April 9, 1957 J. J. SABATINI 2,787,910

ENGINE STARTER DRIVE

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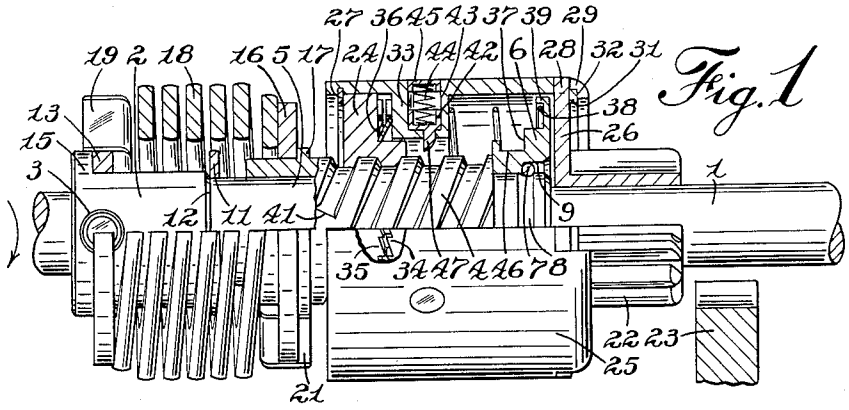


Fig. 1

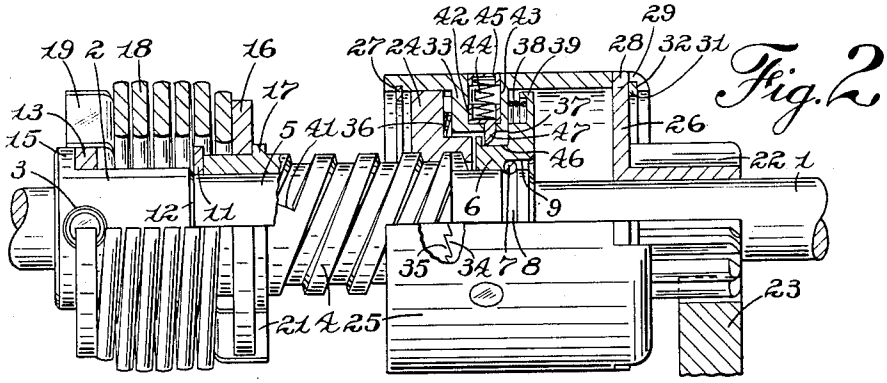


Fig. 2

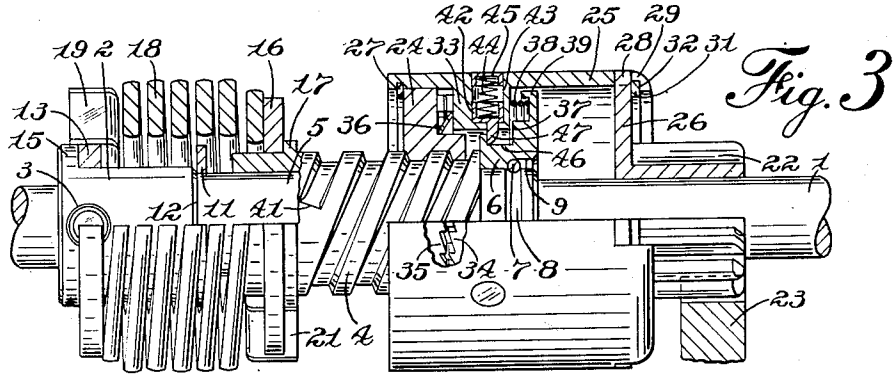


Fig. 3

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ENGINE STARTER DRIVE

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The present invention relates to an engine starter drive and more particularly to that type of automatically disconnectible gearing in which disconnection is delayed until a successful start is secured, now commonly known as a "folo-thru" drive.

Starter drives of this type commonly incorporate an overrunning connection which permits the drive pinion to be rotated by the engine ring gear without transmission of torque back to the starting motor, and self tightening dental clutches have been found to be particularly well adapted for this purpose. Some clutches of this type as usually constructed, however, are inclined to be noisy while overrunning, and in some installations this noise may be found to be objectionable.

