June 28, 1927. 1,633,862

S. L. KELLY ET AL

ENGINE STARTER

Filed Aug. 1, 1925 2 Sheets-Sheet 1

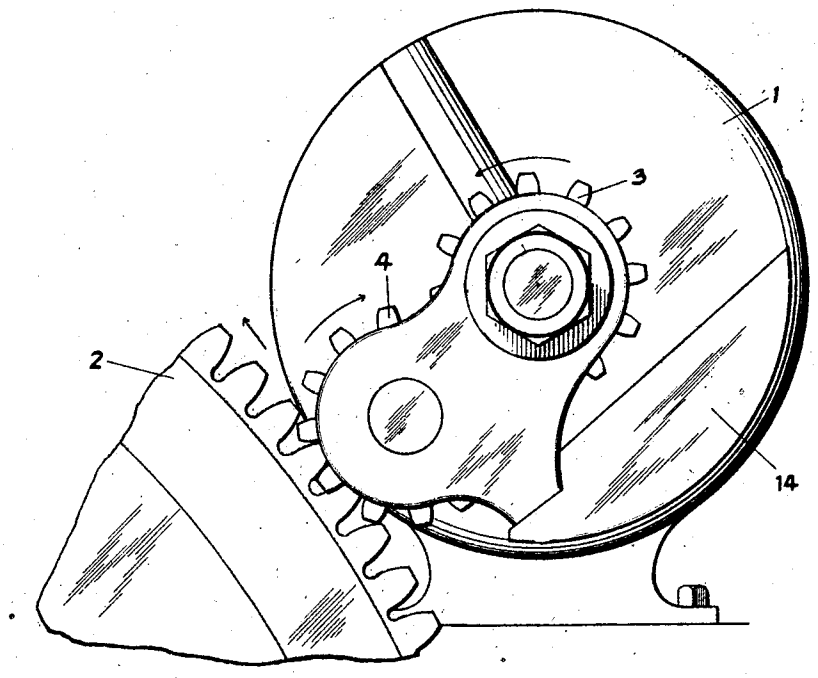


Fig 1

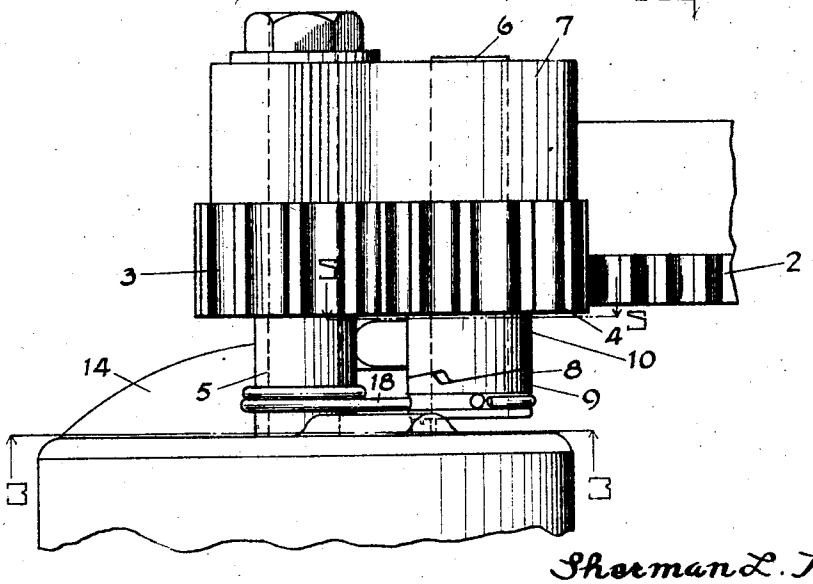


Fig 2

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ENGINE STARTER

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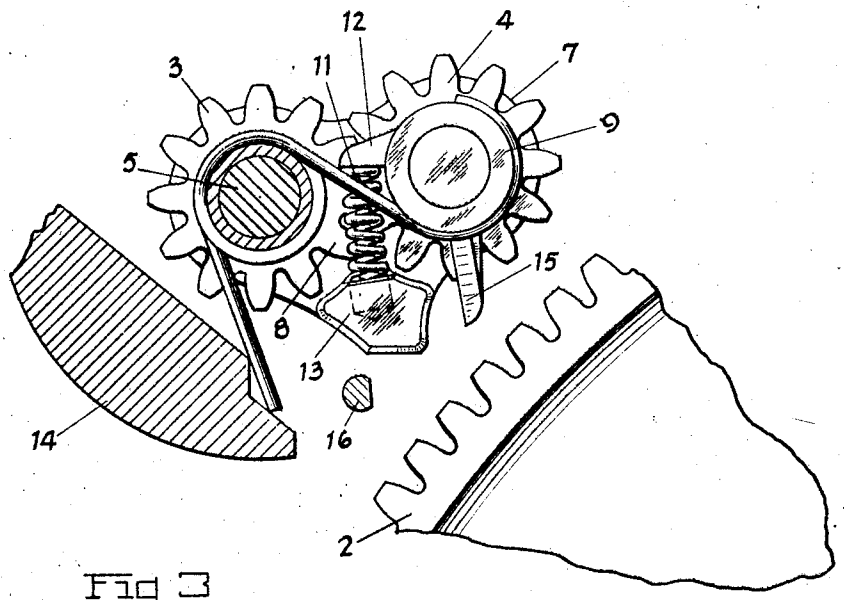


