June 3, 1930. H. SCHWARZE 1,761,540

ENGINE STARTING APPARATUS

Filed March 16, 1929 2 Sheets-Sheet 1

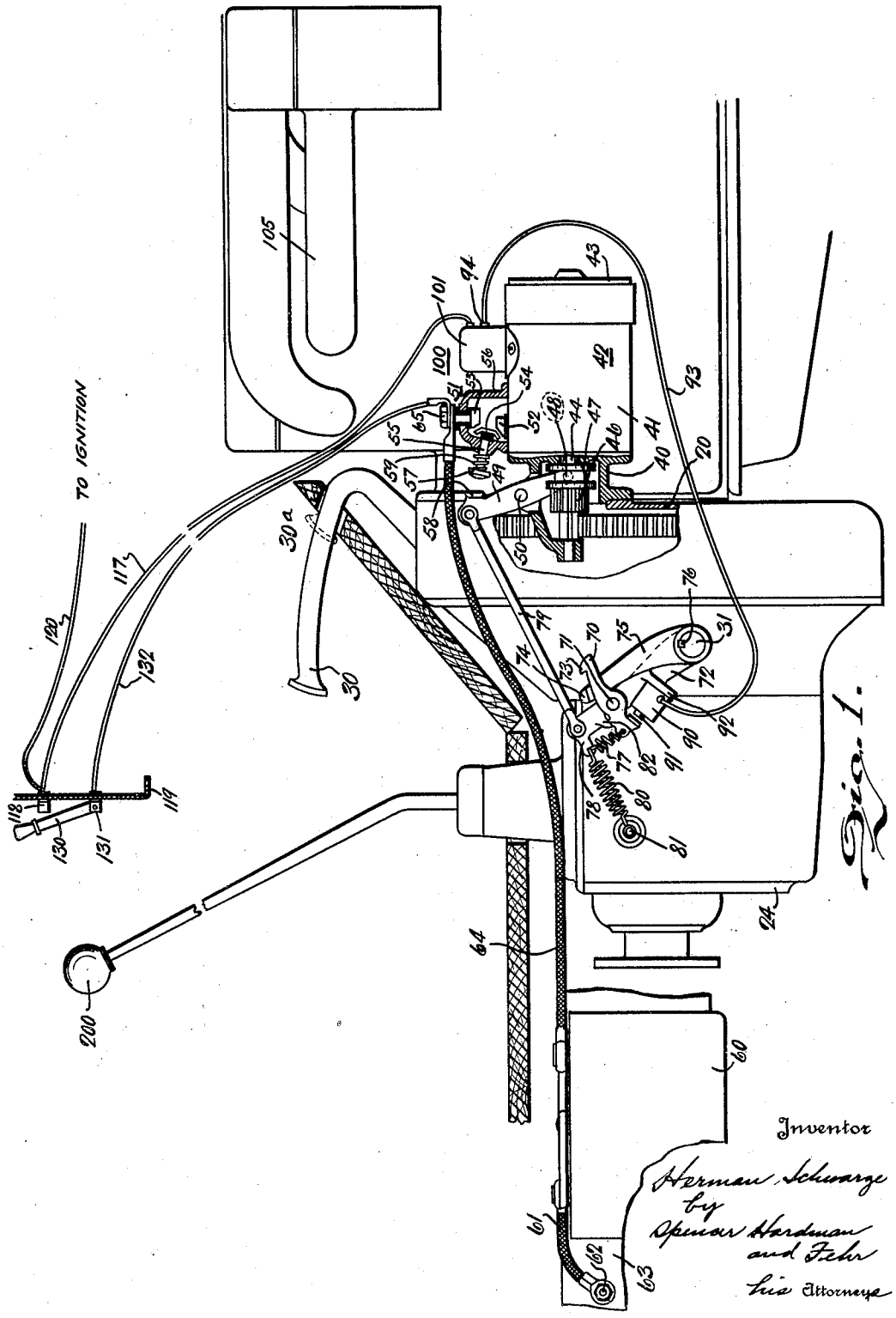


Fig. 1.

