Dec. 29, 1942. B. W. JONES 2,306,539

ENGINE STARTER DRIVE

Filed April 19, 1940

Fig. 1

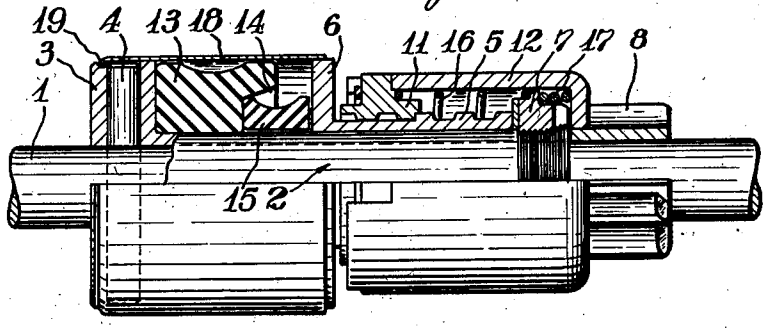
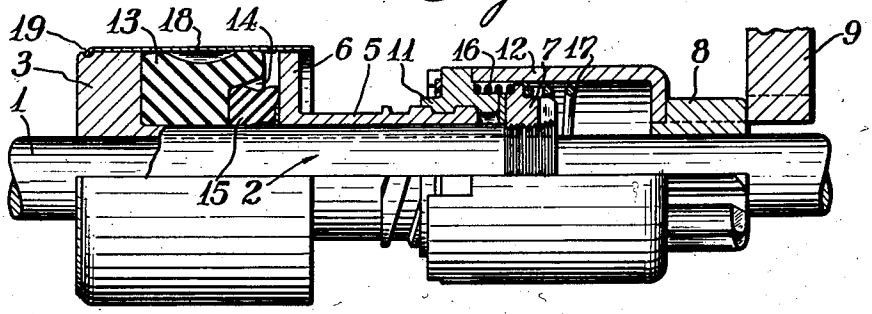


Fig. 2



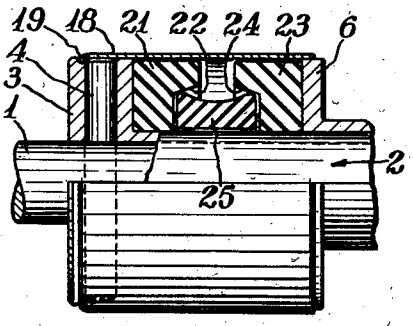


Fig. 3

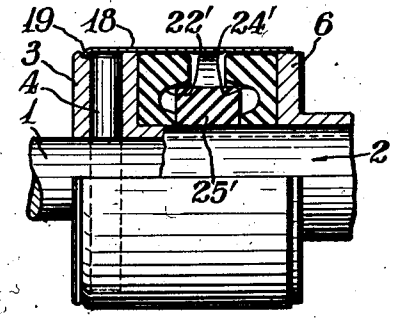


Fig. 4

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Patented Dec. 29, 1942 2,306,539

UNITED STATES PATENT OFFICE

2,306,539

ENGINE STARTER DRIVE

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Application April 19, 1940, Serial No. 330,551

4 Claims. (Cl. 74—7)

The present invention relates to engine starter drives and more particularly to starter gearing of the automatically meshing and demeshing type incorporating special provisions to insure proper meshing and operation of the gearing.

In starter drives of the type in which energization of the starting motor causes engagement of the gearing, yielding means are usually provided in the operating connection, principally for the purpose of insuring proper engagement of the gears and to cushion the shock incident to the establishment of the driving connection. Attempts have been made with varying success to utilize elasticially deformable materials such as rubber for the yielding means in order to secure the advantages possessed by such materials for certain types of installation, such as their sound-deadening properties and their indifference to reversals of load. Such attempts have been hampered, however, by the condition that optimum adaptation to the various desired functions calls for divergent properties in the yieldable material. Thus, the function of mesh enforcement might be best secured by using comparatively soft material to provide the necessary yield, whereas the yielding driving function might call for material having a considerably higher resistance to deformation. The design of a yielding connection represented a comprise between conflicting requirements, none of which were exactly satisfied.

It is an object of the present invention to provide a novel starter drive incorporating a composite yielding member.

It is another object to provide such a device in which the components of the yielding member are particularly adapted for the various parts of the cranking operation.

It is another object to provide such a device in which said components supplement each other in carrying out the cranking operation.

It is a further object to provide such a device in which the more elastic part of the yielding member is protected from overloading by the stiffer part thereof.

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

Fig. 1 is a side elevation partly in section of an engine starter drive incorporating a preferred embodiment of the invention;

Fig. 2 is a similar view showing the parts in the positions assumed in case of tooth abutment between the drive pinion and engine gear;

Fig. 3 is a detail in side elevation partly in section of a drive according to the present invention incorporating another form of composite yielding member; and

Fig. 4 is a view similar to Fig. 3, showing a third form of composite yielding member.

In Fig. 1 there is illustrated a power shaft 1 having a sleeve 2 provided with a driving head 3 fixed thereon in any suitable manner as by means of a pin 4. A screw shaft 5 having a driven head 6 is slidably journalled on the sleeve 2 and consequently on the power shaft 1, and is confined on the sleeve by a stop nut 7 rigidly fixed on the end of the sleeve.

A pinion 8 is slidably journalled on the power shaft for longitudinal movement into and out of engagement with a member such as a gear 9 of an engine to be started. The pinion 8 has a threaded connection with the screw shaft 5 by means of a control nut 11 threaded on the screw shaft and rigidly connected to the pinion as by means of a barrel 12.

