

- [54] REMOTE CONTROL STARTING DEVICE
FOR INTERNAL COMBUSTION ENGINE**

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- [56]
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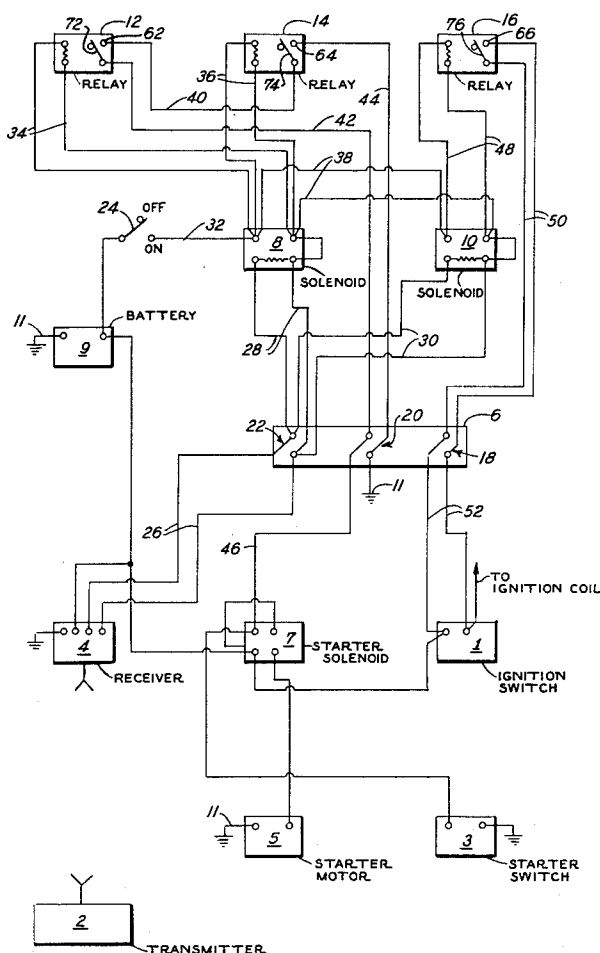
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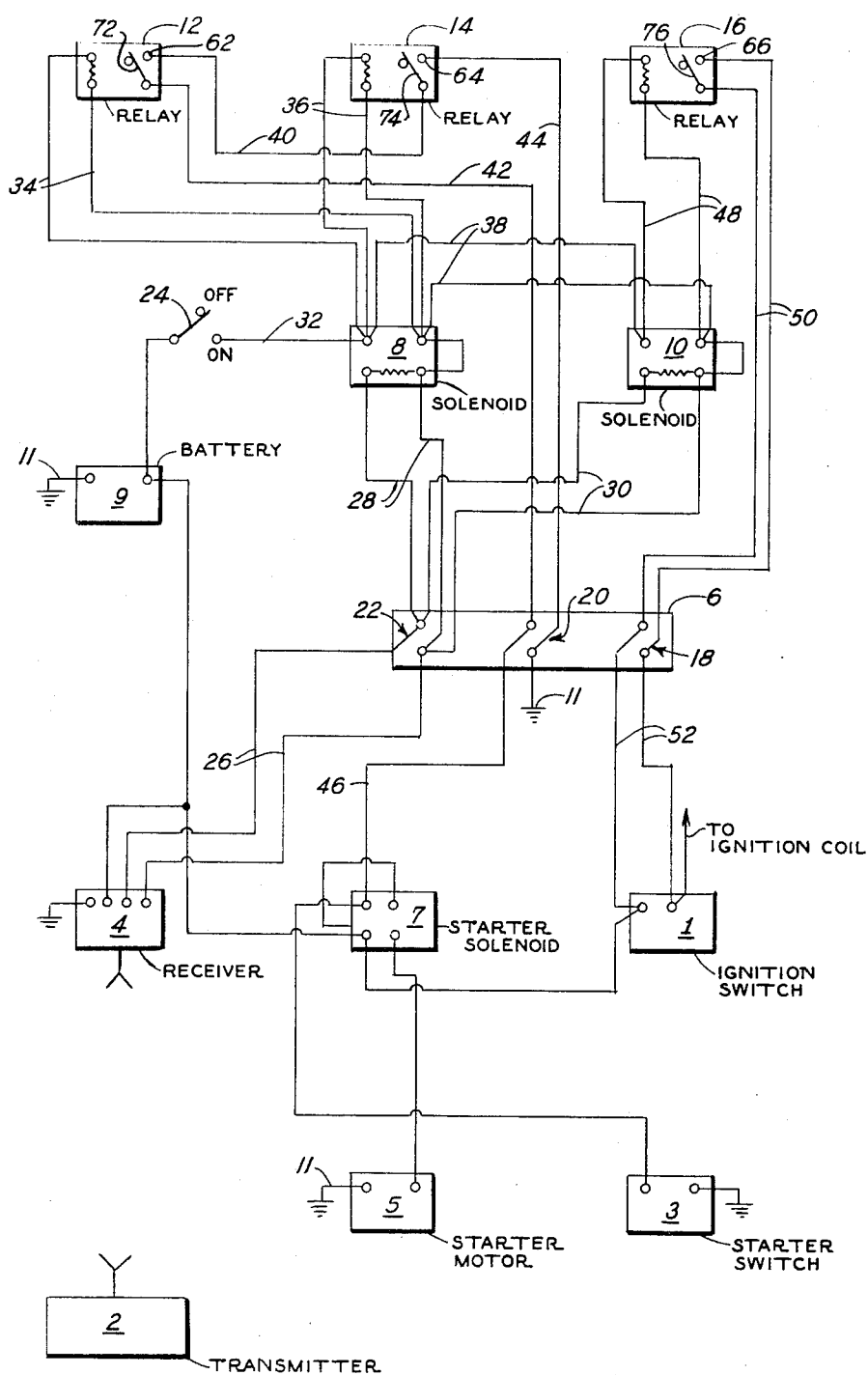
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[57] **ABSTRACT**

