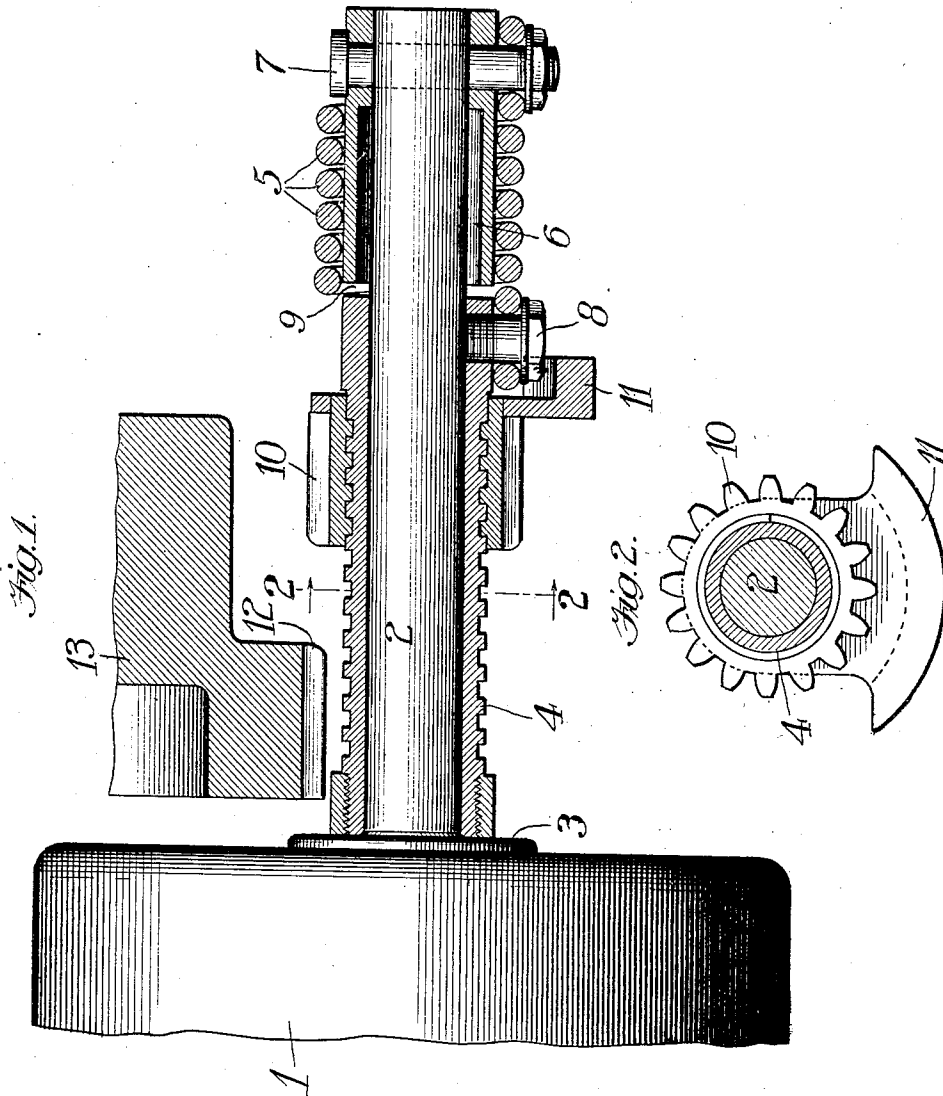


V. BENDIX.
 STARTER FOR ENGINES.
 APPLICATION FILED MAY 2, 1914.

1,125,935.

Patented Jan. 26, 1915.
 2 SHEETS—SHEET 1.



Witnesses
 Robert Dobberman
 Martin H. Olsen.

