

United States Patent

Abplanalp et al.

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[54] BLOCKING CIRCUIT FOR INBOARD ENGINE IGNITION

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[52] U.S. Cl. **123/179 B**, 307/9, 98/1

[51] Int. Cl. **F02n 17/00**

[58] Field of Search 123/179 A, 179 B, 179 BG;
307/9, 141.4; 114/211; 98/1

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[57]

ABSTRACT

A blocking circuit is provided in combination with an inboard motorboat engine, blower and ignition circuit, which prevents actuation of the ignition circuit until after the blower has functioned for a certain length of time to expel the fumes from the engine compartment. A bimetallic switch, a timer motor, or a switching circuit is utilized to open and close the leads to the ignition circuit. In the embodiment featuring the bimetallic switch, either a pair of alternately operating heating coils cause the switch to transfer from activating the blower to connecting the ignition circuit to the operator's switch, or a single coil by itself or in parallel with the solenoid supply this function.

3 Claims, 7 Drawing Figures

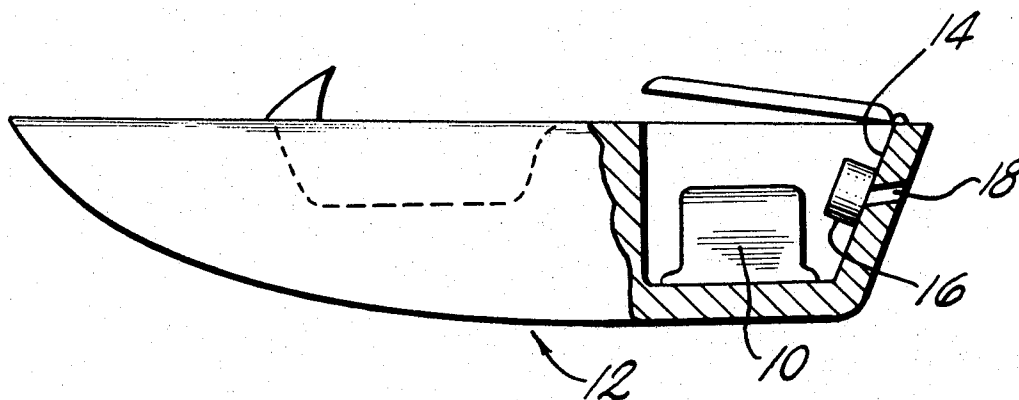


FIG. 1

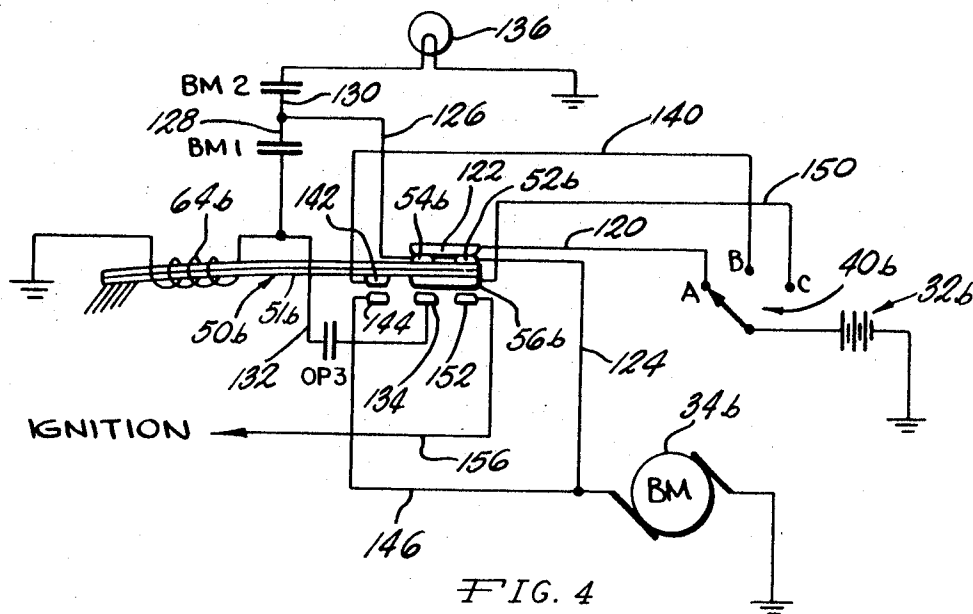
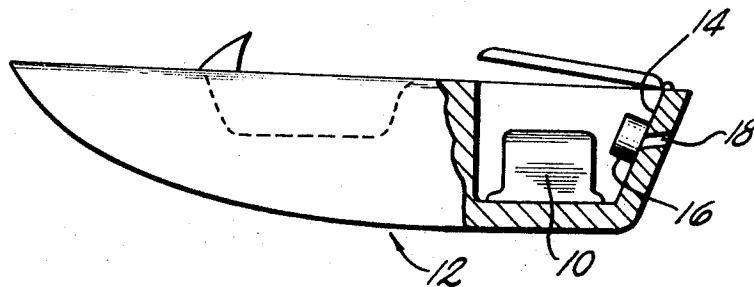


