Dec. 21, 1954 T. G. HARE 2,697,423

STARTER MECHANISM FOR ENGINES

Filed April 2, 1953 2 Sheets-Sheet 1

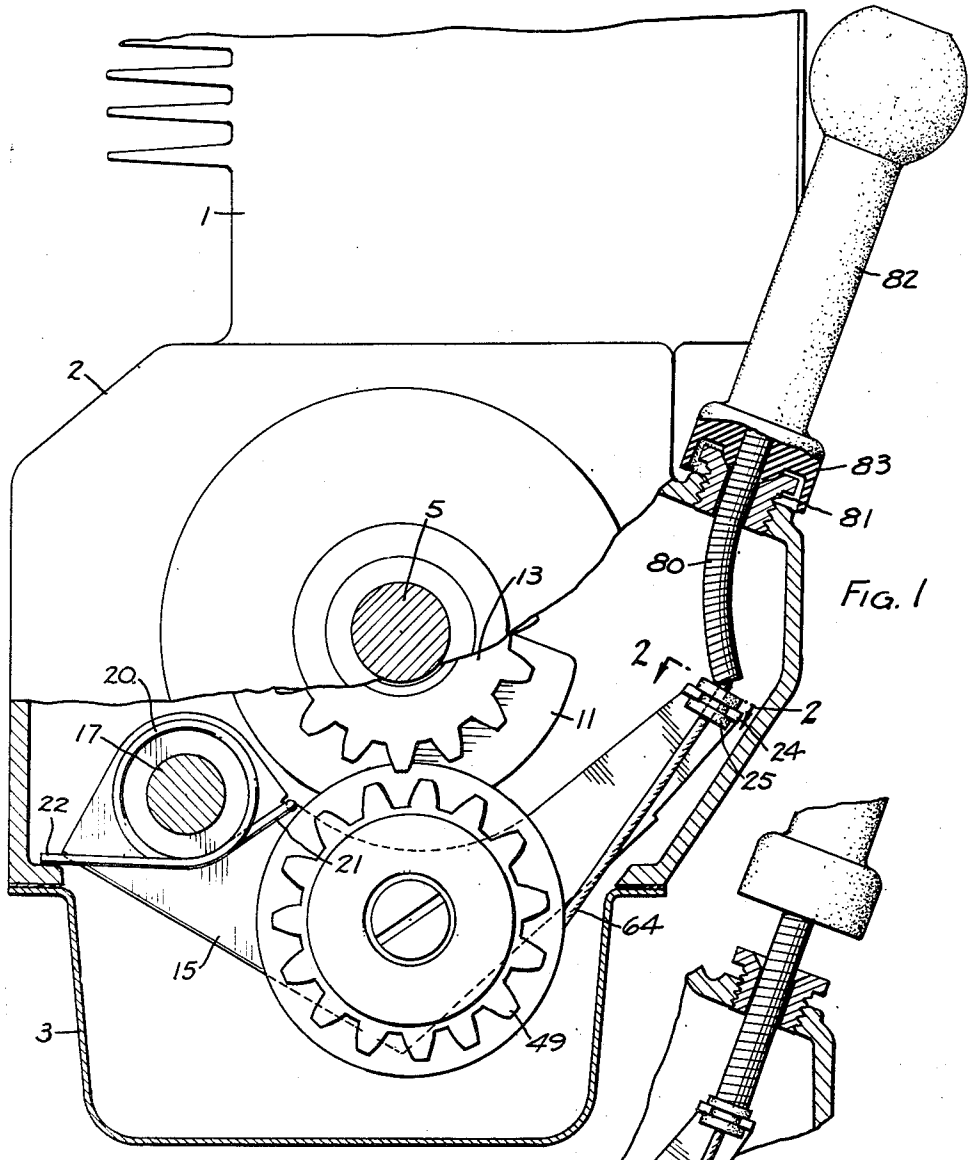


FIG. 1

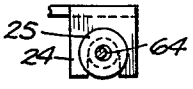


FIG. 2

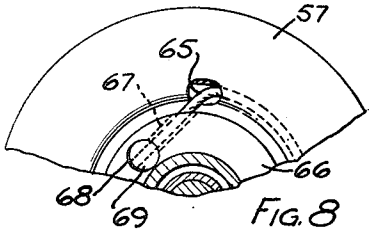


FIG. 8

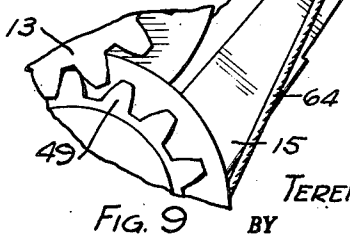


FIG. 9

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STARTER MECHANISM FOR ENGINES

