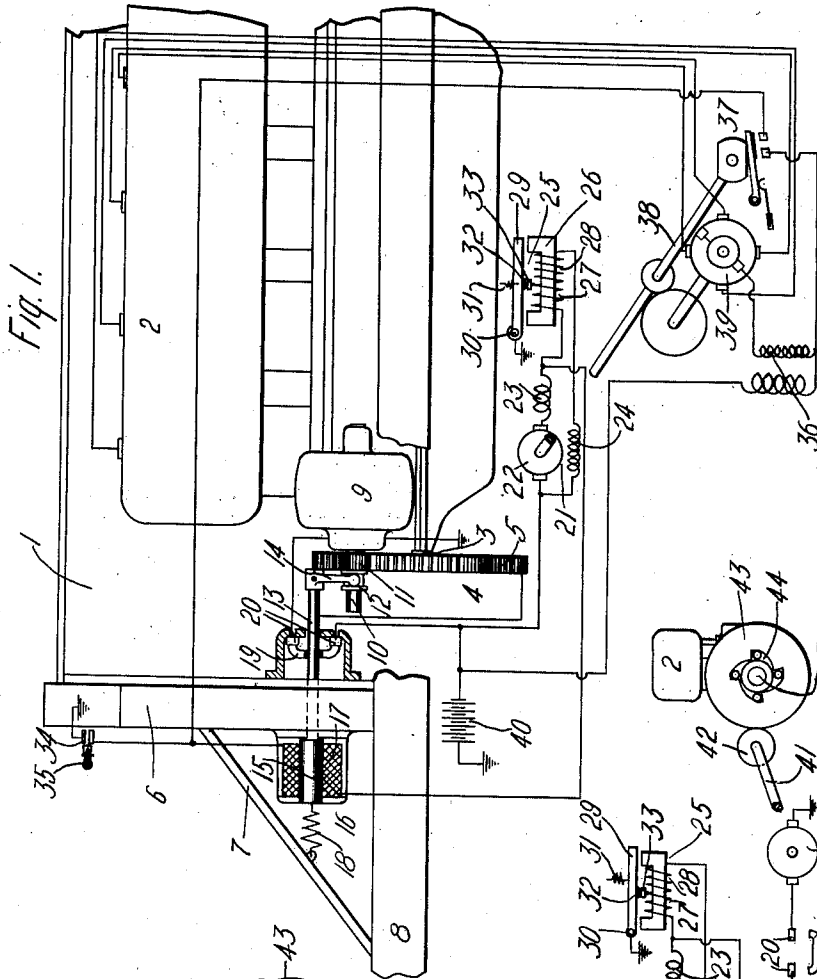
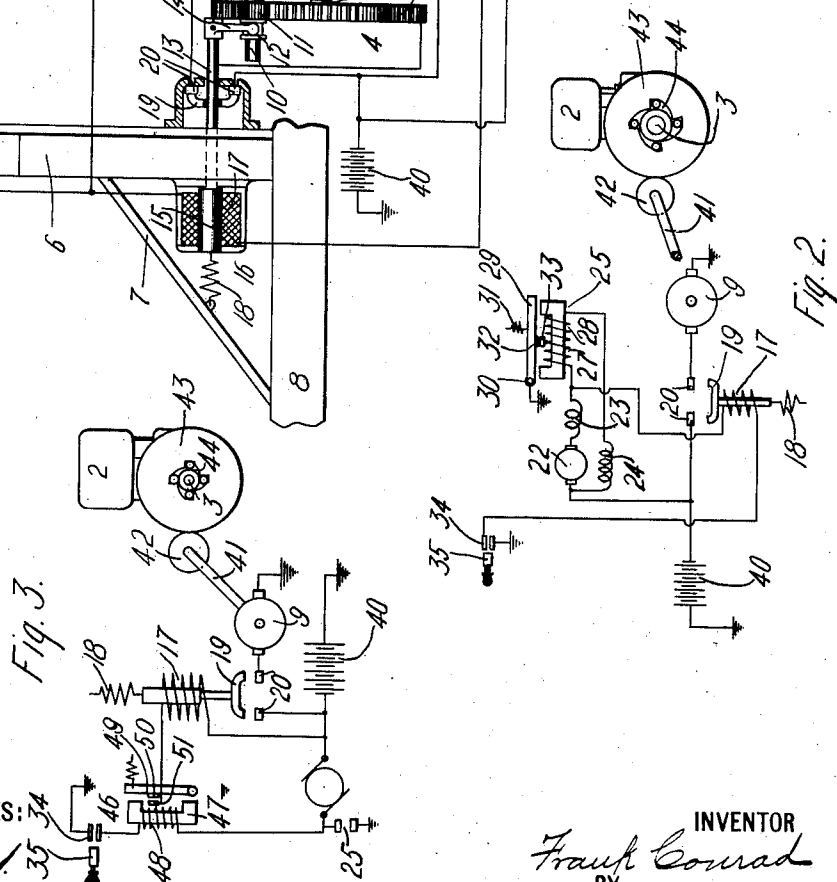
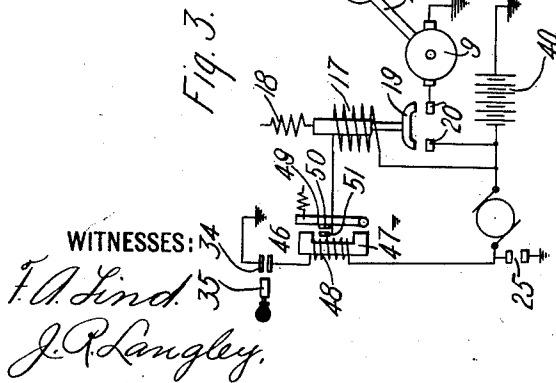