FIG. 4

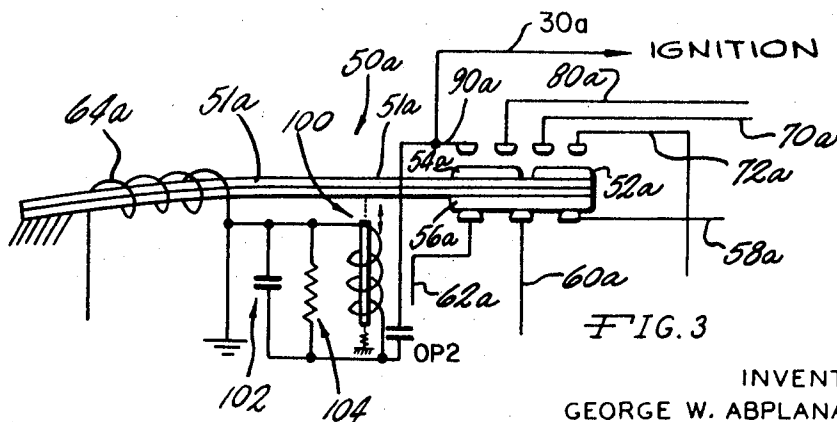


FIG. 3

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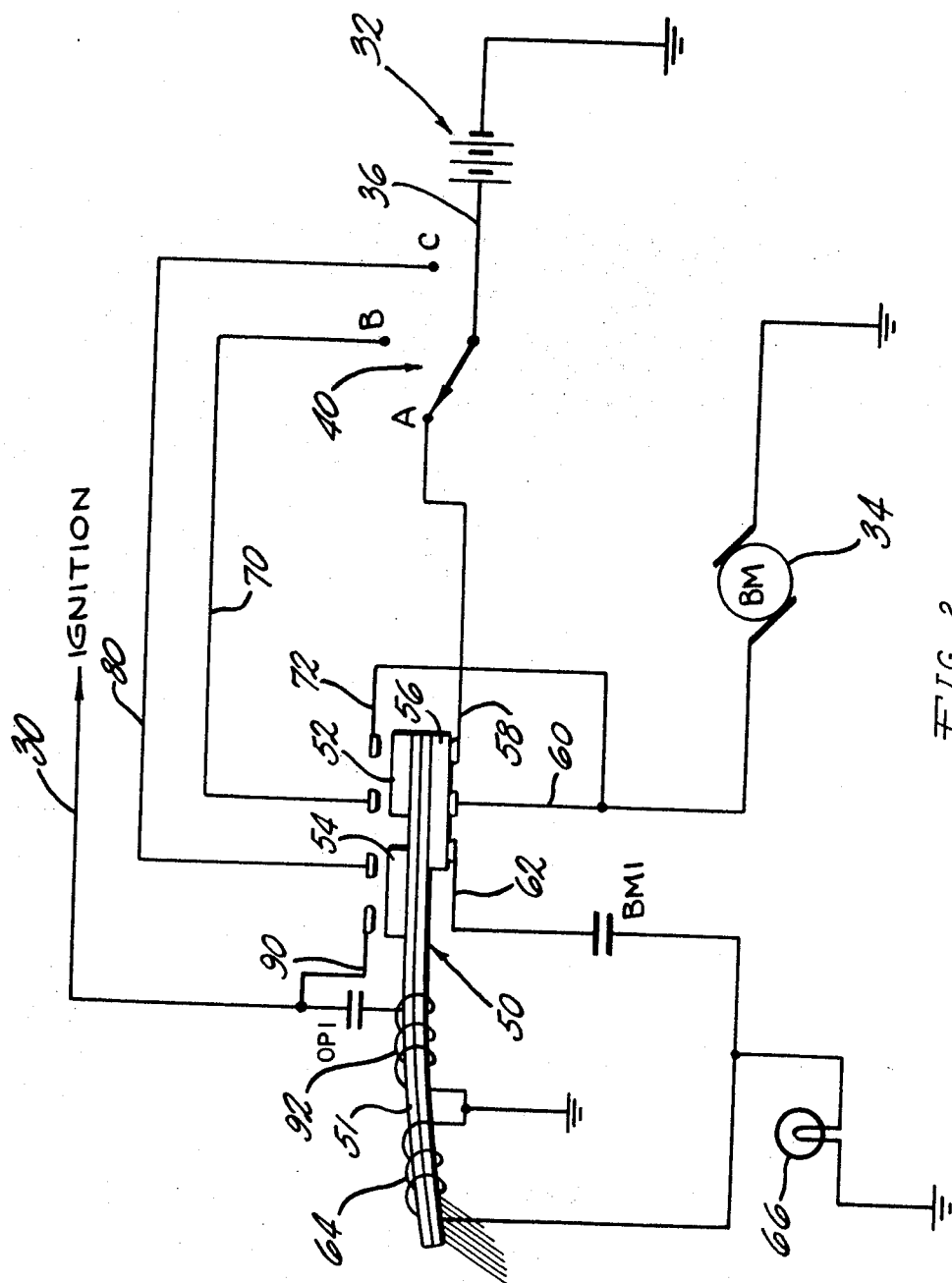
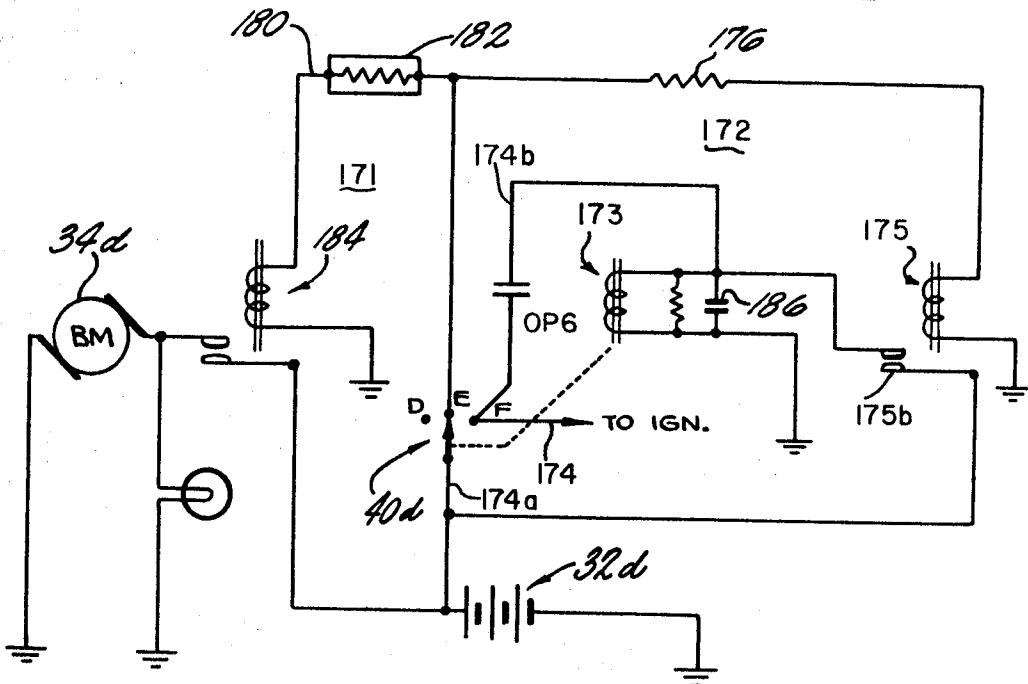
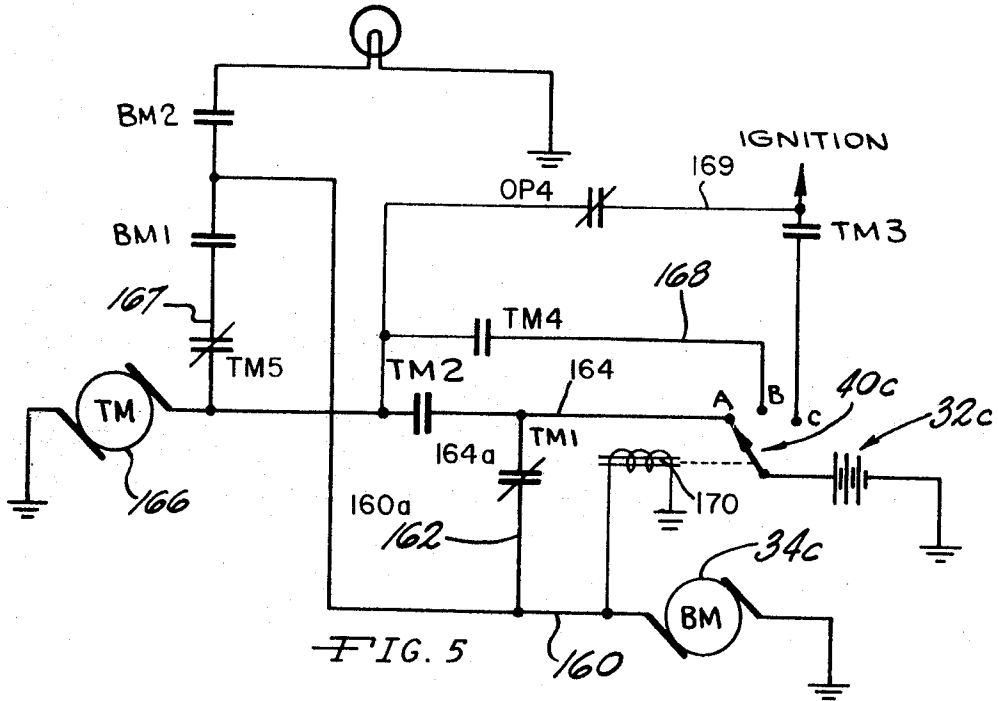


FIG. 2

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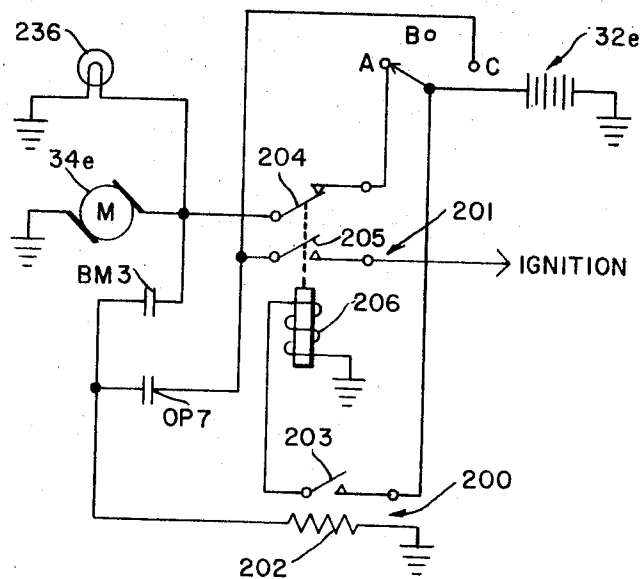


FIG. 7

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BLOCKING CIRCUIT FOR INBOARD ENGINE IGNITION RELATED APPLICATIONS

This application is a continuation-in-part application of our co-pending application Ser. No. 16,355, filed Mar. 4, 1970 now abandoned.

