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3,134,376

ENGINE STARTER REEL AND METHOD OF MAKING THE SAME

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FIG. 1.

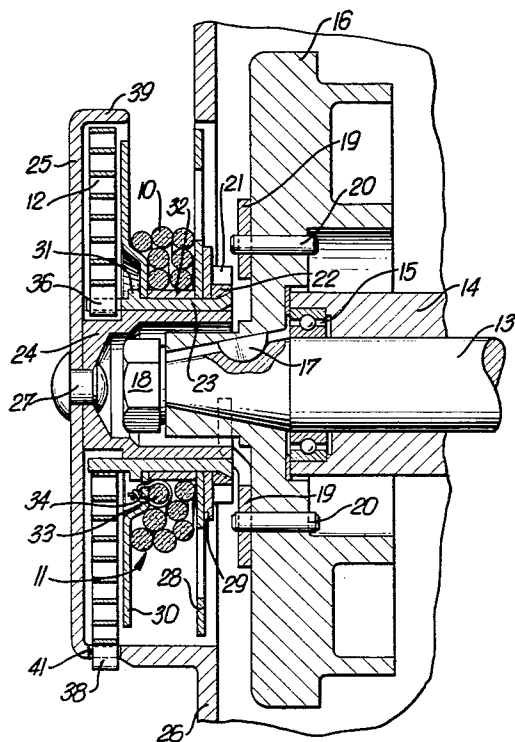


FIG. 2.

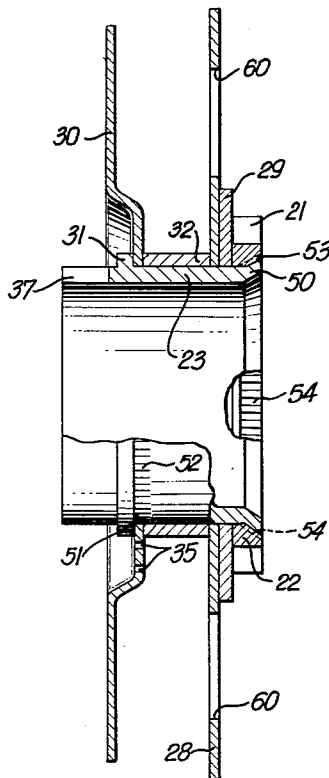
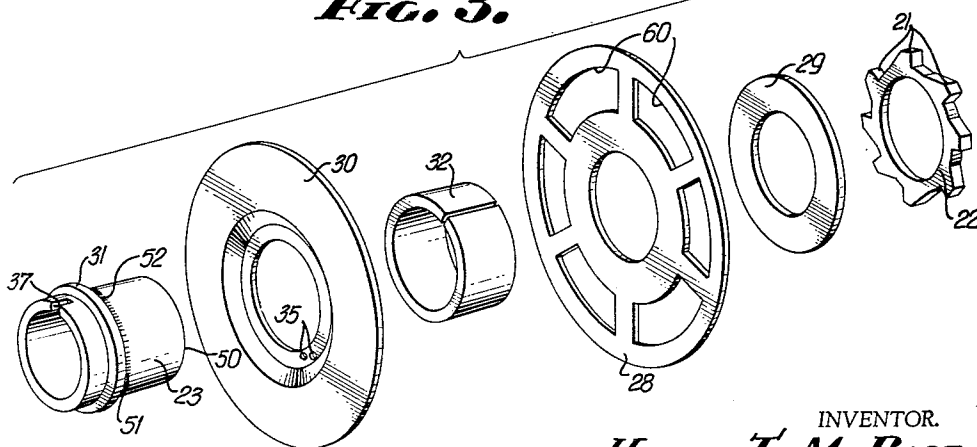


FIG. 3.



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ENGINE STARTER REEL AND METHOD OF MAKING THE SAME

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11 Claims. (Cl. 123—185)

The present invention relates to engine starter ap-
paratus of the type in which starting of the engine is ini-
tiated by pulling a starting cord wound upon a reel,
and more particularly to the starting reel itself.

An object of the invention is to provide a starter reel,
which is compact and relatively economical to manu-
facture.