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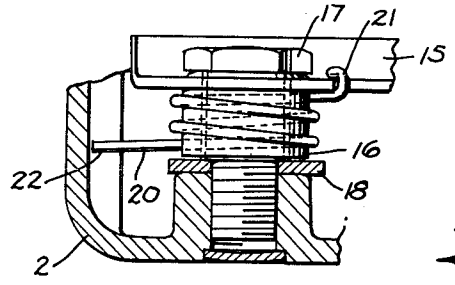


FIG. 5

FIG. 3

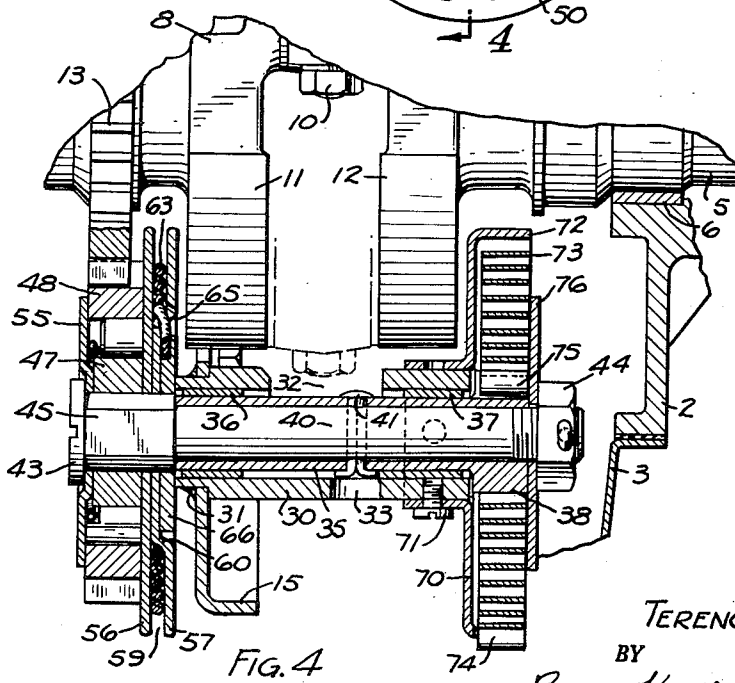


FIG. 4

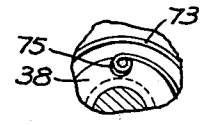


FIG. 6

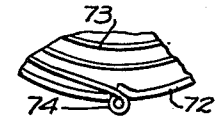


FIG. 7

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STARTER MECHANISM FOR ENGINES

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Application April 2, 1953, Serial No. 346,338

4 Claims. (Cl. 123—185)

This invention relates to mechanism for starting an internal combustion engine and it has to do particularly with a hand manipulated starter of the type employed for starting small engines which may be employed for a variety of purposes.

The starter of this invention is one of the type which transmits turning torque to the shaft of the engine by means of an operator pulling upon a flexible element such as a rope or cable which is wound upon a surface or wound in or upon a pulley-like device and which is caused to be rotated as the flexible element is subjected to pulling movement. One object of the invention is to provide a starter mechanism which may be relatively permanently associated with the engine and normally operatively disengaged therefrom wherein an operating element is brought into engagement with an engine part upon initial exertion of pulling force on the flexible element and wherein the operating element remains operably connected with the engine part during the starting operation even though the operator successively a number of times, exerts pulling action on the flexible element to cause the turning motion and then allows the flexible element to retract to wound position preparatory to a subsequent pulling action. In this connection, the flexible element is retained in wound condition by spring means. Thus a person starting an engine may successively pull on the flexible element and release the same while the starter mechanism remains operatively connected to the engine. Other objects of the invention will appear as the description is considered and these include a starter mechanism mounted compactly within an exterior case or housing of the engine so compactly arranged as to provide for movement of engine parts. A starter constructed in accordance with the invention is disclosed in the accompanying drawings:

Fig. 1 is a general view partly in elevation with parts cut away and some parts shown in section illustrating the engine shaft and some of the starter mechanism.

