

Oct. 18, 1932.

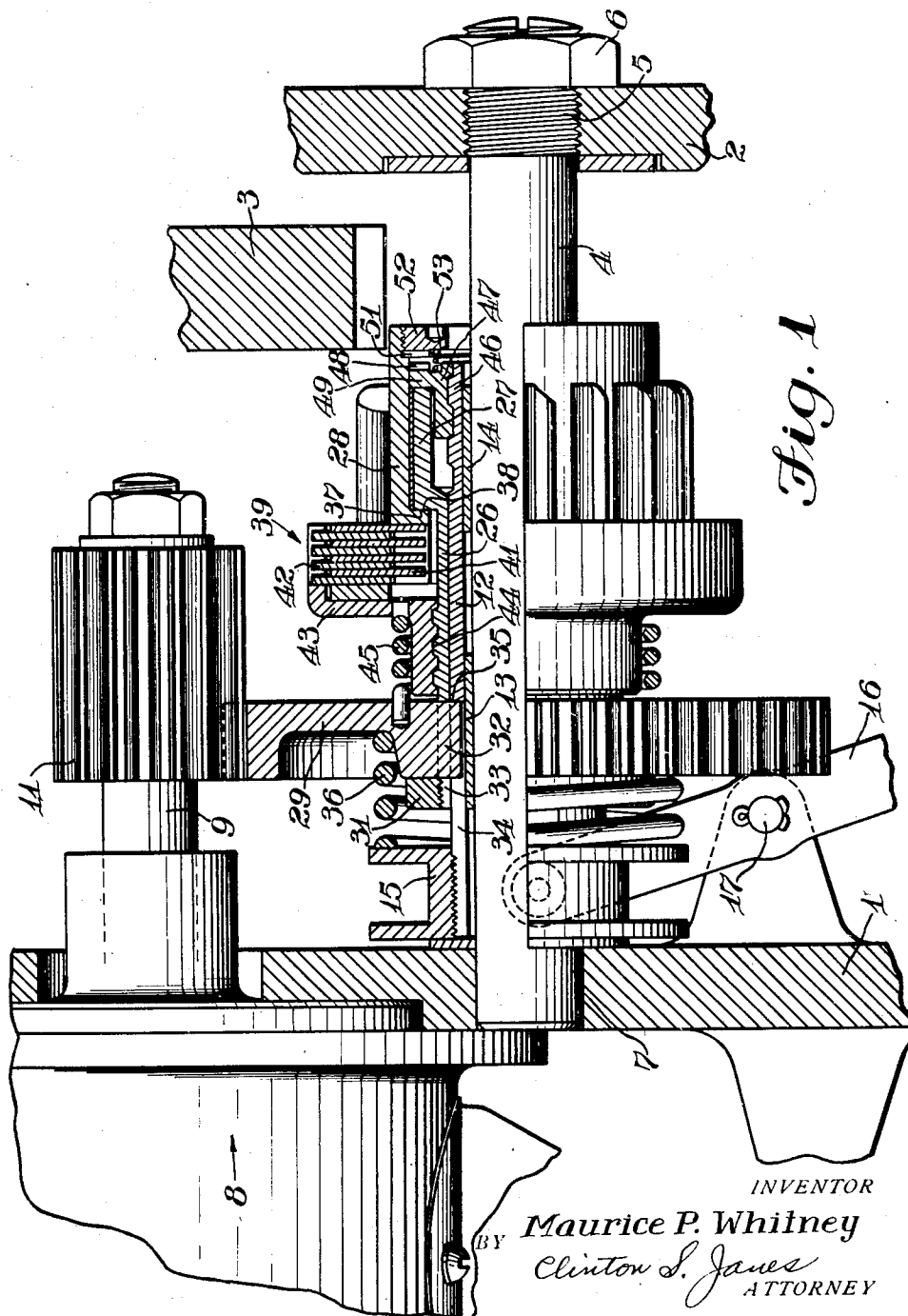
M. P. WHITNEY

1,883,432

STARTING MECHANISM

Filed July 31, 1931

3 Sheets-Sheet 1



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STARTING MECHANISM

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3 Sheets-Sheet 2

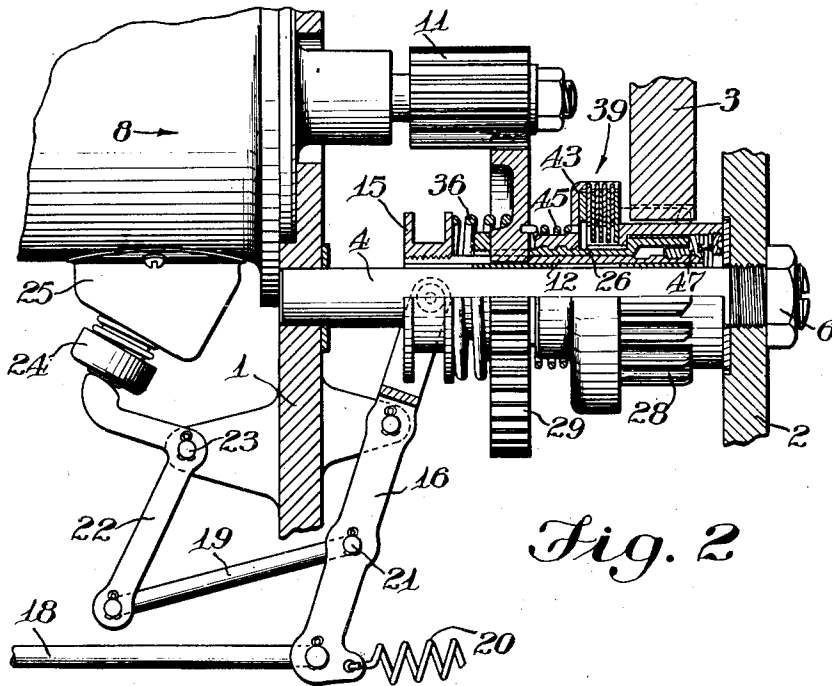


Fig. 2

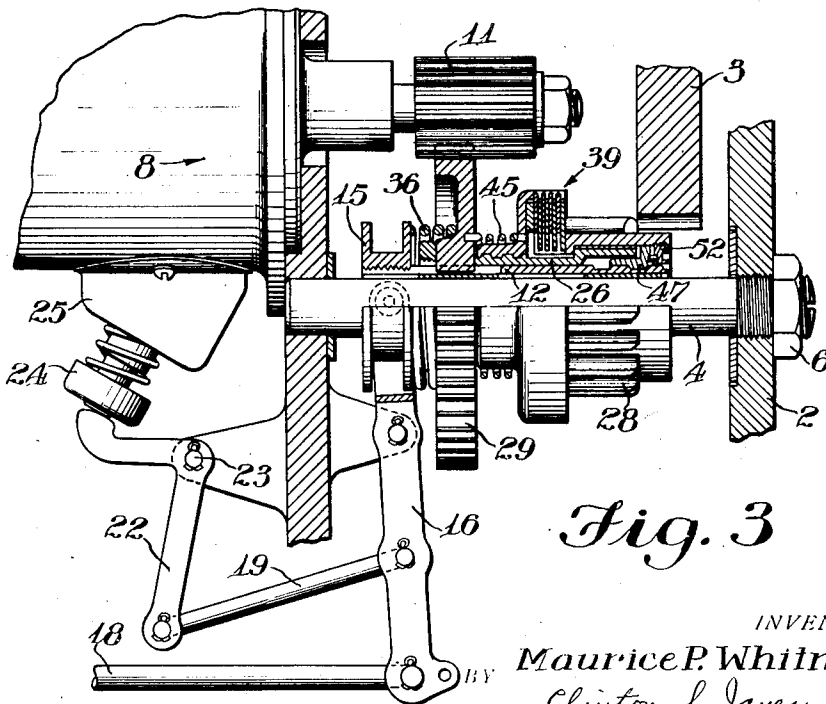


Fig. 3

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3 Sheets-Sheet 3

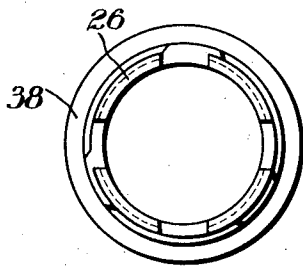


Fig. 5

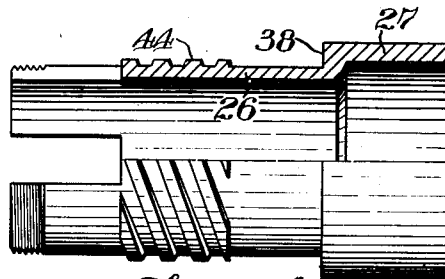


Fig. 4

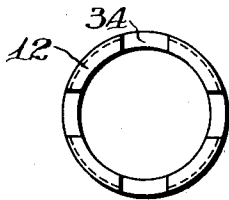


Fig. 7

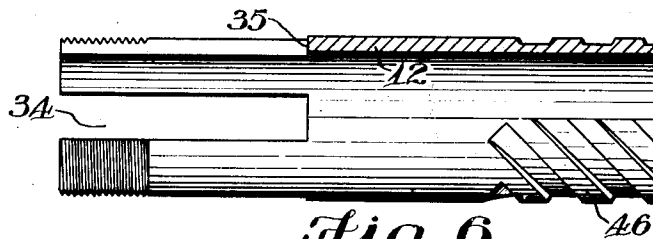


Fig. 6

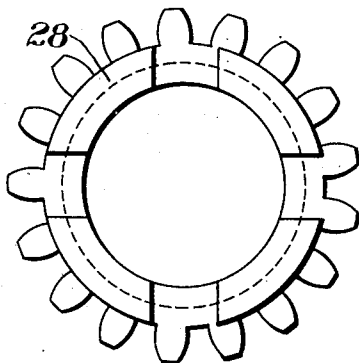


Fig. 9

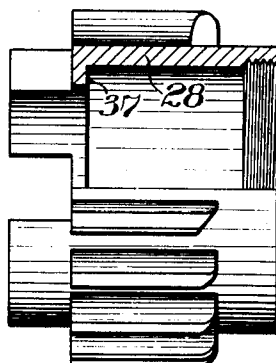


