March 30, 1954 A. J. STROZINSKI 2,673,467

ENGINE STARTER GEARING

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Fig. 2

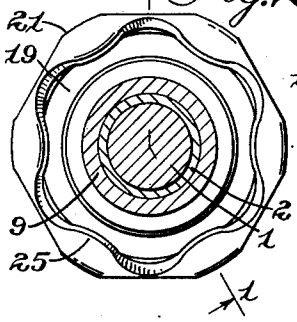


Fig. 1

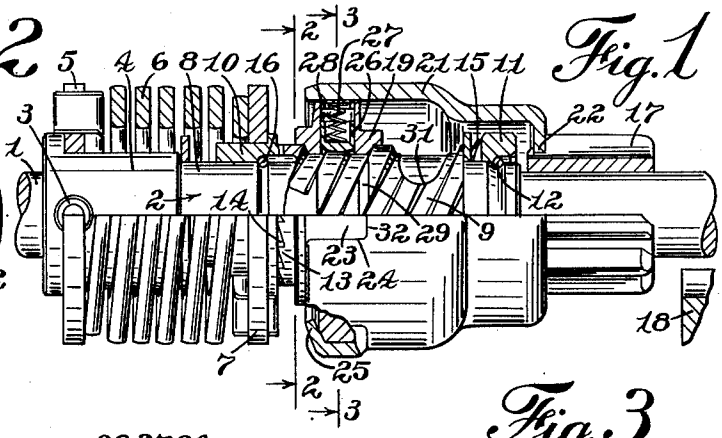
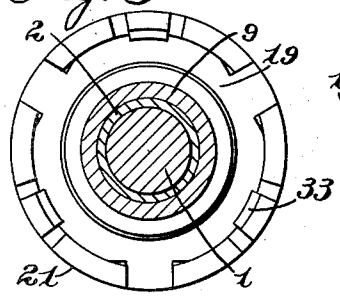


Fig. 5



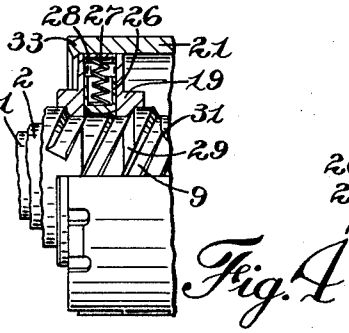
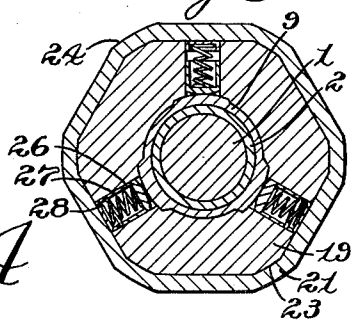


Fig. 4

Fig. 3



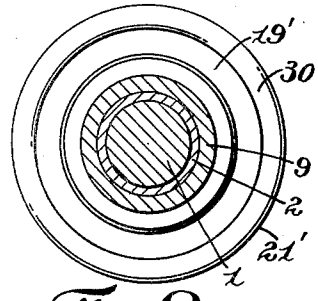


Fig. 8

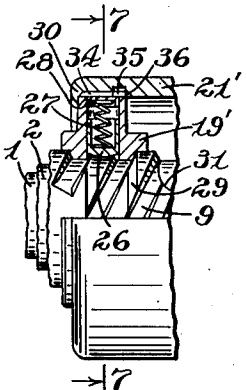


Fig. 6

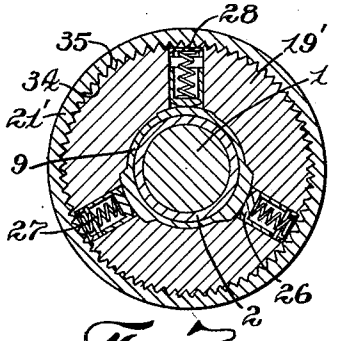


Fig. 7

WITNESS:

