Sept. 1, 1959 J. J. DIGBY 2,901,912

ENGINE STARTER GEARING

Filed Jan. 2, 1958 2 Sheets-Sheet 1

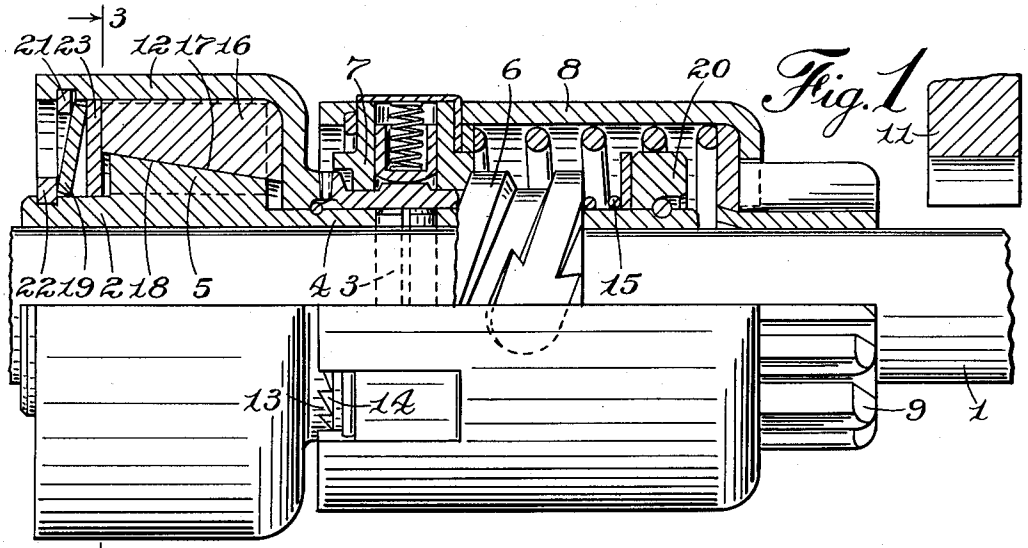


Fig. 1

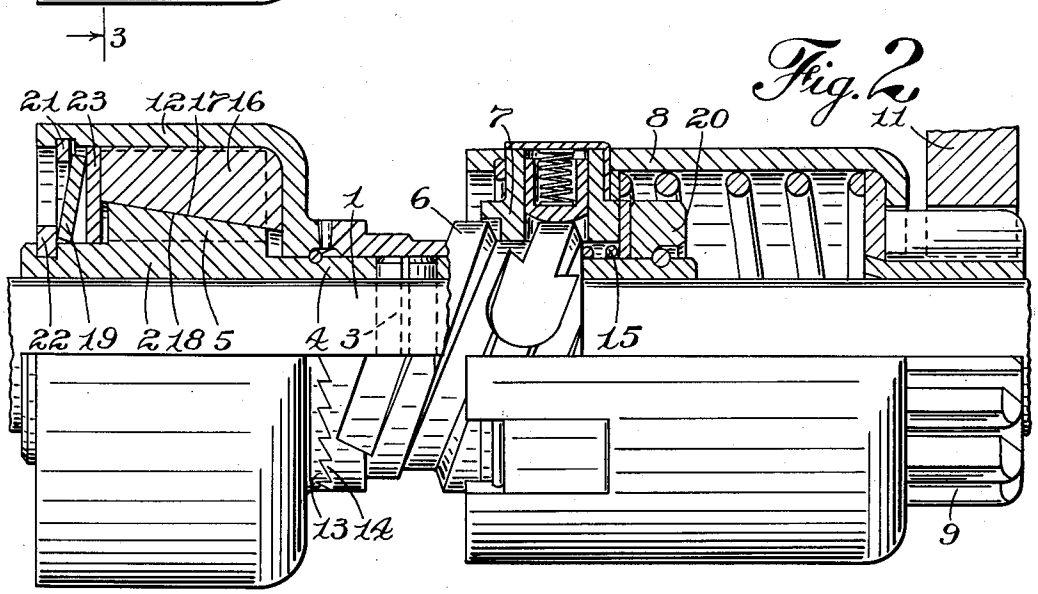


Fig. 2

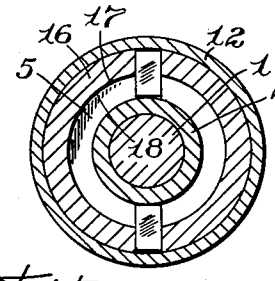


Fig. 3

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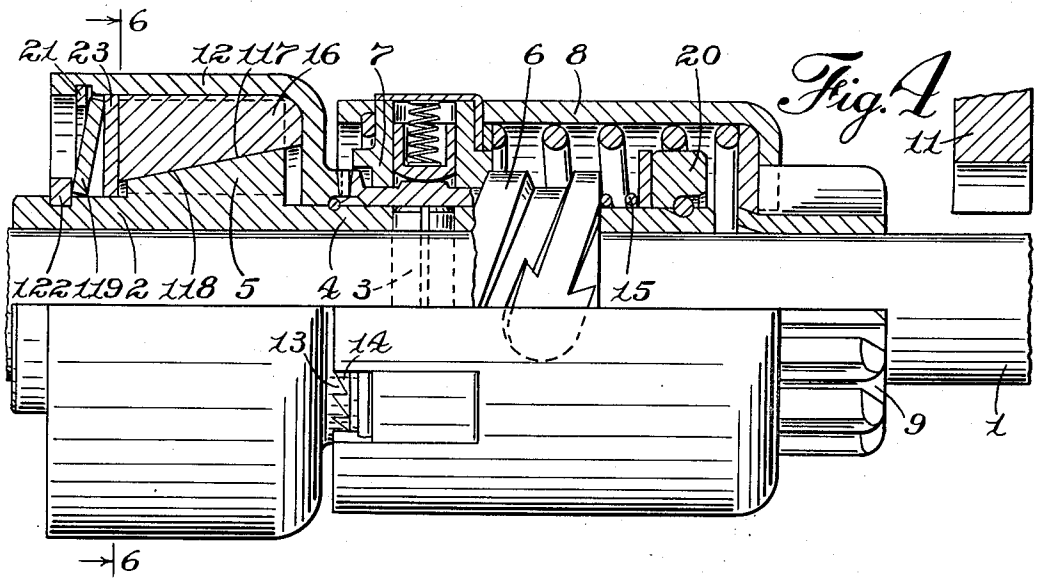


Fig. 4

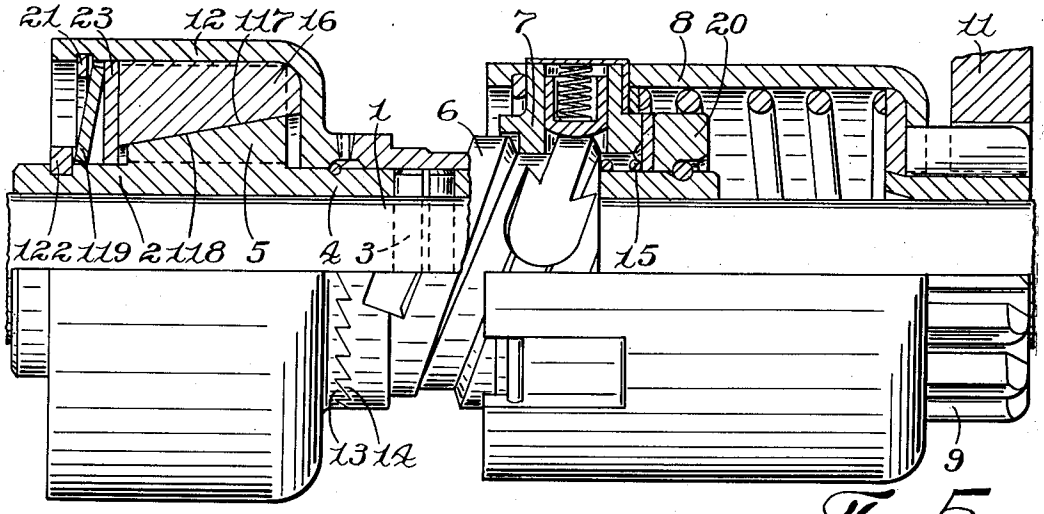


Fig. 5

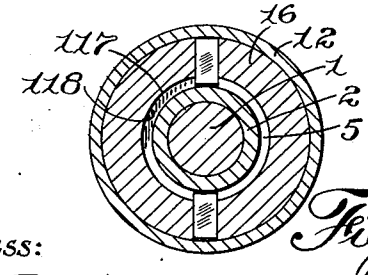


Fig. 6

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2,901,912

ENGINE STARTER GEARING

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3 Claims. (Cl. 74—7)

The present invention relates to engine starter gearing and more particularly to that type in which a pinion is traversed into mesh with the gear of the engine to be started by acceleration of the starting motor.

In starter drives of this type, means are commonly used to absorb or dissipate the shock attendant upon the establishment of the cranking connection. Various forms of frictional coupling means have been adapted for this purpose, one such for instance being shown in the patent to Sekella 2,609,696 issued September 9, 1952, in which a self-tightening disc clutch connection is disclosed.

In some installations of this general type it is desirable to have the torque capacity of the frictional connection substantially uniform under all conditions; an example of a drive operating on this principle being disclosed in the patent to Gleasman 2,450,129 issued September 28, 1948.

It is an obejct of the present invention to provide a novel starting drive incorporating a frictional coupling, the torque capacity of which is directly and positively controlled by means which operates in accordance with a function of the load.

It is another object to provide such a device which is efficient and reliable in operation, and simple and economical in construction.

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

Fig. 1 is a side elevation partly broken away and in section of one embodiment of the invention showing the parts in idle position;

Fig. 2 is a similar view showing the parts in cranking position;

Fig. 3 is a section taken substantially on the line 3—3 of Fig. 1 on a reduced scale;

Fig. 4 is a view similar to Fig. 1 showing a second embodiment of the invention;

Fig. 5 is a similar view showing the parts in cranking position; and

Fig. 6 is a section on the line 6—6 of Fig. 4 on a reduced scale.