A composite yielding member of elastically deformable material is interposed between the driving head 3 and driven head 6 in order to form a yielding connection therebetween both as respects longitudinal and rotary movement. As here shown, this member comprises a ring 13 of comparatively stiff elastic material abutting the driving head 3 and having a recess 14, and a ring 15 of comparatively soft elastic material seated in said recess and extending therefrom into engagement with the driven head 6. As here shown, sufficient space is provided in the recess 14 to completely receive the soft elastic ring 15 when it is fully compressed therein, at which time the ring 13 of stiffer material engages the driven head 6 and transmits rotation directly thereto.

Means are provided for normally maintaining the pinion in idle position as illustrated in Fig. 1 in the form of an anti-drift spring 16 bearing on the control nut 11 and the stop nut 7. Preferably, the threads of the screw shaft 5 terminate adjacent the idle position of the nut 11 whereby the nut with its associated parts is permitted to overrun the screw shaft. A spring 17 bearing on the stop nut 7 and against the end of the barrel 12, is provided to insure re-entry of the control nut 11 on the threads of the screw shaft 5 upon actuation of the drive.

Enclosing means for the yielding member 13, 14 is preferably provided in the form of a sleeve 18 bearing on the driving and driven heads and preferably attached to one of said heads as indicated at 19.

The combined free length of the yielding member 13, 15 and screw shaft 5 is made slightly

greater than the space between the drive head 3 and stop nut 7 whereby the yielding member is maintained under slight initial compression.

In the operation of this embodiment of the invention, rotation of the power shaft 1 is transmitted through the sleeve 2 and yielding member 13, 14 to the driven head 6 by virtue of the initial compression of the yielding member. The consequent rotation of the screw shaft 5 causes the nut 11 to traverse the pinion 8 into engagement with the engine gear 9, at which time longitudinal movement of the control nut 11 is arrested by the stop nut 7. Further rotation of the power shaft then causes the screw shaft 5 to be threaded back, compressing the soft ring 15 into the recess 14, and then compressing the stiff ring 13 until sufficient torque is built up to cause rotation of the engine gear. When the engine starts, the acceleration of the engine gear causes the pinion and control nut to overrun the screw shaft 5 whereby the parts are returned to idle position.

If during the meshing operation tooth abutment should occur between the pinion 8 and engine gear 9, the longitudinal movement of the control nut and its associated parts is thereby interrupted and the screw shaft 5 caused to move back against the resistance of the soft ring 15. The resistance to deformation of this ring is suitably chosen to cause the friction between the threads of the control nut and pinion to build up gradually until the teeth of the pinion 8 are indexed into proper registry with the tooth spaces of the engine gear. The ring 15 thereupon expands to snap the pinion into initial mesh with the ring gear so as to prevent milling of the teeth thereof.

In the embodiment of the invention illustrated in Fig. 3, the composite yielding member is formed of three elements, namely, a ring 21 of comparatively stiff elastic material bearing against the driving head 3 and having a recess 22, a similar ring 23 bearing against the driven head 6 and having a recess 24, and a ring 25 of comparatively soft elastic material interposed between the first-mentioned rings and seated at its ends in the recesses 22 and 24 thereof. In this embodiment of the invention the cross section of the soft ring 25 is such that it is completely housed in the space formed by the recesses 22 and 24 when the rings 21 and 23 are pressed into engagement.

In Fig. 4 the arrangement of the composite yielding member is substantially the same as in Fig. 3 except that the soft ring 25' is here formed of rectangular cross section, and recesses 22' and 24' are formed to receive the soft ring 25' as it is deformed by axial pressure.

The operation of the drive in each case is substantially similar in that the mesh-enforcing function is accomplished by the ring of easily deformable springy material, whereas the cushioning of the drive is accomplished by the ring or rings of stiffer material, each of the components of the yielding member being chosen and formed for the optimum performance of its particular function.

Although certain embodiments of the invention have been shown and described in detail, it will be understood that other embodiments are possible and various changes may be made in the design and arrangement of the parts without departing from the spirit of the invention as defined in the claims appended hereto.

What is claimed is:

1. In an engine starter drive, a power shaft, a pinion, and means actuated by the power shaft for moving the pinion into engagement with a gear of an engine to be started and thereafter rotating the pinion, said means including a body of elastically deformable material placed under pressure by the transmission of torque through the drive, and a second body of elastically deformable material of substantially less resistance to deformation, placed under compression by stoppage of the engaging movement of the pinion.

2. In an engine starter drive, a pinion, means for moving the pinion into mesh with a gear on an engine to be started including a body of elastically deformable material arranged to yield in case of tooth abutment between the pinion and gear and to expand and snap the pinion into mesh with the gear when proper registry is secured, and means for rotating the pinion to crank the engine including a second body of elastically deformable material and means cooperating therewith to limit the deformation of the first body during the cranking operation.

3. In an engine starter drive, a pinion, means for moving the pinion longitudinally into mesh with a gear on an engine to be started including a body of elastically deformable material arranged to yield in case of tooth abutment between the pinion and gear, and means for rotating the pinion to crank the engine including a second body of elastically deformable material, said second body having a recess adapted to receive the first body during the cranking operation.

4. In an engine starter drive a power shaft, a pinion, and means actuated by the power shaft for moving the pinion into engagement with a gear of an engine to be started and thereafter rotating the pinion, said means including a plurality of bodies of elastically deformable material placed under pressure by the transmission of torque through the drive, and a body of elastically deformable material of substantially less resistance to deformation, interposed between said first bodies and placed under compression by resistance to the engaging movement of the pinion.

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