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ENGINE STARTING APPARATUS

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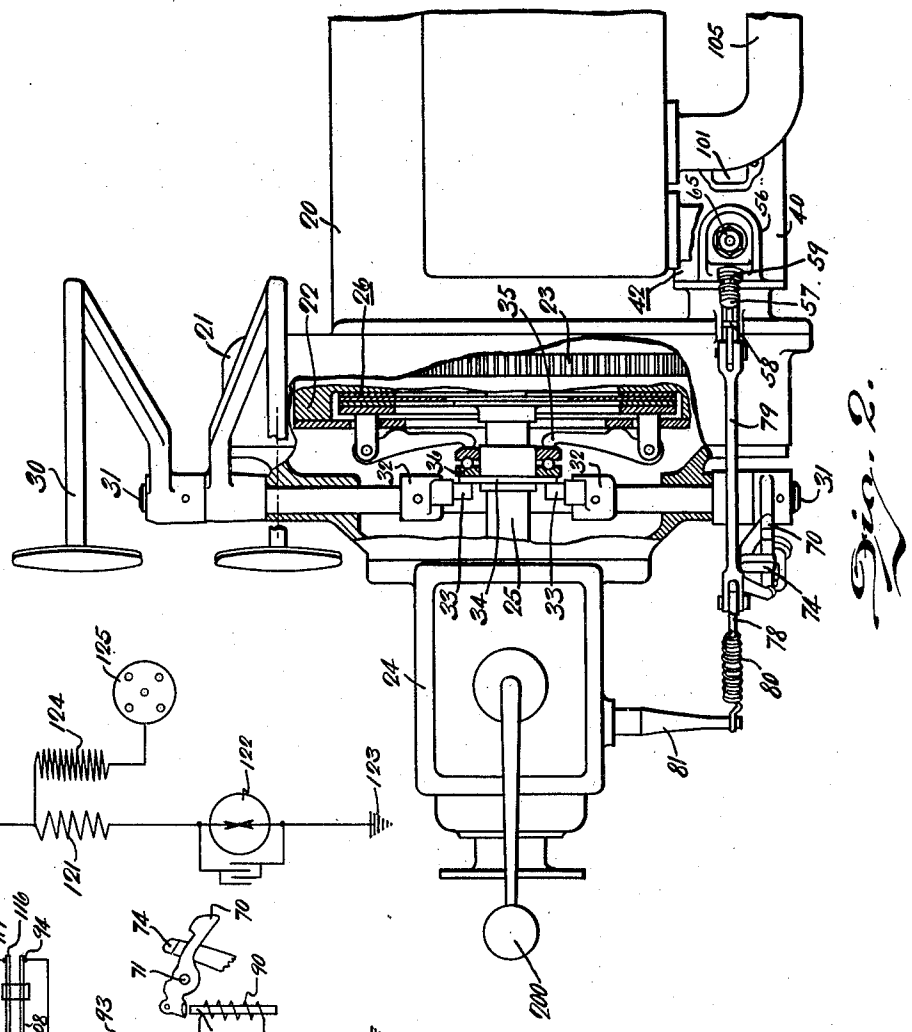


Fig. 2.

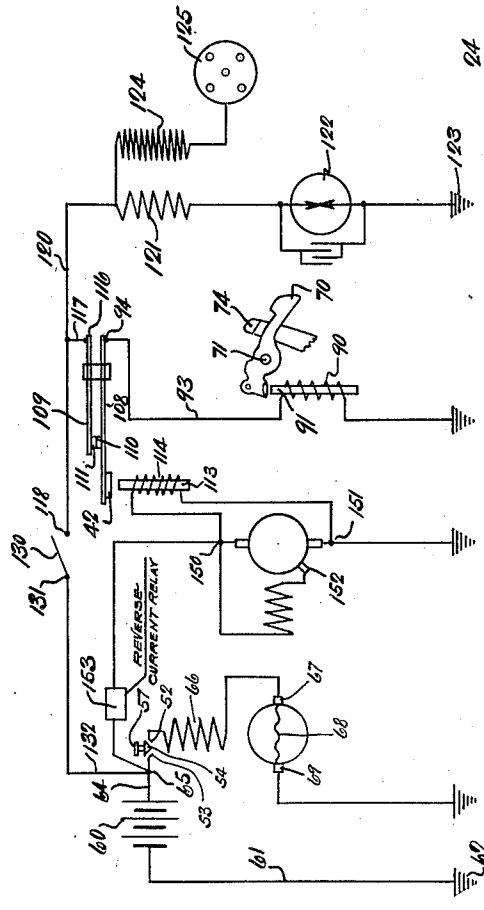


Fig. 3.