F. CONRAD.
ELECTRICAL SYSTEM.
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ELECTRICAL SYSTEM.

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To all whom it may concern:

Be it known that I, FRANK CONRAD, a citizen of the United States, and a resident of Swissvale, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electrical Systems, of which the following is a specification.

My invention relates to electrical systems such as are particularly adapted for use in connection with automobiles or other motor vehicles.

My invention has for one of its objects to provide a system which operates automatically to propel a motor vehicle in case the engine stops from any cause.

Another object of my invention is to provide a means whereby the circuit of a starting motor is controlled by the ignition switch.

In the operation of motor vehicles, it sometimes occurs that the operator, by mistake or inadvertence, stops or "stalls" the engine. It may happen that such an event occurs at such a time or under such circumstances that there is insufficient time to crank the engine in order to move the vehicle to a place of safety or to avoid a congestion of traffic. For example, in case the engine should stop when the engine is on a railway crossing in front of an approaching train, it is highly important that the vehicle should be immediately moved out of danger.

It is customary, in the ordinary operation of an automobile, to remove the switch plug when the machine is left unattended, and thereby prevent unauthorized persons from starting the engine, the ignition circuit being permanently opened. It is possible, when a starting motor is employed, for the vehicle to be removed notwithstanding this precaution, by anyone accustomed to the operation of the starting device. I have provided means whereby the starting motor cannot be operated when the switch plug is removed.

I have provided a system which comprises a starting motor, the circuit of which is controlled by an automatic switch and by the plug switch of the ignition system. The automatic switch is controlled by the engine speed by means of the voltage values of a generator which is connected to the engine

shaft. When the engine stops, the motor automatically propels the vehicle or starts the engine.

In the accompanying drawings, Figure 1 is a side view in elevation of a portion of an automobile with my invention applied thereto, the electrical circuits and certain of the apparatus being shown diagrammatically. Fig. 2 is a diagrammatic view of circuits and apparatus embodying a modification of my invention. Fig. 3 is a view, similar to Fig. 2, of a second modification.

Referring particularly to Fig. 1, an automobile 1 comprises the usual gas engine 2 having a shaft 3 and a fly wheel 4 that is provided with gear teeth 5 upon its outer periphery. The body portion of the vehicle comprises a dashboard 6, a footboard 7, and frame members 8. An electric motor 9, which is supported in any suitable manner, is provided with an extended armature shaft 10. A pinion 11, having an integral grooved collar 12, is slidably mounted on the armature shaft 10. The pinion is adapted to be shifted into and out of mesh with the fly wheel gear teeth 5 by means of a shift rod 13 and a yoke member 14 which engages the collar 12.