In Fig. 1 of the drawing there is illustrated a power shaft 1 on which a driving clutch member 2 is fixedly mounted as by means of a cross pin 3. The clutch member 2 comprises a smooth sleeve portion 4 and a conical portion 5. A screw shaft 6 is slidably and rotatably mounted on the sleeve portion 4 of the driving clutch member 2, and a control nut 7 threaded thereon is connected by means of a barrel member 8 to a pinion 9 which is slidably journalled on the power shaft 1 and adapted to be moved into and out of mesh with a gear 11 on the engine to be started.

A hollow cylindrical coupling member 12 is journalled at one end on the sleeve portion 4 of the driving clutch member 2, and provided with overrunning clutch teeth 13 arranged to engage similar teeth 14 on the adjacent end of the screw shaft 6. A spring 15 located between the end of the screw shaft and a stop ring 20 fixed on

the end of sleeve portion 4 normally holds the overrunning clutch teeth in engagement.

A driven clutch member 16 fixedly mounted in any suitable manner in the interior of the coupling member 12 is formed with a conical internal surface 17 engaging a similar surface 18 on the driving clutch member 2. A dished spring washer 19 is retained in the end of the clutch member 12 by a lock ring 21, and bears against a lock ring 22 in the end of the clutch member 2 which is so positioned as to cause the spring washer 19 to tend to separate the clutch surfaces 17, 18. A thrust washer 23 interposed between the spring washer 19 and the driven clutch member 16 forms a bearing for the open end of the coupling member 12, and cooperates with the spring washer and the driven clutch member to form an initial frictional drive connection from the driving clutch member 2 to the coupling member 12.

In operation, starting with the parts in the positions illustrated in Fig. 1, rotation of the power shaft 1 by the starting motor not illustrated is transmitted through the driving clutch member 2, spring washer 19 and thrust washer 23 to the coupling member 12 and from thence through the overrunning clutch connection 13, 14 to the screw shaft 6. The control nut 7, barrel 8 and pinion 9 are thus traversed to bring the pinion into mesh with the engine gear 11, the travel of the control nut being arrested by the stop ring 20. The screw shaft 6 is thus caused to move to the left in Fig. 1, compressing the overrunning clutch connection 13, 14 and the conical clutch surfaces 17, 18 until torque is built up sufficiently to cause the pinion 9 to rotate the engine gear 11. When the engine starts, the acceleration of the pinion 9 by the engine gear causes the control nut 7 to be traversed back to its idle position, relieving the thrust on the screw shaft and permitting the spring washer 19 to relieve the pressure on the clutch surfaces 17, 18.

In the embodiment of the invention illustrated in Figs. 4, 5 and 6, with the exception of the conical clutch members the parts are the same as the embodiment first described and are similarly numbered. In this embodiment however the apex of the conical surface 117 of the driven clutch member is at the right in Fig. 4, while the conical surface 118 of the driving clutch member tapers to the left. The spring washer 119 therefore holds these clutch surfaces in operating engagement, and is so calibrated and stressed by the lock ring 122 as to load the conical clutch members sufficiently to transmit normal cranking torque in spite of the screw-jack action of the screw shaft 6 and control nut 7 which now tend to release said clutch members. In case of an overload of the drive such as during initial engagement, or in case of a backfire the axial pressure of the screw shaft 6 overcomes the pressure of the spring washer 119 sufficiently to permit the cone clutch members to slip and thus protect the drive from damage.

The operation of this embodiment of the invention is otherwise the same as that first described.

Although certain structure has been shown and described in detail it will be understood that changes may be made in the design and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. In an engine starter drive a power shaft, a driving clutch member fixed thereon comprising a smooth sleeve portion and a conical portion, a screw shaft rotatably and slidably mounted on said sleeve portion of the driving clutch member, a hollow coupling member slidably journalled on said sleeve portion enclosing said conical portion of the driving clutch member and having an overrunning clutch and thrust connection to the screw shaft, a driven conical clutch member fixedly mounted in the coupling member in position to cooperate with the conical

portion of the driving clutch member, means including a spring in the coupling member mounted on the driving clutch member and having thrust connections with both clutch members urging the clutch members axially in opposite directions; a control nut threaded on the screw shaft, a pinion slidably journalled on the power shaft, means connecting the control nut and pinion for movement in unison, a stop member fixedly mounted on the sleeve portion of the driving clutch member in the path of movement of the control nut to limit the travel of the control nut on the screw shaft away from the coupling member, the movement of the screw shaft away from said stop member being arranged to move the coupling member and driven clutch member relatively to the driving clutch member in opposition to said spring.

2. An engine starter drive as set forth in claim 1 in which said spring urges the clutch members in the direction to separate the clutch surfaces, and the thrust of the screw shaft presses said surface together, and including further a frictional connection actuated by said spring forming an initial rotary connection from the driving clutch member to the driven clutch member and the coupling member.

3. An engine starter drive as set forth in claim 1 in which said spring urges the clutch members into contact with each other, and the thrust of the screw shaft opposes the force of the spring to thereby cause slippage of the clutch members to take place at a predetermined torque.

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