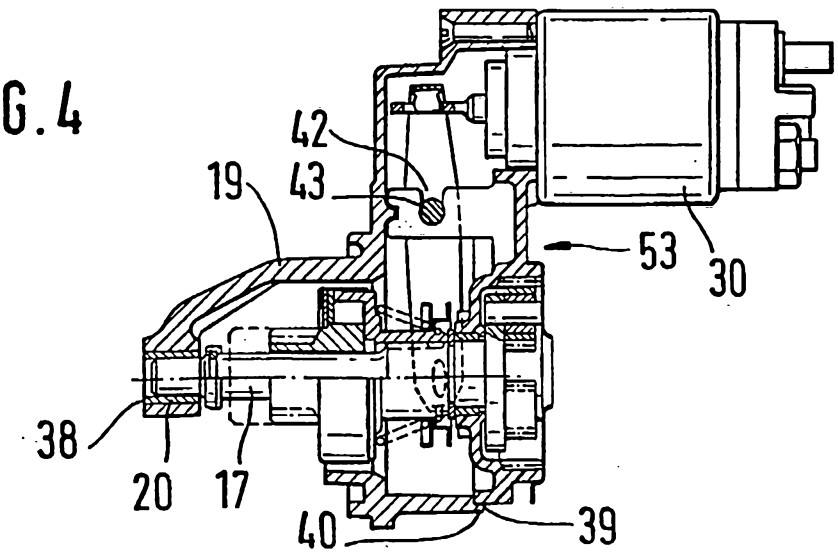


FIG. 7

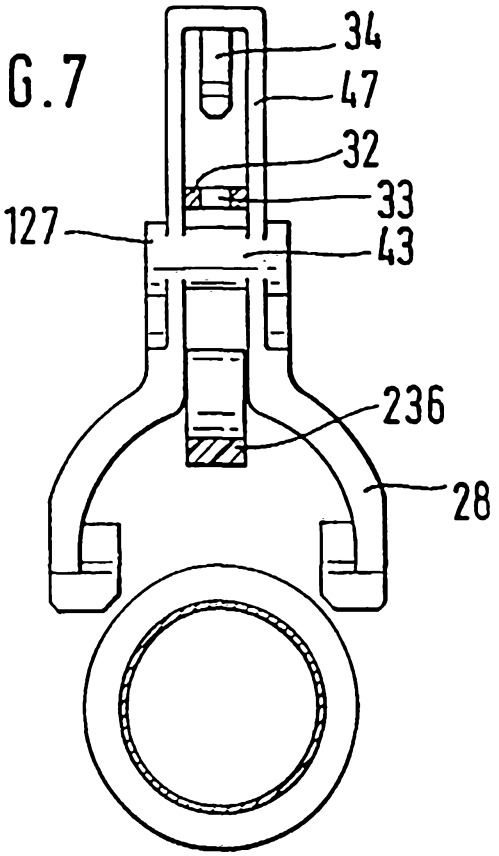
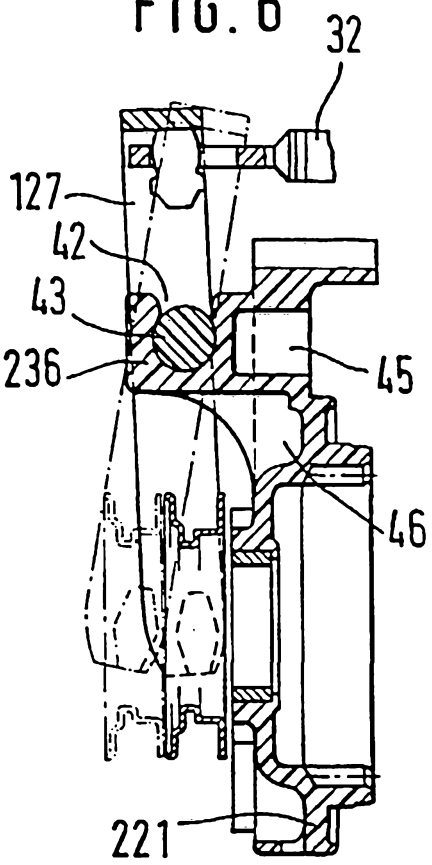