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UNITED STATES PATENT OFFICE

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ENGINE-STARTING APPARATUS

Application filed March 16, 1929. Serial No. 347,545.

This invention relates to starting apparatus for internal combustion engines, and particularly for engines which propel automotive vehicles.

The present invention includes among its objects the provision of improvements in engine starters of the type disclosed in the Patent No. 1,150,523, granted August 17, 1915, to Charles F. Kettering. This patent discloses, among other things, an engine starter which is caused to operate to crank the engine by pressing down the clutch pedal to disconnect the engine from the transmission. The clutch pedal is connected with the actuator of the starting apparatus through an electromagnetically controlled latch which, after the engine becomes self-operative, is automatically rendered ineffective to transmit motion from the clutch pedal to the actuator of the starting apparatus.

In order to accomplish these objects the present invention provides a starting motor, a starter actuator for causing the starting motor to operate to crank an engine, a manually operated movable member, such as the clutch pedal of the automobile, means for operatively connecting the starter actuator with the manually operated member, such as the electromagnetically operated latch which has been referred to, and a device which is automatically responsive to the running of the engine for rendering inoperative the connecting means. The disclosed form of the present invention includes a switch in circuit with the electromagnetic controller of the latch, said switch being operated by a relay magnet connected with the terminals of the automobile generator. When the engine becomes self-operative the switch opens the circuit of the electromagnetic controller in order that the latch will be rendered inoperative to connect the clutch pedal with the starter actuator while the engine is running.

Further objects and advantages of the present invention will be apparent from the following description reference being had to the accompanying drawings, wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic, fragmentary, side elevation of an engine and transmission assembly to which is applied an engine starter embodying the present invention, certain portions being shown in vertical, longitudinal section.

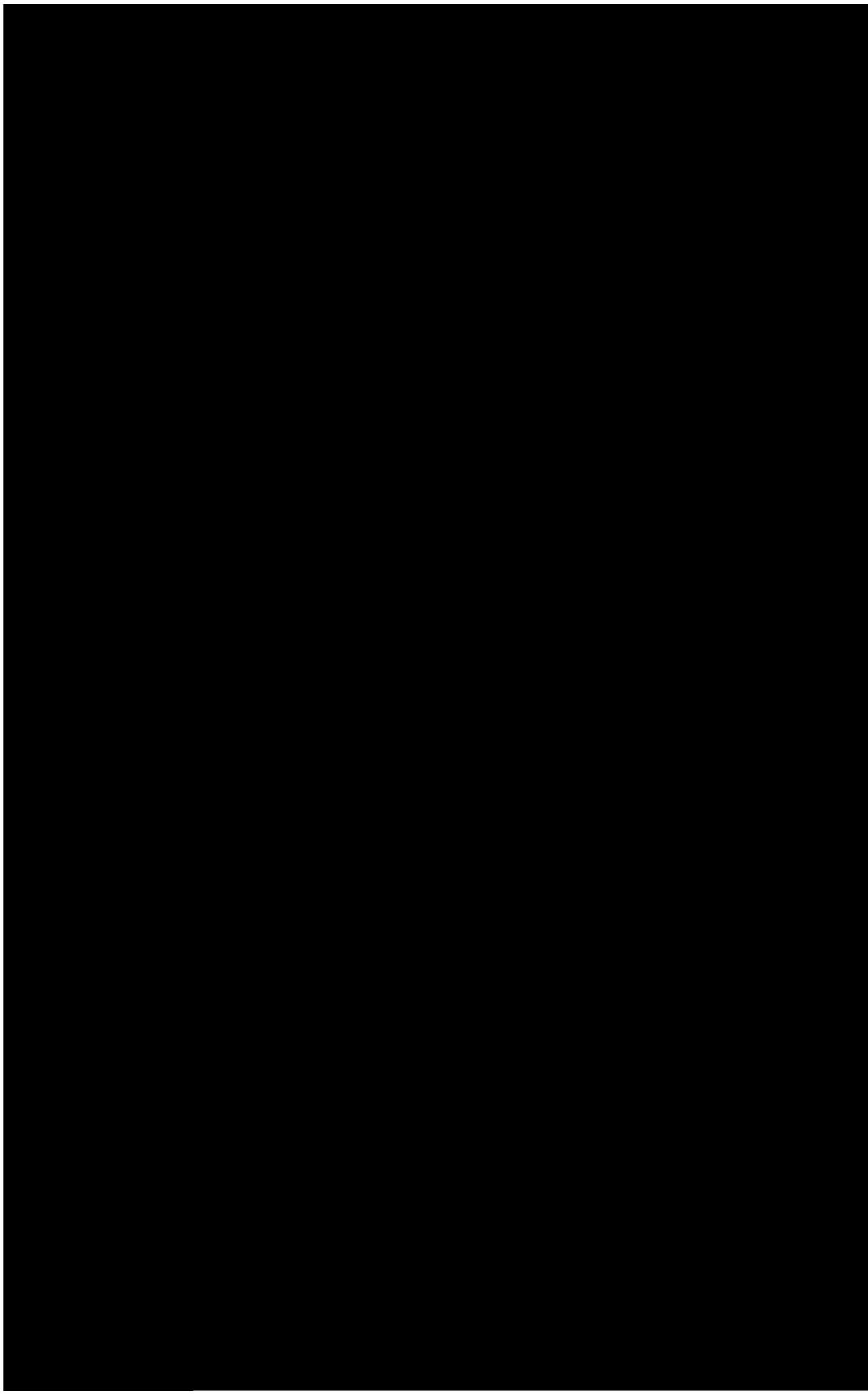
Fig. 2 is a plan view of parts shown in Fig. 1, and shows certain parts broken away and in horizontal, longitudinal section.

