

Sept. 16, 1930.

R. A. COFFMAN

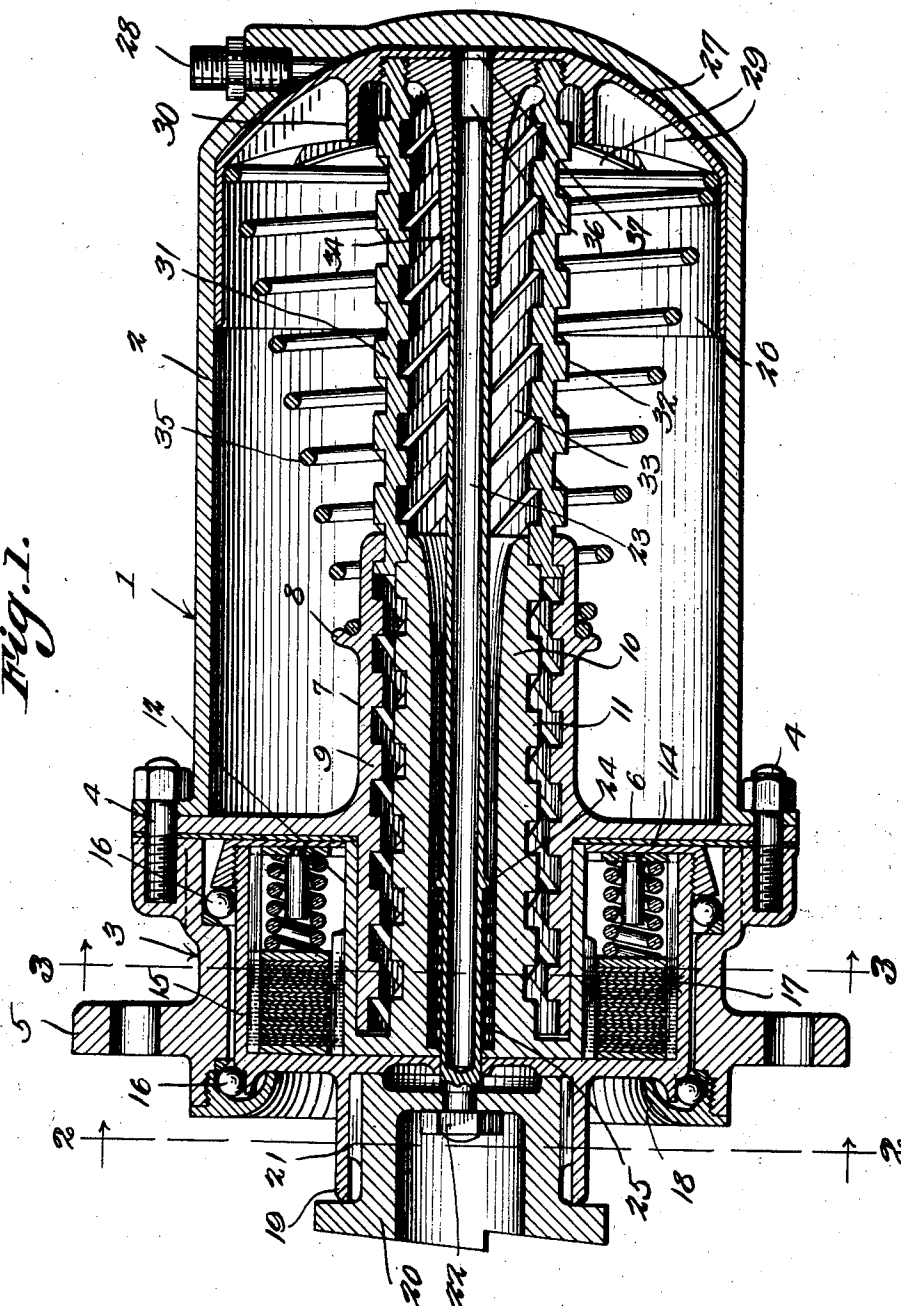
1,776,228

STARTER

Original Filed June 8, 1928

2 Sheets-Sheet 1

Fig. 1.



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Fig. 3.