Another object of the invention is to provide a starter
reel of strong and sturdy construction, which possesses a
long useful life.

A further object of the invention is to provide a starter
reel, in which substantially all of its component parts
can be made by punch press operations, thereby enabling
production of the parts to be obtained with accuracy and
in large volume at a rapid rate, and also economically.

An additional object of the invention is to provide a
starter reel, in which substantially all parts can be made
by punch press operations, the parts, when assembled,
mutually supporting each other so that they can be made
relatively thin and yet provide a strong and sturdy reel
structure.

Another object of the invention is to provide a rapid
and economical method of producing a starter reel.

This invention possesses many other advantages, and
has other objects which may be made more clearly ap-
parent from a consideration of a form in which it may
be embodied and a method of making such form. This
form is shown in the drawings accompanying and form-
ing part of the present specification. The form and meth-
od of making the same will now be described in detail,
for the purpose of illustrating the general principles of
the invention; but it is to be understood that such de-
tailed description is not to be taken in a limiting sense,
since the scope of the invention is best defined by the
appended claims.

Referring to the drawings:

FIGURE 1 is a longitudinal section through an engine
starter embodying the invention;

FIG. 2 is an enlarged longitudinal section, parts be-
ing shown in side elevation, of the starter reel;

FIG. 3 is an exploded isometric projection of the
starter reel disclosed in FIG. 2.

The invention is illustrated in the drawing in con-
junction with an internal combustion engine. As shown,
an engine starter embodies a starting cord or cable 10
wound upon a suitable reel 11, and also a rewind spring
12 for returning the cable to its initial position on the
starter reel. As disclosed in the drawings, an internal
combustion engine crankshaft 13 is mounted in a hous-
ing or crankcase 14 and extends outwardly therefrom,
there being a bearing 15 in the crankcase for rotatably
mounting the outer portion of the crankshaft. A fly-
wheel 16 is secured to the outer end of the crankshaft
in any suitable manner, as by use of a key 17, the fly-
wheel being held on the crankshaft by a nut 18, or the
like, threaded on to the latter.

The flywheel 16 carries a plurality of circumferentially
spaced pawls 19, such as a pair of opposed pawls, each
of which is pivotally mounted on a pin 20 secured to
the flywheel. Offset portions of the pawls, shown in
broken lines in FIG. 1, are engaged by the generally
radial teeth 21 of a ratchet wheel 22, constituting part
of the starter reel, which is suitably fixed to the inner

end portion of a sleeve or hub 23 of the starter reel.
This sleeve or hub is rotatably mounted on a stationary
hub 24 fixed to an end plate 25 of the frame or hous-
ing 26 of the apparatus, as by means of a rivet 27. The
reel further includes an inner end plate 28 mounted on
the inner portion of the sleeve 23, and a stiffener plate
29 mounted on the inner portion of the sleeve adjacent
to the ratchet wheel 22 against which the inner end plate
bears. It also includes an outer plate 30 spaced from
the inner plate 28 and bearing against a flange 31 of the
sleeve or hub 23, the outer plate being secured to the
sleeve 23 in a manner hereinafter described. A split
spacer sleeve 32 is disposed on the rotatable hub 23 be-
tween the plates 28, 30 to maintain them a desired axial
distance apart.

The starting cord or cable 10 is wound upon the reel
between its inner and outer plates 28, 30, the inner end
33 of the cord being suitably secured to the outer plate
30, as by passing a suitable wire clip 34 around the
cord, the legs of which project through a plurality of
openings 35 in the outer plate, the end portions of the
legs being suitably twisted against one another to firmly
secure the end 33 of the starting cord or cable to the
outer plate. The cord is wound around the reel with
its outer, free end extending outwardly therefrom, in a
known manner. Upon pulling on the cord, the reel and
its ratchet wheel 22 are rotated in a proper direction
upon the stationary hub 24, the ratchet teeth 21 enga-
ging the pawls 19 to rotate the flywheel 16, and thereby
turn the crankshaft 13 and initiate starting of the in-
ternal combustion engine. When pulling on the starting
cord 10, additional energy is stored in the spiral rewind
spring 12, the inner end 36 of which is secured to the
reel sleeve 23, as by inserting it through a generally radial
slot 37 in the latter, the outer end 38 of the spiral spring
being secured to the enclosing rim portion 39 of a sta-
tionary housing 26, as by passing such outer end through
a generally radial slot or hole 41 in such rim.