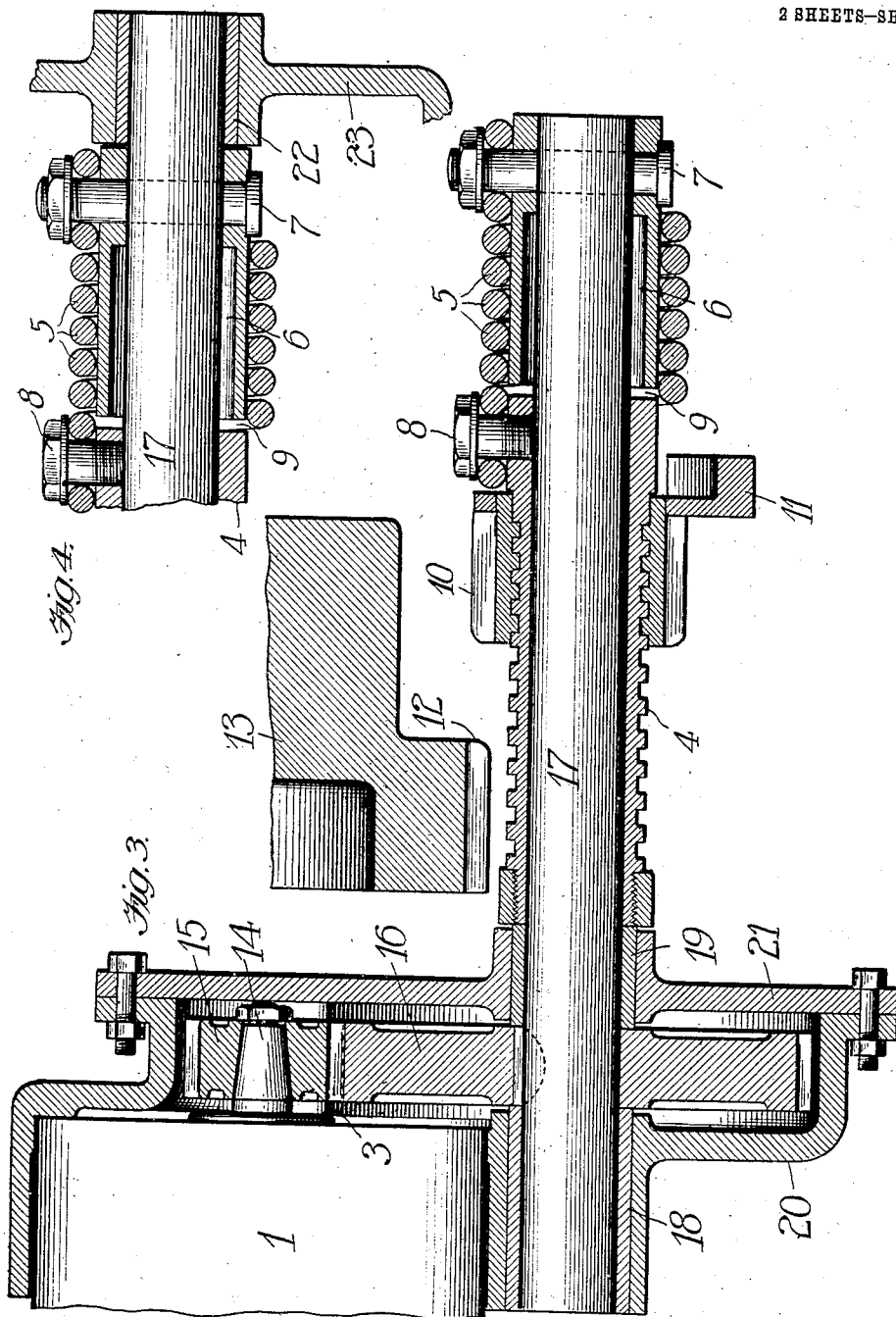
Inventor
 Vincent Bendix
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UNITED STATES PATENT OFFICE.

VINCENT BENDIX, OF CHICAGO, ILLINOIS.

STARTER FOR ENGINES.

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Specification of Letters Patent.

Patented Jan. 26, 1915.

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To all whom it may concern:

Be it known that I, VINCENT BENDIX, a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Starters for Engines, of which the following is a specification.

My invention relates to a starter for an engine such as a gas engine and the object thereof is to provide a simple, efficient and reliable device of this character operated by a prime mover of any kind such, for instance, as an electric motor.