A radio frequency remote control starting system for internal combustion engines is disclosed. A radio receiver is located at the engine that is to be started remotely and preferably mounted on or near the engine. The output of this receiver is connected to a plurality of solenoids and relays which are utilized to start the engine in response to an output signal from the receiver. The relays and solenoids are connected in parallel with the conventional starting system of the engine. An "on-off" switch is provided in the battery circuit of the engine. When the switch is in the "on" position, the engine can be started either remotely or by the conventional starting system. However, when the switch is in the "off" position, the engine can be started only by the conventional starting system. The receiver produces a signal to start the engine in response to a signal received from a small portable transmitter that is located remote from the engine.

12 Claims, 1 Drawing Figure





REMOTE CONTROL STARTING DEVICE FOR INTERNAL COMBUSTION ENGINE

BACKGROUND OF THE INVENTION

This invention relates to remote starting systems for internal combustion engines and, more particularly, to a radio frequency remote starting system for internal combustion engines.

In some instances, internal combustion engines provide power for operating other devices that are located in a remote position from the internal combustion engine, for example electric welders. These engines, of course, are equipped with conventional ignition and starting systems. These conventional systems are, of course, located at the site of the engine and therefore one can stop and start the engine only by going to the engine itself.

In those cases where a tool is being operated remotely from the engine, such as in electric welders, the ability to remotely start the internal combustion engine would be highly desirable. The ability to remotely start and stop the engine of a gasoline powered electric welder, for example, conserves fuel, eliminates unnecessary noise when the welder is not in use, and also eliminates the labor of going to the welder each time to stop or start the unit. Remote control starting devices for internal combustion engines are known in the art. Some of these prior art systems do use a transmitter and receiver to start the engine. However, in some of the systems the engine can only be started and not stopped. In those prior art systems that provide both the ability to start and stop the system, the circuitry involved is rather complex which adds to the overall expense of the system. This invention provides a relatively simple and inexpensive system for both starting and stopping an internal combustion engine. The system can be readily incorporated into any existing internal combustion engine and in no way interferes with the conventional starting system of the engine. Furthermore, the remote starting system can be totally uncoupled from the engine starting system by means of a "on-off" switch that is provided with the system.

