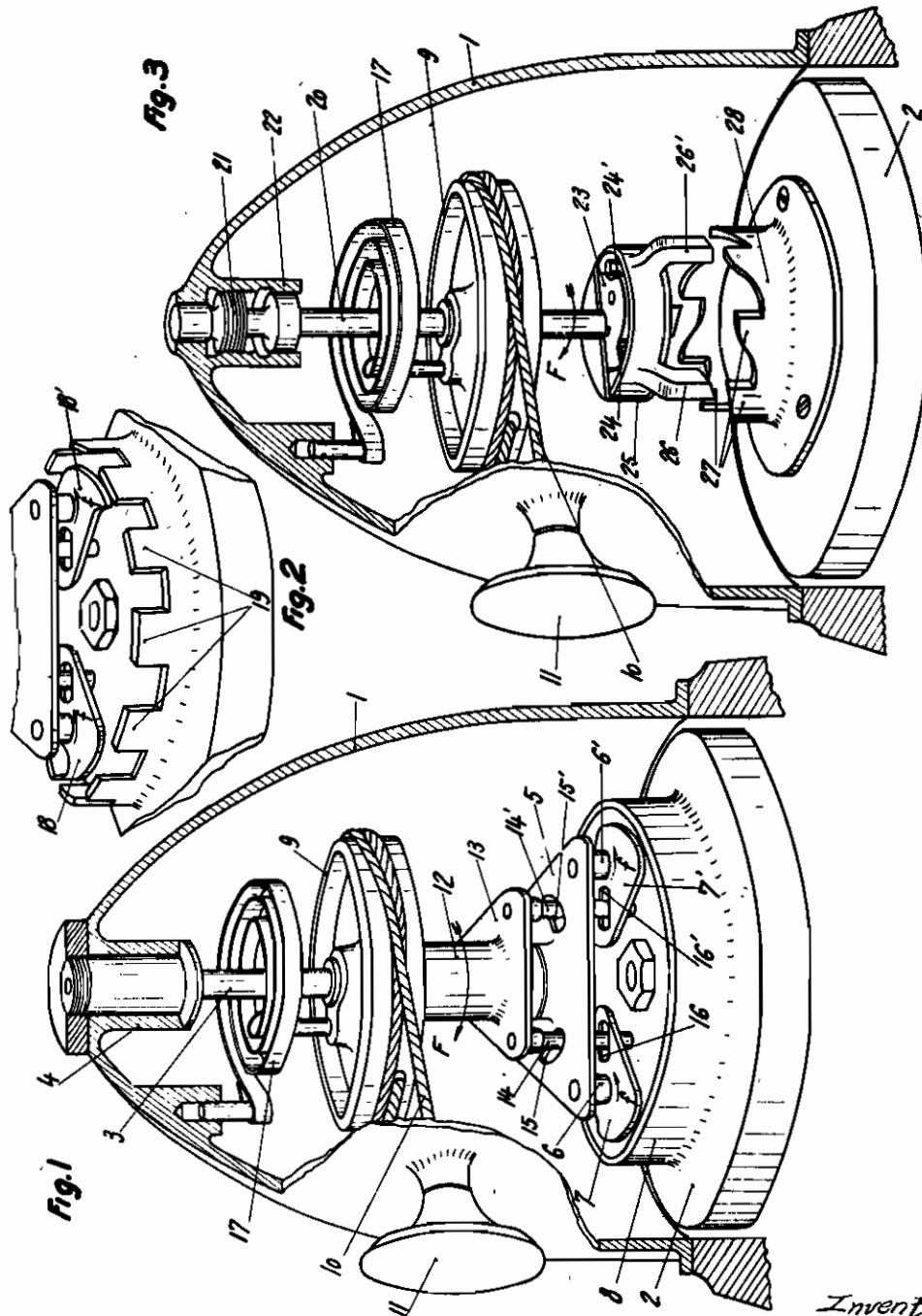


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STARTING DEVICE FOR INTERNAL
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ALIEN PROPERTY CUSTODIAN

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES

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The present invention relates to a starter for explosion engines, particularly applicable to removable out-board engines for boats.

It is known that engines of this type are generally started by means of a cable which is provided with a handle and is wound on a pulley which is retracted by a spring and which is secured to the driving shaft, when the pull is exerted on the cable, by means of a free-wheel, of a pawl coupling, or of a similar device, enabling the pulley to be released from the engine as soon as the latter has started. However, in most of the devices of this type, any backward rotation of the engine, due for example to an overheated spark plug or to a stoppage on the compression stroke, causes the starting pulley to be driven backwards by the engine and consequently the breaking of the cable or, if the latter resists, the breaking of the other members of the device.