Esther M. Stockton

INVENTOR.
Anthony J. Strozinski

BY

Schlueter & James

ATTORNEY

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ENGINE STARTER GEARING

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Fig. 11

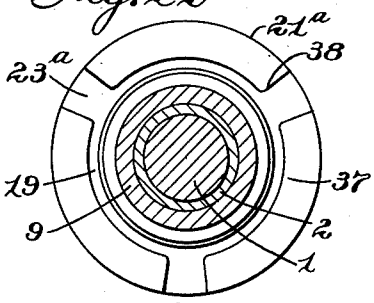


Fig. 9

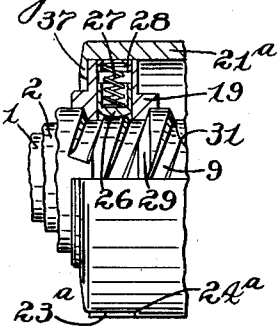


Fig. 10

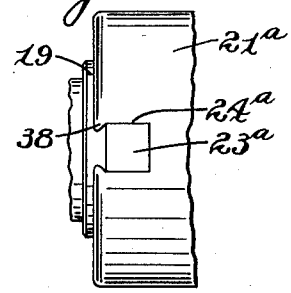


Fig. 14

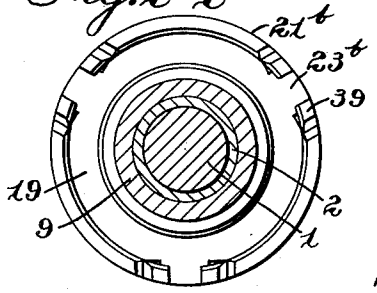


Fig. 12

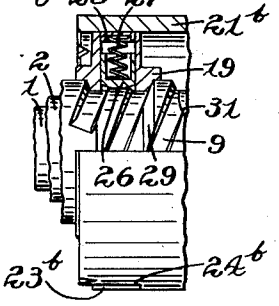


Fig. 13

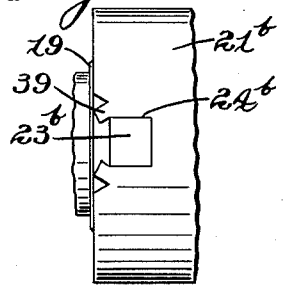


Fig. 17

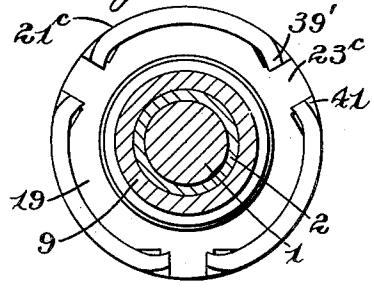


Fig. 15

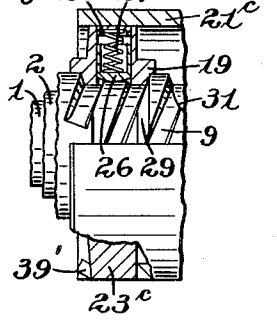
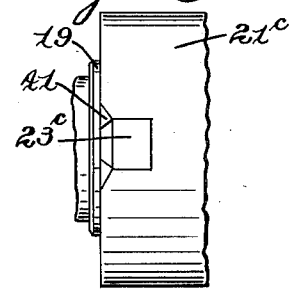


Fig. 16



WITNESS:

Esther M. Stockton

INVENTOR.
Anthony J. Strozinski

BY

Clinton L. Janes

ATTORNEY

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UNITED STATES PATENT OFFICE

2,673,467

ENGINE STARTER GEARING

Anthony J. Strozinski, Horseheads, N. Y., assignor to Bendix Aviation Corporation, a corporation of Delaware

Application July 30, 1952, Serial No. 301,621

3 Claims. (Cl. 74—7)

1

The present invention relates to engine starter gearing and more particularly to that type of drive in which a pinion is slidably mounted directly on a power shaft for engagement with an engine gear, the pinion being actuated from a control nut by means of a connecting barrel member, so that the device is known commercially as a "barrel drive."

In starter drives of this type, difficulty has been encountered in providing economically a connection between the control nut and barrel which will remain rigid and free from lost motion of any kind in spite of the heavy shock loads to which it is subjected in use. It has also been found desirable in some types of installation to have a drive unit which is permanently assembled and cannot be readily disassembled or tampered with.