The specific structure of the pawl and ratchet mech-
anism 19, 22, and their mode of action, form no part
of the present invention, being specifically described and
claimed in my copending application for "Engine Start-
er," Serial No. 106,689, filed May 1, 1961. It is suf-
ficient for purposes of the present application to state
that the pawls 19 are urged by springs (not shown), or
the like, into engagement with the ratchet teeth 21 to
couple the flywheel 16 to the ratchet wheel 22 and the
starter reel. Upon pulling on the starting cord 10, the
rotary motion of the starter reel is transmitted through
the pawl and ratchet device to the flywheel 16, to rotate
the crankshaft 13. When the engine starts, the pawls 19
are disengaged from the ratchet teeth 21 by centrifugal
force, allowing the starting cord 10 to be released, the
spiral spring 12 rewinding the cord on the starting reel,
the engine continuing to run with the pawls 19 main-
tained free from engagement with the ratchet teeth 21.

When the engine stops, the pawls 19 drop back into
engagement with the ratchet teeth 21. If restarting is
desired, the starting cord 10 is in a position to be pulled
in an outward direction, to effect another rotation of
the crankshaft 13, by virtue of the turning effort being
transferred through the starting reel to the pawls 19
and the flywheel 16.

The starter reel is of strong and sturdy construction,
and can be made from a relatively small number of parts,
and by punch press operations. Thus, the outer plate 30,
inner end plate 28, stiffener plate 29 and ratchet wheel
22, as well as the spacer sleeve 32, can all be suitably
produced on punch presses containing appropriate dies.
The spacer sleeve 32 is formed from strip material and
is then rolled into the split sleeve cylindrical form illus-
trated in the drawings. The rotatable sleeve or hub 23

is formed in any suitable manner, as on a lathe or the like, the slot 37 then being produced therethrough in any suitable manner for reception of the inner end 36 of the rewind spring 12. Initially, the end portion 50 of the rotatable hub 23, remote from its slotted portion, is cylindrical, rather than being outwardly flared, as disclosed in FIG. 2. This enables the outer plate 30, spacer sleeve 32, inner end plate 28, stiffener plate 29 and ratchet wheel 22 to be mounted on the hub or main bushing 23. The periphery 51 of the sleeve 23 adjacent to its flange 31 has longitudinal extending teeth 52 thereon and therearound, which can be produced in any suitable manner, as by a knurling operation, which will produce the raised knurls or teeth on the sleeve or hub. The inner and outer end portion 53 of the ratchet wheel 22 is beveled or flared in an outward direction, and this tapered or beveled portion also has teeth 54 disposed therearound, which may be formed in any suitable manner, as by a knurling operation.

In assembling the starter reel, the outer plate 30, spacer sleeve 32, inner end plate 28, stiffener plate 29, and ratchet wheel 22 are slipped over the sleeve or bushing 23 in a manner referred to above. The outer plate 30 will be prevented, at first, from moving against the sleeve flange 31 by the peripheral knurls or teeth 52. However, upon providing an endwise force on the ratchet wheel 22, the outer plate 30 is forced over the knurls or teeth 52, which cut mating grooves in the inner surface of the outer plate, and thereby key such plate rigidly to the sleeve or hub 23. The parts are all held in appropriate assembly, and the bushing 23 firmly secured to the ratchet wheel 22, by outwardly flaring the end portion 50 of the bushing, its periphery being embedded in the internal teeth 54 on the ratchet wheel, thereby keying the sleeve or bushing to the ratchet wheel, and also preventing axial displacement between the several parts mounted on the sleeve 23, holding all of the parts firmly between the flared end portion 50 of the sleeve and its flange 31. One manner of fastening the ratchet wheel 22 to the bushing 23 is by spinning the bushing and, during the spinning operation, exerting an outward pressure on its end portion 50, flaring it outwardly and causing the teeth or knurls 54 on the ratchet wheel to be embedded therewithin. The spinning operation also firmly abuts the several parts on the sleeve 23 against one another, with the outer plate 30 firmly engaging the flange 31 and the outwardly tapering or flared end portion 50 of the sleeve firmly secured to the ratchet wheel 22.