SUMMARY OF THE INVENTION

A remote starting and stopping radio frequency system for internal combustion engines is disclosed. The system comprises a portable transmitter located remote from the internal combustion engine. The internal combustion engine is equipped with a receiver and a plurality of relays and solenoids. In addition, an "on-off" switch is provided at the engine to totally disable the remote starting system. The solenoids and relays are responsive to the output of the receiver which provides and output signal in response to a signal received from the transmitter. When the receiver provides an output, the engine will be either started or stopped as the case may be if the disabling switch is in the "on" position. The remote starting circuitry is connected in parallel with the conventional starting circuitry of the internal combustion engine so that the remote starting circuitry in no way interferes with conventional starting of the engine even when the disabling switch is in the "on" position.

It is therefore an object of this invention to provide a remote control system for internal combustion engines.

It is another object of this invention to provide a remote starting system for internal combustion engines.

It is still another object of this invention to provide a remote control stopping system for internal combustion engines.

It is a further object of this invention to provide a radio frequency remote control starting system for internal combustion engines.

It is still a further object of this invention to provide a radio frequency remote control stopping system for internal combustion engines.

DESCRIPTION OF THE DRAWING

The above mentioned and other objects of the invention will become readily apparent from the following detailed description when read in conjunction with the annexed drawing in which the single FIGURE shows a preferred embodiment of the invention.

DESCRIPTION OF THE INVENTION

The single FIGURE shows a preferred embodiment of the invention and the conventional starting apparatus of an internal combustion engine. Generally, the starting apparatus of an internal combustion engine comprises, as shown in the FIGURE, an ignition switch 1, a starter switch 3, a starter motor 5, a starter solenoid 7, and a battery 9. The ignition switch, starter switch, starter motor, solenoid and battery are interconnected in a conventional manner and the internal combustion engine is also conventionally started by closing the ignition switch which is normally accomplished by means of a key and then closing the starter switch to activate starter solenoid 7 and energize starter motor 5. Since all this circuitry and the operation thereof is conventional and well known, a complete description thereof is not deemed necessary.

The apparatus of this invention, as shown in the FIGURE, comprises a transmitter 2, a receiver 4, a first solenoid 8, a second solenoid 10, a first relay 12, a second relay 14, a third relay 16, an "on-off" switch 24, and a terminal board 6 utilized to interconnect the various components of the invention to each other and to the conventional starting apparatus.

Transmitter 2 is preferably a single band portable transmitter that can readily be carried from place to place. Transmitter 2 would normally be located remote from the internal combustion engine. Receiver 4 would normally be a single band receiver that is tuned to the frequency of the transmitter. Receiver 4 is mounted on the internal combustion engine or in close proximity thereto. Receiver 4 obtains its operating power from battery 9 as is shown in the FIGURE. While transmitter 2 and receiver 4 may be any type of suitable transmitter and receiver, the type of transmitter and receiver used in conventional garage door operating systems are ideally suitable for use with this invention.

As shown in the FIGURE, the output of receiver 4 is connected to the terminals 22 of terminal board 6 by means of the conductors 26. The coils of solenoids 8 and 10 are also connected to terminals 22 by means of the conductors 28 and 30, respectively. Solenoids 8 and 10 are connected to each other by means of the conductors 38. Solenoid 8 is also connected to relays 12 and 14 by means of the conductors 34 and 36, respectively. Relay 12 is connected to relay 14 by means of the conductor 40 and to one of the two terminals 20 by means of the conductor 42. Relay 14 is connected

to the other terminal of terminals 20 by means of the conductor 44. The terminal 20 connected to relay 12 is also connected to starter solenoid 7 by means of the conductor 46. The terminal 20 that is connected to relay 14 is connected directly to the ground 11. Solenoid 8 is also connected to battery 9 through the switch 24 by means of the conductor 32. Relay 16 is connected to solenoid 10 by means of the conductors 48 and to the terminals 18 of terminal board 6 by means of the conductors 50. Terminals 18 are also connected to ignition switch 1 by means of the conductors 52.

Now that the apparatus of the invention and the manner in which it is interconnected has been described, the operation thereof will be described. When "on-off" switch 24 is in the "off" position as shown in the FIGURE, the remote control circuitry of this invention is effectively disconnected from the starting circuitry of the internal combustion engine and therefore the engine cannot be started remotely. In order to use the remote control apparatus of this invention, switch 24 must be first switched to the "on" position. It should be noted however that even though the internal combustion engine can now be started remotely with the apparatus of this invention, the engine can still be started in a conventional manner even though switch 24 is "on." The circuitry and apparatus of this invention as should be obvious from the above description, is connected in parallel with the conventional starting system and therefore does not prevent starting of the engine by this conventional system.