Fig 3

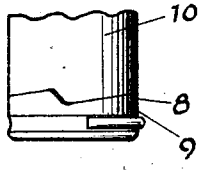


Fig 4

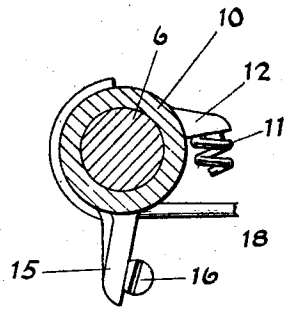


Fig 5

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UNITED STATES PATENT OFFICE.

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ENGINE STARTER.

Application filed August 1, 1925. Serial No. 47,478.

Our invention provides an efficient, durable engine starter having means for automatically connecting an electric motor to the shaft of an internal combustion engine in a manner that will prevent clashing of gears and for automatically disconnecting the motor from the shaft when the engine acquires speed greater than that produced by the electric motor, that is, when the engine starts. The invention has particularly for its object to eliminate all means that depends on the inertia of a gear or other object to rotation, or other movement for making connection between the starter and the engine and provides a positive means for bringing about the connection and yet without clash of gears. It thus avoids the necessity of using longitudinally movable gear wheels as commonly done in connection with automobile engines for starting the engine and which depend upon their inertia to rotation to produce a longitudinal movement for establishing the required connection between the starter and the engine and eliminates the complicated mechanism required to secure releasement of the connection through the return longitudinal movements of the gear wheels.

Our invention may be used for establishing connection between driving and driven members in mechanisms of different forms and for different purposes, but it finds its particular advantage when used for starting internal combustion engines of automobiles. The invention may be contained in constructions of different forms and to illustrate a practical application and present a description of its operation, we have selected a starter containing the invention as an example of different structures that embody the invention and shall describe the starter hereinafter. The starter selected for purposes of illustration is shown in the accompanying drawings.

Figure 1 of the drawings illustrates an end view of the starter and shows a part of a gear wheel of the type commonly used in connection with automobile engines and which is connected to the shaft of the engine. The starter is shown as connected to the gear wheel. Fig. 2 illustrates a top view of parts of the starter and the gear wheel shown in Fig. 1. Fig. 3 illustrates a view of a section taken on the plane of the line 3—3 indicated in Fig. 2. Fig. 4 illustrates a top view of a clutch member when the clutch is closed. Fig. 5 illustrates a view of a section taken on the plane of the line 5—5 indicated in Fig. 4, and illustrates the means for opening the clutch to release and permit rotation of one of the pinions of the starter.

The engine starter shown in the drawings is supported beside the engine on a suitable table or bracket that is secured to or forms a part of the chassis of the automobile. An electric motor 1 of the type commonly used in starters, may be secured in position by any suitable means so that the axis of its shaft is parallel to the axis of the crank shaft of the engine and in such a position so that it may be connected to the crank shaft of the engine through a suitable gear. Automobile engines are provided with the fly wheel to which is secured the ring gear 2 of which a part is shown in Figs. 1, 2, and 3 of the drawings. A pair of inter-meshing pinions 3 and 4 are supported on the shaft 5 of the electric motor 1 and have diameters such that when their axes lie in the plane of the axis of the crank shaft a driving connection will be made between the electric motor shaft and the engine crank shaft. The pinion 3 is keyed to the shaft 5 of the electric motor 1 while the pinion 4 acts as an idler between the pinion 3 and the ring gear 2. Looking towards the motor, the pinion 3, has a counter-clockwise movement. The pinion 4 has a clockwise movement which produces a counter-clockwise movement in the shaft of the engine when the connection has been established through the gear wheels.