FIG. 6



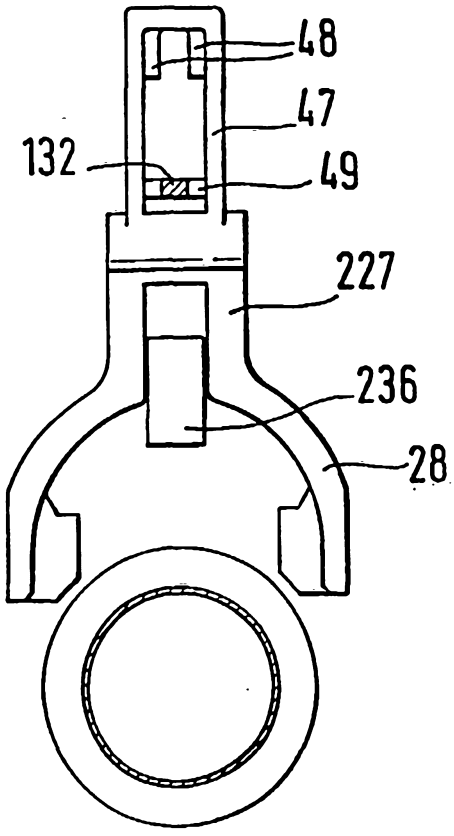


FIG. 8

FIG.9

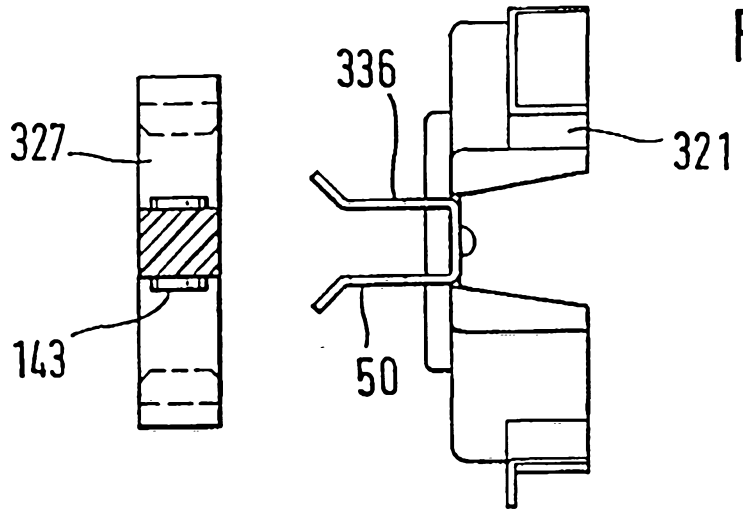


FIG.10

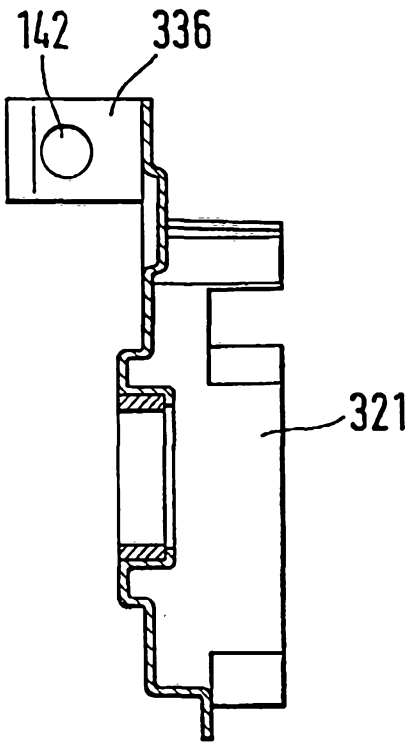
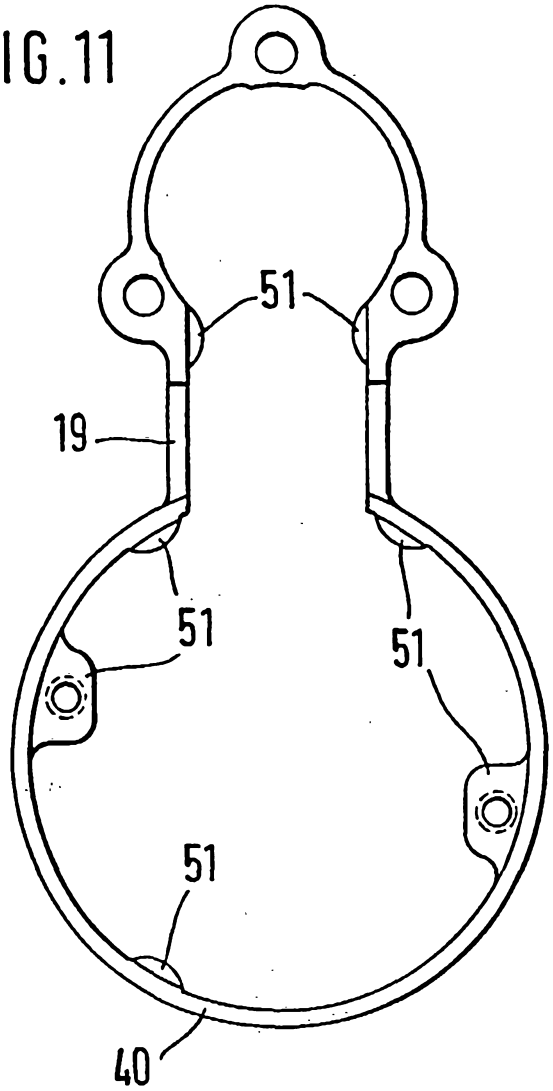