It is an object of the present invention to provide a novel barrel-type starter drive in which the connection between the control nut and barrel is effected in a stable and permanent manner.

It is another object to provide such a device in which the connection is of such a nature as to be readily made by ordinary production methods.

It is another object to provide such a device in which the connection includes interlocking projections and recesses in said members, the adjacent material being displaced in a manner to effectively prevent relative movement.

It is another object to provide such a device including one or more centrifugal detents for controlling the meshing and demeshing of the drive pinion, which detents are readily assembled and retained in position as an incident to the assembly of the control nut and barrel.

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 of a starter drive embodying a preferred form of the invention partly broken away and in section along the line 1—1 of Fig. 2;

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1;

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

Fig. 4 is a detail of a control nut and barrel joined in accordance with the applicant's novel principles by forcing radially inward certain of the portions of the rim of the barrel;

Fig. 5 is an end view of the structure shown in Fig. 4;

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Fig. 6 is a detail similar to Fig. 4 in which the joint between the control nut and barrel is accomplished by means of ribs or flutes on said members, with the rim of the barrel spun over the control nut;

Fig. 7 is a section taken substantially on the line 7—7 of Fig. 6;

Fig. 8 is an end view of the structure shown in Fig. 6;

Fig. 9 is a detail similar to Fig. 4 in which the joint between the control nut and barrel comprises lugs and recesses on said members, with the rim of the barrel spun over the control nut;

Fig. 10 is a side elevation of the structure shown in Fig. 9;

Fig. 11 is an end view of the same;

Fig. 12 is a detail similar to Fig. 9 in which the lugs of the control nut are retained in the barrel by partially severing and bending sections of the rim of the barrel;

Fig. 13 is a side elevation of the structure shown in Fig. 12;

Fig. 14 is an end view of the same;

Fig. 15 is a detail similar to Fig. 12 in which the portions of the barrel rim which retain the lugs of the control nut are bent radially inward as well as caused to embrace said lugs;

Fig. 16 is a side elevation of the structure shown in Fig. 15; and

Fig. 17 is an end view of the same.

In Fig. 1 of the drawing there is illustrated a starter drive including a power shaft 1 on which a sleeve 2 is rigidly mounted as by means of a cross pin 3. Sleeve 2 has a driving head 4 on which is non-rotatably mounted an anchor plate 5 which is yieldingly connected through a spring 6 with a second anchor plate 7 which latter is non-rotatably mounted on a clutch member 10 slidably journaled on a smooth reduced portion 8 of sleeve 2.

A screw shaft 9 is slidably journaled on the smooth portion 8 of the sleeve 2 and is retained thereon by a stop member 11 which is anchored on the sleeve by a lock ring 12. Screw shaft 9 has overrunning clutch teeth 13 cooperating with similar clutch teeth 14 on the clutch member 10, said teeth being yieldably held in engagement by a clutch spring 15 located between the end of the screw shaft and the stop member 11. Movement of the anchor plate 7 toward the screw shaft is limited by a lock ring 16 on the sleeve which maintains the drive spring 6 under initial compression.

A pinion 17 is slidably journaled on the power shaft 1 for movement into and out of mesh with

an engine gear 18, and means for actuating the pinion are provided comprising a control nut 19 threaded on the screw shaft 9, and a barrel member 21 which is anchored at one end to the pinion in any suitable manner as indicated at 22.

In the embodiment of the invention illustrated in Figs. 1, 2, and 3, the control nut and barrel are non-rotatably connected together by forming the nut with a polygonal contour as indicated at 23, fitting tightly in the end of the barrel which conforms thereto as shown at 24, the nut being retained therein by bending radially inward the rim of the barrel as shown at 25.

