

Feb. 14, 1933.

Y. SEKELLA

1,897,916

ENGINE STARTER

Filed April 22, 1932

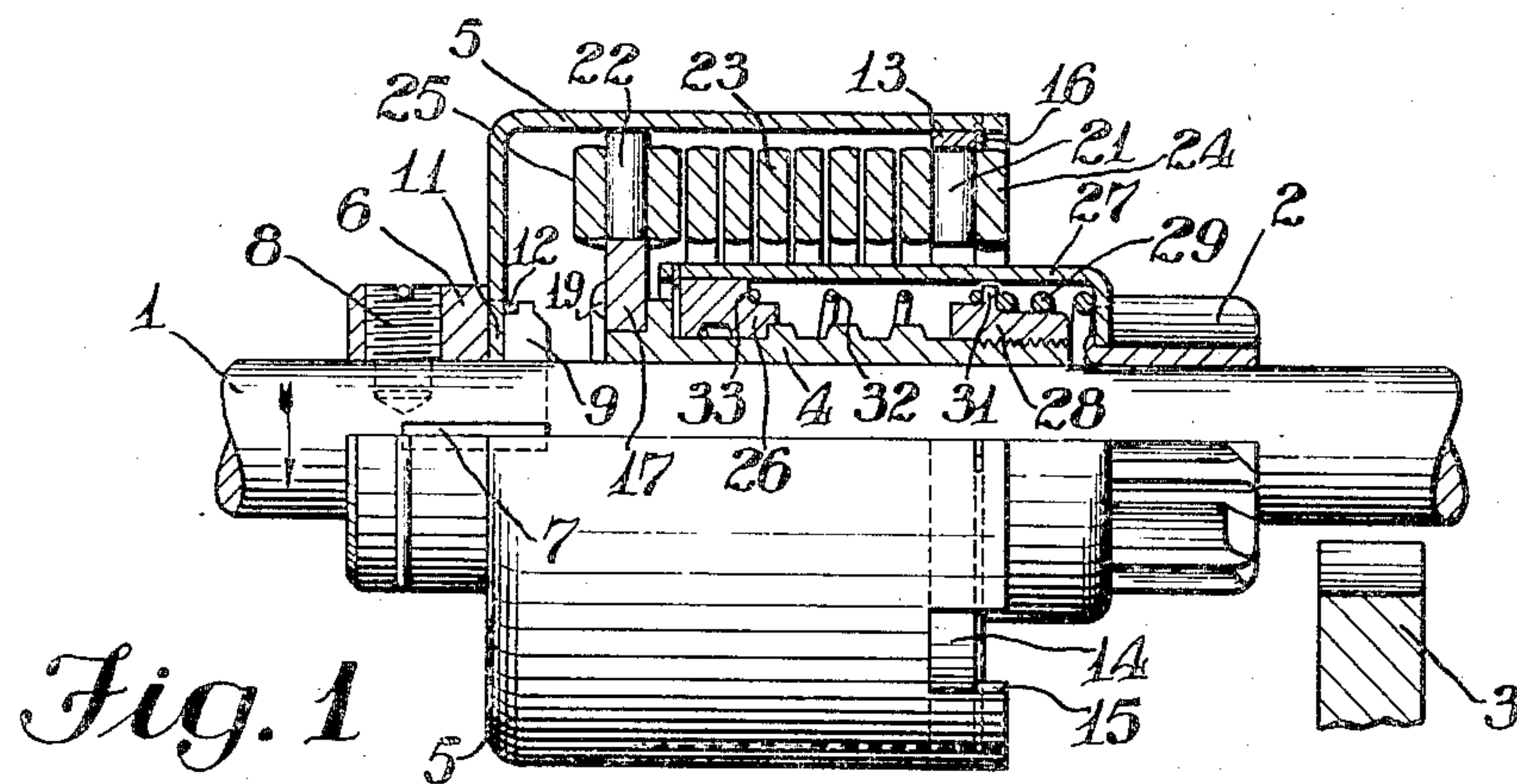


Fig. 1

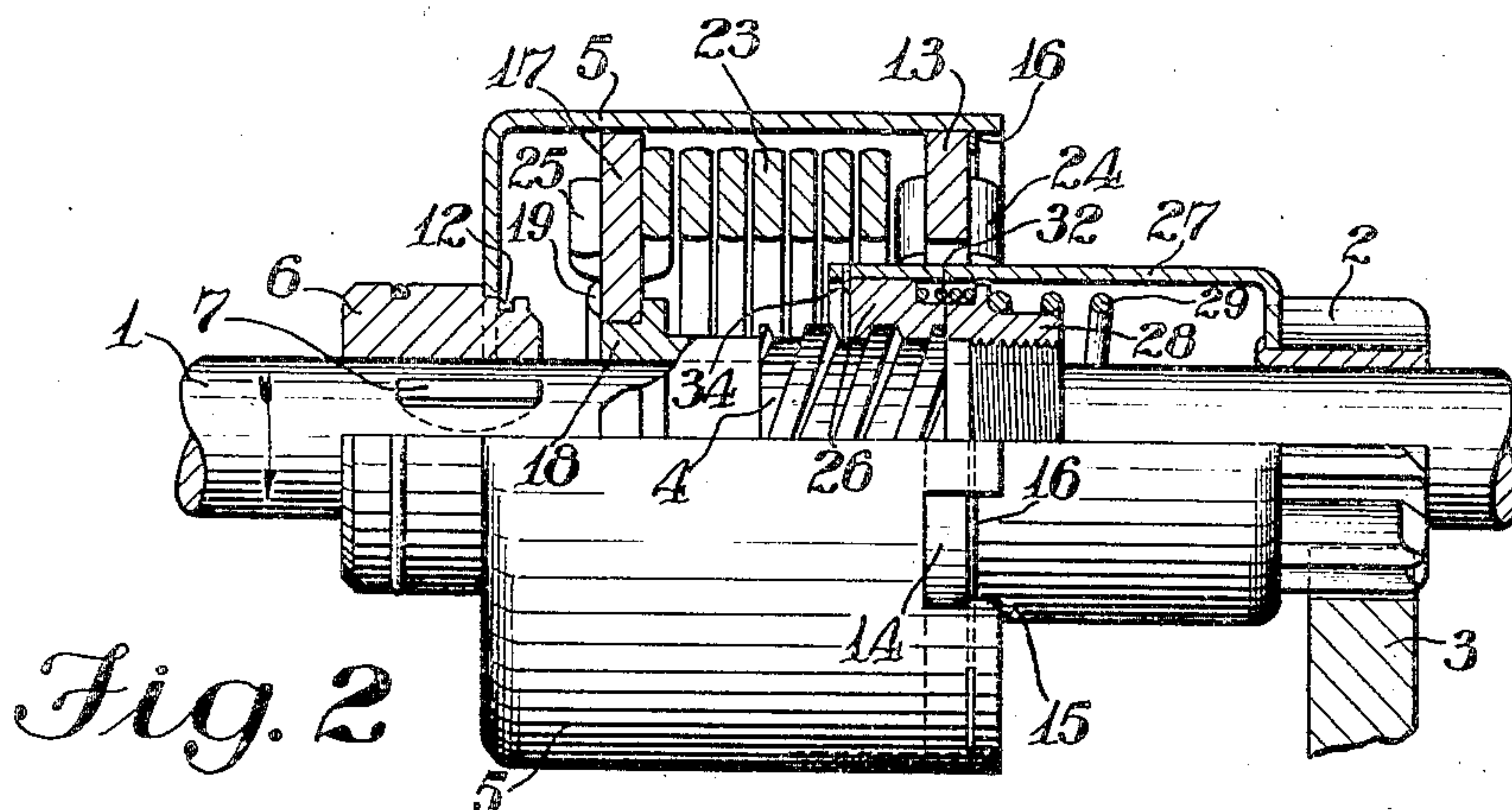


Fig. 2

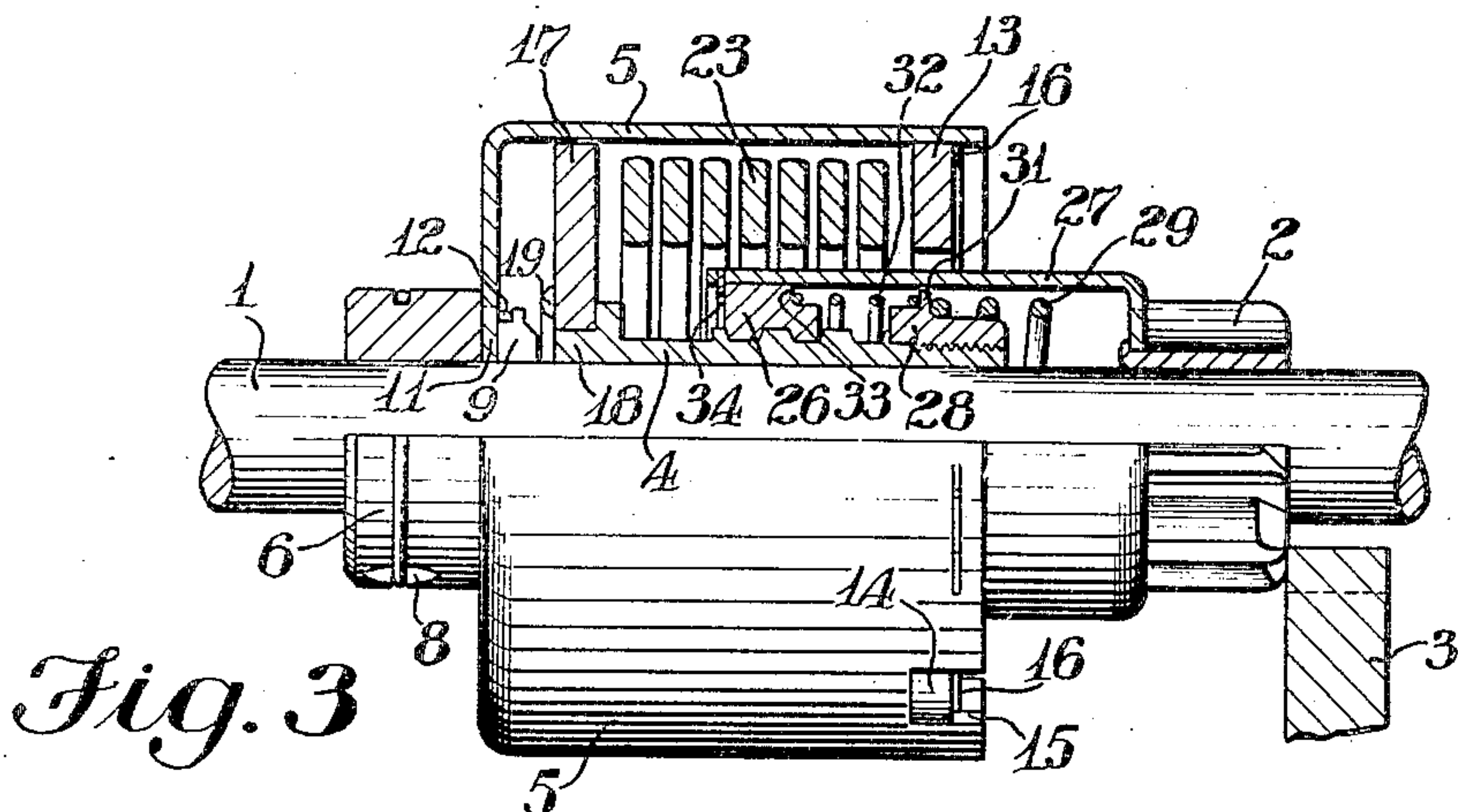


Fig. 3

WITNESS:  
Burr W. Jones

INVENTOR  
Youston Sekella  
BY Clinton S. Jones.  
ATTORNEY



# UNITED STATES PATENT OFFICE

YOUSTON SEKELLA, OF ELMIRA HEIGHTS, NEW YORK, ASSIGNOR TO ECLIPSE MACHINE COMPANY, OF ELMIRA, NEW YORK, A CORPORATION OF NEW YORK

## ENGINE STARTER

Application filed April 22, 1932. Serial No. 606,940.

This invention relates to engine starters and more particularly to a starter pinion drive for automatically connecting and disconnecting a starting motor with a gear on an engine to be started.

