

[54] **GEARING STARTER**
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[22] Filed: **May 25, 1971**
[21] Appl. No.: **146,641**

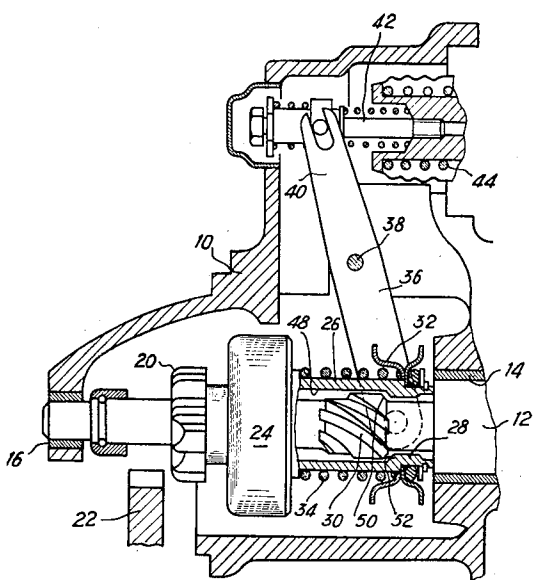
[30] **Foreign Application Priority Data**
June 1, 1970 France.....7019970
[52] U.S. Cl.....74/6
[51] Int. Cl.....F02n 11/00
[58] Field of Search.....74/6, 7 R, 7 A, 7 B

[56] **References Cited**
UNITED STATES PATENTS
3,280,811 10/1966 Baker et al.74/6

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[57] **ABSTRACT**
Starter gearing of the positive shift type for an internal combustion engine in which the sleeve has short splines slightly shorter than the half of the length of the sleeve at the end of the latter opposite to the one connected to the free wheel. Adjacent the free wheel an inner cavity is provided in the sleeve the walls of which do not contact the splines when the starter drive assembly is in its released condition. With such an arrangement the engine vibrations cannot cause the advance of the pinion towards the flywheel.

