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STARTING DEVICE

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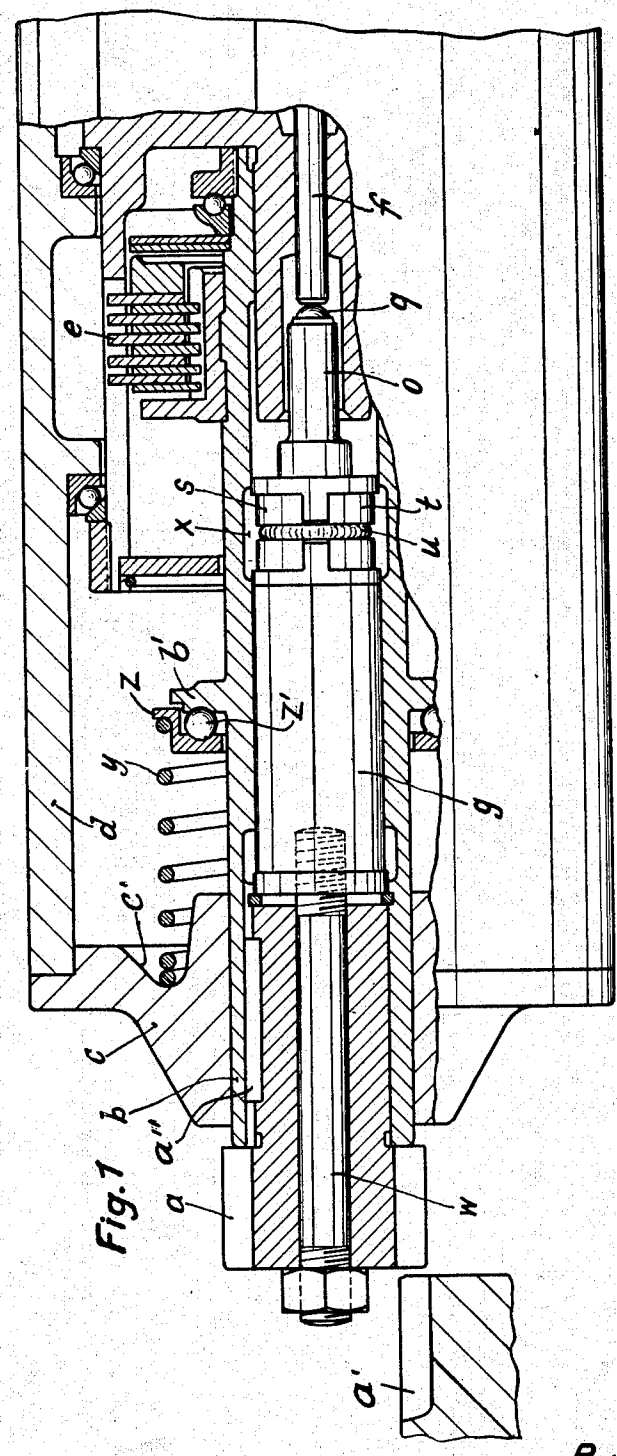


Fig. 1

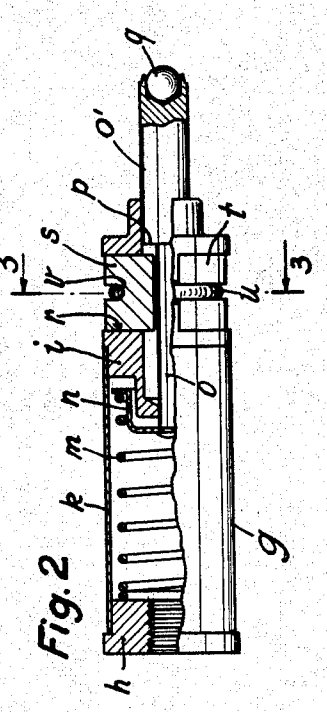


Fig. 2

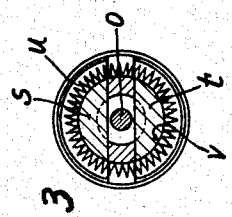


Fig. 3

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STARTING DEVICE

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5 Claims. (Cl. 74—6)

This invention relates to a starting device for internal combustion engines, of the type in which a coupling member is engaged with the engine by means of a push rod operating in the axial direction of the coupling member, against action of a return spring.