For purposes of this discussion, assume that the internal combustion engine is not running, that switch 24 is in the "on" position and that one now desires to start the engine. To so start the engine, one energizes transmitter 2 thereby transmitting a signal to receiver 4. In response to the transmitted signal, receiver 4 provides an output voltage at terminals 22 of terminal board 6. This voltage activates solenoids 8 and 10. When solenoids 8 and 10 are activated, relays 12, 14 and 16 are energized. When relay 12 is energized, the relay arm 72 is closed on the contact 62. Similarly, the relay arm 74 is closed on the contact 64 of relay 14 and the arm 76 is closed on contact 66 of relay 16 when these two relays are energized. When contact arm 76 is closed on contact 66, ignition switch 4 is closed. The closing of contacts 62 and 64 of relays 12 and 14, respectively, applies power to starter solenoid 7 to activate this solenoid and thereby energize starter motor 5 to start the internal combustion engine. Transmitter 2 is kept energized until the internal combustion engine is started. At that point the transmitter is turned off. When transmitter 2 is turned off after the engine has started, relays 16 and 12 remain closed on contacts 66 and 62, respectively. Whereas, arm 74 of relay 14 moves off of contact 64 to open this contact when transmitter 2 is turned off. Relays 12 and 16 are the type of relay that closes when energized and remains closed until the relays are again energized. Upon the second energization of these relays, the relays are opened. Relay 14 on the other hand is a type of relay that closes only when energized. It is, of course, obvious why relay 16 must remain closed on contact 66. If the relay did not remain closed on this contact, ignition switch 1 would be open and the engine would stop. Thus, relay 16 in effect operates as the ignition key for the engine. The reason that relay 12 remains latched will become apparent later.

Assume now that the engine is to be stopped. To stop the engine, transmitter 2 is again turned on to transmit a signal to receiver 4. Receiver 4 again provides an output voltage at terminals 22 in response to the signal from transmitter 2. This voltage at terminals 22 again activates solenoids 8 and 10. When solenoids 8 and 10 are activated, relays 12, 14 and 16 are energized as before. Since relays 12 and 16, as was pointed out above, are the type of relays that remain latched until energized for a second time, these relays will now open contacts 66 and 62. The opening of contacts 62 and 66 stops the internal combustion engine. This is, of course, obvious since ignition switch 1 is opened when relay arm 76 moves off of contact 66. This re-energization of relay 14 and thereby the closing of relay arm 74 on contact 64 has no effect on starter solenoid 7, since arm 72 of relay 12 moves off of contact 62 when relay 12 is re-energized. Thus, even though relay 14 is closed on contact 64, no voltage is applied to starter solenoid 7 since contact 62 of relay 12 is now open. When the internal combustion engine has stopped, the transmitter is turned off and all the relays are no longer energized. Contacts 62, 64 and 66 are now all open. These contacts will remain open until the relays are again energized.

The manner in which relays 12 and 14 operate provides the ability to start and stop the engine by means of transmitter 2 and receiver 4. If relay 12 were not the type of relay that latched close when initially energized and then latched open when subsequently energized, the turning on of transmitter 2 would always activate starter solenoid 7. Since relay 12 remains closed on contact 62 while the engine is running and then opens when it is again energized, no voltage is applied to starter solenoid 7 during the stopping process. Relay 14 of course closes on contact 64 every time this relay is energized. However, the closing of contact 64 has no effect on starter solenoid 7 during the stopping procedure because contact 62 opens as soon as it is energized. In order to insure that contact 62 is opened before contact 64 is closed, relay 12 can be a slightly faster acting relay than relay 14.

From the foregoing description it is quite obvious that the apparatus of this invention provides a simple and straight forward means for starting and stopping an internal combustion engine. Only simple circuit elements such as relays and solenoids are used in combination with the transmitter and receiver. In this respect it should be noted that the solenoids provide isolation of the high starting current from radio receiver 4. This, of course, is necessary to prevent damage to receiver 4. It should also be obvious from the foregoing description that this invention can be readily added to any existing internal combustion engine. Of course, the invention could also be incorporated into the engine starting system at the manufacturing plant.