In other devices which have also already been proposed, the members of the starter which are adapted to engage with the engine are first of all subjected to an axial movement by means of a screw and nut system, the pulley which is actuated by the cable resting on the flywheel of the engine by means of thrust ball bearings and being secured to a screw-threaded bush on which is engaged a braked nut which carries the actuating members adapted to engage with said flywheel. This device enables the accidents due to the reverse rotation of the engine to be avoided, but has the drawback that any lack of lubrication or any introduction of a foreign body into the thrust ball bearings produces an untimely coupling which causes serious damage.

The starter which is the object of the present invention is intended to remedy all these drawbacks and it is characterized by the feature that the coupling between the starting pulley and the engine is effected in such a manner that none of the members of the starter is in contact with the driving shaft when the cable is released.

By way of example, two embodiments of the starter which is the object of the invention have been described hereinafter and illustrated in the accompanying drawing in which:

Fig. 1 is a perspective view, with parts broken away, of a first embodiment of the invention.

Fig. 2 is a partial view of a modification of the device of Fig. 1.

Fig. 3 is a perspective view of a second embodiment of the invention.

Referring to the drawing (Fig. 1), in a case 1, which is fixed on the crankcase of the engine above the flywheel 2 of the latter, there is

mounted, in such a manner that it can rotate freely, a shaft 3 which is arranged in the extension of the shaft of the engine, but is not in contact with said engine shaft, said shaft 3 being suspended in a bearing 4 secured to the top of the case 1. The lower end of the shaft 3 carries a plate 5 on which are pivoted, on spindles 6, 6' . . . eccentric cams 7, 7' . . . which are adapted to wedge, by pivoting in the direction of the arrows *f*, against a cylindrical flange 8 provided on the flywheel 2 of the engine. According to the invention, this pivoting of the cams is positively controlled by the starting operation and as soon as said operation is finished, the cams 7 are automatically returned to their initial position so as to eliminate any contact between the starter and the engine. For this purpose, the pulley 9, on which the cable 10 actuated by the handle 11 is wound and fixed by its end, is loosely mounted on the shaft 3 by means of a sleeve 12, the lower end of which carries a plate 13 on which are fixed fingers 14, 14' . . . which are equal in number to the cams 7, 7' . . . and pass through the plate 5 of the shaft 3 in arcuate grooves 15, 15' . . . and engage in radial grooves 16, 16' . . . provided in the cams 7, 7' . . . A retracting spring 17, which opposes the pull of the cable 10, connects the pulley 9 to the case 1.

The device operates as follows:

A pull exerted on the cable 10 by means of the handle 11 causes the pulley 9 and the plate 13 to rotate in the direction of the arrow *F*; during the first phase of this movement, the fingers 14 of the plate 13 move, without driving the plate 5, in the grooves 15 and cause the cams 7 to pivot and wedge themselves against the circular flange 8 of the flywheel 2, so that, from this time onwards, the engine is rotated. When the engine has been started and the cable 10 released, the retracting spring 17 returns the pulley backwards, this return movement causing the coupling cams 7 to be pivoted in the opposite direction by the fingers 14. In this manner, the starter is completely separated from the engine and there is no danger of any accident when a backward rotation of the engine occurs and no untimely coupling can take place.

In the modification shown in Fig. 2, the cams are shaped like pawls 18, 18' . . . the noses of which are adapted to engage with teeth 19 provided on the circular flange 8 of the flywheel 2, the operation being identical with that described above with reference to the device shown in Fig. 1.

In the embodiment shown in Fig. 3, the pul-

ley 9, which is actuated by the cable 10 and the handle 11, is fixed on a shaft 20, the upper end of which is provided with a screw-thread 21 engaged in a tapped bush 22 secured to the top of the case 1, said screw-thread being such that the shaft 20 moves downwards as it rotates when the cable 10 is pulled, and moves upwards again by the action of the retracting spring 17 when the cable is released. The lower end of the shaft 20 carries a free-wheel formed by a plate 23 provided with ramps, rollers 24, 24' . . . and an external ring 25 carrying teeth 26, 26' which are adapted to mesh, when the shaft 20 is in its low position, with the teeth 27 of a cylindrical flange 28 fixed on the flywheel 2 of the engine.

When a pull is exerted on the cable 10 by means of the handle 11, the pulley is rotated and rotates the shaft 20 and the free-wheel 23—24—25, the whole arrangement effecting a downward movement owing to the screw-thread 21—22,

so that the teeth 26 mesh with the teeth 27 and drive the engine. When the engine has been started, the cable is released and the retracting spring 17 causes the whole arrangement to move upwards into its initial position, thereby completely separating the starter from the engine. In the event of a backward rotation of the engine during the starting operation, the teeth 27 rotate the free-wheel in the reverse direction to the starting direction, thereby causing the shaft 20 to screw into the bush 22 and therefore the teeth 26 to become quickly disengaged, so that any danger of an accident is eliminated.

While there has been described what is at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention.

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