It is an object of the present invention to provide a starter drive which is small in size and of light weight while being powerful and efficient in operation.

Another object is to provide such a device which is economical to manufacture and assemble and in which the working parts are inclosed and protected.

A further object is to provide such a device which is arranged to permit the use of a small starting pinion whereby suitable gear reductions can be secured in conjunction with small engine gears.

Another object is to provide such a device in which the pinion is effectively prevented from drifting toward the engine gear when the starting motor idles and from bounding back toward the engine gear when thrown out of mesh as the engine starts.

Further objects and advantages will be apparent to those skilled in this art from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a side elevation partly in section of a preferred embodiment of the invention showing the parts in idle position;

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

Fig. 3 is a similar view showing the parts in the positions assumed in case during the meshing movement of the pinion a tooth thereof should abut a tooth of the engine gear.

Referring first to Fig. 1 of the drawing there is illustrated a power shaft 1 which may be the extended armature shaft of a starting motor, not shown. A driving member in the form of a pinion 2 is slidably journaled on the power shaft and arranged to move into and out of mesh with an engine member in the form of a flywheel gear a fragment of which is illustrated at 3.

An operating member for the driving member in the form of a hollow screw shaft 4 is slidably journaled on the power shaft 1

in tandem with the pinion 2 and has a yielding driving connection with the power shaft. This yielding driving connection comprises a barrel member 5 one end of which is suitably anchored to the power shaft as by means of a collar 6 keyed and pinned to the power shaft as indicated at 7 and 8 respectively and having slots 9 arranged to receive inwardly extending tongues 11 in the end of said barrel, said tongues being locked in said slots as by means of a split ring 12. The free end of the barrel 5 has an annular member 13 keyed therein as by means of radial lugs 14 engaging in slots 15 in said barrel and retained therein by a split ring 16. A second annular member 17 is rigidly mounted on the end of the screw shaft 4 farthest from the pinion 2, as by means of a non-circular hub 18 on said shaft forming a seat for said member and a retaining lip 19 spun thereon. The annular members 13 and 17 are provided with radial slots 21 and 22, and a torsion drive spring 23 is mounted in said barrel and provided with terminal lugs 24 and 25 adapted to be received in said slots whereby the spring is anchored to said barrel and screw shaft with the barrel and spring telescoped over said screw shaft.

The spring 23 is preferably formed with its convolutions flattened in order to increase its torsional stiffness while facilitating the stretching action thereof, the convolutions being normally in contact or closely adjacent each other. The spring is adapted to transmit torque in either direction of rotation and the barrel 5 is arranged to inclose the spring with sufficient clearance to allow normal expansion of the spring when driving in a direction to unwind the spring, but adapted to limit the expansion of the spring under abnormal stress.

A shifting and driving connection from the operating shaft 4 to the driving member 2 is provided in the form of a nut 26 threaded on said shaft and rigidly connected with the pinion 2 as by means of an inner barrel member 27 suitably keyed to said nut and pinion. A stop for the nut 26 on the screw shaft 4 is provided in the form of a stop nut 28 suitably fixed on said shaft and



serving to define the driving position of the nut 26 and pinion 2.

In order to prevent rebounding of the pinion when it is thrown out of mesh with the engine gear, the threads of the operating shaft 4 are terminated just short of the idle position of the nut 26 as shown in Fig. 1, thereby leaving a smooth portion on the shaft 4 on which said nut may rotate freely. Means are provided for normally urging the nut into initial engagement with the threads on the operating shaft in the form of a compression spring 29 mounted on the stop nut 28 and bearing at one end against a shoulder 31 thereon and at the other end against the end of the barrel member 27.

Means are provided for preventing the pinion from drifting away from its idle position in the form of a light compression spring 32 arranged to bear at its ends against the flange 31 on stop nut 28 and against a seat 33 on the nut member 26.

