July 23, 1957 S. B. KURZINA, JR 2,800,026

ENGINE STARTING DEVICE

Filed April 20, 1953

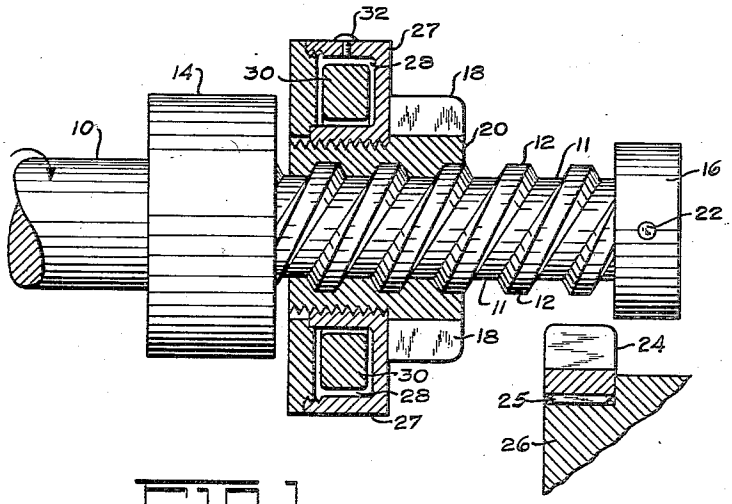


FIG. 1

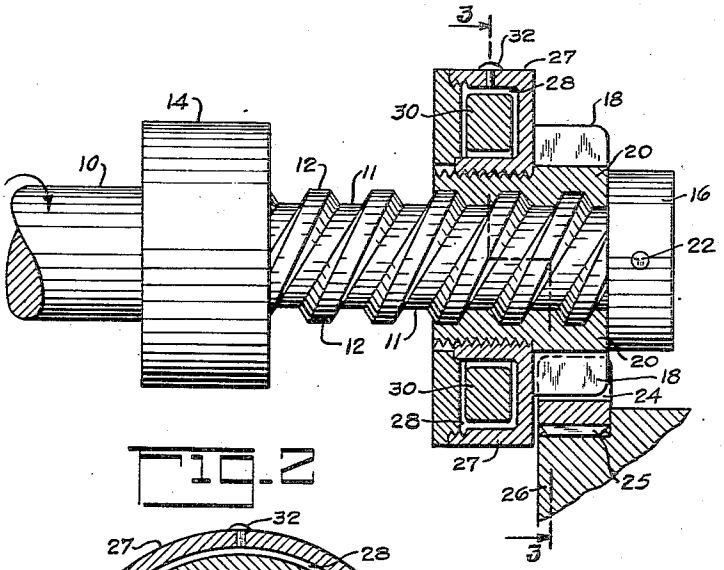


FIG. 2

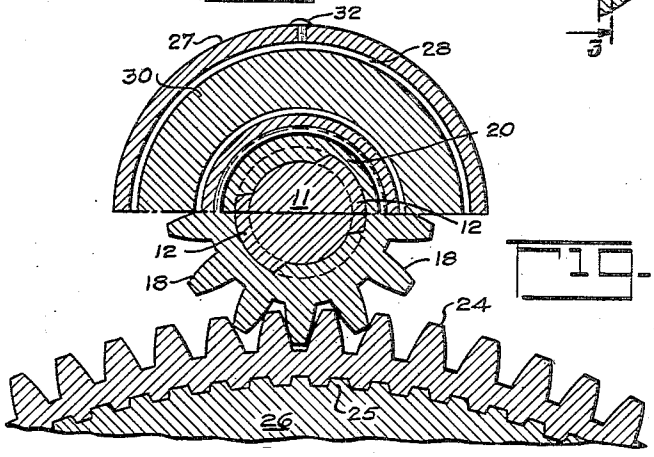


FIG. 3

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2,800,026

Patented July 23, 1957

2,800,026

ENGINE STARTING DEVICE

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Application April 20, 1953, Serial No. 349,675

1 Claim. (Cl. 74—7)

This invention relates to engine starters and is particularly directed to engine starters of the type having a weighted pinion which, because of its inertia and upon energization of the starter motor, helically screws along the starter shaft into engagement with an engine gear for starting the engine and when the engine starts the pinion helically screws back along said shaft out of mesh with the engine gear.

In said type of engine starter, after the engine starts, the starter pinion sometimes moves against the stop, defining its de-meshed position, with such force that said pinion rebounds toward and clashes with the engine gear. An object of the invention comprises the provision of a starter of said type in which means are provided for preventing or at least minimizing said rebound action of the starter pinion. A further object of the invention comprises the provision of an inertia ring connected to the starter pinion by a viscous fluid so that the viscous or friction drag on the starter pinion resulting from relative rotation of the inertia ring and starter pinion prevents or at least minimizes said rebound action of the starter pinion.

Other objects of the invention will become apparent upon reading the annexed detailed description in connection with the drawing in which:

Fig. 1 is an axial sectional view through an engine starting apparatus embodying the invention and illustrating the starter pinion in its de-meshed position;

Fig. 2 is a view similar to Fig. 1 but illustrating the starter pinion in its meshed position; and

Fig. 3 is a sectional view taken along line 3—3 of Fig. 2.