BACKGROUND OF THE INVENTION

The confinement of the engine in inboard motorboats to a closed compartment requires that the accumulated fumes in the engine compartment be completely exhausted therefrom prior to the connection of the power supply to the ignition circuit and the subsequent starting of the engine. Failure to adequately do so can result in an explosion capable of destroying the boat and everything on it.

The conventional approach to the problem has been to rely on the operator to remember to so vent the compartment prior to the ignition. It will be readily apparent that such an approach is dangerous, due to the fallibility of human operators.

A further safety feature which is needed is the automatic venting of the engine compartment immediately prior to ignition regardless of the preceding conditions. Thus, a safety device may be deactivated by the operator when he first comes on board. However, if the device does not insure that the blower operates immediately prior to the operator turning on the ignition no matter how much later the latter occurs, the safety device will not be adequate.

SUMMARY OF THE INVENTION

The disclosure relates to a safety device in inboard motorboats which precludes the actuation of the ignition prior to the immediately preceding venting or expelling of fumes from the engine compartment. Specifically, there is provided an improved combination of an inboard boat engine, an ignition circuit for the engine and a blower especially adapted for blowing fumes out of the engine compartment. The improvement features a blocking means for automatically blocking or delaying the circuit from actuation until after the blower has functioned a length of time adequate to expel fumes from the engine compartment. Means are also included for automatically reactivating the blower if either the engine is turned off or if the engine is not started within a predetermined time after the unblocking of the circuit occurs.

Accordingly, it is an object of the invention to provide a circuit which will prevent explosions on inboard boats due to the failure of the operator to properly ventilate the engine compartment and bilge before starting the engine.

It is another object of the invention to provide such a circuit which will automatically prevent actuation of ignition on inboard boats until after the fumes have been expelled from the engine compartment.

It is a related object of the invention to provide such a circuit which will preclude ignition if the blower for the engine compartment is not operating properly.

Other objects and advantages will become apparent upon reference to the following drawings and detailed discussion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially schematic elevational view with parts in section of an inboard boat utilizing the invention;

FIG. 2 is a schematic circuit diagram illustrating a blocking circuit constructed in accordance with the invention;

FIG. 3 is a fragmentary diagram illustrating an alternate construction of the circuit of FIG. 2; and

FIGS. 4 through 7 are schematic circuit diagrams similar to FIG. 2 but illustrating other embodiments.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The disclosure concerns a safety circuit for the operation of an engine 10 in an inboard motorboat 12, the engine being customarily kept in a closed compartment 14. A blower 16 is

conventionally utilized to vent the compartment 14 by expelling the fumes therein out through an exit 18. (See FIG. 1.)

In the remaining drawings, these symbols have the following meaning: BM represents a blower motor 34 for the blower 16, BM1 and BM3 represent switches actuated through the operation of the blower motor, TM represents the timer motor in one of the embodiments, TM1 through TM5 represent switches which operate in sequence through the functioning of the timer motor, and OP1 through OP7 represent oil pressure switches activated by the presence of oil pressure developed by the operation of the boat engine.

In accordance with one aspect of the invention, a blocking circuit is provided to prevent by means of a switch 50 the connection of the ignition or main circuit 30 to a power supply 32 through a three-way switch 40 until after the blower motor 34 has functioned on a secondary circuit for a time sufficient to expel the gases from the compartment 14. Specifically, as shown in FIG. 2, a lead line 36 connects the power supply 32 to the three-way switch 40 which has the three positions A, B, and C. As explained hereinafter, the A terminal is the "blower on" position, the B terminal is the "off" position, and the C terminal is the "ignition on" position. Still another switch position, not shown, is a conventional starter motor position operated in conjunction with the terminal C. A bimetallic switch 50 featuring a bimetallic element 51 activates either the blower (the secondary circuit), or the ignition (the main circuit) by opening and closing a plurality of multiple-pole contacts 52, 54 and 56. The contact 56 is a triple pole contact mounted on the element 51 which is normally closed to complete several circuits with a line 58 extending from the terminal A in the switch 40. Specifically, the contact 56 when closed connects a line 60 with the line 58 to supply current to the blower motor 34. Also when closed the contact 56 supplies current from the line 58 to a line 62 which connects with switch BM1, an air switch actuated by air pressure delivered by the blower 16. The air switch BM1 insures that the current will be carried by the line 62 only when the blower actually is functioning. A coil 64 and an indicator lamp 66 are wired in parallel from the switch BM1, the coil serving to heat the bimetallic switch 50 to alter its normal position.