Fig. 8

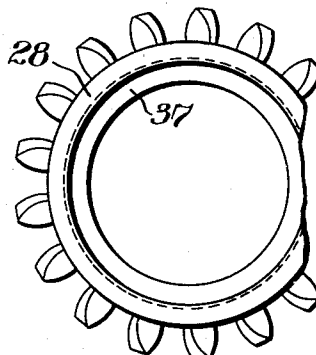


Fig. 10

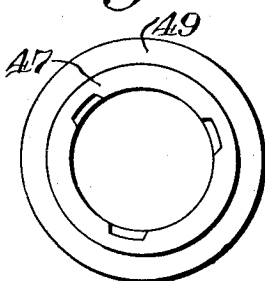


Fig. 12

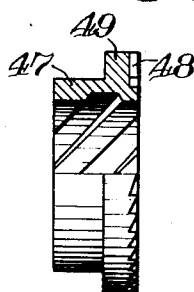


Fig. 11



Fig. 14



Fig. 13

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STARTING MECHANISM

Application filed July 31, 1931. Serial No. 554,245.

This invention relates to starting mechanism for internal combustion engines and more particularly to an engine starter of the manual shift type in which a motor driven pinion is moved manually into mesh with a member such as a flywheel gear of an engine to be started, and thereafter, the motor is energized to crank the engine.

In devices of this character it is desirable that the parts should engage readily without undue shock, that means be provided for indexing the pinion in case the teeth of the pinion should abut end to end with the teeth of the flywheel gear, and that the rotating connections be automatically interrupted to overrun freely when the engine starts.

It is an object of the present invention to provide a novel starter gearing of the manual shift type which is adapted to operate in an improved and efficient manner.

It is another object of the invention to provide such a device which includes positive automatic means for indexing the driving pinion, in case of tooth abutment.

It is a further object of the invention to provide such a device in which the indexing means are independent and outside the line of transmission of torque for cranking positions.