One or more centrifugal detents 26 are mounted in the control nut 19 for radial sliding movement, and are pressed against the surface of the screw shaft 9 by means of springs 27. The outer ends of the detent springs are preferably seated in cup members 28 which bear against the interior surface of the barrel 21. Inclined shoulders 29 are formed on the screw shaft to cooperate with the detents 26 in opposing initial meshing movement of the pinion and barrel assembly, and radial shoulders 31 are formed on the screw shaft in position to be engaged by the detents and thereby prevent demeshing movement of the pinion until the assembly has reached sufficient rotational speed to withdraw the detents from engagement with the shoulders 31.

When the barrel 21 is assembled to the control nut 19, the detent subassemblies are compressed in a suitable jig and the barrel slid over the nut until the lugs 23 engage the ends 32 of the recesses in the barrel. The rim of the barrel is then bent inwardly as shown at 25, clamping the lugs in said recesses and thereby forming a permanent shake-proof connection.

In the embodiment of the invention shown in Figs. 4 and 5, the connection between the control nut and barrel is similar to that illustrated in Figs. 1, 2, and 3 except that the inwardly bent portions of the rim of the barrel are partially severed from the body of the barrel as indicated at 33 in Fig. 4, so as to facilitate the clamping action of the final assembly operation.

In Figs. 6, 7, and 8 the periphery of the nut 19' is provided with axial ribs or flutes 34 which are received by conforming recesses 35 in the interior of the barrel 21'. The entire rim of the barrel is then spun over as shown at 30, clamping the nut against circumferential shoulder 36 in the interior of the barrel.

In Figs. 9, 10, and 11, the connection between the control nut and barrel is similar to that illustrated in Figs. 1, 2, and 3, but in this case the rim of the barrel 21^a is not only bent radially inward as shown at 37, but is also pressed around the lugs 23^a of the control nut as shown at 38 so as to embrace the lugs and clamp them firmly in the recesses 24^a in the barrel.

In Figs. 12, 13, and 14 of the drawing, the lugs 23^b of the control nut are retained in the recesses 24^b of the barrel by partially severing portions of the rim of the barrel 21^b and bending these portions toward each other as best shown

at 39 in Fig. 13 so as to embrace the lugs 23^b and clamp them in the recesses 24^b.

The embodiment illustrated in Figs. 15, 16, and 17 is similar to that shown in Figs. 12, 13 and 14 except that the portions 39' of the rim of the barrel 21^c are pressed radially inward and toward each other whereby they are caused to firmly seize the lugs 23^c of the control nut and to flow around the sides of the lugs as shown at 41 in Fig. 16.

It will be appreciated that in each embodiment of the invention, the connection between the control nut and barrel is of such a character as to preclude the possibility of loosening due to the shock loads encountered in use, and that the connection cannot be disturbed without damaging or destroying the parts.

Although certain embodiments of the invention have been here disclosed, it will be understood that the principles involved may be embodied in other forms without departing from the spirit of the invention.

I claim:

1. In an engine starter drive a power shaft, a screw shaft slidably journaled thereon, means for yieldably driving the screw shaft from the power shaft, a control nut threaded on the screw shaft, a pinion slidably journaled on the power shaft for movement into and out of mesh with a gear of the engine to be started, and a barrel member rigidly anchored at one end to the pinion and having a plurality of axially extending recesses in its other end, said control nut having a plurality of axially extending projections seated in said recesses, the rim of the barrel adjacent said recesses being displaced inwardly to embrace said projections and hold them firmly in the recesses; including further means for positively limiting the longitudinal movement of the control nut on the screw shaft, a centrifugal detent mounted for radial movement in the control nut intermediate said projections, and a compression spring confined within said barrel, pressing the detent against the surface of the screw shaft.

2. An engine starter drive as set forth in claim 1 in which the recesses in the barrel member extend inward from the end of the barrel and terminate in circumferential shoulders, and the inwardly displaced portions of the rim of the barrel serve to clamp the projections of the control nut against said shoulders.

3. An engine starter drive as set forth in claim 2 in which the control nut is provided with a cylindrical portion fitting the interior of the barrel from which said projections extend radially into the recesses in the barrel, and the displaced portions of the rim of the barrel extend radially inward, overlapping the cylindrical portion of the control nut, and extend toward each other so as to embrace said projections.

ANTHONY J. STROZINSKI.

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