When the switch 50 moves into its alternate position after being heated for a time by coil 64, a double pole contact 52 on the lever 51 connects a line 70 which extends from the terminal B in the switch 40, to a line 72. The line 72 junctions with the line 60 so that when the switch 40 contacts the B terminal with the bimetallic switch 50 in its alternate position, the blower motor 34 is reactivated. The double pole contact 54 when closed completes a circuit between a line 80 which extends from the terminal C and a line 90 which junctions with the ignition circuit 30. A second heating coil 92 is shunted from the line 90 and serves to continue heating the bimetallic switch 50 to retain the switch in the position which completes the circuit with the lines 70, 72, 80 and 90, which lines are otherwise open circuits. However, oil pressure switch OP1 which is normally open prevents energization of heating coil 92 until the engine is operating to produce an oil pressure sufficient to close OP1. This switch OP1, thus, functions as a safety switch to prevent the contacts 52 and 54 from remaining in upwardly closed position once the engine is shut off and thereby preventing current from flowing to the ignition until the blower BM exhausts the fumes.

Still another result of the bimetallic switch being heated is the breaking of the circuit between the lines 58, 60, and 62 by removing the contact 56 therefrom. This causes the blower motor 34 to shut off when the switch 40 is in the A position and remain shut off when in the C position and also to de-energize the heating coil 64 and the indicator light 66.

OPERATION

The operation of the circuit shown in FIG. 2 proceeds from an orientation in which the switch 40 initially contacts the terminal B which is the "off" position. If the switch 40 is then

turned to terminal C, nothing happens as the terminals or poles for lines 70, 72, 80 and 90 are initially open circuits. The operator then turns the switch 40 to the terminal A, thereby activating the blower 34 due to the triple pole contact 56 completing the circuit for the lines 58, 60 and 62. When the blower 16 operates, it closes switch BM1, which electrically connects coil 64 and the indicator lamp 66 through the line 62. After the bimetallic switch heats up, which occurs over a finite span of time dependent upon the characteristics of the switch element 51, it transfers to the position which opens the circuit between the contact 56 and the terminals for the lines 58, 60 and 62 and closes the circuit between the contacts 52 and 54, and the terminals for the lines 70, 72, 80 and 90. For this reason, the blower motor 34 and the indicator light 66 shut off, informing the operator that switch 50 is now in the "ready" position and that he may now actuate the ignition circuit by moving the switch 40 to the terminal C. In the event the operator fails to do this at this time, the bimetallic switch 50 cools so as to return to its initial position as shown in FIG. 2, thereby activating the blower motor 34 with the switch 40 still contacting terminal A. However, assuming that the operator does transfer the switch 40 to terminal C, then the line 80 is electrically connected to the line 90, which supplies power to the ignition circuit 30 as well as to the second heating coil 92 when the engine is operating which maintains the switch 50 in this second position.

The ignition circuit 30 having been activated, it is then possible to start engine 10 by a conventional starter switch, not shown. The operation of the motor causes switch OP1 to close, thus energizing coil 92. However, should the switch 40 be transferred from terminal C to terminal B and immediately thereafter to C again, the engine shuts off and switch OP1 opens, terminating the flow of current through coil 92. In such case, the bimetallic switch 50 is retained in its second, heated position only temporarily and subsequent actuation to the second heated position requires energizing coil 64 through the closing of contact 56 on the leads to lines 62, 60 and 58. Thus, it is not possible to shut off the engine 10 and retain the switch 50 in the "ready" position without operating the blower.

When the operation of the engine is terminated by transferring the switch 40 from terminal C to terminal B, the switch 50 for a temporary period maintains the circuit closed between the lines 70 and 72 by contact 52. For that reason, the blower motor 34 reactivates again for a period of time until the bimetallic switch 50 cools and reverts to its original position. This temporary retention of the switch 50 in its switched position due to the residual heat of the coil 92 also serves to allow the engine to be restarted immediately in the event the shutdown was momentary only, such as would be the case if it were accidental. The cooling of the switch 50 will eventually occur because there is now an open circuit to the line 80, preventing the supply of current to the second heating coil 92.

ALTERNATE EMBODIMENTS

FIG. 3 illustrates a modification of FIG. 2 wherein only one heating coil is utilized to activate the bimetallic switch. Parts similar to those previously described bear the same reference numeral to which the distinguishing suffix "a" has been added. Thus, the lines 58a, 60a and 62a normally are closed by triple pole contact 56a mounted on the bimetallic lever 51a. Lines 58a, 60a and 62a lead to the same circuit elements 58, 60 and 62 of FIG. 2. Similarly, lines 70a, 72a, 80a and 90a normally are in an open circuit due to the double pole contacts 52a and 54a being out of contact therewith, the lines 70a, 72a and 80a also leading to the same circuit elements 70, 72 and 80 of FIG. 2. Heating coil 64a provides the heat to bimetallic switch 50a to actuate the switch so as to close the circuit between lines 70a and 72a and the circuit between lines 80a and 90a. In contrast with FIG. 2, instead of providing a second heating element in parallel with the ignition circuit, a solenoid 100 is provided in parallel with the ignition circuit to hold the bimetallic switch 50a in the altered or second position. A capacitor 102

is shunted across the solenoid along with a resistor 104, providing a timed holding feature, the holding time being determined by the capacitors discharge time. Thus, in the event the three-way switch (not shown) is turned "off" momentarily, such as by accident, the capacitor 102 discharging through resistance 104 will hold the bimetallic switch 50a for a period of time so that the ignition can be reactivated. However, capacitor 102 will eventually discharge so that the engine thereafter cannot be restarted immediately. Alternatively, an electromagnet can be used in place of the solenoid 100 to magnetically hold switch 50a.