My starter is of that type having a screw shaft or the like operated by the prime mover either directly from the armature shaft or indirectly by gearing and having mounted thereon a driving member in the form of a pinion adapted to engage or mesh with some member of the engine for rotating its crank shaft or the like.

The particular object of my invention is to improve the structure and mode of operation of a construction of this general type. In the drawings Figure 1 is a section of my starter showing a part of the electric motor in elevation and a part of the engine member such as the fly wheel in section; Fig. 2 a cross section on the line 2—2 of Fig. 1; Fig. 3 a section of a modified form of my starter in which the screw shaft or sleeve is driven indirectly by the prime mover; and Fig. 4 a detail section of a modified form of construction of the outer end of the rotatable shaft.

In the drawings I have shown two different forms of drive from the prime mover to the screw shaft or sleeve, one being a direct drive, as shown in Fig. 1, and the other an indirect drive as shown in Fig. 3. However, with this exception the construction and principle of operation are the same in both cases.

Referring to the construction shown in Figs. 1 and 2, the prime mover 1 is here an electric motor whose armature shaft is by preference extended to form the driving shaft 2. This shaft has a bearing at 3 in one end of the motor body or casing but by preference it has no outboard bearing at all although one might be provided at the outer end as shown in Fig. 4, which will be hereinafter described in detail. Upon the inner portion of this shaft there is mounted

a sleeve 4 which is free thereon and also capable of some oscillation and longitudinal movement. A yielding driving connection is provided between the shaft 2 and the sleeve 4, this connection comprising a coiled spring 5 which is anchored at one end to the shaft and at the other end to the sleeve. According to the specific construction shown a spring barrel 6 is arranged concentrically of the shaft 2 and held in place at the outer end of such shaft by means of the pin or bolt 7, which bolt also forms the means for anchoring the outer end of the spring 5. This barrel forms a support on which the spring may coil solidly to prevent excess coiling and consequent setting. The other end of the spring is anchored to a stud or bolt 8 screwing into the outer end of the sleeve 2. The shaft and the spring barrel are arranged in alinement but they are not in contact inasmuch as a space 9 is left between the inner end of the barrel and the outer end of the sleeve in order that such sleeve may have a slight movement outwardly against the tension of the spring for a purpose hereinafter explained.

A pinion 10 is screw-threaded upon the sleeve and the same has a depending portion 11 of the same or other suitable material for the purpose of weighting such pinion and thereby assuring longitudinal travel thereof with respect to the sleeve when the latter is rotated. In so far as the present invention is concerned it is immaterial whether the pinion be weighted or not. This pinion is adapted to mesh with the teeth 12 of some rotatable member such as the fly wheel 13 of a gasoline engine.

As shown in the drawings and by preference the starter mechanism is so constructed and arranged that the motor is placed in juxtaposition to the fly wheel or similar engine member with the bearing of the shaft 2 adjacent or in proximity thereto and the pinion 10 is normally toward the outer end of the sleeve and in the starting operation such pinion is adapted to move inwardly and engage the fly wheel at or toward its inward position at which time it is itself quite close to said bearing. This construction and arrangement is of advantage in that the shaft and sleeve are relieved of any leverage effect during the actual starting of the fly wheel which would be the case if the

pinion engaged such wheel when at its outward position. In so far as this particular feature of the invention is concerned it is immaterial whether the shaft and sleeve
 5 be made in two separate parts or be made in one piece or whether the sleeve, which may be considered a hollow shaft, be made hollow or solid. Consequently in the claims the sleeve is referred to broadly as a screw-
 10 threaded shaft meaning thereby either the hollow shaft shown or solid shaft, or the like.