The shift rod 13 extends through a suitable opening in the dashboard 6 and is provided at its rear end with an enlarged portion 15 which serves as the movable core member of an electromagnet 16. The core member 15 is surrounded by an actuating winding 17, which when energized, shifts the rod 13 forwardly against the tension of a spring 18 that is connected to the rod 13 and to the footboard 7. A switch member 19 is carried by the rod 13 and is shifted into and out of engagement with two contact members 20 simultaneously with the shifting of the pinion 11 into and out of mesh with the fly wheel gear teeth 5.

A generator 21, the armature of which is indicated at 22, comprises a series field winding 23 and a shunt field winding 24. A cut out switch 25 comprises a core member 26 and coils 27 and 28 which are normally in series with the series field winding 23 and the shunt field winding 24, respectively. An armature 29 has a pivotal support at 30 and is normally held upward by a spring 31. A contact member 32, carried by the armature 29, coacts with a fixed con-

tact member 33 that is connected to a common point of the coils 27 and 28.

A switch 34, comprising a plug 35, and which is the usual plug switch for controlling the ignition systems of automobiles, is mounted on the dashboard 6 and is connected in series with the coil 17.

An ignition system which is employed in connection with the starting system, comprises an induction coil 36, an interrupter 37, mounted on the generator shaft 38 and a distributor 39 that is operatively connected to the generator shaft. A battery 40 supplies current to the ignition system when the generator voltage is low. I do not wish to limit myself to the details of the ignition system as the same form no part of my present invention.

It may be assumed that the various parts are stationary and in their respective inoperative positions. When it is desired to start the engine, the plug switch is inserted and a circuit is completed from the ungrounded side of the battery through the generator armature 22, series field winding 23, coil 17 and plug switch 34 to ground. The coil 17 is energized to effect the meshing of the pinion 11 with the fly wheel gear teeth 5 and to close the switch 19. The motor circuit, which is thereby completed, extends from the ungrounded side of the battery through the switch member 19, and contact members 20 and the motor armature to ground. The motor then operates to start the engine.

As the engine speeds up, the generator is operated at an increasing speed, and its electromotive force increases and opposes the electromotive force of the battery. When a predetermined speed is reached, the coil 17 is sufficiently deenergized to permit the spring 18 to retract the shift rod 13 and thereby withdraw the pinion 11 from the fly wheel gear teeth 5 and, at the same time, to open the switch 19.

When the generator voltage has increased to a predetermined value, the coils 27 and 28 of the cut-out switch, which are wound to assist each other, are sufficiently energized to draw the armature 29 downwardly and thereby connect the negative terminal of the generator to ground. The connection extends through the series coil 27, contact members 32 and 33 and the armature 29. The coil 17 is short circuited when the armature 29 is in its lower position. The generator then charges the storage battery as long as the generator voltage exceeds that of the battery. Current is also supplied to the ignition system and may be utilized for lighting purposes, if desired.

When the generator voltage falls below that of the battery, current tends to flow in the reverse direction through the series coil 27 and causes a magnetizing force to oppose that of the coil 28. The armature 29 is then

drawn upwardly by the spring 31 to break the charging circuit of the generator and to remove the short circuit of the coil 17.

When the engine stops, from any cause except the removal of the switch plug 35, or the generator voltage decreases to such a value that the effective voltage of the battery is sufficient to energize the coil 17, the pinion 11 will again be meshed with the fly wheel gear teeth 5 and the motor circuit will be closed. The engine will be started again or, if the usual engine clutch, or transmission clutch, (not shown) be held in, the vehicle will be propelled by the motor 9 for a period limited only by the capacity of the storage battery or by the removal of the switch plug 35. The circuit comprising the coil 17 is broken by the removal of the switch plug 35, and the spring 18 retracts the rod 13 to disconnect the motor 9 from the engine shaft and to open the switch 19.

The removal of the plug 35, when the vehicle is not in use, will effectually prevent the use of the starting motor. In view of the fact that the starting motor operates substantially noiselessly, it is important that the unauthorized removal of the car by this means be prevented.