An oil pressure switch OP2 is preferably provided in the line between ignition circuit 30a and solenoid 100 as a safety factor to prevent connection of solenoid 100 to line 80a and power source 32 unless the engine is operating, thus preventing the element 51a from being held upwardly before the gases and fumes are exhausted.

FIG. 4 illustrates still another embodiment wherein the same heating coil is utilized to heat the bimetallic switch when the latter is in either of its two positions. Parts similar to those previously described bear the same reference numeral to which the distinguishing suffix "b" has been added. Thus, a power source 32b is connected to a three-way switch 40b having terminals A, B, and C. The bimetallic switch 50b has terminals 52b and 54b and a double pole contact 56b, rather than three multiple pole contacts as before, the terminal 52b being capable of supplying electricity to a blower motor 34b. A heating coil 64b causes the bimetallic switch to transfer from the normal position shown in FIG. 4 to the position which reverses the state of the contacts shown therein. In contrast with the embodiment shown in FIG. 2, the lines leading from the three-way switch 40b and their terminal connections are altered in the following manner: Terminal A in switch 40b is connected to a line 120 the opposite end of which is supplied with a double pole contact 122. The contact 122 normally closes the circuit between the bimetallic switch terminals 52b and 54b. The terminal 52b is permanently connected to a line 124 which supplies current to the blower motor 34b. The terminal 54b is permanently connected to a line 126 from which is branched two lines 128 and 130. The line 128 has in series therein the heating coil 64b and an air switch BM1 which is activated by the functioning of the blower 16. Junctioned to the line 128 is a line 132 with a normally open switch OP3 and pole or terminal 134. The line 130 has in series therewith the air switch BM2 and the indicator light 136. Terminal B in the switch 40b is mounted on a line 140 which has at its opposite end a normally opened terminal 142 mounted on the bimetallic lever 51b. Cooperating with the terminal 142 is a terminal 144 on a line 146 which junctions with line 124. The terminal C is mounted on a line 150 which is permanently connected to the double pole contact 56b mounted on the lever 51b. That contact is normally open, but when closed it connects terminals or poles 152 and 134. The terminal 152 is the terminal for the line 156 which leads to the ignition circuit.

One skilled in the art will readily appreciate that the circuit in FIG. 4 operates by presenting an open circuit to the line 150 when the switch 40b is initially turned to the "on" position, terminal C, from the "off" position represented by terminal B. When the switch is turned to terminal A, line 124 is supplied with power so as to activate the blower motor 34b, the driven blower 16 causing the air switches BM1 and BM2 to close, thereby heating up the coil 64b. The bimetallic switch 50b is caused to transfer upon heating by the heating coil to its second position, thereby closing the circuit between the line 150 and the line 156. This allows the ignition circuit to be activated. Line 124 is at this time presented with an open circuit, shutting off the blower motor 34b. The closing of the circuit between terminal 134 and line 150 with the double pole contact 56b insures that the heating coil 64b will hold the bimetallic switch in its second position when switch 40b is turned to terminal C, but only if the engine 10 is started more or less immediately, so that switch OP3 is closed. But, if the operator fails to turn the switch 40b to C, lines 126, 132 and 150 are

presented with an open circuit, thereby shutting off the heating coil 64b. Thus, switch 50b recycles when coil 64b cools. When the switch 40b is turned from terminal C to the "off" position (terminal B), the contact between the terminal 142 and 144 causes the blower motor 34b to be reactivated. Also in that case, the lines 126, 132 and 150 are presented with an open circuit, so that the bimetallic switch 50b will eventually revert to its original position shown in FIG. 4. Until then, the line 156 is still electrically connected with line 150 so that the engine can be restarted immediately if desired.

FIG. 5 illustrates yet another embodiment wherein a timer motor is utilized instead of the bimetallic switch to unblock the ignition circuit after the blower or secondary circuit has been operating a predetermined period of time. Parts similar to those previously described bear the same reference numeral to which the distinguishing suffix "c" has been added. The identical switches BM1 and BM2 are utilized in the circuit as were utilized in FIG. 4. Thus, a power supply 32c is connected to a three-way switch 40c, having terminals A, B, and C. The blower motor 34c is normally electrically connected with the terminal A by means of a circuit comprising lines 160, 162 and 164. A normally closed switch TM1 is located in line 162 for controlling the operation of the blower motor in conjunction with the timer 166. The initial timer circuit for timer 166 includes the lines 164, 162, 160a and 167, air switch BM1 and timer switch TM5 being located in line 167 for controlling the timer in response to operation of blower 16. A timer holding circuit is formed through line 64a connected to line 167, and having therein a switch TM2 which is normally open. Terminal B connects with line 167 by a line 168 which has therein a normally open timer switch TM4. Terminal C is electrically connected to the ignition circuit through a normally open timer switch TM3. A line 169 is connected between the ignition circuit and line 167 through a normally closed oil pressure switch OP4. A solenoid 170 is shunted across the blower motor 34c an operatively connected to the switch 40c so as to be energized while the timer motor is running, and before the timer switches are actuated thereby. This prevents the operator from switching switch 40c to positions B or C until the timer motor has run for a predetermined time (i.e., 5 minutes) so as to prevent incomplete cycling of the timer motor. Any suitable arrangement for accomplishing this can be used, such as a tumbler.