The pinion 4 is normally disconnected from the ring gear 2 and the connection is automatically established, when the shaft 5 of the electric motor 1 is rotated. In order to automatically establish this connection the pinion 4 is supported on a shaft 6 that is secured in a block or arm 7. The block 7 is supported on the end of the shaft 5 in such a manner that the shaft 5 will rotate the block 7 except when the block 7 has been rotated so as to connect the engine crank shaft with the shaft 5 through the pinions 3 and 4 and the gear 2. The end of the shaft 6 is provided with a clutch 8 having the parts 9 and 10. The part 9 is secured to the end of the shaft 6 while the part 10 is movable on the shaft 6. The parts 9 and 10 have opposing cam shaped or inclined surfaces that tend to force the part 10 against the face of the pinion 4 or to release the pinion 4 according to the direction of rotation of the part 10

relative to the part 9. The clutch thus forms a means for causing frictional engagement between the pinion 4 and its support. The part 10 of the clutch is normally maintained in position to frictionally hold the pinion 4 by means of a spring 11 that is supported between a finger 12 that protrudes from the part 10 and a boss 13 that extends from the block 7 below the pinions 3 and 4. Thus when the shaft 5 is rotated the block 7 will be carried counter-clockwise downward so as to place the axes of the pinions 3 and 4 in the plane of the axis of the crank shaft of the engine which will occur when the block 7 strikes a protruding shelf 14 formed on the end of the frame of the motor 1. Ordinarily the block 7 will strike the shelf 14 with a considerable force which will jar the crank shaft of the engine loose in case any gummed oil should cause it to stick. This will reduce the force required to start the engine. As the block 7 strikes the shelf 14, a finger 15 that extends from the part 10 of the clutch, will strike a pin 16 that is secured to the end of the frame or casing of the electric motor 1. The pin 16 is located in the path of movement of the finger 15 and so as to cause the clutch part 10 to release its frictional engagement with the pinion 4 after the teeth of the pinion 4 mesh with the pinion of the ring gear 2. The pinion 3 will cause the pinion 4 to rotate clock-wise while the block 7 is moving counter-clockwise and thus the pinion 4 will mesh with the teeth of the ring gear 2 without the clashing of the teeth. The rotation of the pinion 3 will thus be communicated to the crank shaft through the idler 4 and the fly wheel of the engine.

Rotation of the crank shaft will, when the proper ignition conditions of the engine exist, cause the engine to operate as and in the manner well known in the art. When the driving pressure is released by the starting of the engine the spring 18 will raise the block 7 and carry the pinion 4 substantially out of mesh with the ring gear 2. If then the circuit through the motor is opened, the block 7 will be raised by the operation of the spring 18 which is pressed against the shaft 14 at one end and is coiled around the boss 19 on which the shaft 5 is located around the part 9 of the clutch 8 that is secured to the end of the bearing shaft 6. Thus the block 7 together with the pinion 4 is elastically raised so as to disconnect the pinion 4 entirely from the ring gear 2. At the same time that the block 7 is raised, the finger 15 is separated from the pin 16 and the clutch, by the operation of the spring 11 on the finger 12, causes the part 10 to frictionally engage the face of the pinion which places it in condition for causing the electric motor to be automatically connected with the engine upon the subsequent operation of the shaft of the motor.

We claim:

1. In an engine starter, a motor shaft, a pinion on the motor shaft, a member supported on the motor shaft and oscillatable about the axis of the motor shaft, a stub shaft secured to the member, an idler rotatably supported on the stub shaft and meshing with the pinion, means located on the stub shaft for locking the idler from rotation on the stub shaft and means for releasing the idler when it is carried into mesh with the gear wheel by the rotation of the pinion and the member.

2. In an engine starter, a motor shaft, a pinion on the motor shaft, an arm located on the motor shaft, a stub shaft connected to the arm, an idler pivotally supported on the stub shaft and meshing with the pinion, a clutch member rotatably supported on the stub shaft for locking the idler from rotation on the stub shaft and means for rotating the clutch member to release the idler when it is moved to mesh with the ring gear of the engine.

3. In an engine starter a motor shaft, a pinion connected to the motor shaft, an arm rotatably supported on the motor shaft, a stub shaft secured to the arm, an idler located on the stub shaft and meshing with the pinion, a spring pressed clutch member located on the stub shaft and carried by the arm, a stop for engaging the clutch member to release the idler and permit rotation of the idler on the stub shaft when the idler engages the ring gear of the engine.

4. In an engine starter, a motor shaft, a pinion connected to the motor shaft, an arm located on and rotatable relative to the motor shaft, a stub shaft carried by the arm, an idler located on the stub shaft and meshing with the pinion, a clutch member located on the stub shaft for frictionally engaging the pinion, a means for rotating the clutch member on the stub shaft to release the pinion when the arm has moved to cause the pinion to mesh with the ring gear.

5. In an engine starter, a motor shaft, a pinion secured to the motor shaft, a spring pressed arm located on the motor shaft, a stub shaft carried by the arm, an idler supported on the stub shaft and meshing with the pinion, a clutch member pivotally supported on the stub shaft, a spring for operating the clutch member to frictionally engage the idler to prevent rotation of the idler on the stub shaft, the said clutch member and spring being carried by the arm, a stop for engaging the clutch member to release the idler when the idler meshes the ring gear of the engine.

In testimony whereof we have hereunto signed our names to this specification.

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LAWRENCE E. KOOS.