By virtue of the keying of the outer plate 30 and the ratchet wheel 22 to the sleeve or bushing, torque can be transmitted from the outer plate 30 to the sleeve or bushing 23, and from the sleeve or bushing to the ratchet wheel 22. It is unnecessary to secure a firm attachment of the inner end plate 28 to the sleeve, since the inner portion 33 of the starting cord or cable 10 is secured firmly to the outer plate.

The outer plate 30, inner plate 28, stiffener plate 29 and ratchet wheel 22 can be made comparatively thin. The torque imposed upon the outer plate 30, due to pulling on the starting cord 10, is transmitted at the inner portion of the plate adjacent to the flange 31 of the sleeve, which flange provides an appropriate backing for the outer plate 30 and resists its deflection. Similarly, the torque transmitted between the ratchet wheel 22 and the pawls 19 will not effect a deflection of the ratchet wheel, since it is supported by the stiffener or back-up plate 29, which, in turn, engages the inner end plate 28, the inner end plate being supported at its inner portion by the spacer sleeve 32, which provides a firm brace or support between the inner and outer end plates 28, 30.

When the flywheel 16 is also to function as the rotor of a blower, suitable air can enter the apparatus, for action by the flywheel, through large ventilating openings 60 in the inner end plate 28.

It is evident from the foregoing description and draw-

ings that the starter reel can be made in an economical manner almost entirely from punch press parts. These parts mutually support one another and can, therefore, be made relatively thin, resulting in a compact starter reel of strong and sturdy construction. The torque transmitting elements are firmly keyed to one another, as by virtue of comparatively simple and rapid knurling operations. The spinning of the bushing or sleeve 23, to flare its end 50 outwardly, firmly abuts the parts against one another, as well as results in keying of the ratchet wheel 22 to the sleeve 23.

I claim:

1. In a starter reel on which a starting cord is adapted to be wound: a sleeve; spaced plates mounted on said sleeve and between which the cord is adapted to be disposed, at least one of said plates being secured to said sleeve; means spacing said plates from each other at said sleeve; and a ratchet wheel mounted on and secured to said sleeve.

2. In a starter reel on which a starting cord is adapted to be wound: a sleeve; spaced plates mounted on the periphery of said sleeve and between which the cord is adapted to be disposed, at least one of said plates being secured to said sleeve; means spacing said plates from each other at said sleeve; a ratchet wheel mounted on said sleeve and having a knurled portion; a portion of said sleeve being embedded in said knurled portion to secure said ratchet wheel to said sleeve.

3. In a starter reel on which a starting cord is adapted to be wound: a sleeve having a knurled portion; spaced plates mounted on the periphery of said sleeve and between which the cord is adapted to be disposed, one of said plates having said knurled portion embedded therein to secure said one plate to said sleeve; means spacing said plates from each other at said sleeve; a ratchet wheel mounted on said sleeve and having a knurled portion; a portion of said sleeve being embedded in said knurled portion of said ratchet wheel to secure said ratchet wheel to said sleeve.

4. In a starter reel on which a starting cord is adapted to be wound: a sleeve having a flange; a first plate mounted on the periphery of said sleeve and abutting said flange; a second plate mounted on the periphery of said sleeve in spaced relation to said first plate, the cord being receivable between said plates; means for securing at least one of said plates to said sleeve; means spacing said plates from each other at said sleeve; and a ratchet wheel mounted on and secured to said sleeve.

5. In a starter reel on which a starting cord is adapted to be wound: a rotatable sleeve having a flange; a first plate mounted on and secured to said sleeve in abutting relation to said flange; a second plate mounted on said sleeve; a spacer sleeve on said rotatable sleeve between and engaging said plates, the cord being receivable between said plates and around said spacer sleeve; and a ratchet wheel mounted on said rotatable sleeve adjacent to said second plate and secured to said rotatable sleeve.