Fig. 2 is a detail view taken substantially on line 2—2 of Fig. 1.

Fig. 3 is a view largely in section and with parts cut away illustrating the position of the parts immediately following initial manipulation of the operation handle.

Fig. 4 is a sectional view taken substantially on line 4—4 of Fig. 3 showing the reel for the flexible element, the spring, and illustrating the starter gear in engagement with a gear on the engine.

Fig. 5 is a sectional view taken substantially on line 5—5 of Fig. 3 showing a mounting structure.

Fig. 6 is a detailed view illustrating one end of a coil spring anchored to a hub portion.

Fig. 7 is a detailed view showing one end of a spring anchored to a housing structure.

Fig. 8 is a view illustrating how the end of the flexible element is anchored.

Fig. 9 is a view illustrating the position of parts when the carrier 15 has been shifted to engage the gear teeth and before the handle has been pulled for operation purposes.

The engine shown in Fig. 1 has a cylinder 1, a crank case 2, and a closure or pan 3. The crank shaft of the engine is illustrated at 5 which is suitably journalled in the crank case by suitable bearings, one of which is illustrated at 6. The crank shaft 5 has a suitable crank or throw 8 to which a connecting rod (not shown) is attached as by means of cap screws 10 and mounted on the shaft are suitable counter-weights 11 and 12. Also

mounted on the shaft is a starter gear 13. The engine illustrated has but a single cylinder but, of course, the starter mechanism may be applied to engines with more than one cylinder.

There is a carrier or carrying arm generally illustrated at 15 which may conveniently be formed of fashioned sheet metal, one end of which is pivotally mounted as shown in Fig. 5. For this purpose, the carrier is provided with a hollow extension 16 constituting a bearing rotatably mounted on a stud 17 which is screw threaded into the crank case. The stud 17 is shouldered, as shown in Fig. 5, so that it may be tied in position, leaving the bearing 16 free to oscillate thereon between the head 17 and a washer 18. A coil spring 20 is disposed around the bearing 16, one end of which is engaged with the carrier arm 15 as at 21 and the opposite end engaged with a portion of the crank case as shown at 22. As illustrated in Fig. 1 the action of this spring swings the arm clockwise about the stud 17.

The opposite end of the carrier arm has an inturned notched portion 24 which receives and holds a spool-like bushing 25 which may conveniently be of plastic substance such as nylon. There is an assembly of parts mounted on the frame 15 as shown in Fig. 4. This assembly resides in the tubular bearing member 30, rigidly affixed to the arm 15 as by means of welding as shown at 31 and it is cut away as shown at 32, for clearance of the nuts 10 and/or the connecting rod cap and provided with an opening 33. A spacer sleeve 35 is disposed in this bearing preferably on suitable bearing members 36 and 37 and this spacer sleeve has a hub portion 38 at one end.

Within the spacer sleeve is a stud or shaft 40 secured to the sleeve by a cross pin or rivet 41 and it has a head 43 at one end and a nut 44 at the other. Adjacent the head 43 the stud has an enlarged portion 45 which is out of round and which advantageously has two flat sides as shown in Fig. 3 and mounted thereon is the inner element 47 of a one-way clutch. The outer element 48 of the one-way clutch is a gear having gear teeth 49. Between the inner and outer elements are devices so arranged that when the inner element 47 is rotated counter-clockwise as Fig. 3 is viewed, the outer gear element 48 is driven counter-clockwise. However, when the element 47 rotates clockwise, it may do so without movement of the outer element 48. This overrunning clutch may be of any known one-way clutch construction but is shown herein as comprising sprag type devices 50 with rollers alternately arranged, as shown at 52, with the sprag devices held by a circular coil spring 53. A protecting cover or washer 55 is disposed, as shown in Fig. 4.