3 Claims, 2 Drawing Figures



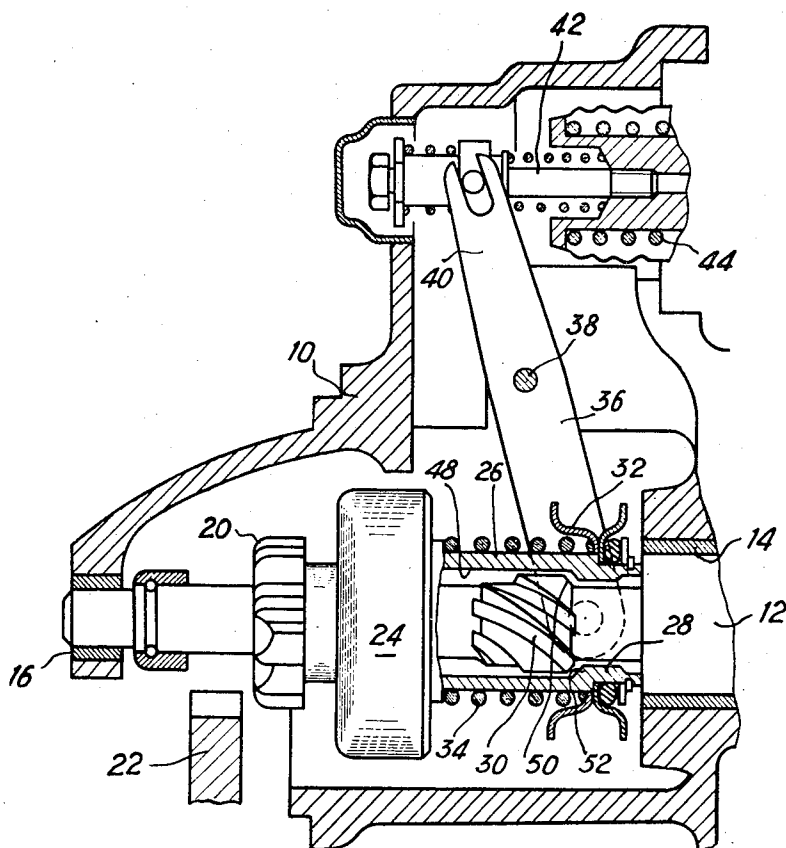


FIG. 1

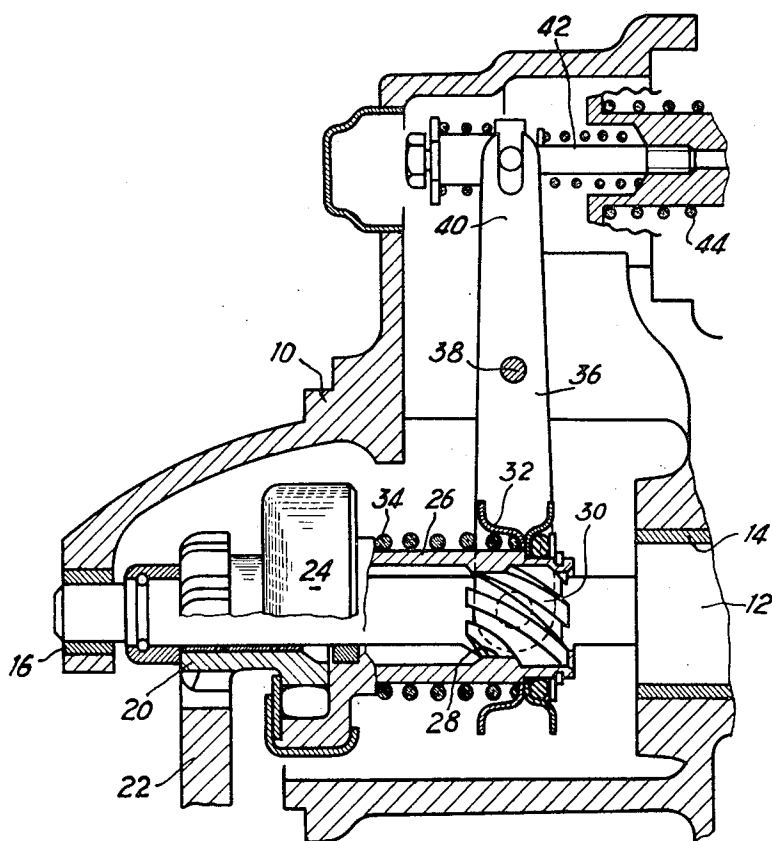


FIG. 2

GEARING STARTER

This invention relates to improvements in starter gearings for internal combustion engines.

In a starting motor of the "positive shift" type the starter drive assembly comprises a pinion connected by a oneway clutch to a sleeve having internal splines which cooperate with corresponding splines provided on the shaft of the rotor of the electrical motor. The sleeve carries a pulley and a forked member actuated by a solenoid is adapted to urge by its free ends said pulley and thence the starter drive assembly towards the toothed wheel of the engine to be started.

Because of the vibrations of the internal combustion engine the starter drive assembly has a trend to advance towards the toothed wheel and it generally results therefrom an undesired engagement between the pinion and the wheel causing damage to the teeth.

The invention proposes a starting motor of the positive shift type for internal combustion engine comprising a starter drive assembly having a sleeve member splined on the shaft of said motor and connected to the driving portion of a unidirectional clutch the driven portion of which is connected to a pinion adapted to mesh with the toothed wheel of the internal combustion engine when said starter drive assembly is moved towards said toothed wheel against spring return means characterized in that the sleeve member comprises splines on its internal surface or its end portion opposite to the one connected to said clutch and an inner cavity adjacent said clutch having radial and axial dimensions larger than those of the splines of said shaft so that said cavity receives said shaft splines without contact therein when said starter drive assembly is retracted under the action of said spring return means.

With such an arrangement it may be understood that when the rotor shaft rotates under the influence of vibrations the sleeve member does not advance since the splines thereof are no longer cooperating with those of the shaft when the starter drive assembly is in its retracted position.

The invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a partial longitudinal cross sectional view of a starting motor according to the invention in its released position, and

FIG. 2 is a view similar to the one FIG. 1 showing the pinion of the starter drive meshing with the toothed wheel of the engine.