6. In a starter reel on which a starting cord is adapted to be wound: a rotatable sleeve having a flange; a first plate mounted on and secured to said sleeve in abutting relation to said flange; a second plate mounted on said sleeve; a spacer sleeve on said rotatable sleeve between and engaging said plate, the cord being receivable between said plates and around said spacer sleeve; and a ratchet wheel mounted on said rotatable sleeve adjacent to said second plate and secured to said rotatable sleeve; said rotatable sleeve having an outwardly directed portion engaging said ratchet wheel to hold said wheel, plates and spacer sleeve in assembled relation with said first plate against said flange.

7. In a starter reel on which a starting cord is adapted to be wound: a rotatable sleeve having a flange and a knurled portion adjacent to said flange; a first plate mounted on said sleeve in abutting relation to said flange and with said knurled portion embedded in said first plate

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to secure said first plate to said sleeve; a second plate mounted on said sleeve; a spacer sleeve on said rotatable sleeve between and engaging said plates, the cord being receivable between said plates and around said spacer sleeve; a ratchet wheel mounted on said rotatable sleeve adjacent to said second plate and having a knurled portion; a portion of said rotatable sleeve being embedded in said knurled portion of said ratchet wheel to secure said ratchet wheel to said rotatable sleeve.

8. In a starter reel on which a starting cord is adapted to be wound: a rotatable sleeve having a flange and a knurled portion adjacent to said flange; a first plate mounted on said sleeve in abutting relation to said flange and with said knurled portion embedded in said first plate to secure said first plate to said sleeve; a second plate mounted on said sleeve; a spacer sleeve on said rotatable sleeve between and engaging said plates, the cord being receivable between said plates and around said spacer sleeve; a ratchet wheel mounted on said rotatable sleeve adjacent to said second plate and having an outwardly flaring knurled portion; said rotatable sleeve having an outwardly directed portion embedded in said knurled portion of said wheel to hold said wheel, plates and spacer sleeve in assembled relation with said first plate against said flange.

9. In a starter reel on which a starting cord is adapted to be wound: a rotatable sleeve having a flange and a knurled portion adjacent to said flange; a first plate mounted on said sleeve in abutting relation to said flange and with said knurled portion embedded in said first plate to secure said first plate to said sleeve; a second plate mounted on said sleeve; a spacer sleeve on said rotatable sleeve between and engaging said plates, the cord being receivable between said plates and around said spacer sleeve; a stiffener plate on said rotatable sleeve engaging said second plate; a ratchet wheel mounted on said rotatable sleeve adjacent to said stiffener plate and having an outwardly flaring knurled portion; said rotatable sleeve having an outwardly directed portion embedded in said knurled portion of said wheel to hold said wheel, plates and spacer sleeve in assembled relation with said first plate against said flange.

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10. The method of producing a starter reel on which a starting cord is adapted to be wound, comprising providing a rotatable sleeve having a flange, knurling said sleeve adjacent to said flange, mounting first and second plates and an intervening spacer sleeve on said rotatable sleeve, providing a ratchet wheel with a knurled tapered portion, placing said wheel on said rotatable sleeve adjacent to said second plate, forcing said first plate on the knurled portion of said rotatable sleeve and against said flange; and spinning said rotatable sleeve, plates, spacer sleeve and wheel while forcing an end portion of said rotatable sleeve outwardly to embed said end portion in said knurled tapered portion of said ratchet wheel.

11. The method of producing a starter reel on which a starting cord is adapted to be wound, comprising providing a rotatable sleeve having a flange, knurling said sleeve adjacent to said flange, mounting first and second plates and an intervening spacer sleeve on said rotatable sleeve, mounting a stiffener plate on said rotatable sleeve against the exterior of said second plate, providing a ratchet wheel with a knurled tapered portion, placing said wheel on said rotatable sleeve against said stiffener plate, forcing said first plate on the knurled portion of said rotatable sleeve and against said flange, spinning said rotatable sleeve, plates, spacer sleeve and wheel while forcing an end portion of said rotatable sleeve outwardly to embed said knurled tapered portion of said ratchet wheel in said end portion to secure said ratchet wheel to said rotatable sleeve and to hold said first plate firmly against said flange.

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