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STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES

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Fig. 1

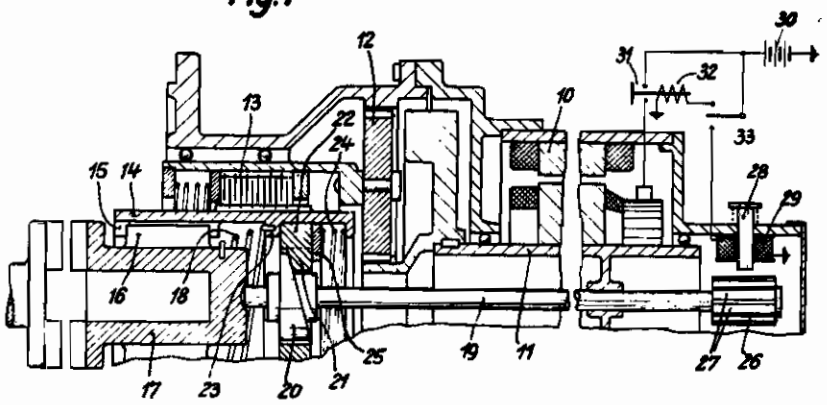
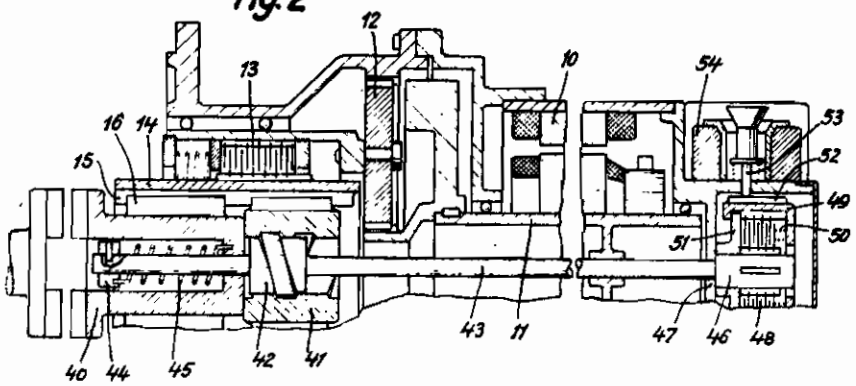


Fig. 2



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ALIEN PROPERTY CUSTODIAN

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES

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The invention relates to a starting device for internal combustion engines, in which the clutch element engaging on the internal combustion engine is engaged by a shifting arrangement as disclosed in my former patent application. In the device according to my former patent application the clutch element is shifted forward immediately at the beginning of the turning of the starting device. This form of construction is therefore not suited for starting devices, in which the energy required for the starting is first accumulated in a centrifugal mass or in a similar power accumulator. In order to make the shifting arrangement suitable for such starting devices one of the two elements to be mutually turned for effecting the forward shifting is, according to the invention, arbitrarily retarded or held.

Two embodiments of the invention are illustrated in section by way of example in the accompanying drawing, in which

Fig. 1 shows the first embodiment of the invention, and

Fig. 2 a modification of Fig. 1.

As shown in Fig. 1 an electromotor 10 is provided as driving engine for the starting device, a flywheel being keyed on the hollow armature shaft 11 of this electromotor. The flywheel is connected by a planet gear 12 with a friction disc clutch 13, which transmits the turning force of the centrifugal mass upon a sleeve 14. This sleeve 14 has on its inner side ledges 15 between which ledges 16 of a clutch element 17 engage which is shiftable in longitudinal direction in the sleeve. The inner distance between the ledges 15 of the sleeve, on the one hand, is so great and the width of the ledges 16, on the other hand, is so small that the clutch element 17 can rotate by a predetermined amount relative to the sleeve. A torsion spring 18 is inserted between the sleeve and the clutch element and destined to turn forward the clutch element relative to the sleeve in the direction of rotation of the starting device.

