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STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES

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To all whom it may concern:

Be it known that I, THOMAS HERBERT DENNIS, a subject of the King of England, residing at Salisbury, in the Colony of Southern Rhodesia, have invented certain new and useful Improvements in Starting Devices for Internal-Combustion Engines, of which the following is a specification.

This invention relates to starting devices for internal-combustion engines.

If an engine starting device be put in operation when the ignition is advanced there is a danger that the engine will backfire, that is will fire before reaching dead-centre on the compression stroke, and so start running in the wrong direction. The object of this invention is to provide means to prevent the starting device being operated to start the engine except when the ignition is retarded to an extent sufficient to ensure that no backfire will take place.

Accordingly the present invention provides a safety device for use for the above purposes comprising the combination with a locking member movable into and out of a position in which it prevents operation of the starting device, of coupling means interconnecting the locking member aforesaid with the ignition timing lever in such manner that the locking member is moved towards its locking position by an advance of the timing lever and away from that position by a retarding movement of the lever.

The device provided by the invention may be used in conjunction with a self-starting mechanism of electrical, pneumatic or other type which is controlled by a press button, hand lever or other manually or pedal operated part. In this case the locking member aforesaid conveniently comprises an abutment which is guided for movement into and out of the path of the starting button or equivalent part so that when located in said path it prevents the button being depressed or equivalent part being operated.

Another application of the invention is to the ordinary cranked starting handle or equivalent part of a manually operated starting mechanism. In such an application the locking member aforesaid is arranged for movement into and out of a position into which it prevents either (a) rotational movement of the starting handle or (b) axial movement of the starting handle shaft into engagement with the engine shaft.

Two examples of this invention will now be described with reference to the accompanying drawings (largely diagrammatic) in which—

Figure 1 is a plan view of a safety device for a self-starter according to my invention;

Figure 2 is a side elevation of the same;

Figure 3 is a plan view of a modification as applied to an ordinary hand starting crank, and

Figure 4 is an elevation of the same, showing the starting crank shaft in cross-section.

Like reference numerals indicate like parts in the various figures.

Referring to Figures 1 and 2, the press button 5 which controls the operation of the starter is formed with a circumferential flange 6, and the aforesaid locking member for the button is a forked bar 7 the two arms of which embrace the stem below the flange 6. The arms of the bar 7 are so spaced apart that at one end (i.e. at the open end of the fork) the gap between them is greater than the diameter of the flange 6 and at the other end (i.e. the closed end) is less than said diameter. The forked bar is guided by brackets 8 for movement in a plan at right angles to the axis of the starting button. When the outer end of the forked bar is adjacent to the button the gap between the arms is sufficient to allow the button to be depressed and the starter thus brought into operation. This position of the bar is shown in chain lines in Figure 1. When the bar is moved into the full line position in Figure 1, i.e. so as to bring the narrow end of the fork adjacent to the stem, the flange 6 overlies the arms of the bar and thus prevents depression of the starting button. A radial arm 9 is connected to the spindle 10 of the ignition timing lever 11 so as to be movable therewith, and the outer end of the arm 9 is connected by means of a flexible coupling 12 with the aforesaid bar 7 at the junction between the arms thereof. The nature of the coupling 12 will of course depend on the relative positions occupied by the timing lever 11 and the starting button 5. In some cases it may be possible to provide a more or less rigid connecting rod coupled at opposite ends by ball-and-socket or other flexible joints with the radial arm and forked bar respectively. In other cases it may be more convenient to interconnect the lever 11 and bar 7 by means of a flexible cable as shown. Whatever be
the nature of the coupling member, means (such as the turn-buckle 13) are preferably provided in order to vary its effective length. Where a flexible coupling member is employed, spring means (not shown) are provided to constrain the forked bar towards its locking position.

In the second example, illustrated in Figures 3 and 4, the shaft 14 which carries the starting handle (not shown) is formed with a circumferential flange 6 and on the inside of this flange (i.e., that side which is towards the engine) a bar 7, constituting the movable abutment aforesaid, is guided by brackets 8 for movement in a direction at right-angles to the axis of the starting shaft. One end of the bar 7 is operatively connected by a flexible coupling member 12 to an arm 9 mounted on the spindle 10 of the ignition timing lever. As before the exact nature of the coupling 12 depends on the relative positions occupied by the ignition timing lever and the starting handle. When the end of the bar remote from that coupled to the timing lever is adjacent to the flange 6, the bar forms an abutment for the flange and so prevents axial movement of the starting shaft into engagement with the engine shaft. The opposite end of the bar 7 is bent outwardly away from the starting shaft, as shown in Figure 4, so as to form an off-set portion which, when adjacent to the flange aforesaid will be clear of the latter and so permit of the starting shaft being moved axially to bring the clutch part 13 at its inner end into engagement with the co-operating part on the engine shaft 16. In Figure 4 which shows the bar 7 in its free position, the locking position is also indicated by dotted lines. The end of the bar remote from that coupled with the timing lever is held by a spring 17 which opposes movement of the bar towards its locking position. This spring though not sufficiently strong to overcome the resistance of the timing lever, coupling member and bar, assists in or effects the movement of the locking bar towards the free position when the timing lever is moved towards a retarded position.

The flexible coupling 12 is connected to the bar 7 by an attachment 18 by means of which the effective length of the coupling member can be varied.

In each of the foregoing examples the arrangement may be such that the locking bar 7 does not free the press button or the starting handle as the case may be until the timing lever has been moved to the limit of its travel in the retarding direction. Alternatively, the bar may be arranged to release the press button or starting handle at some intermediate position of the timing lever which corresponds to an ignition setting in which the spark is sufficiently retarded to ensure that no backfire will take place. It will be appreciated that by use of the device 12 or 13, the effective length of the coupling member 12 may be varied, thus effecting a corresponding variation in the extent to which said lever must be moved towards its fully retarded position before the bar 7 is freed.

The locking bar 7 may be replaced by any other convenient form of abutment operatively connected to the ignition lever so as to fulfil the function of preventing initiation of the starting mechanism except at such times as the ignition lever is in a predetermined safety position.

What I claim as my invention and desire to secure by Letters Patent is:

1. For an internal-combustion engine, the combination with engine starting mechanism, of a locking member movable into and out of a position in which it prevents operation of said starting mechanism, an ignition timing lever, coupling means interconnecting the locking member aforesaid with said timing lever in such manner that the locking member is moved towards its locking position by an advance of the timing lever and away from that position by a retarding movement of the lever, and means to vary the effective length of the coupling means aforesaid.

2. In an internal combustion engine, in combination, an engine starting mechanism having a movable operating member, a projection on said member, a slidable mounted rod adapted to be moved into position to engage said projection and prevent operation of said starting mechanism, an ignition timing lever, and means for connecting said timing lever to said slidable rod so that the rod is moved into locking engagement with said projection when the timing lever is advanced.

3. The combination as claimed in claim 2 in which said connecting means is adjustable so as to vary the position of the timing lever at which locking takes place.

In testimony whereof I affix my signature.

THOMAS HERBERT DENNIS.