In assembling the drive, the nut 26 is first mounted on the screw shaft 4, the spring 32 is placed thereon and the stop nut 28 mounted on the end of said shaft. The spring 29 is placed in the inner barrel 27 and the inner barrel and pinion assembly is telescoped over the shaft 4 and the inner end of the barrel fixed to the nut 26 by suitable means such as a spring ring 34. The drive spring 23 is then telescoped over the screw shaft and pinion assembly and anchored to the annular member 17. The annular member 13 is then anchored to the outer end of the spring 23 and the barrel 5 is telescoped over the entire assembly and the annular member 13 keyed thereto and retained by the ring 16. The assembly is then slid on the power shaft 1 and retained thereon by means of the key 7 and set screw 8.

In the operation of the device, rotation of the power shaft 1 in the direction of the arrow is yieldingly transmitted through the barrel 5 and spring 23 to the operating shaft 4. The nut 26 and pinion 27 by reason of their inertia do not immediately partake of this rotation and are therefore translated axially to the right, until the nut 26 engages the stop nut 28, at which time the pinion 2 is in proper meshing relation with the engine gear 3. At this time, the pinion 2 is constrained to rotate with the screw shaft 4 and is therefore driven from the power shaft in order to crank the engine.

When the engine starts, the acceleration of the pinion 2 causes the nut 26 to be threaded back along the screw shaft 4 to its idle position as illustrated in Fig. 1 whereby the pinion 2 is moved out of mesh with the engine gear 3 and is prevented from bounding back against the engine gear by reason of the overrunning of the nut 26 on the smooth portion of the screw shaft, the spring 29 being slightly compressed during this over-

running action. Upon reactivation of the starter, the spring 29 starts the nut 26 on the threads of the operating shaft whereupon the starting operation is repeated.

If during the engaging movement of the pinion a tooth thereof should engage end to end with a tooth of the engine gear as illustrated in Fig. 3, the spring 23 is arranged to stretch and permit the operating shaft 4 to move to the left and thus allow a time interval during which the friction between the threads of the shaft and nut builds up sufficiently to index the pinion into proper registry with the gear teeth whereupon the pinion 2 is snapped into initial engagement with the gear teeth by the contraction of said spring and meshing and cranking proceed as above set forth.

It will be seen that there is here provided a starter drive in which the pinion is mounted directly on the power shaft whereby a pinion of small diameter may be used and the driving parts for the pinion are of comparatively cheap construction and are arranged so that the drive is of small dimensions and the parts thereof are protected and inclosed.

Although but one embodiment of the invention has been shown and described in detail, it will be understood that other embodiments are possible and various changes may be made in the construction and arrangements 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, a power shaft, a driving member and an operating member slidably journaled thereon, connecting means for transmitting longitudinal and rotary movement from the operating member to the driving member and a yielding driving connection from the power shaft to the operating member including a spring surrounding the operating member and connected thereto at one end and a barrel inclosing said spring and connecting the free end of the spring to said power shaft.

2. In an engine starter, a power shaft, a driving member and an operating member slidably journaled thereon, connecting means for transmitting longitudinal and rotary movement from the operating member to the driving member and a yielding driving connection from the power shaft to the operating member including a spring surrounding the operating member and connected thereto at one end, and a barrel inclosing said spring and connecting the free end of the spring to said power shaft, said spring being anchored to said shaft by said barrel at the outer end thereof and serving to yieldably position the operating member on said shaft whereby obstruction of the outward movement of the pinion causes stretching of said spring.



3. In an engine starter a power shaft, a driving member and an operating member slidably journaled thereon, means for yieldingly connecting the operating member for rotation with the power shaft, connecting means whereby rotation of the operating member moves the driving member longitudinally into driving position and thereafter rotates the same to crank the engine, said connecting means being arranged on overrunning of the driving member to withdraw the same to idle position and thereafter to disconnect and allow the driving member to overrun freely.

4. In an engine starter, a power shaft, a driving member and an operating member slidably journaled thereon, means for yieldingly connecting the operating member for rotation with the power shaft, connecting means whereby rotation of the operating member moves the driving member longitudinally into driving position and thereafter rotates the same to crank the engine, said connecting means being arranged on overrunning of the driving member to withdraw the same to idle position and thereafter to disconnect and allow the driving member to overrun freely, and yielding means for assuring reengagement of the connecting means upon actuation of the operating member.