All of the switches TM1, TM2, TM3, TM4 and TM5 are operated generally by the operation of the timer motor 166 which in turn is operated due to the closing of switch BM1. As shown in FIG. 5, the circuit is at the starting position with the blower motor 34c activated. Switch BM1 closes when the blower 16 is activated by the blower motor 34c. The switches TM2 and TM1 close and open, respectively, either in that order or simultaneously as the timer motor 166 operates, thereby turning off blower motor 34c while maintaining the activation of the timer motor. Switches TM3 and TM4 are closed by the timer motor 166 so that the ignition can be activated by moving the switch 40c to terminal C, which movement of the switch 40c also shuts off the timer motor unless the engine does not open the oil pressure switch OP4. In the event the switch 40c is maintained on the terminal A, the timer motor 166 will continue to recycle to cause the blower motor 34c to periodically reactivate. It should be noted that transferring the switch 40c from terminal C to terminal B also reactivates the timer motor 166 through now closed switch TM4, so as to eventually return the switches TM1 through TM5 to their original positions shown in FIG. 5. However, this occurs after a prescribed period of time during which the switch TM3 remains closed so that the engine can be restarted immediately if its turn-off was intended to be momentary only. Switch OP4 closes whenever the engine 10 is turned off by turning switch 40c from C to B. With TM3 closed this permits the continued energization of timer motor 166 upon switching back to C position until it completes its cycle to open timer switch TM3. This prevents the operator from turning switch 40c from C to B and back to C and then leaving the controls

with TM3 closed which would leave the ignition circuit closed making possible subsequent starting of the motor without exhaust of the fumes. The latter step prevents immediate restarting of the engine 10 until such time as the blower motor 34c is reactivated to evacuate the fumes.

An additional safety feature provided by this embodiment is the use of the solenoid 170. Thus, when the switch 40c is turned to terminal A initially, the closed switch TM1 activates both the motor 34c and the solenoid 170, the latter preventing switch 40c from being actuated from terminal A until motor 34c has run its course for the evacuation of the fumes.

The switches TM1 through TM5 can be operated by the timer motor 166 in any desired fashion, the preferable construction being a cam directly driven by the timer motor 166 which cam is itself one half of the contacts for the five switches.

FIG. 6 illustrates a circuit wherein the bimetallic switch has been replaced by a switching circuit and relays, the switching circuit first activating the secondary blower circuit and then rendering actuatable the main or ignition circuit. Parts similar to those previously described bear the same reference numeral to which the distinguishing suffix "d" has been added. Thus, the power supply 32d is connected to a three-way switch 40d having terminals D, E, and F. Terminal E leads to two parallel circuits 171 and 172, circuit 171 activating the blower motor 34d. The circuit 172 is characterized by a blocking and actuating solenoid 173 positioned physically adjacent to the switch 40d with one end of the solenoid actuator blocking the switch 40d from moving to the terminal F and spring biasing the switch 40d to position E when the solenoid 173 is de-energized. However, when the solenoid 173 is energized either through line 174 or 174b, the switch 40d is unblocked so that the terminal F can be contacted.

The solenoid 173 is energized when switch 40d is in the E position by closing of solenoid contacts 175b as will be hereinafter described and is energized when switch 40d is in the F position only when the oil pressure switch OP6 is closed by operation of the engine. Thus, the switch 40d can be in the F position only during the discharge time of capacitor 186 after contacts 175b are open and thereafter only if the engine is operating and OP6 is closed. The solenoid 173 is in parallel with a line 174a leading to the ignition, both the line 174a and the solenoid 173 being in parallel with a relay 175. The relay 175 in turn is in series with a resistor 176 utilized in the switching of the circuit in a manner hereinafter described.

The blower circuit 171 comprises the blower motor 34d, a line 180, a thermistor 182, and a relay 184 in series with the thermistor and in parallel with the blower motor 34d.

The resistance values of the resistor 176 and the thermistor 182 must be adjusted so that the resistance of the resistor 176 is very much larger than that of the thermistor when the latter is cold, and very much smaller than that of the thermistor when the latter is hot. Although in no case will the larger resistance completely prevent current flow in the other circuit, the relays 175 and 184 can be adjusted so as to operate only with a current which exceeds the minimum current flowing through that large resistance. It should be understood that the parameters of the resistor 182 and resistance 176 can be chosen to provide the desired time cycle during which resistor 182 will heat up and block flow of current to solenoid 184 and after which current will flow to solenoid 175 as resistor 182 is cooling.

Thus, it will be readily appreciated that the switching circuit of FIG. 6 operates in the following manner: With the solenoid 173 deactivated, the switch 40d is blocked from contacting the terminal F. Accordingly, this switch may be turned to terminal E at which time the current initially flows through line 180 almost entirely, due to the lack of resistance in the thermistor 182. This current flow activates the relay 184 so as to bring current to the blower motor 34d. Eventually, the thermistor 182 heats up to the point at which the resistance therein is far greater than that of the circuit 172. Thus, the relay 184 opens due to the lack of current through line 180.