Fig. 3 is a wiring diagram showing the circuits of the present invention.

Referring to the drawings, 20 designates the frame of an internal combustion engine, said frame being attached to a flywheel housing 21 enclosing a flywheel 22 carrying a flywheel gear 23. The flywheel housing 21 is attached to a transmission gear housing 24. The housing 24 encloses transmission gears not shown, which are driven by a shaft 25 which is connectible with the flywheel 22 by a friction plate clutch 26. The clutch 26 is normally conditioned for transmitting motion from the flywheel 22 to the shaft 25, but may be controlled so that the flywheel 22 may be disconnected from the shaft 25 by moving a clutch pedal 30 from the position shown in full lines in Fig. 1 toward the position indicated at 30^a in broken lines. The pedal 30 is attached to a clutch operating rod 31 operatively connected with lever arms 32 carrying studs 33 located on opposite sides of the shaft 25 and adapted to bear against a collar 34 which is slidable along the shaft 25. Motion is transmitted from the collar 34 to a plurality of clutch throwout arms 35 through an anti-friction thrust bearing 36.

The flywheel housing 21 supports a starter gear housing 40 which supports the field frame 41 of an engine starting motor 42. The housing 40 and an end frame 43 attached to the field frame 41 provides bearings for a motor armature shaft 44 having longitudinal splines 45 along which a motor pinion 46 is slidable and is drivingly connected. The motor pinion 46 is operatively connected with a grooved collar 47, the groove of which receives a stud 48 carried by an actuator lever 49 pivoted at 50 upon the gear housing 40.

The circuit of the electric motor is con-



118. This will cause the ignition primary circuit to be connected with the battery 60 through the following connections: battery 60, wire 64, terminal 65, wire 132, contact 131, switch blade 130, contact 118, wire 120, ignition primary coil 121, timer 122, ground circuit 123, 62, and wire 61. When the ignition circuit is closed the electromagnet coil 90 will be connected with the battery by wire 117, switch contacts 110 and 111, wire 93. When the coil 90 is energized, the latch 70 will be moved electromagnetically in a counter-clockwise direction, thereby locating the hook 73 of the latch 70 in the path of movement of the lug 74 of lever 75. Thus, the clutch pedal lever 30 is operatively connected with the starting motor actuator 49. When the lever 30 is pushed downwardly, the lug 74 will move in a clockwise direction, as viewed in Fig. 1, and will engage the hook 73, thereby causing the levers 72 and 49 to move clockwise about their pivots in order to cause the motor pinion 46 to engage the engine gear 23 and to close the motor switch 51 as previously described. After the engine has been started, the operator will release the clutch pedal 30, thereby permitting the spring 80 to return the levers 72 and 49 to normal position. When the engine becomes self-operative, the voltage coil 114 will be energized sufficient to attract the armature 112 against the resistance afforded by the leaf spring blade 108, thereby separating the contact 110 from the contact 111. When this occurs, the circuit to the electromagnet coil 90 will be interrupted. Therefore, the clutch pedal 30 will be operatively disconnected from the starter actuator 49 because, when the coil 90 is de-energized the spring 77 will move the latch 70 against the stop 82, thereby moving the hook 73 away from the path of movement of the lug 74 of lever 75.