A further object is to provide such a device in which the driving and indexing means are arranged to be connected to opposite ends of the driving pinion.

It is another object to provide such a device in which the driving and indexing means are both automatically disconnected from the pinion when 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 drawings in which:—

Fig. 1 is a side elevation partly in section of a starter gearing embodying a preferred form of my invention showing the parts in their normal or idle position;

Fig. 2 is a similar view on a reduced scale showing the parts in driving position;

Fig. 3 is a view similar to Fig. 2 showing the parts in the positions assumed in case of

tooth abutment between the driving pinion and engine gear;

Fig. 4 is a side view partly in section of the power shaft;

Fig. 5 is an end view thereof;

Fig. 6 is a side elevation partly in section of the shifter sleeve;

Fig. 7 is an end view thereof;

Fig. 8 is a side view partly in section of the driving pinion;

Fig. 9 is an end view of the same; from the left of Fig. 8;

Fig. 10 is an end view of the same from the right of Fig. 8;

Fig. 11 is a side elevation partly in section of the indexing nut and ratchet member;

Fig. 12 is an end view of the same;

Fig. 13 is a side elevation partly in section of the cooperating ratchet collar; and

Fig. 14 is a side view of the spring normally separating the ratchet members.

Referring first to Fig. 1 of the drawings, there is illustrated a frame 1 including an outboard support 2 arranged adjacent a member 3 such as a flywheel gear of the engine to be started, and forming an outboard support for a smooth arbor 4 suitably fixed as by means of a threaded portion 5 and a nut 6 in said support, and seating at its inner end in an opening 7 in the frame 1. A starting motor 8 is suitably mounted in the frame 1 with its armature shaft 9 carrying a pinion 11 in spaced parallel relation with the arbor 4.

A shifter sleeve 12 is slidably journaled on the arbor 4 as by means of bearings 13 and 14 and is provided at its inner end with a shift collar 15 arranged to be engaged by a shifting yoke 16 pivoted at 17 to the frame 1 and adapted to be actuated by a manually operated link 18 (Figs. 2 and 3). A link 19 is pivoted at 21 to an intermediate point of the shift yoke 16 and is connected to a bell crank lever 22 pivoted at 23 to the frame 1 and arranged to depress the button 24 of the starter switch 25 when the shifter sleeve 12 approaches the limit of its outward motion. A spring 20 is preferably provided for returning the parts to normal position.

A power member in the form of a shaft 26 is loosely mounted on the sleeve 12 and is pro-

vided at its outer end with an enlarged portion 27 on which is journaled a driving member in the form of a pinion 28. A gear 29 is mounted on the inner end of power shaft 26, being retained thereon by suitable means such as a stop collar 31, and keyed thereto by means of lugs 32 which extend inwardly through slots 33 in said shaft. The sleeve 12 is provided adjacent its inner end with elongated slots 34 adapted to receive the inner ends of lugs 32 whereby the sleeve and shaft are connected to be rotated in unison by the gear 29. The sleeve 12 is normally maintained with the shoulders 35 constituting the outer ends of slots 34 in engagement with the lugs 32 of gear 29, by means such as a spring 36 which is adapted to yield and allow outward longitudinal motion of the sleeve 12 independent of the shaft 26. Gear 29 is arranged to be driven from pinion 11, said pinion being elongated sufficiently to make driving connection with said gear in all operative positions of the gear.

The pinion 28 is provided with an inwardly extending portion 37 adapted to bear against the shoulder 38 formed by the enlarged portion 27 of shaft 26 whereby the pinion is retained against outward motion with respect to said shaft. A one-way driving connection between the shaft 26 and pinion 28 is provided in the form of a friction clutch 39 comprising friction discs 41 and 42 splined respectively to the inner end of the pinion 28 and to a nut member 43 mounted on and cooperating with an intermediate threaded portion 44 of said shaft. The clutch discs 41 and 42 are normally maintained under a light pressure by a yielding means such as a torsion spring 45 connected at it ends to the nut 43 and gear 29 and tending to rotate the nut 43 in a direction to close the clutch 39. The pitch of the threads 44 is such that torque transmitted from the shaft 26 to the pinion 28 tightens the clutch 39 to form a driving connection therebetween, whereas overrunning of the pinion causes the nut 43 to back off and free the pinion from the shaft 26.

