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REVERSIBLE ENGINE STARTER GEARING

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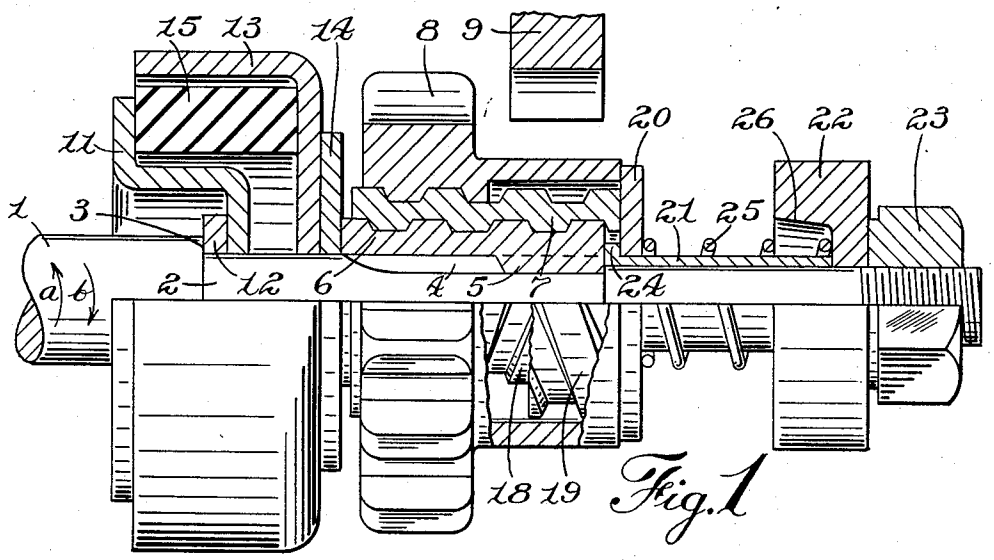


Fig. 1

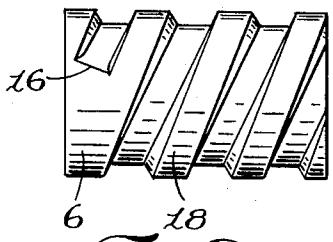


Fig. 2

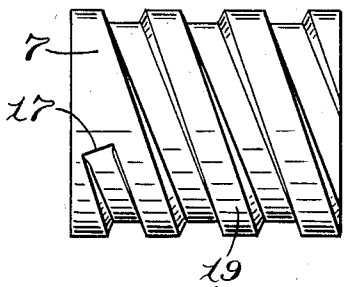


Fig. 3

WITNESS:

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REVERSIBLE ENGINE STARTER GEARING

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4 Claims. (Cl. 74—7)

The present invention relates to reversible engine starter gearing and more particularly to gearing for automatically connecting a reversible starting motor to an internal combustion engine to initiate rotation of the engine optionally in either direction.

In certain types of internal combustion engine power units, notably those employing two cycle engines for marine propulsion, it is desirable to be able to cause the engine to rotate in either direction as for instance to reverse the propeller for maneuvering the boat. This operation requires a starting device which is operable by a reversible starting motor to engage and crank the engine in either direction as required.

It is an object of the present invention to provide a novel reversible engine starter drive which is efficient and reliable in operation and simple and economical in construction.

It is another object to provide such a device the operative components of which are such as have been found satisfactory in the art of automatic engine starter drive gearing.

It is another object to provide such a device which utilizes a single drive pinion with means for traversing it into mesh with an engine gear responsive to acceleration of the starting motor in either direction, the demeshing of the pinion being accomplished automatically in both cases by the acceleration of the engine gear when the engine becomes self-operative.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing in which:

Fig. 1 shows a side elevation of a preferred embodiment of the invention partly broken away and in vertical section.

Fig. 2 is a detail in side elevation of the hollow screw shaft; and

Fig. 3 is a similar detail of the oppositely threaded traversing sleeve.

In Fig. 1 of the drawing there is illustrated a power shaft **1** which may be the extended armature shaft of a reversible electric starting motor not illustrated. The power shaft **1** has a portion **2** of reduced diameter forming a shoulder **3**, and is formed with axially extending spline grooves **4** cooperating with splines **5** formed in the interior of a hollow screw shaft **6** slidably mounted thereon. An internally and externally threaded sleeve **7** is threaded on the screw shaft **6** and a pinion-control-nut member **8** is threaded on the sleeve **7** for axial movement into and out of mesh with a gear **9** of an engine to be started.