From the foregoing description of the construction and mode of operation of the present invention, it is apparent that certain advantages are afforded. The clutch pedal serves to operate the clutch and to control the starter, thereby dispensing with the use of a starter pedal or button extending above the floor-board. When the starter is operated by the clutch pedal, the clutch is thrown out so that while the engine is being cranked it is disconnected from the transmission gears. This is an advantage, especially in cold weather when the oil or grease surrounding the gears is relatively stiff at the start. After the engine has been started and before the pedal 30 is released, the starting motor actuator 49 may return to normal position to open the motor switch and to disconnect the pinion 46 from the engine gear 23. This may occur because the spring 77 can be made strong enough to retract the latch 70 from the lever lug 74 after the generator voltage switch 100 opens the circuit of the coil 90, although the pedal 30 may still be pressed downward. Before releasing the pedal 30 to connect the engine with the transmission, the gear shift lever 200 may be operated to select the proper gearing for starting the vehicle into motion. This feature is particularly desirable when driving in heavy traffic, making frequent stopping necessary. Instead of running the engine idle, the engine may be easily stopped when the vehicle stops by opening the ignition switch. While the vehicle is at rest, the driver generally moves the gear shift lever into neutral position. After receiving the traffic signal to proceed, the driver may quickly start by closing the ignition switch and pressing the clutch pedal, holding the latter down after the engine becomes self-operative, and then shifting the transmission gears into low speed.

The present application discloses a species of the invention described and claimed in my application, Serial Number 347,605, filed March 16, 1929.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Engine starting apparatus comprising, in combination with an engine, a starting motor, a starter actuator for causing the starting motor to operate to crank the engine, a manually operated movable member, means for operatively connecting the starter actuator with the manually operated member, an engine driven generator and a device responsive to generator voltage for rendering inoperative said connecting means.

2. Engine starting apparatus according to claim 1, in which the connecting means includes an electromagnetically operated instrumentality, and the device which renders the connecting means inoperative includes a relay switch responsive to generator voltage.

3. Engine starting apparatus comprising, in combination with an engine, a starting motor, a starter actuator for causing the starting motor to crank the engine, a manually operated movable member, engine ignition apparatus, means for operatively connecting the starter actuator with the manually operated member, control means for rendering the ignition apparatus operative and said connecting means operative, an engine driven generator, and a device responsive to generator voltage for rendering inoperative said connecting means.

4. Engine starting apparatus according to claim 3, in which the connecting means includes an electro-magnetically operated instrumentality, and the device which renders the connecting means inoperative includes a relay switch responsive to generator voltage.

5. Engine starting apparatus comprising in combination with an engine, a starting motor, a starter actuator for causing the starting motor to crank the engine, a manually operated, movable member, electrical ignition apparatus for the engine, an electromagnetically controlled means for operatively connecting the starter actuator with the manually operated member, a switch for rendering the ignition apparatus and electromagnetically controlled connecting means operative, an engine driven generator, and a relay switch responsive to generator voltage for rendering inoperative said connecting means.

6. Engine starting apparatus comprising, in combination with an engine, a starting motor, a starter actuator for causing the starting motor to crank the engine, a manually operated lever, a second lever fulcrumed concentrically with the first lever, a latch pivoted on one lever and engageable with the other lever, means connecting the second lever with the starter actuator, an electro-magnet for causing the latch to connect the levers, an engine driven generator, and a relay switch responsive to generator voltage for open-circuiting the electro-magnet.

In testimony whereof I hereto affix my signature.

HERMAN SCHWARZE.