Furthermore in starter drives of this type it is customary to employ some device for preventing the drive pinion from drifting into engagement in the engine gear while the engine is running due principally to vibration, and the use of a light compression spring for this purpose has been found to have certain advantages. However when such an anti-drift spring is incorporated in the conventional manner in a "folo-thru" drive, it tends to undesirably increase the pressure on the dental clutch during the time that it is overrunning with the pinion in mesh with the engine gear, and the anti-drift spring consequently compressed.

It is an object of the present invention to provide a novel engine starter drive of the above type incorporating a dental overrunning clutch, the members of which are disengaged during overrunning.

It is another object to provide such a device having a coiled compression spring for preventing the pinion from drifting into engagement with the engine gear, and means for relieving the dental clutch from the pressure of the anti-drift spring while the clutch is overrunning with the pinion in mesh with the engine gear.

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 broken away and in section, of a starter drive constituting a preferred embodiment of the invention with the parts in idle position;

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

Fig. 3 is a view similar to Fig. 1 showing the parts in the positions assumed when the engine gear causes the drive pinion to overrun while being held in mesh therewith.

In Fig. 1 of the drawing there is illustrated a power shaft 1 on which a hollow sleeve 2 is fixedly mounted in any suitable manner as indicated at 3. A screw shaft 4 is slidably journalled on a reduced portion 5 of the sleeve 2 and is retained thereon by a stop collar 6 anchored on the sleeve by means of a split lock ring 7 engaging in a groove 8 of the sleeve and a counterbore 9 in the stop collar. Motion of the screw shaft away from the stop collar is limited by a thrust washer 11

seated against a shoulder 12 formed by the reduction in diameter of the sleeve 2.

An anchor plate 13 is non-rotatably mounted on the end of the sleeve 2 against a flange 15, and a second anchor plate 16 is similarly mounted on the adjacent end of the screw shaft 4 against a flange 17. Anchor plates 13 and 16 are yieldably connected by a torsion and compression spring 18 on the outturned ends 19 and 21 of which engage in radial cutout portions of the anchor plates.

A pinion 22 is slidably journalled on the power shaft 1 for movement into and out of mesh with an engine ring gear 23. Means for actuating the pinion is provided comprising a control nut 24 threaded on the screw shaft 4, and a barrel member 25 which is connected at one end to a flange 26 rigidly mounted on the pinion 22, and at its other end is slidably journalled on the control nut 24 which is retained therein by a split lock ring 27. As illustrated, the connection between the barrel 25 and pinion flange 26 is made by means of a plurality of radial lugs 28 on the pinion flange entering corresponding slots 29 in the end of a the barrel and being retained therein by a split lock ring 31 seated in an internal groove 32 in the barrel.

The barrel 25 is provided with an internal annular shoulder or abutment 33 having clutch teeth 34 formed on one side thereof in position to cooperate with similar teeth 35 on the adjacent side of the control nut 24 and thus provide an overrunning clutch connection therebetween. The clutch teeth 34, 35 are normally held out of engagement by a spring washer 36 located between the control nut and the abutment 33. Spring 36 presses the control nut 24 against the lock ring 27 with sufficient force to provide a frictional connection between the control nut and barrel during those times when the dental clutch is disengaged.

The stop collar 6 is provided with a shoulder 37 in position to engage and arrest the longitudinal movement of the abutment 33 and thereby define the meshing position of the pinion 22 with the engine gear 23 as shown in Fig. 2. An anti-drift spring 38 is located between the abutment 33 of the barrel and a recessed flange 39 formed on the stop collar 6, which spring serves to normally maintain the pinion and its associated parts in idle position as determined by the engagement of the control nut 24 against the shoulders 41 formed at the ends of the threads on the screw shaft 4.

A centrifugal detent or latch 42 is slidably mounted for radial movement in a passage 43 formed in the abutment 33 of the barrel 25, and is yieldably maintained in its inner position as illustrated by a spring 44 retained in the barrel by a cap 45 pressed therein. The stop collar 6 is provided with a groove 46 within which the projecting end 47 of the latch 42 is adapted to engage when the drive pinion is meshed with the engine gear, the advancing side of the projection 47 being suitably inclined to facilitate entry into the groove just prior to the termination of the meshing movement.