Yielding means for resisting axial movement of the screw shaft in the direction away from the engine gear **9** is provided comprising a collar **11** mounted on the smooth portion **2** of the power shaft adjacent the shoulder **3**, a thrust ring **12** being preferably interposed between the collar and said shoulder. A cup-shaped thimble **13** is also slidably mounted on the smooth portion **2** of the power shaft and a thrust ring **14** is interposed between

said thimble and the adjacent end of the screw shaft **6**. An annular block **15** of elastically deformable material such as rubber is interposed between the collar **11** and thimble **13**, to yieldingly hold them axially separated and thus resist movement of the screw shaft toward the shoulder **3**.

The threads of the screw shaft **6** terminate in shoulders or heels **16** (Fig. 2) which limit the movement of the threaded sleeve **7** thereon in the demeshing direction, and the external threads of the sleeve **7** also terminate in shoulders or heels **17** (Fig. 3) which limit the demeshing movement of the control nut thereon. The threads **18** of the screw shaft **6** and corresponding internal threads of the sleeve **7** are of the opposite hand from the exterior threads **19** of the sleeve **7** and the corresponding threads in the pinion-control nut **8**.

Means for positively limiting the movement of the pinion-control nut in the meshing direction and thereby defining the meshed position of the pinion is provided comprising a thrust ring **20** slidably mounted on a bushing **21** mounted on a reduced extension of the power shaft **1**, and an abutment member **22** which is clamped against the outer end of the bushing by a clamp nut **23** threaded on the end of the power shaft. The bushing **21** abuts against the ends of the splines on the power shaft, and has a flange **24** retaining the thrust ring **20** thereon.

Yielding means are provided for normally holding the parts in idle position as illustrated in the form of an anti-drift spring **25** located between the thrust ring **20** and abutment member **22**, the abutment member being hollowed out as shown at **26** to receive such spring when the pinion-control nut is in meshed position.

In operation, starting with the parts in the positions illustrated in Fig. 1, rotation of the power shaft in the direction of arrow (*a*) will be transmitted through the splined connection **4**, **5** to the screw shaft **6**, and since the sleeve **7** is prevented from moving to the left in the drawing by reason of the thread shoulders **16** on the screw shaft, the pinion-control nut **8** is traversed to the right on said sleeve, until it is meshed with the engine gear **9**, and its traversal then arrested by the engagement of the thrust ring **20** with the abutment member **22**. Further rotation of the power shaft **1** causes the pinion to rotate the engine gear **9**, the transmission of cranking torque being cushioned by compression of the elastic block **15** responsive to the axial thrust of the screw shaft **6** due to the screw-jack action of the pinion-control nut transmitted through the sleeve **7** to the screw shaft.

When the engine starts, the overrunning of the pinion-control nut **8** responsive to acceleration of the engine gear **9** causes it to return to its idle position with the assistance of the anti-drift spring **25** which thereafter holds the parts in their normal or idle positions.

When it is desired to operate the engine in the reverse direction, rotation of the power shaft **1** in the direction of the arrow (*b*) causes the sleeve **7** to be traversed to the right on the screw shaft **6**, carrying with it the pinion-control nut **8** by virtue of the thread shoulders **17** on said sleeve. The traversal of the sleeve and pinion-control nut **8** is arrested by engagement of the thrust ring **20** with the abutment member **22**, and cranking of the engine takes place as above described.

When the engine starts, the sleeve **7** and pinion-control nut **8** are caused to overrun the screw shaft **6** and return to their idle positions with the assistance of anti-drift spring **25** as previously described.

Although but one embodiment of the invention has been shown and described in detail, changes may be made in the precise form and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. In a reversible engine starter drive a power shaft, a hollow screw shaft splined thereon, an internally and externally threaded sleeve threaded on the screw shaft, a pinion-control nut threaded on the sleeve for movement of the pinion into and out of mesh with a gear of an engine to be started, the internal and external threads of said sleeve being of opposite hand; means positively limiting the movement of the pinion-control nut and sleeve in the meshing direction, and yielding means resisting movement of the screw shaft in the opposite direction.

2. An engine starter drive as set forth in claim 1, including further yielding means urging the sleeve and pinion-control nut in the direction to demesh the pinion from the engine gear.

3. An engine starter drive as set forth in claim 2 including further means on the screw-shaft to limit the travel of the threaded sleeve thereon in the demeshing direction.

4. An engine starter drive as set forth in claim 3 including further means on the threaded sleeve for limiting the travel of the pinion-control nut thereon in the demeshing direction.

No references cited.