A shifting arrangement with a cam drive serves for engaging the clutch element. On a rod 18 located in the hollow armature shaft a cam disc 20 is fixed on that end of the rod which projects into the sleeve 14. On said cam disc 20 slides a tooth 21 of a disc 22 which is mounted so that it can rotate relative to the sleeve between a collar 23 of the sleeve and a friction disc 25 submitted to the pressure of a weak spring 24. A head 26 having grooves 27 is mounted on the other end of the rod. A pin 28 mounted on the circumference of the head is adapted to be brought into engagement with the grooves of head 26 by means of an electromagnet 29, so that in this position this pin prevents the rod from rotating.

For feeding the electromotor and the electromagnet a battery 30 is provided and connected with the electromotor by an electro-magnetically actuated switch 31, the exciter coil 32 of this switch being adapted to be switched in and cut out by means of a change-over switch 33, by which also the electromagnet 29 is controlled. The switch is constructed so that it actuates alternately in the one position the switch of the electromotor and in the other position the electromagnet.

The starting device operates as follows:

For starting the internal combustion engine the electromagnet 10 is first switched in and brings the flywheel to a high number of revolutions. The clutch 13, the sleeve 14 with the clutch element 17 and the cam disc 20 with rod 19 revolve at first idly with the flywheel. When the flywheel has attained the required number of revolutions, the switch 33 is laid over and the coil 29 switched in. The pin 28 engages in the grooves 27 of head 26 and thus secures the rod 19 against further rotation. The result hereof is, that the tooth 21 slides on the cam disc 20 and shifts the rod 19 towards the clutch element and engages this clutch element. When the front ends of the claws of the clutch elements encounter the one the other, the shifting forward of rod 19 is prematurely stopped. The shifting force exerted in axial direction by the rod 19 remains, however, low for the reason that disc 22 can slide between stop 23 and disc 25. The clutch element 17 can therefore easily be turned by the sleeve 14 moving behind the same, in order that this clutch element can engage into the next following gap.

The embodiment shown in Fig. 2 differs from the first embodiment only as regards the shifting arrangement for the claw, the other elements, as far as they are shown, are therefore designated by the same reference numerals as in Fig. 1. The clutch claw 40 is pushed forward by a nut 41 which is arranged in sleeve 14 so that it can shift in the longitudinal direction and can be drawn along by the ledges 15 of the sleeve. The nut can screw on a screw-threaded piece 42 of a rod 43 provided in the starting device. The rod projects, on one side of the screw-threaded piece, into the clutch claw and carries on its end a ring 44 fixed on it by pins. In this ring 44

one end of a helical spring 45 is fixed, the other end of said spring being fixed in the clutch claw. This spring corresponds to the torsion spring 18 of Fig. 1. On the other side of the screw-threaded piece a rod 43 extends beyond the electromotor and carries a grooved head 46 which bears against the bearing shield 47 of the electromotor and prevents the rod from shifting relative to the claw. A friction disc clutch 48 is mounted on the grooved head. Some of the friction discs are connected with the grooved head and the other friction discs with a sleeve 49. The friction discs are under the pressure of a spring 50 which presses the discs against a supporting plate 51. The sleeve 49 has grooves 52 in its outer side into which grooves a pin 53 can engage which is moved by an electromagnet 54. The switching of the electromagnet is similar as in the first embodiment of the invention.

During the upward turning of the centrifugal mass the pin 53 is not in engagement with sleeve 49. The rod 43 can therefore turn with the nut 41 or with the sleeve. When the upward turning is terminated and the driver switches in the electromagnet 54, the pin 53 comes into engagement with the grooves of sleeve 59 and stops the rod 43 by means of the friction clutch 48. Consequently the nut 41 screws forward on the screw-threaded piece 42 and pushes the claw in front of it. When the forward shifting is terminated the weak friction clutch 48 slides through.

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