Referring to the drawing, reference numeral 10 designates the power shaft of an engine starter motor (not shown) which, as is conventional, may comprise an electric motor to which the shaft 10 is yieldably connected as by a spring or slipping clutch. As indicated by the arrow in Fig. 1, the shaft 10 is arranged to rotate clockwise as viewed from the left of Fig. 1. Secured to the shaft 10 is a shaft portion 11 having helical threads or splines 12 which extend between annular flanges or collars 14 and 16 rigidly secured to the shaft 10. A starter drive pinion 18 has a hub 20 with internal helical splines meshing with the splines 12 on the shaft 10 for helical sliding motion therealong. The collar 16 is secured to the shaft 10 in any suitable manner, as by the pin 22, after the pinion 18 is screwed onto the shaft splines 12. The pinion 18 is shiftable along the helical splines 12 into and out of meshing engagement with an engine gear 24. As is conventional in starting apparatus for automobile engines the engine gear 24 may be drivably connected to the engine flywheel 26 as by axial splines 25.

The shaft 10 and its collars 14 and 16 are so disposed relative to the engine gear 24 that when the starter drive pinion 18 abuts the collar 16 said pinion is in meshing engagement with the engine gear 24 for driving the engine and when said pinion abuts the collar 14 said pinion is out of meshing engagement with the engine gear.

The pinion 18 is weighted, as by the member 27, so that when the starter motor is energized to rotate the shaft 10 the inertia of the pinion and its weight member 27 causes said pinion to rotationally lag behind the shaft and as a result the pinion screws along the shaft splines 12. The weight member 27 may be symmetrical or it may have an unbalanced weight portion on one side. With the shaft 10 rotating in the direction indicated and with the helical splines having a left hand lead as illustrated, upon energization of the starter the inertia of the pinion 18 and its weight member 27 causes the pinion to screw along the helical splines 12 to the right (as viewed in Figs. 1 and 2) against the collar 16 to engage the engine gear 24 and crank the engine. When the engine starts and the engine gear 24 drives the pinion 18 faster than the starter shaft 10 the resulting overspeeding of the pinion 18 relative to the shaft 10 causes the pinion to screw along the splines 12 to the left (as viewed in Figs. 1 and 2) toward the collar 14.

With the structure so far described and in the absence of the present invention, when the engine starts the rapid acceleration of the engine gear 24 may cause substantial overspeeding of the pinion 18 relative to the shaft 10 with the result that said pinion strikes the collar 14 with considerable force and may actually rebound from the collar 14 to clash with the engine gear 24. Such rebounding action of the pinion 18 is prevented or at least minimized by the present invention.

In accordance with the present invention the weight member 27 constitutes a hollow casing having an annular chamber 28 co-axial with the pinion 18 and within which a heavy ring 30 is substantially co-axially disposed. As illustrated, the casing 26 has a multi-part construction to permit assembly of the ring 30 therein. The space between the ring 30 and the walls of the chamber 28 is filled with a viscous liquid preferably of substantially constant viscosity, such as a viscous silicone. The casing 27 is provided with a small filling opening which is sealed as by a plug 32 after the casing chamber 28 has been filled to the extent desired. The ring 30 is so dimensioned that it has clearance with all the adjacent walls of the chamber 28 whereby said ring in effect floats in the liquid within said chamber. Preferably the magnitude of the clearance between the ring 30 and the walls of the chamber 28 is small in order to provide substantial viscous or frictional drag between the ring 30 and casing 27 upon relative rotation of said ring and casing.

With the structure described, when the engine starts and the engine gear 24 causes the starter pinion 18 to rotationally accelerate and overspeed the shaft 12, the inertia of the floating ring 30 causes it to lag behind the pinion 18 whereupon said ring through the viscous liquid within the chamber 28 exerts a frictional drag on the pinion tending to reduce the overspeeding of the pinion thereby reducing the force with which the pinion strikes the collar 14. In addition, and what is even more important, after the pinion 18 strikes the collar 14 the floating ring 30, by virtue of its inertia, continues to rotate and overspeed the shaft 10 whereby through the viscous liquid the ring 30 exerts a frictional drag on the pinion tending to screw the pinion to the left (as viewed in Figs. 1 and 2) thereby preventing or at least minimizing any tendency of the pinion rebounding in the opposite direction toward the collar 16 and clashing with the engine gear 24.

While I have described my invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding my invention, that various changes and modifications may be made therein

without departing from the spirit or scope thereof. I aim in the appended claim to cover all such modifications.

I claim as my invention:

Engine starter mechanism comprising a power shaft; a pinion helically slidable along said shaft into and out of driving engagement with an engine gear; an abutment connected to said shaft to limit movement of said pinion along said shaft out of said driving engagement; an annular casing structure rigidly connected to said pinion and having an annular chamber co-axial therewith; a viscous fluid within said chamber; and an annular ring-shaped weight member shaped substantially symmetrical relative to its axis and substantially co-axially disposed within said hollow casing, said weight member being at least partially immersed in said fluid so that said viscous fluid floatingly supports said weight member to provide a frictional drag connection between said pinion and weight member such that said weight member is effective upon actuation of the starter mechanism to help cause the pinion to move toward said driving engagement and, after the pinion moves out of said driving engagement, said weight member is effective to minimize rebound of said pinion from said abutment.

References Cited in the file of this patent

UNITED STATES PATENTS

1,276,862	Bendix	Aug. 27, 1918
2,002,561	Wike	May 28, 1935
2,585,382	Guernsey	Feb. 12, 1952
2,635,470	Lewis	Apr. 21, 1953
2,635,471	Lewis	Apr. 21, 1953
2,636,399	O'Connor	Apr. 28, 1953