By this time, enough current has been diverted by thermistor 182 into circuit 172 to close the relay 175. The closing of the relay 175 acts to unblock the solenoid 173, thereby allowing the switch 40d to be transferred to terminal F. The capacitor 186 shunted across the solenoid 173 allows the solenoid to remain activated for a short period of time after the switch is transferred from terminal F to terminal E, so that the engine can be restarted if its shut-down was intended to be only momentary. The amount of current required by relay 184 to activate can be adjusted so that if the switch 40d is maintained on terminal E, the relay 184 will periodically reactivate as the thermistor alternately cools down and heats up due to the fluctuation of the flow of current through the line 180. Reactivation of the relay 184 causes the blower to recycle.

FIG. 7 illustrates still another circuit wherein the combination of a time delay relay 200 and a magnetic relay 201 are utilized in the circuits for controlling the blower motor and preventing connection of the ignition before the blower motor expels all of the fumes. As shown, the time delay relay 200 of a conventional type, comprises the heater element 202 which closes the contacts 203 when energized. The magnetic relay comprises the normally closed contacts 204 and the normally open contacts 205 which are opened and closed, respectively, when actuated by the relay coil 206.

A blower motor 34e is shown electrically connected to electrical source 32e through the "blower-on" switch contact A and the contacts 204. Thus, the circuit of blower motor 34e is completed through the source of potential 32e by means of the switch contact A and magnetic relay contacts 204. Connected in parallel with blower motor 34e is the indicator light 236 which indicates when blower motor is energized. The heating element 202 of the time delay relay 200 is also connected in parallel with blower motor 34e through the blower switch BM3. Thus, when blower motor 34e is operated, blower switch BM3 is closed and a circuit is completed through time delay heater element 202, blower switch BM3, magnetic relay contacts 204, "blower-on" contact switch A and the source of potential 32e.

As previously stated, the energization of the heater element 202 closes the contacts 203 which energize the relay coil 206. This energizes relay coil 206 which opens contacts 204 and closes contacts 205 causing the opening of the circuit through blower motor 34e, indicator light 236 and the heater element 202. The closing of the relay contacts 205 permits the closing of the circuit through the ignition when the main switch is moved to the ignition on contact C. However, such completion of the ignition circuit occurs for only a short time unless the motor is operated in which event the oil pressure switch OP7 is closed and a circuit is completed therethrough from potential 32e and to the heater element 202. It should be readily evident that this circuit operates in substantially the same way as that previously described in relation to the other circuits. In other words, the ignition circuit cannot be energized or completed through the source of potential until such time as the blower motor has operated for a predetermined time depending upon the time delay relay which closes the contacts 203. Thus, it is necessary that the main switch be positioned on the "blower-on" contact A for a predetermined time after which switching to the ignition-on position C will permit the completion of a circuit through the ignition.

Although the invention has been described in connection with certain preferred embodiments, it will be apparent that equivalent arrangements can be made which practice the in-

vention. For example, in some instances it may not be necessary to run the blower motor when the switch 40 is turned to the "off" position. In that case, the line such as line 72 in FIG. 2 can be omitted. Also, instead of a blower the secondary circuit could utilize some other form of combustion reducing device, such as a valve for emitting a gas which prevents combustion of any fumes present. Thus, it is intended that the invention cover these other equivalent arrangements, unless the following claims by their wording expressly state otherwise.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

1. In a motorboat having an engine compartment, an engine, an ignition system for said engine, a power supply for said ignition system, a blower for ventilating said engine compartment and a blocking circuit connected in a circuit between said power supply and said ignition system to ensure operation of said blower for a predetermined time prior to operation of said engine, the improvement in said blocking circuit comprising:

a time-delay relay having a coil and a pair of normally open contact elements;

an air-actuated switch having a pair of normally open contact elements, closable in response to the operation of said blower;

a magnetic relay having a coil, a second pair of normally open contacts, and a pair of normally closed contacts;

a pressure-sensing switch having a pair of normally open contacts responsive to operation of said engine;

first circuit means connecting said power supply to one of said pair of contacts on said time-delay switch being connected to said coil of said magnetic relay;

second circuit means connecting said power supply to one of said pair of normally closed contacts on said magnetic relay;

third circuit means connecting the other of said pair of normally closed contacts on said magnetic relay to said blower and to one of said air-switch contacts;

fourth circuit means connecting the other of said air-switch contacts to one of said pressure switch contacts and to said time-delay relay coil; and

fifth circuit means connecting the other of said pressure-switch contacts to said normally open contact on said magnetic relay and to said power supply, the other of said normally open contacts on said magnetic relay being connected to said ignition system; whereby operation of said blower closes said air switch thereby connecting said power supply to the coil of said time-delay relay, said time-delay relay coils remaining normally open for a predetermined time after such connection whereupon said time delay relay contacts close thereby energizing said magnetic relay to open said circuit to said blower and close said circuit to said ignition.

2. The blocking circuit defined in claim 1 wherein operation of said engine closes said pressure switch contacts connecting said power supply to said time-delay relay coil thereby holding said time-delay relay contacts in closed position maintaining said magnetic relay energized.

3. The blocking circuit defined in claim 1 and further comprising a selector switch having a movable switching element therein connected in circuit with said first and said fifth circuit means to selectively connect said power supply to either of said first and said fifth circuit means.

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