A modification of my invention is diagrammatically shown in Fig. 2, in which like numerals designate corresponding parts. The ignition system is omitted from this view as being unnecessary in view of its illustration in Fig. 1. This system differs from that of Fig. 1 in the means by which the motor is connected to the engine shaft. The motor armature shaft 41 is provided with a pinion 42 which meshes with a gear wheel 43. A roller clutch 44 connects the gear wheel 43 to the engine shaft 3.

The operation of the electrical circuits of the modified form of my invention is identical with that of Fig. 1. The clutch 44 allows the engine shaft 3 to overrun the gear wheel 43 when the engine is running. When the motor is operated to start the engine or is operated automatically when the engine stops, the clutch connects the gear wheel 43 to the engine shaft and the motor operates as above described to start the engine or to propel the vehicle.

The advantages of this modified form of my invention are that no meshing of gear wheels is required before the motor is operatively connected to the engine shaft and that the motor is disconnected from the engine shaft whenever the speed of the latter exceeds that of the former.

A second modification of my invention is shown in Fig. 3, in which like numerals designate corresponding parts. A relay switch 46, which controls the circuit of the coil 17, comprises a core member 47 which is surrounded by a coil 48, and an armature 49. The coil 48 is in series with the generator

armature 22 and the battery 40. The armature 49 carries a grounded contact member 50 which coacts with a stationary contact member 51 to open and close the circuit of the coil 17.

When the switch plug 35 is inserted, the coil 48 is energized to draw the armature 49 downwardly to engage the contact members 50 and 51. The coil 17 is thereby energized to close the motor circuit to start the engine in the manner above described in connection with Fig. 2. When the generator voltage reaches a predetermined value, the coil 48 is sufficiently deenergized to release the armature 49 which breaks the circuit of the coil 17. The spring 18 then withdraws the switch member 19 to break the motor circuit.

I claim as my invention:

1. The combination with an engine shaft, a motor normally disconnected therefrom, and means for operatively connecting said devices, of means operable at a predetermined speed of said shaft to effect the actuation of said motor and the operative connection of said motor to said shaft, and, at a second predetermined speed, to effect the disconnection of said motor from said shaft and to render said motor inactive, said means comprising an electromagnetically operable switch for controlling the circuit of said motor.

2. The combination with an engine shaft, an electric motor, and means for operatively connecting said devices, of a source of current at substantially constant voltage, and means for controlling the connection of said motor to said source, said means comprising said source, a source of electromotive force, the value of which varies in accordance with the speed of said engine shaft, and an electromagnetically operable switch that is controlled in accordance with the relative values of said electromotive forces.

3. The combination with a source of current, and an electric motor in circuit therewith, of a switch for controlling the motor circuit and comprising a coil in circuit with said source, and a generator in circuit with said coil and said source.

4. The combination with a source of current and an electric motor in circuit therewith, of means for controlling the operation of said motor, said means comprising a generator and a switch having a coil subject to the difference between the voltages of said source and said generator.

5. The combination with a source of current and an electric motor in circuit therewith, of an electromagnetic switch in circuit with said motor and said source, said switch comprising a coil in circuit with said source, and a generator so connected that its voltage opposes that of said source.

6. The combination with a source of current and an electric motor in circuit therewith, of a generator in circuit with said source, an electromagnetic switch for controlling the motor circuit and comprising a coil in circuit with said source and said generator.

7. The combination with an internal combustion engine and an ignition system comprising a plug switch, of an electric motor, an electromagnetically operable switch in circuit with said motor comprising a coil in circuit with said plug switch, and means for controlling the energizing of said coil in accordance with the speed of said engine.

8. The combination with an engine shaft, an electric motor that is disconnected from said engine shaft under normal operating conditions, and means for operatively connecting the same, of means for automatically effecting the operative connection of the motor to said engine shaft and actuating said motor when the speed of the engine shaft reaches a predetermined minimum and for rendering said motor inactive and effecting the disconnection of the motor from the engine shaft when the engine speed reaches a predetermined maximum.

In testimony whereof, I have hereunto subscribed my name this 2nd day of August, 1913.

FRANK CONRAD.

Witnesses:

WILLIAM M. BRADSHAW,
B. B. HINES.