In operation, starting with parts as illustrated in Fig. 1 rotation of the power shaft 1 in the direction of the arrow is transmitted through the drive spring 18 to the screw shaft 4, and since rotation of the control nut 24 is resisted by its frictional connection with the barrel 25 by virtue of the spring 36, the control nut, barrel and pinion 22 are traversed to the right until the pinion is meshed with the engine gear 23. During the final meshing movement the point 47 of detent 42 snaps into the groove 46 in the stop collar 6. When traversal of the barrel 25 is arrested by engagement of the abutment 33 against the shoulder 37 of the stop collar 6, further movement of the control nut 24 closes the dental clutch 34, 35, whereupon the rotation of the screw shaft 4 is trans-

mitted positively through the barrel 25 to the pinion 22 to crank the engine.

When the engine fires, the acceleration of the engine gear 23 rotates the pinion 22 faster than the power shaft 1 whereupon the control nut 24 backs away on the screw shaft from the abutment 33 permitting the pinion and barrel to overrun while the pinion is held in mesh with the engine gear by the engagement of the latch 42 in the groove 46 of the stop collar 6.

When a successful start has been secured as evidenced by continued rotation of the pinion and barrel assembly by the engine gear 23 above a predetermined speed, the latch 42 is withdrawn by centrifugal force, permitting the control nut to thread itself back to idle position, after which the pinion and barrel assembly are maintained in idle position by the anti-drift spring 38.

It is within the scope of the invention that the clutch opening spring 36 be made comparatively weak or even omitted altogether so that the anti-drift spring 38 will hold the clutch teeth 34, 35 in engagement when the parts are in idle position. In such case, the control nut 24 will be positively connected through the clutch with the barrel 25 during the meshing movement of the parts as well as during the cranking operation. In such case however a certain amount of noise will be produced by the overrunning of the clutch after the parts are returned to idle position before they come to rest on the power shaft. In either case however the overrunning of the clutch will place quietly so long as the parts are in meshing position, since at that time the reaction of the anti-drift spring 38 is taken by the latch 42.

Although certain structure has been shown and described in detail it will be understood that 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 an engine starter drive a power shaft, a hollow screw shaft slidably and rotatably mounted thereon, a stop collar fixedly mounted on the power shaft, yielding driving means for rotating the screw shaft by the power shaft, a pinion slidably journalled on the power shaft for movement into and out of mesh with a gear of the engine to be started; a control nut having driving clutch surfaces threaded on the screw shaft, a barrel member rigidly connected to the pinion at one end, slidably journalled on the control nut at the other end, the barrel member having an intermediate portion formed with driven clutch surfaces; said intermediate portion being arranged to engage said stop collar to define the meshed position of the pinion; yielding means normally holding the clutch surfaces of the control nut and barrel member separated, and means for limiting the separation of said clutch surfaces and cooperating with said last named means to form a frictional driving connection between the control nut and barrel.

2. An engine starter drive as set forth in claim 1 in which the stop collar is provided with a peripheral groove, and including further a centrifugal latch mounted in the barrel in position to engage in said groove when the pinion is in meshed position and prevent demeshing movement of the pinion until the latch is withdrawn by centrifugal force.

3. An engine starter drive as set forth in claim 1 including further a compression spring in the barrel located between said intermediate portion and the stop collar, operative to prevent the pinion from drifting away from its idle position.

4. In an engine starter drive a power shaft, a pinion slidably journaled thereon for movement into and out of mesh with a gear on the engine to be started, means for actuating the pinion from the power shaft including a screw shaft mounted on the power shaft, means for rotating the screw shaft from the power shaft, a control nut on the screw shaft, a barrel member rotatably mounted on the control nut at one end with freedom for limited longitudinal movement thereon and having a rigid connection to the pinion at its other end, said barrel having an intermediate internal annular abutment, the control nut and said annular abutment having cooperating overrunning clutch teeth; a stop collar rigidly connected to the power shaft limiting the meshing movement of the barrel by engagement with said internal abutment, and having a peripheral groove, and a centrifugal latch slidably mounted in the barrel in position to engage in said groove when the pinion is in meshed position, and hold the pinion in mesh until it is rotated above a predetermined speed; and a coiled compression spring between the internal abutment in the barrel and the stop collar, urging the barrel toward idle position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,302,295 Buxton ---------- Nov. 17, 1942