Also, mounted on the portion 45 of the stud is a spool or pulley constituted by a plate 56 and a plate 57 fashioned as shown to provide a groove 59 therebetween. For this purpose the plate 57 is fashioned with an offset 60 which forms the bottom of the groove. A flexible element, such as a cable 64, is wound on the pulley in the groove 59 and its inner end is anchored. As shown in Fig. 8 the plate 57 is provided with an opening 65 through which the inner end of the cable is passed. A washer 66 serves as a filler element for the hub of the pulley and is provided with an angular slot 67 through which the cable passes, the slot terminating in an enlarged opening or cavity 68 in which is located an anchoring piece 69 secured to the end of the cable.

The end of the bearing 30 remote from the plate 15 carries a housing 70 secured to the bearing as by means of a screw 71. The housing has a flange 72 within which is located a spiral spring 73. The outer end of the spring is anchored to the flange as shown at 74 in Fig. 7 and the inner end is anchored to the portion 38 of the spacer sleeve 35 as at 75. A protecting washer 76 is disposed between the nut 44 and the spring. When the nut 44 is tightened the spacer sleeve 35 serves to space the elements so that the spacer sleeve and the stud 40, the pulley, and the inner part 47 of the overrunning clutch are free to turn, and then also the washer 46 does not bind the spring 73.

The cable 64, as shown in Fig. 3, passes through the bushing 25 and into a cable casing 80 which preferably

is somewhat flexible. The cable **80** passes through a bushing **81** in the crank case **2** and the casing **80**, as well as the cable **64**, are anchored in a handle **82**. This handle preferably is formed with a flange **83** which fits over the bushing **81** in the position shown in Fig. 1, and it has a protuberance or sealing member **84** arranged to seat in a counter-bored part **85** of the bushing **81** when the parts are in the position shown in Fig. 1.

The normal position of the parts, when not being employed for starting purposes, is as shown in Fig. 1. The spring **20** holds the arm **15** and all parts assembled thereon in the position indicated with the gear **49** removed from and disengaged from the gear **13**. The spring **73** has wound up the cable on the pulley to the point where the casing **80** strikes the bushing **25** and the spring **73** pulls the sealing element **84** into and against the seat **85** thus closing the bushing **81**. When the apparatus is to be manipulated to start the engine, a person grasps the handle **82** and pulls it. The spring **20** is weaker than the spring **73** and the result is that the arm **15** is swung on its pivot thus moving the gear teeth **49** into mesh with those of the gear **13**. The spring **73** is sufficiently strong so that the casing **80** at this point is still held by the spring **73** against the bushing **25**. Now upon continued movement outwardly by the pull on the handle **82** the cable is unwound causing the pulley to turn and this rotates the inner member **47** thus causing rotation of the outer gear member **48** clockwise as Fig. 3 is viewed, and causing rotation of the crank shaft as Fig. 3 is viewed.

After pulling the handle outwardly for a suitable distance, provided the engine does not start, the operator may so relieve the applied force that the spring **73** winds up the cable. This occurs without rotation of the outer member **48** and the teeth **49** remain in engagement with the gear **13** as the carrier **15** is still held in the position shown in Fig. 3. This occurs because the spring **20** is weaker than spring **73**. Having allowed the cable to again become wound on the pulley the operator may again pull the cable outwardly thus again turning the engine crank shaft. Thus if it is difficult to start the engine a person operating the mechanism may perform a sequence of pulling and releasing operations on the handle so that the engine crank shaft is subjected to successive rotary movements all with the teeth **49** remaining in engagement with the gear **13**. When the engine is started the handle may be released. The teeth **49** remain in engagement with the gear **13** until the spring **73** has wound up the cable to an extent that the casing **80** strikes the bushing **25** on the end of the arm as shown in Fig. 3 at which time the forces acting against spring **20** are relieved and the spring **20** shifts the carrier to the position shown in Fig. 1 with the teeth **49** disengaged from those of the gear **13**.

In the structure shown the carrier **15** and its associated parts are spaced axially from the winding spring, and the stud and spacer sleeve are elongated. This structure facilitates the mounting of the structure within the crank case of the engine with parts astride the throw of the crank shaft. Even the tubular bearing member **30** is cut away to provide clearance for parts on the crank shaft. However, the structure may be more compacted axially for other installations.