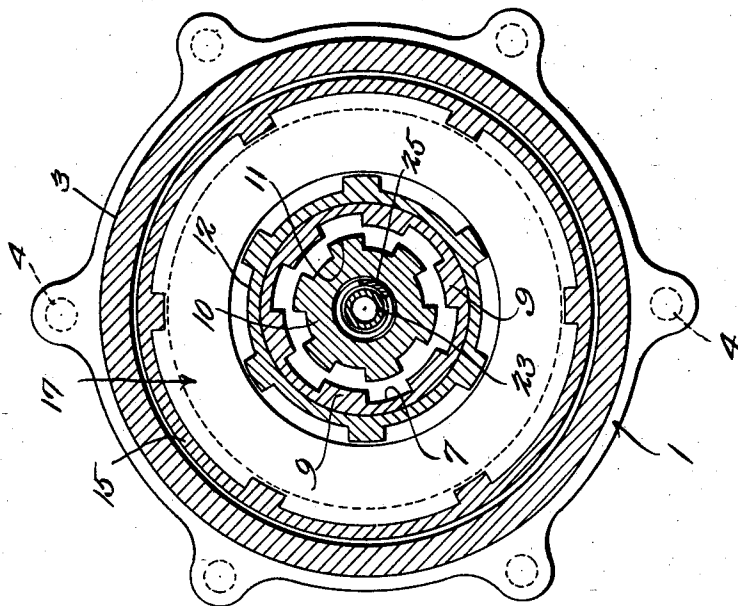
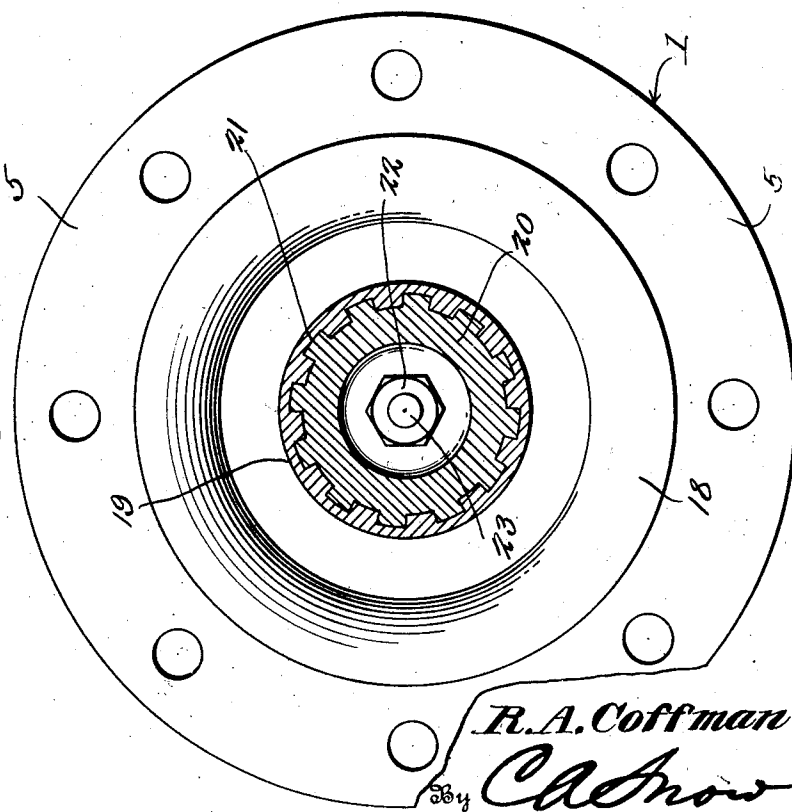


Fig. 2.



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UNITED STATES PATENT OFFICE

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STARTER

Application filed June 8, 1928, Serial No. 283,858. Renewed August 28, 1929.

This invention aims to provide a starter for internal combustions engines, and, especially, the engines of airplanes, the starter being capable of mounting in the place of starters now in use, and the starter being so constructed that it may be very short and still give a large number of turns to an engine shaft with a minimum amount of right line sliding movement in the actuating piston.

It is within the province of the disclosure to improve generally and to enhance the utility of devices of that type to which the invention appertains.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed, may be made within the scope of what is claimed, without departing from the spirit of the invention.

In the accompanying drawings:—

Figure 1 shows in longitudinal section, a device constructed in accordance with the invention;

Figures 2 and 3 are sections taken, respectively, on the lines 2—2 and 3—3 of Figure 1.