The outer end of the shifter sleeve 12 is provided with a coarse thread as indicated at 46, and an indexing member in the form of a nut 47 is threaded thereon. A one-way driving connection is provided between the indexing nut 47 and the outer end of the pinion 28 in the form of ratchet teeth 48 (Fig. 12) formed on a radial flange 49 of said nut, and cooperating ratchet teeth 51 on a collar 52 threaded into the outer end of pinion 28. The ratchet teeth are normally held out of engagement by yielding means such as a spring 53 interposed between the nut and collar.

The nut member 47 is arranged to extend within the enlarged portion 27 of shaft 26, with the flange 49 bearing against the outer end of said enlarged portion under the in-

fluence of spring 53. The nut is thus swivelled loosely to the shaft 26 while having a one-way driving connection to the pinion 28 which may be established by outward movement of said nut. The pitch of the threads 46 on the shifter sleeve 12 is such that outward motion of the sleeve through the power shaft 26, after establishing the ratchet connection 48, 51, causes the nut to rotate in a forward direction, this rotation being transmitted to the pinion through said ratchet to index the pinion in case of tooth abutment.

In operation, and starting with the parts in the positions shown in Fig. 1, manual operation of the shifter yoke 16 in a clockwise direction causes the shifter sleeve 12 and the entire assembly thereon to be moved outwardly until the pinion 28 comes into engagement with the engine member 3. Further movement of the yoke 16 causes closure of the starting switch 25 whereby motor 8 is actuated to rotate the power shaft 26 by means of pinion 11 and gear 29. Initial rotation of the power shaft causes the clutch nut 43 to move outwardly and compress the clutch 39, whereupon rotation is transmitted to pinion 28 to crank the engine (Fig. 2).

When the engine starts, the acceleration of the engine member 3 causes the pinion 28 to overrun, thus backing off the nut 43 whereby the pinion is allowed to rotate freely until the shift is moved to idle position by the operator.

In case, when the pinion 28 is moved into engagement with the engine member 3, the teeth of the pinion should abut end to end with the teeth of the engine gear as shown in Fig. 3, longitudinal motion of the pinion and the power shaft 26 is arrested. The shifter sleeve 12 however can move outward through the shaft 26 against the resistance of the spring 36 causing engagement of ratchet teeth 48, 51. Further motion of sleeve 12 through the nut 47 causes forward rotation of said nut which is transmitted through the ratchet 48, 51 to the outer end of pinion 28, causing indexing motion thereof until the pinion teeth align with the tooth spaces of the engine member. Spring 36 thereupon expands and moves the power shaft and its associated parts into driving position, the ratchet 48, 51 being first separated, the nut 47 being then pushed out and rotated back to its normal position on sleeve 12 by engagement of the end of shaft 26 against the flange 49. Closure of the starting switch then causes cranking to take place as usual.

Although but one form of the invention has been shown and described in detail, it will be understood that various other forms are possible and certain changes may be made in the proportions and arrangements of the parts without departing from the spirit of the in-

vention as defined in the claims appended hereto.

What is claimed is:—

1. In a manual shift for starter gearing, a longitudinally shiftable sleeve, a pinion rotatably mounted thereon and normally movable longitudinally therewith into engagement with a member of the engine to be started, means for rotating said pinion relatively to the sleeve by longitudinal movement of the sleeve, when the longitudinal motion of the pinion is arrested, and means independent of said sleeve to rotate the pinion to start the engine.

2. In a manual shift for starter gearing, a longitudinally shiftable sleeve, a pinion rotatably mounted thereon and normally movable longitudinally therewith into engagement with a member of the engine to be started, means including an inclined sliding connection and a one-way driving connection between the pinion and sleeve for rotating said pinion relatively to the sleeve by longitudinal movement of the sleeve when the longitudinal motion of the pinion is arrested and means independent of said sleeve to rotate the pinion to start the engine.