While the invention has been described with reference to a preferred embodiment, it will be obvious to those skilled in the art that various changes and modifications can be made to the embodiment shown and described without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. In combination with an internal combustion engine having an ignition switch, a starter switch, a starter solenoid, a starter motor, and a battery; a remote control

starting and stopping system for said internal combustion engine comprising:

a radio transmitter located remote from said internal combustion engine;

a radio receiver responsive to said radio transmitter located in close proximity to said internal combustion engine;

first and second switching means each having a separate voltage responsive actuating means;

means to connect each said separate voltage responsive actuating means of said first and second switching means in parallel to the output of said radio receiver;

third and fourth switching means each having a separate voltage responsive actuating means;

means to connect said separate voltage responsive actuating means of said third and fourth switching means in parallel to said first switching means;

fifth switching means having a voltage responsive actuating means;

means to connect said voltage responsive actuating means of said fifth switching means to said second switching means;

means for electrically connecting said third switching means to said fourth switching means;

means for electrically connecting said third switching means to said starter solenoid;

means to connect said fourth switching means to a common potential point;

means for electrically connecting said fifth switching means to said ignition switch; and

means for selectively connecting said first and second switching means to said battery.

2. A remote control starting and stopping system as defined in claim 1 wherein said first and second switching means in combination with their said respective separate voltage responsive actuating means are solenoids.

3. A remote control starting and stopping system as defined in claim 2 wherein said third, fourth and fifth switching means in combination with their respective said voltage responsive actuating means are first, second and third relays, respectively.

4. A remote control starting system as defined in claim 3 wherein said first and third relays are relays that make and hold upon energization and break and hold upon re-energization and wherein said second relay is a type of relay that closes only when energized.

5. A remote control starting and stopping system as defined in claim 4 wherein said means for selectively connecting said battery to said first and second solenoids is an "on-off" switch, said "on-off" switch being so connected that it disables the remote control starting and stopping system when it is in its off position.

6. A remote control starting and stopping system as defined in claim 5 wherein said transmitter is a single band transmitter and said receiver is a single band receiver tuned to the frequency of said transmitter.

7. A remote control starting and stopping system as defined in claim 6 wherein said radio receiver is mounted on said internal combustion engine.

8. A remote control starting and stopping system as

defined in claim 7 wherein said third relay is so connected to said ignition switch and said first and second relays are so connected to said starter solenoid that said internal combustion engine can be started by the conventional starting system of said internal combustion engine as well as by said remote control starting and stopping system.

9. In combination with an internal combustion engine having an ignition switch, a starter switch, a starter motor, a starter solenoid, and a battery; a remote control starting and stopping system comprising:

a radio transmitter located remote from said internal combustion engine;

a radio receiver tuned to said transmitter located adjacent to said internal combustion engine;

first and second solenoids connected to the output of said receiver such that said first and second solenoids are energized when said receiver provides an output signal;

an "on-off" switch connected between said battery and said first and second solenoids;

first and second relays each having an arm and a closed contact connected to said first solenoid in such a manner that said first and second relays are energized when said first solenoid is activated and said "on-off" switch is in its "on" position;

a third relay having a relay arm and a closed contact connected to said second solenoid in such a manner that said third relay is energized when said second solenoid is activated and said "on-off" switch is in its "on" position;

means to connect said relay arm and said closed contact of said third relay to said ignition coil;

means to connect said starter solenoid to said arm of said first relay;

means to connect said closed contact of said first relay to said arm of said second relay; and

means to connect said closed contact of said second relay to a common potential point.

10. A remote control starting and stopping system as defined in claim 9 wherein said arm of said first relay is closed on said closed contact of said first relay and said arm of said third relay is closed on said closed contact of said third relay at all times while said internal combustion engine is running and wherein said arm of said second relay is removed from said closed contact while said engine is running.

11. A remote control starting and stopping system as defined in claim 10 wherein said arm of said first relay is closed on said closed contact of said first relay, said arm of said second relay is closed on said closed contact of said second relay and said arm of said third relay is closed on said closed contact of said third relay when said internal combustion engine is being started.

12. A remote control starting and stopping system as defined in claim 11 wherein said arm of said first relay is removed from said closed contact, said arm of said second relay is closed on said closed contact and said arm of said third relay is removed from said closed contact of said third relay when said engine is being stopped.

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