The starter being constructed as above described operates as follows: When it is desired to start the engine the electric motor is started whereupon the shaft 2 and the sleeve 4 are rotated with the result that the pinion 10 will be automatically moved longitudinally of the sleeve and into mesh with
 20 the teeth of the fly wheel. As soon as meshing occurs and the pinion is stopped in its inward travel it will rotate in unison with the sleeve and will consequently rotate the fly wheel. The spring driving connection
 25 between the shaft and the sleeve prevents any shock or jar which is liable to occur in the initial starting of the fly wheel or other engine member from a state of rest, the resistance offered causing a winding up of the
 30 spring and a consequent storing up of energy therein which increases the power or energy applicable to the starting of the fly wheel. Moreover, such driving connection takes care of the varying resistances offered
 35 by the engine member due to the passing of compression points in the engine and gives substantially uniform and positive drive to the pinion thereby preventing the same from vibrating back and forth along the
 40 sleeve. If the teeth of the pinion 10 should not register with the teeth 12 of the fly wheel when the pinion is advanced and the teeth should consequently abut at their ends any shock due to this resistance will be absorbed by the sleeve which is adapted to
 45 yield by being movable longitudinally against the tension of the spring 5. Of course this contact of the teeth would tend to stop the longitudinal movement of the
 50 pinion and start a slight rotary movement thereof sufficient to bring the teeth into register after which the pinion will be advanced into full mesh with the fly wheel. After the engine has started on its own
 55 power the excess speed of rotation of the fly wheel will cause the pinion to be automatically withdrawn from mesh but the pinion will not immediately travel longitudinally to its normal or inactive position but will
 60 pause in such travel just after unmeshing and will rotate with the screw shaft of sleeve until the latter slows down somewhat, whereupon the pinion will then move toward its normal position inasmuch as its momentum
 65 will exceed that of the shaft which is of

course subjected to much drag. This pausing of the pinion is due to a binding action between the shaft and pinion caused by centrifugal force of the weight and the fact that such weight is not centered on the shaft
 70 but located at one end, thereby causing a binding on the shaft. By this action a too-rapid travel and forcible return of the pinion are prevented, inasmuch as the final return of the pinion takes place after the
 75 momentum has been considerably decreased during said pause in its longitudinal travel.

In Fig. 3 the parts are substantially the same except for those changes necessitated by the provision of an indirect drive from
 80 the electric motor as distinguished from the direct drive shown in Fig. 1. The parts having the same construction are similarly numbered in Fig. 3. In this modification the motor has a short armature shaft 14 to
 85 which is secured a pinion 15 meshing with a gear 16 secured to a shaft 17 which is the same as the shaft 2 with the exception that it is not an extended armature shaft or a shaft in line therewith. This shaft has two
 90 bearings 18 and 19 on opposite sides of the gear wheel 16 and formed in the supporting casing 20 and its cover plate 21 respectively. This casing also supports the electric motor. It is obvious that the rotation of the armature shaft 14 will rotate the shaft 17 through
 95 the medium of the pinion 15 and gear 16 whereupon the operation already described in reference to the other construction will result.
 100

As above stated it is preferred to dispense with any outboard bearing for the shafts 2 and 17 but if desired such a bearing 22 as shown in Fig. 4 may be provided. This bearing engages the extreme
 105 outer end of the shaft 17 as formed in any suitable supporting bracket or casing 23.

I claim:

1. A starter for engines comprising in combination with a motor-driven shaft, a
 110 screw-threaded sleeve mounted thereon and adapted to be driven thereby, and a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are
 115 rotated, said shaft and sleeve having driving connections between them.

2. A starter for engines comprising in combination with a motor having an extended driving shaft, a screw-threaded
 120 sleeve mounted on the shaft and adapted to be driven thereby, and a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated, said shaft and sleeve having driving connections between them.
 125

3. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon, a
 130

yielding driving connection between the shaft and sleeve, and a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated.

4. A starter for engines comprising a rotatable shaft having a yielding longitudinal movement, and a driving member which is mounted thereon for both longitudinal movement thereof and rotary movement therewith.

5. A starter for engines comprising in combination with a motor-driven screw-threaded shaft having a yielding longitudinal movement, and a driving member which is screw-threaded upon said shaft and adapted to travel longitudinally thereon when the shaft is rotated.

6. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon and having a yielding movement longitudinally thereof, and a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated, said shaft and sleeves having driving connections between them.

7. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon, a yielding driving connection between the shaft and sleeve, comprising a spring connected respectively to the shaft and sleeve, and a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated.

8. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon, a yielding driving connection between the shaft and sleeve comprising a coiled spring which is concentric of the shaft axis and which has one end anchored to the shaft and the other to the sleeve, a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated.

9. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon, a yielding driving connection between the shaft and sleeve comprising a coiled spring which is concentric of the shaft axis and which has one end anchored to the shaft and the other to the sleeve, a barrel which is secured to the shaft and on which the spring coils, and a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated.

10. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon, a

yielding driving connection between the shaft and sleeve comprising a coiled spring which is concentric of the shaft axis and which has one end anchored to the shaft and the other to the sleeve, a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated, said sleeve having a loose fit upon the shaft and capable of a slight longitudinal movement thereon against the tension of the spring.

11. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon and adapted to be driven thereby, and a pinion which is screw-threaded upon the sleeve and adapted to travel longitudinally thereon, said shaft and sleeve having driving connections between them.

12. A starter for engines comprising in combination with a motor-driven shaft, a screw-threaded sleeve mounted thereon, a spring connected respectively to the shaft and sleeve, and a pinion screw-threaded upon the sleeve and adapted to travel longitudinally thereon.

13. A starter for engines comprising in combination with a rotatable shaft supported at its inner end, and a driving member which is mounted on the shaft for both longitudinal movement thereof and rotary movement therewith, said member being normally toward the outer end of the shaft but movable inwardly when the shaft is rotated.

14. A starter for engines comprising in combination with a motor driven shaft, a screw-threaded sleeve mounted thereon, a yielding driving connection between the shaft and sleeve comprising a coiled spring which is concentric of the shaft axis and which has one end anchored to the shaft and the other to the sleeve, a barrel which is secured to the shaft and on which the spring coils, and a driving member which is screw-threaded upon said sleeve and adapted to travel longitudinally thereon when the shaft and its sleeve are rotated, said barrel and sleeve being in alinement but separated a slight distance to permit the sleeve to move longitudinally on the shaft against the tension of the spring.

15. A starter for engines comprising in combination with a motor-driven screw-threaded shaft supported at its inner end, and a driving member which is screw-threaded upon said shaft and adapted to travel longitudinally thereon when the shaft is rotated, said driving member being normally toward the outer end of the shaft but movable inwardly to the supported end thereof.

16. A starter for engines comprising in combination with a motor-driven shaft sup-

ported at its inner end, a screw-threaded sleeve mounted thereon, and a driving member which is screw-threaded upon the sleeve and adapted to travel longitudinally thereon into engagement with said driven member when the sleeve is rotated, said driving member being normally toward the outer end of the sleeve but movable inwardly to the opposite end and adjacent the supported portion of said shaft.

17. A starter for engines comprising in combination with a rotatable driving shaft, a sleeve mounted thereon and adapted to be driven thereby, and an engine driving member which is mounted upon the sleeve for both longitudinal movement thereof and rotary movement therewith, said shaft and sleeve having a driving connection between them.

18. A starter for engines comprising in combination with a rotatable driving shaft, a sleeve surrounding and supported by the shaft and adapted to be driven thereby, and an engine driving member which is mounted upon the sleeve for both longitudinal movement thereof and rotary movement there-

with, said shaft and sleeve having a driving connection between them.

19. A starter for engines comprising in combination with a rotatable driving shaft, a sleeve mounted thereon and adapted to be driven thereby, and an engine driving member which is mounted upon the sleeve for both longitudinal movement thereof and rotary movement therewith, said shaft and sleeve having a yielding driving connection between them.

20. A starter for engines comprising in combination with a rotatable driving shaft, a sleeve mounted thereon and driven thereby, said sleeve having a rotary and a longitudinal movement relative thereto, and an engine driving member which is mounted upon the sleeve for both longitudinal movement thereof and rotary movement therewith, said shaft and sleeve having a driving connection between them.

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Witnesses:

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