3. In a manual shift for starter gearing, a longitudinally shiftable sleeve, a pinion rotatably mounted thereon and normally movable longitudinally therewith into engagement with a member of the engine to be started, means including an inclined sliding connection and a one-way driving connection between the pinion and sleeve for rotating said pinion relatively to the sleeve by longitudinal movement of the sleeve when the longitudinal motion of the pinion is arrested, power means, and a one-way driving connection between the power means and the pinion.

4. In a manual shift for starter gearing, a longitudinally shiftable sleeve, a pinion rotatably mounted thereon and normally movable longitudinally therewith into engagement with a member of the engine to be started, means including an inclined sliding connection and a one-way driving connection between the pinion and sleeve for rotating said pinion relatively to the sleeve by longitudinal movement of the sleeve when the longitudinal motion of the pinion is arrested, power means, and a friction clutch connection between the power means and the pinion, said clutch connection being tightened automatically by the energization of the driving means.

5. A manual shift for starter gearing including a power member, a driving member swivelled thereon and having a one-way driving connection therewith, and indexing means for the driving member including a manually shiftable member slidably and non-rotatably connected to the power member, and connections between said shiftable mem-

ber and said driving member, whereby movement of the shifting member with respect to the power member causes indexing of the driving member.

6. A manual shift for starter gearing including a power member, a driving member swivelled thereon and having a one-way driving connection therewith, and indexing means for the driving member including a manually shiftable member slidably and non-rotatably connected to the power member, and connections between said shiftable member and said driving member including an inclined sliding connection and a one-way driving connection whereby movement of the shaft with respect to the power member causes indexing of the driving member, said one-way driving connection being arranged to allow the driving member to overrun when the engine starts.

7. A manual shift for starter gearing including a power member, a driving member swivelled thereon and having a one-way driving connection therewith, and indexing means for the driving member including a manually shiftable member splined within the power member, yielding means for transmitting longitudinal movement of the shiftable member to the power member, and means connecting the shiftable member to the driving member arranged to rotate the driving member in case its longitudinal motion with the power member is arrested.

8. In a manual shift for starter gearing, a pinion, means to shift said pinion into and out of engagement with an engine gear, driving means connected to one end of said pinion, and indexing means connected to the opposite end thereof.

9. In a manual shift for starter gearing, a pinion, manual means for shifting the pinion into and out of mesh with an engine gear, power driving means connected to one end of said pinion and means connected to the opposite end thereof operable by said shifting means to index the pinion in case of tooth abutment.

10. In a manual shift for starter gearing, a pinion, manual means for shifting the pinion into and out of mesh with an engine gear, power driving means connected to one end of said pinion and means connected to the opposite end thereof operable by said shifting means to index the pinion in case of tooth abutment, both said connections being arranged to overrun when the engine starts.

11. In an engine starter, a fixed arbor, a hollow sleeve slidably journaled thereon, a power member mounted on said sleeve, a driving member journaled on said power member, means for rotating the driving member from the power member, and independent means for rotating the driving member from the sleeve.

12. In an engine starter, a fixed arbor, a hollow sleeve slidably journaled thereon, a power shaft mounted on said sleeve, a driving member journaled on said power shaft, means connected to one end of the driving member for rotating the same from the power shaft and independent means connected to the opposite end of the driving member for rotating the same.
13. In an engine starter, a power shaft, a driving member journaled thereon and connected at one end to be rotated thereby, a shifting sleeve slidable within the power shaft, and connections between the shifting sleeve and the other end of the driving member for indexing the driving member.
14. In an engine starter, a power shaft, a driving member journaled thereon and connected at one end to be rotated thereby, a shifting sleeve slidable within the power shaft, and connections between the shifting sleeve and the other end of the driving member whereby longitudinal movement of said sleeve within the power shaft causes indexing of the pinion.
15. In an engine starter, a driving member, means including a shifting member for moving said driving member into and out of mesh with a member of an engine to be started, means for rotating said driving member including a power member splined on said shifting member, and means whereby relative longitudinal movement of the shifting member and power member causes rotation of the driving member.

In testimony whereof I have signed this specification.

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