It is an important object of the present invention to provide means, in starting devices of the type referred to, for de-meshing the coupling member in time, in case of improper operation of the starting device by the operator.

With this and further objects in view, as may become apparent from the within disclosures, the invention consists not only in the structures herein pointed out and illustrated by the drawings, but includes further structures coming within the scope of what hereinafter may be claimed.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawing in which:

Fig. 1 is a side elevation, partly in section, of a starting device having the invention applied thereto.

Fig. 2 is a detail, partly in section.

Fig. 3 is a cross sectional view on line 3—3 of Fig. 2.

Similar characters of reference denote similar parts in the different views.

According to an important feature of the present invention a transmission member is arranged within the hollow driving shaft of the pinion, between the push rod and the coupling member, consisting of relatively slidable parts which are locked by means of catch members that can be released by centrifugal force at a predetermined speed.

Referring now to the drawing in greater detail, item *a* is a pinion constituting the coupling member of the starting device, by which the same can be connected with a gear *a'* of the engine. This pinion is connected, by a key *a''*, to a hollow shaft *b* which is seated in a bearing bracket *c* of the starting device and, at its end projecting into the starter casing *d*, is connected, through a free motion friction clutch *e*, with a gear system (not shown) which in turn can be driven from any source of power (not shown), such as an electric motor, fly wheel or the like. The clutch *e* and its drive may be of any conventional form and has no direct bearing upon the operating principle of the present invention, so that a more detailed description thereof will not be required. The hollow shaft together with parts of the friction clutch is arranged to be axially slidable in the bearing, to permit the pinion to be thrown into mesh with a member, such as the flywheel gear *a'*, of the engine. A push rod *f* arranged co-axially with the hollow shaft and extending through the starting device, with its inner end projecting into the hollow shaft, serves for axially moving the hollow shaft with the pinion. Provided between the end of the push rod and the pinion is a transmission member *g* by which the control motion of the rod *f* may be transmitted to the hollow shaft and the pinion connected thereto.

The transmission member *g* is shown in greater detail in Figs. 2 and 3 and comprises two annular bodies *h* and *i* interconnected by a sheet metal sleeve *k*. The opposite ends of a pressure spring *m* in the sleeve bear against the annular body *h* and against a spring plate *n*, respectively. A rod *o* riveted to the spring plate extends through the annular body *i* and has a thickened end portion *o'* projecting from the body *i*, thus forming a shoulder *p*. A ball *q* is seated in a recess on the front end of the rod *o*. The body *i* is formed with two segment-shaped recesses *r* for reception of a pair of centrifugal weights *s* and *t* which are held together by a helical spring *u* formed into a ring which is seated in grooves *v* of the two centrifugal weights. The weights in their position of rest project inwardly into the bore of the annular body. The complete transmission member *g* forming an independent, self-contained unit which as such can be inserted into the device is secured to the pinion by a screw *w* passing through the pinion and screwed into the annular body *h*. The inner face of hollow shaft *b* opposite the centrifugal weights is formed with a groove *x* into which the centrifugal weights may expand under action of their centrifugal force and against action of their spring *u*. Moreover, a spring *y* engaging at one end a shoulder *b'* of the hollow shaft *b*, through a spring plate *z* and balls *z'* and bearing at its opposite end against an annular groove *c'* in the bearing bracket *c*, serves as a return spring.

The operation of our novel device is as follows:

In order to start the engine, the operator or driver moves the push rod *f* engaging the ball *q* of rod *o*. The thrust motion is transmitted from the shoulder *p* of the rod *o* to the centrifugal weights which at the beginning of the starting operation are in the position of rest, and withal the hollow shaft *b* and the pinion *a* are axially moved to the left, through the sleeve *k*, and against action of spring *y*, until the pinion is in full mesh with gear *a'*. Assuming that the operator, after the engine has been started and has picked up speed, should fail to withdraw the push rod for demeshing the pinion, the centrifugal weights *s* and *t* owing to the high speed imparted to them through the pinion and the transmission member *g*, will spread out so far as to clear the shoulder *p* and to permit their sliding over the thickened portion *o'* of the rod *o*. Thus, the return spring *y* is permitted to withdraw the

hollow shaft *b* together with the pinion *a*, although the rod *f* has not been withdrawn. As the starter slows down, the centrifugal weights are contracted by their spring *u* and at first engage the thickened portion of the rod *o*. When the driver withdraws the thrust rod *f*, the spring *m* acts to move the rod *o* to the right, thus withdrawing the thickened portion *o'* thereof from the space intermediate the two centrifugal weights *s* and *t* which in consequence thereof fall in behind the shoulder *p*, whereby the starting device is made ready for another starting operation.