5. In an engine starter, a power shaft, a driving member and an operating member slidably journaled thereon, a driving connection between the power shaft and operating member, connecting means including a barrel whereby rotation of the operating member moves the driving member longitudinally into driving position and thereafter rotates the same to crank the engine, said connecting means being arranged to disconnect and allow the driving member to overrun and maintain the driving member in idle position when the engine starts, means in said barrel for assuring reengagement of the connecting means on reactuation of the operating member and yielding means for preventing the driving member from drifting away from its idle position.

6. In an engine starter, a power shaft, a driving member and an operating member slidably journaled thereon, a driving connection between the power shaft and operating member, connecting means including a barrel whereby rotation of the operating member moves the driving member longitudinally into driving position and thereafter rotates the same to crank the engine, said connecting means being arranged to disconnect and allow the driving member to overrun and maintain the driving member in idle position when the engine starts, yielding means in said barrel for assuring reengagement of the connecting means on actuation of the operating member and spring anti-

drift means for the driving member within said barrel.

7. In an engine starter, a power shaft, a hollow screw shaft slidably journaled thereon and yieldably connected for actuation therewith, a driving member slidably journaled on the power shaft, a nut threaded on said hollow shaft and means connecting the driving member to said nut for longitudinal movement and rotary movement therewith, the threads on said hollow shaft terminating just short of the idle position of the nut thereon.

8. In an engine starter, a power shaft, a hollow screw shaft slidably journaled thereon and yieldably connected for actuation therewith, a driving member slidably journaled on the power shaft, a nut threaded on said hollow shaft, means connecting the driving member to said nut for longitudinal movement and rotary movement therewith, stop means on the hollow shaft for limiting the travel of the nut thereon in the direction to move the driving member into driving position, the threads on said hollow shaft terminating just short of the idle position of the nut thereon and a spring mounted between said stop means and said driving member operative to start the nut on said threads when the operating member is actuated.

9. An engine starter drive including a power shaft, a screw shaft and a pinion slidably journaled in tandem thereon, a nut on said screw shaft, a barrel telescoped over said screw shaft and connecting said nut to said pinion, an outer barrel fixed to said power shaft and telescoped over said first barrel and screw shaft, a pair of annular members within said outer barrel and fixed respectively thereto and to said screw shaft and a spring within said outer barrel connecting said annular members.

10. An engine starter drive including a power shaft, a screw shaft and a pinion slidably journaled in tandem thereon, a nut on said screw shaft, a barrel telescoped over said screw shaft and connecting said nut to said pinion, an outer barrel fixed to said power shaft and telescoped over said first barrel and screw shaft, a pair of annular members within said outer barrel and fixed respectively thereto and to said screw shaft, said annular members having slots, and a torsion drive spring within said outer barrel having terminal lugs adapted to anchor in said slots.

11. An engine starter drive including a power shaft, a screw shaft and a pinion slidably journaled in tandem thereon, a nut on said screw shaft, a barrel telescoped over said screw shaft and connecting said nut to said pinion, an outer barrel fixed to said power shaft and telescoped over said first barrel and screw shaft, a pair of annular members within said outer barrel and fixed respectively thereto and to said screw shaft, said annular



members having slots, and a torsion driving spring within said outer barrel having terminal lugs adapted to anchor in said slots, the convolutions of said spring being flattened to  
5 increase its torsional stiffness and said outer barrel being arranged to cooperate therewith to limit the unwinding thereof.

12. An engine starter drive including a power shaft, a screw shaft and a pinion slid-  
10 ably journaled in tandem thereon, a nut on said screw shaft, a barrel telescoped over said screw shaft and connecting said nut to said pinion, an outer barrel fixed to said power shaft and telescoped over said first  
15 barrel and screw shaft, a pair of annular members within said outer barrel and fixed respectively thereto and to said screw shaft, said annular members having slots and a torsion drive spring within said outer barrel  
20 having terminal lugs adapted to anchor in said slots, the convolutions of said spring being closely wound and the anchorages for said spring being so arranged that obstruction of the movement of said pinion toward driving  
25 position causes the spring to be stretched.

In testimony whereof, I have hereunto signed my name.

YOUSTON SEKELLA.

30

35

40

45

50

55

60