The device comprises a casing or support 1, of any desired construction, but embodying a cup shaped body or cylinder 2, and an annular head 3 attached by securing elements 4 to one end of the body 2, the head 3 having a bolting flange 5 which may be so constructed that it will be possible to substitute the starter hereinafter described for the standard starters now in use.

A partition 6 is held by the securing elements 4 between the body 2 and the head 3 and carries a sleeve 7 which may be considered as a fixed part of the casing or support 1. The sleeve 7 extends at one end into the body 2, and at its opposite end within the head 3, as shown clearly in Figure 1. The part of the sleeve 7 that is located within the body 2 has an external shoulder 8. The sleeve 7 is supplied with an internal spiral rib 9.

Within the sleeve 7 is located a rotatable tubular member 10 which has an external spiral rib 11 the twist of which is opposite to the twist of the rib 9 of the sleeve 7. At its forward end, the tubular member 10 is provided with a cuff 12 mounted to turn about one end portion of the sleeve 7, the cuff extending backwardly to a wear plate 14, which may be made of bronze, the wear plate being disposed against the partition 6 and being bound between the partition and the head 3.

A cup shaped rotator 15 is mounted to turn inside of the head 3 and about the cuff 12, in spaced relation to the cuff. The forward end of the rotatable tubular member 10 abuts against the end wall of the rotator 15. A ring 18 is threaded or mounted otherwise in the head 3. The rotator 15 turns on ball bearings 16, one set of the ball bearings being retained by the ring 18. A clutch mechanism 17 forms a driving connection between the cuff 12 of the rotatable member 10 and the rotator 15. The clutch mechanism 17 has not been described in detail, because a person skilled in the art will understand its construction readily, without a description; and because it may be desirable to use a different kind of a clutch mechanism at the place stated. The end wall of the rotator 15 has an outstanding socket 19.

The numeral 20 designates a clutch or equivalent structure whereby the shaft of an internal combustion engine (not shown) may be engaged and turned. The clutch 20 is splined at 21 into the socket 19 of the rotator 15, for right line sliding movement on the rotator, and for rotation with the rotator, the rotator being designated by that name because it is the part by which rotation is imparted immediately to the clutch 20. The clutch 20 is secured at 22 to one end of a hollow piston rod, which may be denominated a first piston. The piston rod 23 slides in the end wall of the rotator 15 and in the adjacent end portion of the tubular member 10. The piston 23 has an external shoulder 24 located inside of the tubular member 10. A compression spring 25 surrounds part of the piston 23, one end of the

spring abutting against the shoulder 24, and the opposite end of the spring finding an abutment against the tubular member 10.

The numeral 26 marks a hollow piston, hereinafter referred to as the second piston, and slidable in the body or cylinder 2. The head 27 of the second piston 26 conforms approximately in shape to the end of the cylinder 2, as Figure 1 will show, and air or other fluid under pressure is admitted between the head 27 of the piston 26 and the end of the cylinder 2 through an inlet 28 mounted in the end of the cylinder.

The head 27 of the piston 26 is reinforced by radial fins 29 which extend inwardly to a hub 30. Into the base of the hub 30 is threaded a driving member 31 of tubular form, the driving member having external spiral ribs 32 and internal spiral ribs 33, the pitch of the ribs 32 and 33 being opposite. The ribs 33 cooperate with the parts 11 of the rotatable tubular member 10, and the ribs 32 cooperate with the parts 9 of the fixed sleeve 7. For convenience of expression, the member 31 may be alluded to as a part of the second piston 26, and as being threaded in one direction on the fixed sleeve 7 of the support 1, and as being threaded in an opposite direction upon the rotatable tubular member 10. A guide 34 is threaded into the outer end of the driving member 31, the piston 23 being slidable in the guide 34, and the guide having a passage 36 which registers with an opening 37 in the head 27 of the piston 26 to admit fluid pressure upon the piston 23. The numeral 35 designates a compression spring bearing at one end on the shoulder 8 of the sleeve 7, and at its opposite end upon the fins 29 which are located within the piston 26. The spring 35 is a return spring for the piston 26, and is much stronger than the return spring 25 for the first piston 23.