I claim:

1. A mechanism for starting an internal combustion engine which has a crankshaft with a gear thereon, comprising, a sub-assembly including a rotary member, a winding spring therefor, a flexible element, means on the rotary member upon which the flexible element is to be wound by the action of the winding spring, said means and winding spring being spaced apart to straddle a throw on the crankshaft of the engine, a gear, a one-way drive coupling between the rotary member and the gear, whereby the gear is turned when the flexible element is pulled to unwind it and does not turn as the spring winds the flexible element on said means; a carrier upon which the sub-assembly is mounted, means movably mounting the carrier so that it is normally positioned with the gear of the sub-assembly spaced from the gear on the engine crankshaft, the winding spring exerting resistance to the unwinding of the flexible element as the flexible element is pulled so that the carrier is moved to bring the teeth on the gear of the sub-assembly into mesh with those of the gear on the motor part, whereby the gear on the motor part is turned as the flexible element is pulled and unwound.

2. A mechanism for starting an internal combustion engine which has a crankshaft with a gear thereon and a crankcase, comprising, a sub-assembly including a rotary member, a winding spring therefor, a flexible element, means on the rotary member upon which the flexible element is to be wound by the action of the winding spring, said means and winding spring being spaced apart to straddle a throw on the crankshaft of the engine, a gear, a one-way drive coupling between the rotary member and the gear, whereby the gear is turned when the flexible element is pulled to unwind it and does not turn as the spring winds the flexible element on said means; a carrier pivotally mounted on the crankcase upon which the sub-assembly is mounted with said rotary member extending substantially parallel to the crankshaft axis and said winding spring and means on the rotary member positioned to straddle a throw on the crankshaft, spring means acting on the carrier holding the gear thereon normally spaced from the gear on the crankshaft, the winding spring offering resistance to the unwinding of the flexible element as it is pulled in excess of the resistance offered by the spring means acting upon the carrier, whereby when the flexible element is pulled the first part of the movement shifts the carrier to bring the teeth of the gears into mesh and following increments of movement, incident to the pulling of the flexible element, rotates the gears.

3. A mechanism for starting an internal combustion engine which has a gear on an operating part, comprising, a sub-assembly including a rotary member, a winding spring therefor, a flexible element, means on the rotary member upon which the flexible element is to be wound by the action of the winding spring, a gear, a one-way drive coupling between the rotary member and the gear, whereby the gear is turned when the flexible element is pulled to unwind it and does not turn as the spring winds the flexible element on said means; a carrier upon which the sub-assembly is mounted, means pivotally mounting one end of the carrier, spring means acting upon the carrier for holding it in a position with a gear thereon free of the gear on the engine part, the carrier, at a point remote from its pivot, having a guide through which the flexible element extends, means on the flexible element for engaging the guide to limit the winding action of the winding spring, the winding spring exerting a resistance to the unwinding of the flexible element in excess of that exerted by the spring acting upon the carrier, whereby as the flexible element is pulled the first part of the movement shifts the carrier to move the gear thereon into engagement with the gear on the engine part and subsequent increments of movement rotate the gears to start the engine.

4. A mechanism for starting an internal combustion engine which has a gear on an operating part, comprising, a sub-assembly including a rotary member, a winding spring therefor, a flexible element, means on the rotary member upon which the flexible element is to be wound by the action of the winding spring, a gear, a one-way drive coupling between the rotary member and the gear, whereby the gear is turned when the flexible element is pulled to unwind it and does not turn as the spring winds the flexible element on said means; a carrier movably mounted within a case of the engine upon which the sub-assembly is mounted, spring means acting upon the carrier to hold the gear thereon spaced from the gear on the engine part, the carrier having a guide through which the flexible element extends, the engine case having an opening, an enlarged device on the flexible element for passing through the opening and including an element for closing the opening in the engine case, the said enlarged device adapted to engage the guide to limit the action of the winding spring, the winding spring exerting a resistance to the unwinding of the flexible element greater than that of the spring means acting upon the carrier, whereby the initial part of the movement, incident to the pulling of the flexible element moves the carrier to bring the gear thereon into operating position with the gear on the engine part, and subsequent increments of movement rotate the gears.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,538,147	Du Shane	Jan. 16, 1951