It will thus be seen from the foregoing that our novel starting device is foolproof inasmuch as automatic de-meshing of the pinion *a* from the engine gear *a'* is ensured if the driver omits to uncouple the starting device in time.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference, but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawing.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

We claim:

1. A starting device for internal combustion engines, comprising in combination a coupling member for transmitting the driving motion of the starter motor to the engine, a hollow driving shaft for said coupling member, a push rod operating axially of said shaft and adapted to engage said coupling member with the engine, by axial displacement of said coupling member, a return spring for said coupling member, and a transmission member disposed within said driving shaft and establishing a thrust-transmitting connection between said coupling member and said push rod, said transmission member comprising a plurality of parts which are axially slidable with respect to each other for permitting reduction of the distance between the thrust-transmitting end faces of the transmission member, under action of said return spring, and means adapted to lock said slidable parts in their position of maximum distance between said faces and to release said parts by action of a predetermined centrifugal force, whereby said coupling member will be disengaged from the engine at a predetermined speed, under action of said return spring.

2. A starting device for internal combustion engines, comprising in combination a coupling member for transmitting the driving motion of the starter motor to the engine, a hollow driving shaft for said coupling member, a push rod operating axially of said shaft and adapted to engage said coupling member with the engine, by axial displacement of said coupling member, a return spring for said coupling member, and a transmission member disposed within said driving shaft and establishing a thrust-transmitting connection between said coupling member and said push rod, said transmission member comprising a plurality of parts which are axially slidable with respect to each other for permitting reduction of the distance between the thrust-transmitting end faces of the transmission member, under action of said return spring, and means adapted to lock said slidable parts in their position of maximum distance between said faces and to release said parts by action of a predetermined centrifugal force, whereby said coupling member will be disengaged from the engine at a predetermined speed, under action of said return spring, said transmission member being in the form of an independent, self contained unit.

3. A starting device for internal combustion engines, comprising in combination a coupling member for transmitting the driving motion of the starter motor to the engine, a hollow driving shaft for said coupling member, a push rod operating axially of said shaft and adapted to engage said coupling member with the engine, by axial displacement of said coupling member, a return spring for said coupling member, and a transmission member disposed within said driving shaft and establishing a thrust-transmitting connection between said coupling member and said push rod, said transmission member comprising a sleeve, two annular end members interconnected by said sleeve, spring-loaded centrifugal weights fitting into segment-shaped recesses of one of said end members, a spring-loaded rod extending centrally between said centrifugal weights and adapted to transmit the axial thrust movement of said push rod upon said transmission member, through said centrifugal weights, by engagement of a shoulder of said spring-loaded rod with the inner portions of the side faces of said centrifugal weights, in the normal position of said weights, said centrifugal weights being adapted to clear said shoulder at a predetermined speed, for permitting disengagement of said coupling member under action of said return spring.

4. A starting device for internal combustion engines comprising, in combination, a coupling member adapted to engage and drive a member of the engine, a hollow driven shaft within which said coupling member is mounted and which engages said coupling member, a return spring for said coupling member, a push rod arranged in said shaft and adapted to axially displace said coupling member, and a transmission member between said push rod and said coupling member, said transmission member comprising two spring-loaded parts axially slidable with respect to each other, and control members acted upon by centrifugal force and adapted to releasably lock said parts in their position of maximum distance apart.

5. A starting device for internal combustion engines comprising, in combination, a pinion adapted to engage and drive a member of the engine, resilient means normally holding said pinion out of engagement with said member, and manually operable means for moving said pinion into starting engagement with said member against the tension of said resilient means, said manually operable means including a push rod and a unitary transmission device to transmit longitudinal movement of said push rod to said pinion to engage the same with said engine member, said transmission device including two spring-loaded members axially slidable relative to each other and speed-controlled means for releasably locking said spring-loaded members spaced apart but permitting movement of one spring-loaded member toward the other when a predetermined speed has been reached.

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