When fluid pressure is admitted by way of the inlet 28, the piston 23 advances first, because the spring 25 is weaker than the spring 35. When the piston 23 advances, the driven member or clutch 20 advances, and couples up with the engine shaft. Then the second piston 26 advances, carrying with it the driving member 31. Rotation is imparted to the driving member 31 and to the piston 26 by the cooperation between the spiral rib 32 of the driving member 31 and the spiral rib 9 of the fixed sleeve 7. When the driving member 31 is advanced and rotated, as aforesaid, the driving member, in turn, rotates the tubular member 10, owing to the cooperation between the spiral rib 33 of the driving member 31 and the spiral rib 11 of the tubular member 10, the general result being that the member 10 will be given many turns, even though the driving member 31 has but a short right line movement.

This enables the starter to be turned out in short and compact form, space and weight

being economized, these considerations being highly desirable generally, and especially when the starter is used on an airplane engine.

When the member 10 is rotated, the cuff 12 is turned, and rotation is imparted to the part 15 by way of the clutch mechanism 17. The splines 21 impart rotation to the driven member 20, and therefrom, rotation is imparted to the engine shaft in the usual way. The clutch 17 is strong enough to afford a driving connection between the cuff 12 and the rotator 15 under working conditions, but the clutch mechanism 17 may be alluded to as a slip clutch, in that if the part 20 and the rotator 15 are reversely turned, in case of a back fire, the clutch mechanism 17 will yield and obviate possible damage to the starter.

When the fluid pressure delivered through the inlet 28 is relieved, the parts are restored to the positions shown in Figure 1, by the operation of the return springs 35 and 25.

In my copending application, Serial No. 388,870, filed August 28, 1929, there is disclosed and claimed means for amplifying the speed of rotation of the driven means in such manner that it has a greater speed of rotation than that of the driving means.

I claim:—

1. In an engine starter, a support, a rotator journaled on the support, means connected to the rotator for engaging an engine shaft, a rotatable member journaled in the support, means for connecting the rotatable member with the rotator, a piston slidable in the support, the piston comprising a part threaded in one direction upon the support and threaded in an opposite direction upon the rotatable member, and means for admitting fluid pressure upon the piston.

2. In an engine starter, a support, a rotator journaled on the support, means connected to the rotator for engaging an engine shaft, a rotatable member journaled in the support, a slip clutch forming a driving connection between the rotatable member and the rotator, a piston slidable in the support, the piston comprising a part threaded in one direction upon the support and threaded in an opposite direction upon the rotatable member, and means for admitting fluid pressure upon the piston.

3. In an engine starter, a support, a rotator journaled on the support, means connected to the rotator for engaging an engine shaft, a rotatable member journaled in the support, means for connecting the rotatable member with the rotator, a piston slidable in the support, the piston comprising a part threaded in one direction upon the support and threaded in an opposite direction upon the rotatable member, means for admitting fluid pressure upon the piston to move the piston in one direction upon its power stroke, and

spring means for moving the piston in an opposite direction upon its return stroke.

4. In an engine starter, a support, a rotator journaled on the support, a first piston having means for engaging an engine shaft, means for connecting the first piston with the rotator, for rotation therewith and for right line sliding movement thereon, a rotatable member journaled in the support, means for connecting the rotatable member with the rotator, a second piston slidable in the support, the second piston comprising a part threaded in one direction upon the support and threaded in an opposite direction upon the rotatable member, and means for admitting fluid pressure upon the pistons.

5. In an engine starter, a support, a rotator journaled on the support, a first piston having means for engaging an engine shaft, means for connecting the first piston with the rotator, for rotation therewith and for right line sliding movement thereon, a rotatable member journaled in the support, means for connecting the rotatable member with the rotator, a second piston slidable in the support, the second piston comprising a part threaded in one direction upon the support and threaded in an opposite direction upon the rotatable member, means for admitting fluid pressure upon the pistons to move them in one direction upon their power strokes, and a spring means cooperating with each piston to move it in an opposite direction upon its return stroke, the spring means for the first piston being weaker than the spring means for the second piston, whereby the first piston will start to move on its power stroke under fluid pressure, before the second piston starts to move on its power stroke, under the same fluid pressure.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

ROSCOE A. COFFMAN.

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