As shown in FIG. 1 and 2 the starter comprises a body 10 in which are mounted a starter motor having a rotor (not shown). The shaft 12 of the rotor is supported by an intermediary bearing 14 and one end bearing 16. Between the bearings 14 and 16 is located a starter drive assembly which comprises: a pinion 20 adapted to mesh with the toothed wheel 22 of the internal combustion engine to be started; a free wheel 24 or any similar unidirectional clutch the driven member of which is connected to pinion 20; a sleeve 26 connected to the driving member of the free wheel and provided on its internal wall with helical splines 28 cooperating with corresponding splines 30 of shaft 12; and a collar 32 of a well known type. Collar 32 is made of two parts; the left hand one (as viewed in the drawing) is urged against the right hand one by a compression spring 34 in abutment against a shoulder of the sleeve or on the

free wheel. The collar 32 is engaged by the two end portions of a forked member 36 adapted to tilt about an axle 38 secured to body 10. The tilting of fork member 36 about the axle 38 occurs when the end 40 of the fork member is pulled towards the right (as viewed in the drawing) by the core of a solenoid (not shown) through the intermediary of a pull rod 42 connected to the fork member 36. A return spring 44 urges the core-rod-fork member in the position shown in FIG. 1 when the solenoid is not energized.

In the known positive shift starting motor such as the one described in French Pat. No. 1,024,682 filed on Sept. 18, 1950 by the Bendix Aviation Corporation, the splines carried by the shaft of the rotor extend on a length which is substantially equal to the distance comprised between the free end of the sleeve and the end of said sleeve connected to the free wheel. It results therefrom that when the starter drive assembly is in its released position the splines of the sleeve and those of the shaft remain in cooperation and because of the vibrations of the engine the pinion may advance towards the teeth of the fly-wheel.

According to the invention, the length of the splines 30 on shaft 12 is only substantially half the length of the bored portion of the sleeve 26. Furthermore in the bored portion of the sleeve adjacent free wheel 24 a cavity 48 has been machined the radial dimensions of which are larger than the maximum radius of the splines 30 of shaft 12. The length or axial dimension of cavity 48 is slightly larger than the length of splines 30 so that they may be confined therein without contact when the starter drive assembly is in its released condition as shown in FIG. 1. With such an arrangement, if the vibrations of the internal combustion engine cause the rotation of the shaft 12 of the starting motor rotor, the sleeve 26 is not rotated and stands in the position where it is in FIG. 1, so that the teeth of pinion 20 do not engage the teeth of the toothed wheel 22 upon vibrations causing the rotation of the rotor.

The operation of the device which is described hereinabove is the same as the one of a conventional positive shift type starting motor having the splines, rectilinear, or helical, of its sleeve and rotor shaft in continuous cooperation. When the solenoid is energized the pull rod 42 causes the tilting of forked member 36 and the splines 28 of sleeve 26 receive the splines 30 of shaft 12. The penetration is favored by the provision of conveniently machined slopes on the surface 50 of the splines 30 of shaft 12 and/or the surface 52 of the splines 28 of the sleeve.

I claim:

1. A starter gearing of the positive shift type for an internal combustion engine, comprising a starter drive assembly having a sleeve member adapted to be splined on the shaft of a starter motor and connected to the driving portion of a unidirectional clutch, the driven portion of which is connected to a pinion adapted to mesh with the toothed wheel of the internal combustion engine when said starter drive assembly is moved towards said toothed wheel against spring return means, characterized in that the sleeve member comprises splines on its internal surface at its end portion opposite to the one connected to said clutch and an inner cavity adjacent said clutch having radial and axial dimensions larger than those of the splines of said

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shaft so that said cavity receives said shaft splines without contact therein when said starter drive assembly is retracted under the action of said spring return means.

2. A starter gearing according to claim 1, characterized in that said splines are helical.

3. A starter gearing according to claim 2, characterized in that the splines of said sleeve member and shaft are machined at their engaging ends with sloped surfaces favoring the penetration therebetween.

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