FIG.11



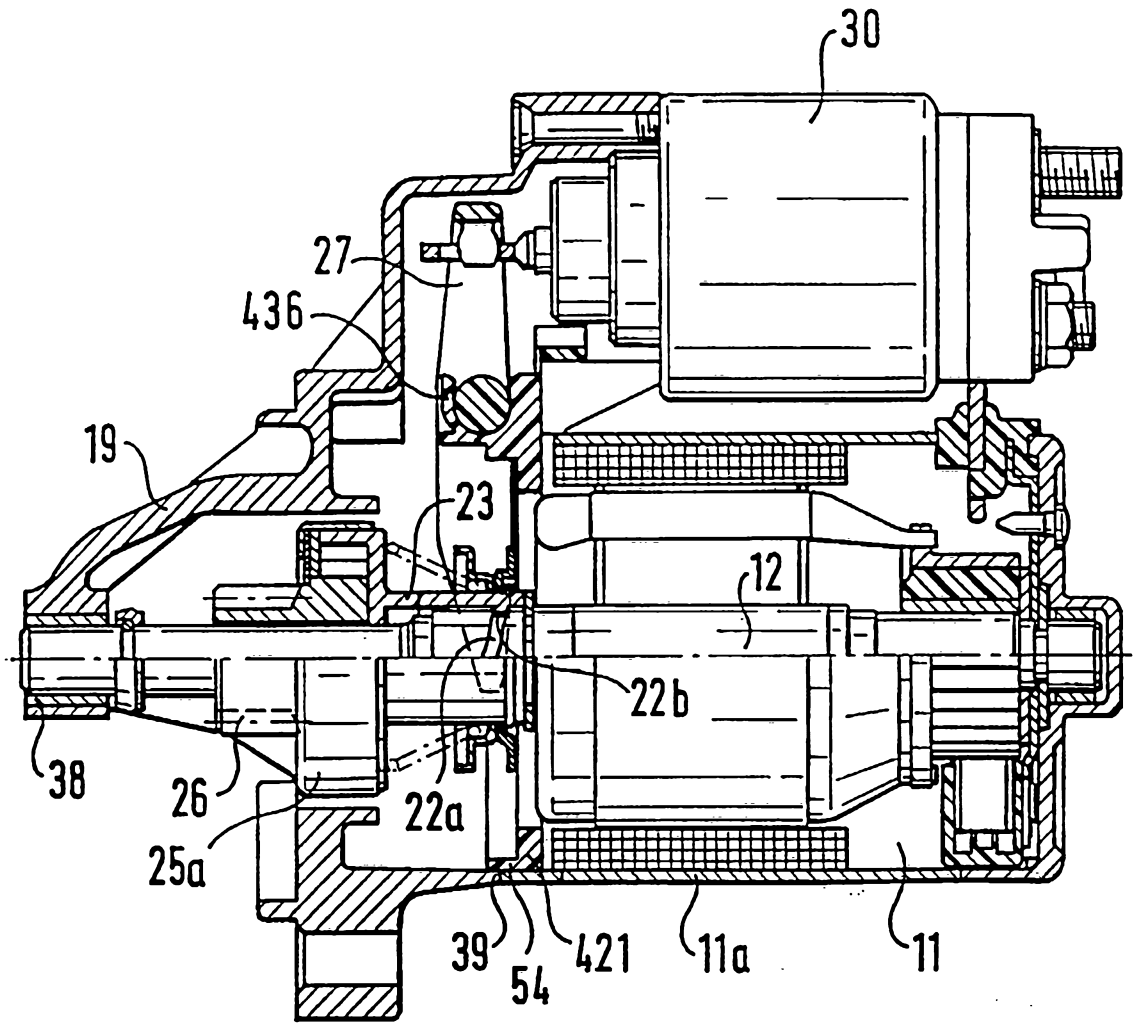


FIG. 12